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Shand, W. L., and P. V. Hunter (22,624), 400
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„ Bros. & Co. (22,804), 200; (22,807), 320; (24,877), 520; (29,098), 560
„ Bros. & Co., and E. A. Laidlaw (21,165), 640
„ Bros. Dynamo Works, Ltd. (22,757), 240
„ Bros. Dynamo Works, Ltd., and E. P. Barfield (23,998), 772
„ Bros. Dynamo Works, Ltd., and H. D. Cook (21,687), 280
„ Bros. Dynamo Works, Ltd., and J. F. Crowley (20,919), 640, (26,245), 940
„ Bros. Dynamo Works, Ltd., and Kieffer (19,083), 360
„ Bros. Dynamo Works, Ltd., Crowley and S. Gowan (19,084), (19,085) 480
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„ Conduits, Ltd., and L. M. Waterhouse (14,650), 320
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„ H. D. (13,886), 80
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„ G. G. (14,1[illegible]), 120
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ELECTRICAL ACCIDENTS IN 1911.

Few documents are of greater human interest to the electrical engineer engaged in practical work than the annual report of H.M. Electrical Inspector of Factories. Therein Mr. G. Scott Ram places on record, clearly and concisely, the tale of accidents that have been brought to his notice during the year, compares it with previous records, and discusses the causes of such misadventures. But he does not stop there: he goes on to show, as far as possible, *why* these accidents happen, and to offer sound advice for their prevention in the future; and we have no doubt that many a workman unconsciously owes his life to the sagacious comments and unsparing criticism often embodied in these reports.

One of the most singular features of the report is the frequency of accidents to skilled persons engaged in cleaning high-pressure switchgear—accidents that often prove fatal. Of all parts of an electrical installation, the switchboard is at once the most exposed and the most respected. Everybody about a high-pressure station is well aware of the hidden dangers of the switchboard—hidden, because electricity offers no indication of its presence. Elaborate safeguards are prescribed, to be observed before any person is given access to the cells containing the switchgear—yet, in spite of the best intentions, sometimes the most obvious and elementary precautions are omitted, with disastrous results.

There is clearly a great want for a really effective and reliable indicator of the fact that an electric conductor is alive. Various devices have been put forward for this purpose, but apparently they do not adequately meet the case—otherwise they would surely be used. Unfortunately, however, very many of the accidents are to be ascribed to carelessness on the part of the person—often highly competent and experienced—who becomes the victim of the accident, and thus pays for his own slackness.

It will be noticed that the number of accidents has appreciably, though but slightly, increased, and in view of the continuous expansion of the electrical industry in all directions, this is not surprising; it is, however, gratifying to observe, from curves given by Mr. Ram, that while the use of electricity for motive power in factories has steadily increased during the last 10 years, the number of accidents occurring annually has been almost at a standstill since 1907—the year in which the draft regulations of the Home Office were issued. Until then they were increasing at the same rate as the use of electricity, and if there had been no check, they would now have numbered twice as many as they did last year. This is a result upon which the Home Office, and Mr. Ram himself, may well be congratulated.

As usual, a considerable number of accidents were due to the use of defective hand lamps and other portable apparatus not efficiently earthed, two of them being fatal at 250 volts D.C. and 220 volts A.C. respectively.

The impossibility of providing against all conceivable eventualities is well illustrated by a fatality which occurred in connection with a dock crane. The trolley wires were enclosed in a conduit with a longitudinal slot, and were apparently inaccessible; yet a man who had dropped something into the conduit put his hand through the slot and touched the conductors.

We regret to note that in many cases compliance with the Home Office Regulations is still avoided, sometimes deliberately and with full knowledge of the fact. Fuses of dangerous types are being installed, even in new work. In some instances fittings, such as portable hand lamps, though described as "of Home Office pattern," and honestly intended to comply with the Regulations, have been found to be radically defective through the ignorance of the designer; indeed, some of the examples described by the Inspector are amazing in their absolute neglect of the most elementary precautions against accident. Many of these instances are presumably due to incompetence in the drawing office; draughtsmen are notoriously underpaid, and many of them are devoid of practical experience, not only in the use of the apparatus they design, but even in the workshop. It is not their fault, and we do not blame them, but their employers. Electrical apparatus ought to be designed by competent men, and no design should leave the drawing office until it has been rigidly scrutinised and passed by an experienced electrical engineer—not merely by a mechanical draughtsman, who may have no acquaintance with the conditions under which the apparatus will be used. But even in the case of important plant—such as high-pressure switchgear—serious defects are reported; for example, on a large main switchboard designed by a firm of consulting engineers, the "isolating" switches were found to be not between the oil switches and the bus-bars, but on the other side of the oil switches. Surely this is the limit.

But, while Mr. Ram necessarily deals mainly with the faults which he has discovered, it is consoling to note his remark that there is an increasing number of examples of excellent work in electrical works and factories, and the general standard is much better than it was a few years ago. While we can never expect to see bad work and carelessness wholly abolished, there is clear evidence of a great improvement on the whole, and we hope to see the accident curve not merely horizontal, but actually trending downwards, whilst the output curve becomes even steeper.

THE RULE OF LAW.

In many of the text-books on Constitutional Law appears the statement that England's claim to greatness is founded upon the respect of her people for the law, If this is a true saying—and we have no reason to doubt that it is—the present state of affairs in the industrial world must cause people to look forward to the future with grave misgiving. We appear to be abandoning those principles of government by which in the Empire beyond the seas a handful of Englishmen is able to govern millions of less civilised races. We once heard Lord Curzon of Kedleston, with the honours of his Viceroyalty fresh upon him, say that ours was not a military rule in India; it was not the English legions which won the respect and admiration of the native population. "It is," he added, "the administration of even-handed justice according to the best traditions of English law."

It is, indeed, by a sober and temperate, yet unflinching, application of English principles of justice that the native is to be controlled. Have we reached such a pitch of excellence nearer home that we can afford to "draw off the watch dog" whose duty it is to preserve public peace and order?

A curious state of things has been revealed in the papers during the last few weeks. In one column one reads of a gross and deliberate outrage perpetrated by a band of lusty strikers upon a weak and defenceless old man. In another, one learns that the Home Secretary—who is the ostensible custodian of public order—has made the following statement in the House of Commons:—"No circumstances have arisen which render it necessary to call out the military." What new form of justice is it that is to be administered or not, according to the degree of interference with the liberty of the subject which has taken place? If 20 men have their heads broken; if 30 dockers are prevented from pursuing their lawful avocation; if 50 women and children are starving to death—prove the attainment of any one of these standards, and we shall set the law in motion, but not before!

Moreover, in considering the amount of harm which is being done, the assaults or other overt acts of a violent picket are but a superficial indication of what is really taking place. The fear of being intimidated is, of itself, an influence well calculated to make a man keep away from his work. Addressing a deputation which recently waited upon him, Mr. Asquith pointed out that there was nowadays less violence in trade disputes than there was 20 years ago. Mr. Baird, to whom the observation was addressed, said: "I think the probable reason is that those who are anxious and willing to work are so intimidated nowadays that they will not move at all."

In what sense, then, has the rule of law been ruthlessly abandoned? Let us glance at the evolution of the law as affecting trade combinations since 1800. In that year it was declared by the Combination Act that every combination for obtaining an advance in wages or altering the hours of work, or decreasing the amount of work, or preventing any person employing whomsoever he might think fit to employ, or for preventing workmen hiring themselves, of attempting to induce workmen to leave their work, was illegal; and not only illegal, but punishable criminally. In 1824 the criminal liability of combination in advancing or fixing the rates of wages was removed. In 1859 peaceful persuasion to induce workmen to abstain from working in order to raise their wages was, for the first time, declared lawful. So much for criminal liability. As regards civil liability, in the reign of Henry VIII Trade Unions were declared unlawful, as being in restraint of trade. Not only are Trade Unions lawful bodies at the present day, but they are above the law, in the sense that they are not to be made responsible for torts which may be committed or instigated by them. And picketing has been declared to be legal by Act of Parliament.

The most melancholy aspect of the present situation is that the Government stoutly refuses to interfere even in a matter where interference would be at once warranted and effective.

There are two kinds of intimidation, open and secret. A man may be made miserable at his work and in his home, although no overt act can be proved against his persecutors. The open act of oppression can be prevented by methods which are swift and sure; but which of us can suggest a remedy for that petty tyranny and spite which can reduce a man to the depths of misery. In refusing that measure of relief which they can afford, the powers that be appear to have forgotten the lines of Dr. Johnson when he wrote:—

> How small of all that human hearts endure,
> That part which laws or Kings can cause or cure!
> Still to ourselves in every place consigned,
> Our own felicity we make or find.
> With secret course, which no loud storms annoy,
> Glides the smooth current of domestic joy.

Mr. Asquith is prepared to admit the existence of such forms of intimidation. In his address to the deputation he said: "Do not let it be supposed that, if you have people who are disposed to practise intimidation, by penalising one particular form of it you get rid of other forms of it. Intimidation is a very subtle thing, and may be exercised in many different ways. And although anything in the nature of violence and hustling is comparatively easily detected and easily dealt with, there are, as we all know, other methods by which people who are evilly enough disposed, can coerce the free will of their neighbours and their fellow employés."

If one were to judge by the results of another form of Government interference—viz., so-called conciliation between masters and men during recent years, it must be confessed that such interference is not very satisfactory. The number of strikes has not diminished. The arrogance of the demands made by labour has also increased; and there is no evidence—indeed, the evidence is all the other way—that the award of a Government arbitrator makes for lasting peace.

The mediator appointed by Government is by a natural tendency the apostle of compromise. Now compromise involves the proposition that each party gives and takes something. Consequently, if there is a strike, and the strikers are content to submit the matters in dispute to the mediation of a Government official, they gain something, even if they do not gain all. In the result they are encouraged to strike again, until the whole of their demands are conceded.

It is not surprising that, in the disheartenment created by all these trade disputes, employers should sigh for the good old days when every man was free to dispose of his capital or labour as he willed. We are convinced that whether the time is near or distant, those days will come again, and the working classes, having been taught in the stern school of experience, will ultimately find that there is little to be gained by strikes and continual disputes with their employers.

Fixing Machinery.

It is a quite common clause in a contract for a machine maker to contract to fix his machinery upon foundations to be provided. Such foundations are now usually in the form of a concrete block, in which are embedded certain vertical boxes of light wood, into which the holding-down bolts are fixed by being grouted up with cement mortar. If a machine supplier engages to "fix," ought this word "fix" to include the whole of the operation of fixing, including the supply and running of the cement grout?

Some contractors say that the grouting is part of the supplying of the foundation. If this construction be allowed, then the fixing of a machine means nothing more than levelling it on a bed by means of wedges, its holding-down bolts simply hanging loose in the bolt sockets. But does not the word "fix" mean to render immovable? and how can the machine be immovable if the bolts are hanging loose? And is not a holding-down bolt a part of the machine? Holding-down bolts are always furnished by the machine or engine builder, and he is, therefore, bound to fix such bolts.

Some engineers say that on no account would they allow their machines to be grouted except by themselves, and this seems to be a proper attitude. Again, if machines are to be grouted at the cost of the client, the machine builder is not responsible for failure if the grouting is badly carried out. It appears to be a correct view to take, to demand that the machine builder shall certainly grout up his own bolts. One would also think that he should construct foundations, for he might fall back on a "bad foundation" to cover a failure of his machine, especially if the foundation did not agree exactly with the drawing he had supplied.

Since there is, perhaps, liable to be a divergence of opinion, would it not be well that engineers should more particularly define the limits between two separate contractors? Thus, a foundation might be specified to be provided not more than $1/n$ of an inch low, and with bolt holes to template to be provided by machine builder, and the machine builder to be called on to fix and grout, or otherwise properly bed his machine, and be responsible for bolt fixing also.

It is not always that the demarcation word admits of such a clear definition as the word "fix" seems to do, and it is thus the more necessary to insert a special clause that shall define without risk of ambiguity where responsibility ends and begins.

Years ago, before machine beds were so easily fixed and bedded on wedges and grout, the fixing of a machine was a bit of careful work which required time. Using planks as levers, the bed was rubbed to and fro on the ashlar masonry of millstone grit of which all beds were built. The blackened stone was dressed down, and a second rubbing was done, the bed being tested at every operation, and the stone dressed away until finally the bed was level, and the stone surface fairly well blackened all over, showing good contact and support. No grout or packing was used; the cast-iron was direct upon the grit. All bolt fixing was done by the machine builder, and there is this precedent to show that fixing always has included the bolts.

THE I.M.E.A. CONVENTION, 1912.

(Concluded from Vol. 70, page 1037.)

The Trading Departments and Rate Relief.

We are very glad to see this most important subject taken up by Mr. Pearce, in whose great city of Manchester the matter is just now a very live consideration.

Mr. Pearce considers with great care the arguments put forward by those who desire to annex profits in relief of rates. Of course he deals with the subject mainly from the point of view of the electricity supply department. The use of tramcars being optional, and their income being derived partly from visitors, it may be fairly argued that some of their profits should go to the community in this direct manner. This is further rendered desirable by the fact that the debt charges on road widening expenditure, due to the tramways, are borne by the rates.

The chief argument of the profit-takers is that the credit of the ratepayers is pledged; they have to take the risk and should, therefore, take the money earned. Mr. Pearce rightly points out, however, that this money should be considered as the underwriters' premium, and should not be spent, but invested so as to reduce the risk. Thus, if there is any profit it should be kept by the department, and if there is no profit—why, then there is nothing for distribution. Of course, if the undertaking has, in previous years, been assisted financially out of the rates, the money so received should be paid back as soon as possible.

Mr. Pearce next goes on to say that, as local authorities raise money at rates some 1¼ per cent. better than do companies, this advantage might fairly be handed over to the rates. We do not greatly object to this, though it is really "fortune of war," and we think the money would be better employed by being kept in the business.

The argument as to the use of highways for distributing mains holds very little water. The undertaking is itself a ratepayer of no mean order, and is entitled to this privilege.

The next argument is that absence of profit-making leads to mismanagement. We have little patience with so absurd a statement. It convicts itself the moment it is uttered. We know that it is the custom to jeer at officialdom, whether municipal or civil; but it would be false to say that, because the Navy, the Army, the Civil Service (with the exception of the Post Office), the police, the highways department, the cleansing department, the education committee, and many other departments of the State or town are not profit-earning, but money-spending departments—that for this reason they are mismanaged. Yet this is the logical conclusion of the "argument." The fact is that officials, as a whole, earn all the money they get, and the outcry against them is largely due to envy and misrepresentation.

Mr. Pearce thinks it seems impossible to justify charging consumers with more than—

(*a*) Production, distribution, and management costs.

(*b*) Debt redemption charges, supplementing these where necessary to make them equivalent to true depreciation.

(*c*) Interest charges.

(*d*) Underwriting charges (relief of rates) at 1 to 1¼ per cent.

We think this is not unfair, though, as we said above, item (*d*) would be better if merged in item (*b*).

In general Scotch law, the rates may not be relieved by trading profits, and in the Potteries Federation Act this provision was imposed by Parliament.

Next Mr. Pearce says it is a point of contention whether relief should be calculated on the total capital or on the outstanding debt; he himself comes to the conclusion that the latter is the correct basis. This outstanding debt is the total risk, and even this is only true if the assets are assumed to be valueless.

While we agree that municipal electric and gas supplies are not fit subjects for any beyond the slightest taxation, we do not think it is true that "there is no justification for indirect taxation upon one part of the community as a means of affording relief to the direct rating of the whole community. This is done every day in Imperial taxation, and we suppose that is justification enough.

Quoting from both the *Municipal Journal* and the *Accountant*, Mr. Pearce points out that if money is taken from the rates, this delays Imperial contributions, and he goes on to say that Mr. Haward, Comptroller to the L.C.C., estimates the claim of the local authorities against the Imperial exchequer for services which are national in character at £7,500,000 per annum. Of course, all this money has to come from the pockets of the community as a whole, and theoretically it makes little difference whence it comes; but it must not, any part of it, be obtained by robbing the electricity supply departments. If the Government paid more it would tend to centralise local administration; and while we think that in many ways this would be an advantage, yet there is no doubt that fierce opposition would be aroused.

The great thing to do, in order to safeguard the ratepayers completely, is to see that the outstanding debt is less than the value of the assets. This does away with all risk, and all justification for payment of money in relief of rates is thus removed. Mr. Pearce rightly emphasises the indirect benefits gained by low charges for electricity in attracting new industries and retaining old ones, besides the lessening of the smoke evil. Those are the advantages of cheap electricity, and they cannot be estimated at so many pence in the £.

In a recent article on Mr. Wilkinson's presidential address, we said that the only reference made, in any of the papers this year, to meters, was in Mr. Pearce's paper. He thinks it an advantage that services, meters, instruments, tools, spare parts, &c., should be bought out of revenue, and where the finances of the undertaking allow of it, there is much to be said in favour of this course. The policy of the L.G.B. is to grant meter loans for five years, thus making it better to buy at once out of revenue. This period is rather short, for good meters will last quite 10 years; but meters are nearly always neglected, and good meter men are scarce. An engineer has no right to expect good meters at the prices which have prevailed in recent years. "I buy a meter for about sixteen shillings, it lasts for two years, and I scrap it. That is economy." So the fallacious argument goes. It is forgotten that during the whole of its life such a meter is getting worse and worse, and losing revenue—the life-blood of the undertaking. This is, as we have pointed out, perhaps the most important of all the directions in which economy can be pursued with the certainty of an immediate and ample return on the expenditure of time and money incurred. It is easy to lump together all the missing units under the heading "unaccounted for," but how many of those units represent a loss of two or three pence each?

The whole subject is full of interest, and we hope that in the future the economic questions attaching to the profession will be more prominent at these conventions than they have been in the past. It is often the case, however, that the expression of any decided views on the part of an engineer attracts hostile notice from members of his town council. As the engineer is probably far better able to think upon the subject than the majority of the councillors of to-day, this fact, besides being cruel and unjust to the engineer, is of grave disadvantage to the community.

The Limitation of Rate Relief from Trading Profits.

By S. L. Pearce, Chief Electrical Engineer, Manchester Corporation.

(*Abstract.*)

The object of this paper is to emphasise the need which exists for a definite pronouncement from Parliament as to the extent to which local authorities should be permitted to relieve the rates from the profits of their trading departments.

First and most important of the arguments usually advanced in advocacy of rate-relief is that the credit of the ratepayers being pledged for the trading undertakings, the ratepayers are in the position of underwriters and as such, bearing the risk of any losses that may be made by those undertakings, they are entitled to some return for their services.

But experience has shown that the risks of losses on well-established supply undertakings are slight.

In any case it is surely absurd to spend the premium which, if the underwriting risk be a real one, ought to be set aside to meet the loss. It will not be seriously contested that the proper safeguards to employ to conserve the ratepayers' interests should be more adequate reserve funds in addition to the statutory sinking funds. But under existing methods the ratepayers of to-day are consuming what ought to be available for ratepayers of perhaps 10 or 20 years hence. The risk, such as it is, would largely fall on the next generation, and as they cannot receive present profits, the only way to help them is to prevent the risk occurring by providing adequate reserve and renewals funds.

The author admits that when an undertaking in the first few years of its existence has made losses, which have fallen on the rates, those losses should be liquidated as and when profits are available in addition to such reasonable annual return as may be made to the ratepayers.

Seeing, however, that local authorities undoubtedly raise money more cheaply than companies do, it may be asked is there any valid reason why the extent of advantage measured by credit should not be accepted as the full measure of rate-relief. Turning to a neutral source, we find that the *Accountant* puts the balance of advantage in favour of the local authority raising money, as compared with companies formed to furnish the supplies now under review, at about $1\frac{1}{4}$ per cent. per annum.

Next, and of much less importance, are the arguments that trading departments enjoy the almost unrestricted use of the highways for distributing mains.

Against these may be put the fact that the main object of municipal trading is the general convenience of the public.

A further argument used is that absence of profit-making leads to mismanagement.

It is difficult to follow the reasoning on which this argument is based. Competition for those supplies with which we in this Association are concerned, viz., light and power, is, and must necessarily be, keen, which in itself is an incentive to economy.

The final argument used is that it is undesirable for any community to use its credit to cheapen those commodities which come within the sphere of municipal trading.

Where the rate-relief from trading equals the percentage already suggested, this argument may be dismissed.

As previously shown, if the total charges for loan interest and ratepayers' underwriting premium equal the charges which would have to be met by private enterprise, then municipal and private trading are on the same economic footing.

As a fair market price it seems impossible to justify charging consumers with more than the following, the total of which would probably equal, if not exceed, the price which would satisfy joint-stock companies working under leases from local authorities.

(*a*) Production, distribution and management costs.

(*b*) Debt redemption charges, supplementing these where necessary to make them equivalent to true depreciation.

(*c*) Interest charges.

(*d*) Underwriting charges (relief of rates) at 1 to $1\frac{1}{4}$ per cent.

Presumably the keenest advocates of rate-relief would not urge that consumers should be worse off under municipal than under private trading.

If this were the case, municipalities would certainly be unable to resist the encroachments of the large power companies, as they have had to do from time to time.

The recent declarations of Parliament are of great interest, and as the decisions of the two Houses are opposed to what may be termed the prevailing practice, they afford some hope that the permissive powers conferred upon local authorities by Sec. 7 of the Electric Lighting (Clauses) Act, 1899, may at no very distant date be reviewed and a statutory limitation of profits be imposed.

In the case of the Salford Corporation Bill of 1909, the House of Lords' Committee proposed to limit the application of gas profits for rate relief to 1 per cent. on the outstanding mortgage debt. The Bill was withdrawn, and now the outside districts have agreed, subject to the approval of the L.G.B., that the profits to be used for rate-relief should be limited to £10,000 per annum, instead of between £5,000 and £6,000 under the House of Lords' decision, and instead of £20,000 as claimed by Salford.

The next example is that of the Glasgow Bill before the House of Commons' Committee at a later date, when the Committee refused to recognise the right and prohibited any profit being applied to rate-relief, thus keeping in line with the general Scotch law regarding gas and other undertakings.

A further example, and one possibly more important still, as indicating the L.G.B.'s present attitude, is the Potteries Federation Act, under which no trading profits are to be devoted to rate-relief.

As far as the assets of any form of municipal enterprise are concerned, clearly the ratepayers' risk, whatever it may be, can only apply to the portion as yet unliquidated by the operations of the sinking fund, and the measure of benefit to be returned must be determined on the basis of the outstanding mortgage debt.

Economists in general do not regard municipal electric and gas supplies as fit subjects for any beyond the slightest taxation. Obviously there is no justification for indirect taxation upon one part of the community as a means of affording relief to the direct rating of the whole community.

Both the *Municipal Journal* and *The Accountant* observe:—

"Corporations which insist upon reducing rates out of profits prevent the focusing of public attention upon the rapidly rising general rates and to the extent to which this is done Imperial contributions are withheld and the reform of local taxation delayed."

It is worth asking what is the main force compelling local authorities to take up this attitude towards municipal trading.

Apparently the answer is to be found in the necessity for meeting the cost of ever-increasing duties imposed on them by Parliament without a corresponding increase of Imperial contributions.

The results of establishing a rational system of rate-aid would clearly be far-reaching.

Trading Committees would be relieved from the present haphazard control which is regulated by local exigencies and considerations external to the real question. They would further be under little temptation to neglect the provision of proper reserve and renewals funds, and for which neglect the author considers the present practices are largely accountable.

The author would here emphasise the invaluable, though indirect, benefits afforded to the ratepayers and citizens generally by a progressive policy of catering for power loads at low rates, consistent with the financial stability of the undertakings.

If large grants in aid are to be made in the future it will be practically impossible for local authorities to supply current for power purposes at prices which will command business, in which event the case for the municipality when threatened by power company legislation is thereby so much the more weakened.

Digressing for a moment, it is worth noting that in not a few local authorities are to be found those who, in addition to advocating substantial rate-aid, urge that the proper policy is not only to render their undertaking free from all debt in the first cycle of the working "life" of the undertaking, but also to provide moneys so as to present their successors with entirely new assets to begin another cycle.

As Parliament has intimated its preparedness to grant reborrowings for assets when worn out, there is surely no need to handicap the present development of electricity undertakings for the financial benefit of posterity.

What, however, is not equitable on the large scale may be welcomed in a small way. It is all a matter of degree. On this score, then, the action of the Local Government Board in recent years in advocating or compelling the purchase of services, meters, instruments, tools, spare parts, &c., out of revenue, instead of raising loan moneys therefor, may be welcomed. The author considers this is in the direct interests of supply undertakings, and in the absence of other checks helps to prevent the undue burdening of trading departments for rate aid.

Returning to the author's main theme, he endorses the suggestion made in various quarters that the matter is worthy of consideration at the hands of a Royal Commission. Alternatively he would ask why should not the Government refer it to the Special Committee now deliberating upon the Relation and Incidence of Imperial and Local Taxation.

As the question is one vitally affecting the development of the electrical industry, the author trusts that both the I.M.E.A. and I.E.E. will take up the idea.

Ald. Bruce (Sunderland), while agreeing as to the policy of reducing the price to the consumer before subsidising the rates from the surplus profits, did not agree that Parliament should limit in any way rate contributions. In his opinion Parliament already dominated the profits made by municipalities, and if further legislative restrictions were introduced, there would be little control left at all to the municipality. He disputed the version of the Salford gas settlement given in the paper, which was finally arranged by mutual agreement, and argued that the present L.G.B. regulations safeguarded future generations, who would unquestionably be much better off than the present one. When an undertaking found itself with a large surplus it should revise its tariff and ensure that it did not occur a second year. In conclusion, he urged that the electrical engineer and his committee were competent to influence the Council, without Parliamentry control.

Bailie Smith (Glasgow), after pointing out the difference between tramway and gas or electricity undertakings, said in the latter case the tariff should be fixed from the balance of the previous year's working. If prices were inflated to produce rate contributions, it would in effect penalise the electricity users as compared with the less enterprising ratepayer who stuck to his smoky chimneys.

Bailie Stevenson (Edinburgh), in an admirable speech, said he was altogether opposed to the policy of relieving the general ratepayer at the expense of the electricity consumer. In Edinburgh during the last eight years, the electricity department had contributed £49,000 to the relief of the rates, which it had been repeatedly urged should be placed to reserve. But the temptation to the Council to appropriate it had always been too strong, and as long as the option existed, the policy of appropration would continue. This was unfair to the electrical undertaking, particularly because the Edinburgh and Leith gas undertaking had no power to subsidise the rates, and thus were able to compete unfairly. The Edinburgh reserve fund was up to the statutory limit of 10 per cent., but it was desired to provide a depreciation fund in addition to meet possible obsolescence—a policy which Ald. Bruce had criticised. In regard to the question of tariffs, they in Edinburgh had estimated for a surplus of only £400 on a revenue of nearly £140,000, on the principle of the prayer "lead us not into temptation, &c.," the temptation, of course, being the surplus, which it was always desired to acquire for the rates. He thought there should be unanimity in asking Parliament to take that temptation away, even if the limit were not fixed.

Mr. A. E. Seaton, who posed as a Manchester ratepayer of some years' standing, jocularly drew attention to the peculiarities of civic promises in October, from all of which he gathered that the race of Ananias was not yet extinct.

Ald. Smith (Liverpool) urged the broader view of responsibility to the municipality; the latter had a right to deal with its own funds in its own way. The ratepayer had a right to the surplus as a guarantor, who would be called on in case some catastrophe happened to the undertaking.

Councillor Leese (Stoke-on-Trent) agreed with the author that a limit should be set to rate appropriation; the reference to the position in the Federation Act was, however, rather misleading.

Mr. Campbell, Brighton, suggested that it might be of more benefit to the community at large to reduce the price of electrical energy than to reduce the rates by a small amount. Parliament should be allowed to step in to safeguard the consumer, because the Corporation was in the position of a monopolist in electricity supply, and could adopt the same methods as a private monopoly.

Bailie Willock (Glasgow) also agreed that the best policy was to reduce the price of electricity rather than contribute to general rate aid.

Mr. S. L. Pearce, in replying, said he was surprised that Parliamentary action should be deprecated. He didn't agree that the Council had a right to take, say, 4 or 5 per cent. or that it should receive nothing; he suggested a middle course. The Parliamentary safeguard was wanted because electricity committees were absolutely powerless to sway the councils. The tendency of legislation was in the direction of restricting rate aid from profits, and he urged the absolute necessity of supplementing sinking fund contributions from a reserve fund where assets would not last their stated life.

Organisation in Electrical Undertakings.

A paper on this subject was contributed by Mr. C. M. Shaw, chief electrical engineer, Worcester, who takes the case of what is apparently a very large undertaking, and outlines by the aid of a skeleton chart the sub-division of duties among the staff. He urges that, subject to the Electricity Committee, the chief engineer should be responsible for the entire control of the undertaking, through the various departmental heads.

The first division is into engineering, clerical and commercial departments; the former covers all engineering work proper, the duties being divided under electrical, steam and mechanical engineers, distributing assistant (sub-station), mains engineer, testing (under chief assistant), chief draughtsman and chief inspector of street lighting, with further sub-division under each of them.

Mr. Shaw also adds a load dispatcher to be responsible for the control of current between the generating station and the consumer. Under the clerical department, the duties are principally divided between a private secretary, chief works clerk, accountant and their assistants.

The commercial department devotes itself to sales and publicity work, with a manager, under whom are advisory experts for the different classes of work undertaken, "business-getters," a correspondence department, showroom and construction department. The author outlines the duties of the various departments, and refers to the apparently harmonious co-operation of the central station and contractor in America, even though the former run wiring departments and sell consuming apparatus.

He points out, however, that the wiring departments confine themselves to large work or work which the contractor neglects, such as the smallest consumers and maintenance work.

We may mention that the relations between the central station and contractor in the States were discussed in connection with the report on residence business at the recent annual convention of the National Electric Light Association, and that it was agreed to appoint a committee to devise means of co-operation with contractors, architects, manufacturers, &c., a proceeding which somewhat qualifies Mr. Shaw's statement.

Mr. C. E. C. Shawfield (Wolverhampton), who opened this discussion, suggested that the author had evidently prepared for one of the national power houses mentioned in the presidential address, judging by his genealogical tree—at any rate, it was a station larger than he knew of, and was generally outside the scope of the average electricity undertaking in this country. The speaker then outlined a system applicable to the average sized plant, dividing the work up under generation, distribution and accountancy. Under the first heading, there would be responsible heads of the boiler house, engine room and for maintenance, while under distribution would be included responsibility for the current from the station to the consumer. This section of the work would cover publicity, mains work and current consuming devices, but more particularly the latter. As regards accountancy, it was absolutely essential that the engineer should be responsible for the allocation of expenditure, and that the electricity department should have charge of its accounts; the accountant should be the auditor to certify the accuracy of the figures.

Mr. Harry Richardson (Dundee) reminded the author that the object of all organisation was simplification, and the scheme was not, perhaps, so simple as might be. It required a higher order of business ability to run an electricity undertaking than to run a tramway, which was practically a monopoly.

Mr. J. E. Edgcome (Kingston-on-Thames) regretted that so large an undertaking had been dealt with, but its size was not mentioned, although the chart mentioned about a hundred heads of departments. He doubted the wisdom of accepting the lowest tender just because it was the lowest one.

Several Councillor members also took part in the discussion, to which Mr. Shaw briefly replied, pointing out that the paper had been prepared in a short time, and that it was originally intended to include the small station in its scope.

Pressure Regulators.

By S. J. Watson, Chief Electrical Engineer, Bury.

(*Abstract of introductory remarks*).

In discussing the question of pressure regulators, it may be as well to eliminate any reference to automatic regulation which may be incorporated in the design of generating machinery. A compound winding may be termed an automatic regulator, and has been found quite suitable for special cases, but impracticable in its application for general supply purposes. The following remarks will, therefore, have reference to regulators which may be provided as a separate piece of apparatus to the machine or machines which are to be regulated.

It may be noted, in passing, that close regulation on a generator, however provided, has a certain market price. Such being the case, it appears not unlikely that, as automatic regulating devices become still further improved and adopted as standard practice, designers may be allowed to attach less importance to regulation, and by so doing, improve the design in other directions, and at the same time effect an economy in materials and in cost.

Automatic regulators have been designed principally with the object of maintaining a constant pressure on the bus-bars at the generating station, or sub-station, or even to produce a compounding effect, so that the bus-bar pressure may be automatically varied to suit the load. They may also be used to maintain a constant speed on direct-current motors, which have to deal with large and frequent fluctuations of load. There exists, however, a much wider field for the application of such appliances. For instance, it is usual to connect up all feeders to a common bus-bar, but feeders are usually of different length, and adjustment of the pressure on each individual feeder may be necessary, owing to variations in the locality of the load, or to changes in the power-factor, during different periods of the 24 hours. The ideal place for the regulator would be the consumer's premises, or even on each large consuming device connected to the system, as, however constant the pressure may be maintained at the bus-bars, or at the feeder points, a certain amount of disturbance to the pressure will occur on the distributing system, through the switching on and off of large individual appliances.

It is, perhaps, well to bear in mind the fact that, although voltage regulation is of the greatest importance in its relation to a direct-current supply, both for lighting and power, and also for alternating-current lighting, the development during the past ten years of alternating-current motors for power purposes necessitates a constant motor speed for many industries, and this can only be obtained by maintaining a constant speed on the prime movers. Where the fluctuations of load are large, it may be necessary to apply the principle of the pressure regulator to the governor of the engine or turbine, so as to ensure, not only a constant voltage for lighting, but also an absolutely constant frequency for power.

Probably the best regulator for a direct-current supply system is a storage battery of large capacity, with an automatic booster or regulating switch controlled by the bus-bar pressure. In addition to acting as a regulator, the battery would be found exceedingly useful at the time of a breakdown or other emergency.

The principal requirement of an automatic regulating device is, of course, that it should be, at all times, and under all conditions, completely automatic in its action. Unfortunately, few automatic devices are free from trouble in this direction.

The majority of the instruments used for the purpose of controlling the pressure of supply, consist, either of a movable iron core, inserted in a shunt coil, or of a movable shunt coil, which can rotate between the poles of a permanent magnet. The shunt coils in both cases being excited from the bus-bars. If the bus-bar pressure falls, the movement of the core or the shunt coil is in one direction, and if the bus-bar pressure rises, the movement is in the other direction.

With ordinary changes of pressure the movement produced, and the power exerted, is quite small; it is, therefore, necessary to magnify the movement or to use relays, in order to obtain a sufficient range of regulation, and the mechanical power required to operate an auxiliary regulating device.

By means of the auxiliary device, which may consist of a small motor or solenoids, regulation is obtained by: (1) Moving the switch which varies the resistance in circuit with the field-winding of the generator; (2) varying the field of a small, separate, exciter supplying the field of the generator; or (3) diverting more or less of the field current of the generator.

When a number of generators are run in parallel, a regulator may be used, controlling them all, in which case any variation in load is distributed equally over all the plant, or with one generator only, which will then deal with the fluctuations and allow the other plant to run at constant load.

Regulators are usually provided with hand adjustment to enable the bus-bar pressure to be varied, when necessary, to suit the load conditions.

Quickness of operation and closeness of control must always be special features in automatic regulating devices, particularly when a mixed system is supplied from a common bus-bar; but for lighting purposes only extreme sensitiveness in the instrument is not so essential. A variation in pressure of 1½ per cent. up or down over a period, say, of 20 seconds, would in such a case, give almost as good results in practice as absolutely instantaneous operation, but where lighting is supplied for general purposes from a power main dealing with a large and fluctuating load, or from a railway supply, a similar regulator would be almost useless.

It is difficult to express the value between a system where the pressure regulation is good and where it is bad: but that it must have a very real value from the user's point of view, is undoubted.

Mr. Frank Ayton (Ipswich) commented on the necessity of automatic regulation where both power and lighting were supplied from the same mains. The introduction of some large motors at Ipswich had led him to investigate the matter, and after inspecting the excellent working of the Taylor-Scotson apparatus at Sunderland, he had decided to install two similar regulators, one between the outers and the other in the middle wire where the worst out-of-balance occurred.

Mr. H. M. Taylor (Middlesbrough) spoke at length on the subject of automatic regulation, pointing out that the great trouble in D.C. supply was voltage variation in the feeders, not in the bus-bars, and that, no doubt, a similar state of things would occur with A.C. feeders as they got loaded up. He described in detail the method of using regulators in Middlesbrough for keeping a constant pressure at any desired feeding point. On most D.C. systems the out-of-balance variation was more serious than the voltage variation in the outers, and this called for the use of a series booster in the neutral. Simultaneous regulation of all generators should be provided, and the regulating apparatus should be applicable to any kind of plant. Mr. Ayton's arrangement provided for regulating the neutral at a different point to the outers, and a pilot board should be used to allow for regulating any required point.

Mr. A. H. Watson (B.T.-H. Co.) described at length the Tirrill regulator; he thought the Thury device was admittedly slow in action, and that the Brown-Boveri apparatus was an improvement on the rheostat arrangement. The checking action of the Tirrill regulator was, he thought, preferable to the pendulum control adopted in the Taylor device, and it seemed that the failure of the latter would upset the excitation unless the booster were hand regulated by the central zero voltmeter. It was a coincidence that one of the first stations to use a Tirrill regulator was Harrogate, but generally it was surprising that automatic regulation was not more often adopted by electric lighting stations.

Mr. C. E. C. Shawfield (Wolverhampton) described how the synchronism of rolling-mill loads in his undertaking sometimes gave 50 to 75 per cent. overloads on the running plant and made automatic regulation imperative. He had used the Tirrill regulator for some time, and its defect was that, without warning, the regulating contacts would remain either in the open or closed position, sending up the bus-bar pressure to, say, 7,000 volts, with damage to lamps, or dropping it to, say, 3,000 volts, which meant practically a shut down. Careful attention would not prevent this occurring, and an abnormal peak was certain to bring it on. As a result of this, he had installed a Brown-Boveri regulator, and found that, while it controlled within 1½ per cent. (as compared with under 1 per cent. in the case of the Tirrill) it was was quite reliable and free from the defects of the latter.

Mr. J. E. Edgcome (Kingston-on-Thames) mentioned the excellent regulation obtained at Kingston, where a large motor had upset the 2,000-volt supply during the day, and the Tirrill regulator had been introduced to take care of this. He was now faced with a more difficult problem of providing a regulator which would deal satisfactorily with the load when two direct driven exciters were installed to run in parallel with three steam driven exciters. He thought both nickel and silver contacts were employed in the Tirrill contacts which had not given much trouble.

Mr. A. H. Watson here said that silver relay contracts were usually supplied, but they were not so satisfactory on low voltage exciters as platinum contacts, and Mr. Shawfield added that he had used both silver and platinum alloy contacts and found only slight improvement with the latter.

Mr. A. J. Beckett (Bridlington) mentioned the effect of the illumination load (20 per cent. of the total) which came on in the evening at his town, and had been met by installing a Tirrill regulator; he was also installing a C.M.B. balancer to deal with the balance in the town.

Mr. W. J. Bache (Cheltenham) mentioned having installed a Taylor-Scotson regulator, which was necessitated by having recently added a traction supply: he regulated on a feeding point 2,000 yards away.

Mr. C. Turnbull (Tynemouth) said he had considered both the Tirrill and Taylor-Scotson devices, but not being able to afford them had borrowed the design of an arrangement made and used by Mr. Watson, at Bury, and having copied this for himself, found it quite satisfactory in use, although not so good as the previously-mentioned devices. Electric cooking would not be satisfactory on a three-wire system on account of pressure variation, even though the feeding point was regulated, and he suggested as a solution distribution from A.C. sub-stations equipped with automatic regulators.

Mr. A. C. Cramb (Croydon) agreed that so long as the Tirrill apparatus was not subjected to severe use it behaved satisfactorily. The Tirrill apparatus, however, had to be added for each machine with increasing expense, while one Taylor-Scotson apparatus would provide for all of them.

Mr. S. J. Watson, in replying, alluded to the necessity of arranging that voltage regulating apparatus should automatically cut itself out of action if anything went wrong.

Baildon Electric Lighting.—The U.D.C. has passed a statutory resolution to apply to the B.O.T. for a prov. order for electricity supply.

COMBINED SWITCH AND PLUG CONNECTORS.

By DONALD SMEATON MUNRO.

The 1911 Wiring Rules of the Institution of Electrical Engineers and the new Home Office Regulations both dwell at some length on the importance of controlling flexible cords by switches at the supply end.

In many towns it has always been the practice to fit a controlling switch for every wall socket, or small group of sockets, and in other districts the precaution has been almost universally ignored.

It is found in practice that the use by the consumer of such separate switches is neglected, very often because they are placed at some little distance from the socket and plug which they control. Even when they are fitted close together, say, on the same block if switch and socket are of raised pattern, or in the same box if they are of sunk flush pattern, the two separate accessories are somewhat clumsy and expensive to fit. Fig. 1 shows a common arrangement, and even when the socket is of the smallest size, the whole fixture with its containing box is large and awkward to fix.

There are now on the mafket several forms of combined switches and sockets. Unfortunately, they are mostly applicable to fitting above the wall or baseboard surface. The requirements of a good switch and socket are difficult to combine in a compact form. The moving parts are not conveniently accessible for repair. Some of these combined patterns are needlessly complicated by arrangements whereby the switch is "off" before the plug can be withdrawn. This quality is, perhaps, desirable in an explosive atmosphere, but for ordinary use it is unnecessary, as even should the switch be left accidentally "on" when the plug is pulled out, the break caused by the prongs is a double-pole one, and the spark is therefore very slight.

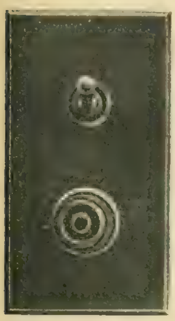


Fig. 1.

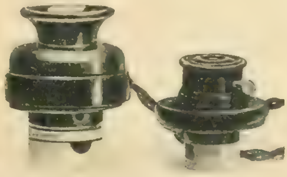


Fig. 2.

In actual use the flexible cord is apt to get broken or pulled out before the user notices that there is a trick about the arrangement. Some forms of combined sockets and switches put an unsafe stress on the contact pins, and are so arranged that the pins enter by the side of the plug instead of the front, so that the plug is liable to fall out and the flexible is apt to be bent sharply at right angles.

There is a further drawback that where ordinary sockets are already fitted switches cannot now be added, to comply with the Insurance and other rules, without changing the whole appliance and probably also injuring the surrounding decorations. These switch sockets are, therefore, but sparingly used.

There are some advantages, the writer considers, in combining the switch with the movable plug instead of with the fixed socket as has hitherto been the practice. Two forms of this arrangement for which patent rights have been applied for are illustrated in fig. 2.

In the larger size a flat pattern tumbler switch is chosen. Instead of having two holes for the hard wires to enter, it carries instead two stout split contact-pins projecting behind, of a size and position to fit any desired make of plug socket.

Grooves for the flexible wires are provided in the base, as is also an axial exit passage, so that the twin or triple flexible may enter and be connected to appropriate terminal sockets. The switch is thereby converted to serve also the purposes of a plug from which the flexible conductors emerge downwards, leaving the switch "dolly" and gear unaltered.

The base of the switch makes an effective hand guard, and a grip for the fingers is formed by fitting a shallow trumpet-shaped piece on the centre screw of the switch, as shown, or the china base or spun cover may be suitably shaped to form a convenient handle.

In places where it is desired to have a very small plug, the miniature piston type of switch as shown is applied, and this is quite neat and effective for single lamp control.

BULK SUFPLY IN DURBAN.

[From our Special Correspondent at Durban.]

Preparations have been in band for some time at the Durban Corporation Electric Power Station for the supply of electric power in bulk to the Government of the Union of South Africa for the railway and harbour requirements in Durban and district, and on Sunday, June 2nd, the change-over was satisfactorily effected.

This means the shutting down of the Government power station, which is only a few years old and was described on page 299 of our issue for August 21st, 1908.

The building now becomes one of the sub-stations at which point the bulk of the supply is taken from three Corporation mains at 6,600 volts three-phase 50 periods.

The cables were supplied by Messrs. Callender's Co., and are of three-core ·1 sq. in., paper-insulated, with copper earth shield, which, after laying and jointing, were tested to 10,000 volts.

At the sub-station there are five Reyrolle standard three-phase switch panels, for controlling the various incoming and outgoing cables; the outgoing cables are two in number and they were laid by the Government at the time the plant was put in; these also are ·1 sq. in. three-core, and are for supplying power for the Point and Bluff.

At the Point section, current is taken at 6,600 volts three-phase and also 500 volts D.C., the conversion from three-phase to D.C. being effected by the previously installed 300-KW. La Cour converters, now taken over by the Corporation.

At the Bluff section, current is taken at 6,600 volts three-phase into the Government sub-station as before, but in this case the Government do the converting.

Under the agreement between the Corporation and the Government, the former takes over certain of the plant, for which payment will be made to the extent of about £26,000, while the Corporation itself has entailed an expenditure of about £50,000 for the extension of plant to meet this bulk supply, and also for future requirements in Durban and district. Among manufacturers and other users of machinery, the plant taken over by the Corporation from the Government is as follows:—Two 750-KW. Willans-Parsons turbines, with three-phase 6,600 volts 50 periods Bruce-Peebles generators; two surface condensing plants and circulating pumps; two 300-KW. La Cour converters; and cables between works and Bluff.

The new plant installed by the Corporation is as follows:—Two 2,000-KW. Parsons turbos three-phase 6,600 volts 50 periods; one barometric condenser (Mirrlees-Watson); two B. & W. boilers, 28,000 lb. evaporation, with chain-grate stokers; extension of cooling tower and pumping plant; three-phase switch panels.

The agreement is for 15 years, and the very low price of ¾d. per unit has been fixed upon with a minimum of 2¼ million units per annum, and it may be of interest to mention that this price is far away the lowest rate for bulk supply in South Africa, as will be seen by comparison with the other Government bulk supplies, as follows:—

Durban	·75d.	per unit,	2¼ million	units	minimum
Pietermaritzburg	1·25d.	,,	750,000	,,	,,
Cape Town ...	1·5d.	,,	1¼ million	,,	,,
Port Elizabeth ...	2d.	,,	150,000	,,	,,
East London ...	3d.	,,	125,000	,,	,,

The average day load taken by the Government is about 1,200 KW., and at night 300 KW. This will very materially help to flatten out the peak and tend to more economical running, and now that the Corporation are in a position to meet practically all demands for power, it is expected that other consumers will follow on; in fact, already one brick company is taking three-phase current for two 300-H.P. motors at a distance of five miles from the centre of the town. It might be of interest to mention that this new load will bring the output of units sold from the Corporation power station to nearly 12 million units per annum, and the next municipal year should see this figure reached if not exceeded. Considering that the population of the town is about 34,000 whites and the same number coloured, the average consumption per head of population far exceeds that which obtains in most English towns.

Touching briefly on the financial side of the undertaking, considering the output the capital expenditure of £350,000 cannot be considered excessive.

The cost of production is also a creditable figure for a Colonial town where wages and coal are high, being ·9d. per unit sold, excluding capital charges.

It is hoped later on to give a full account of the extensions at Durban, as since our description of the plant when first laid down in 1900 many additions have been made and plant has been replaced, causing quite a transformation in the power station.

NOTES FROM CANADA.

[From our Special Correspondent.]

An event of importance in the Canadian electrical world is the Convention of the Canadian Electrical Association, which meets this year at Ottawa during the current month. The programme includes the presentation of reports by various sectional committees, visits to places of interest, and a number of papers will be read.

Work is now in progress on a civic hydro-electric plant for the city of Prince Albert, Saskatchewan. The water power available is some 12,000 H.P. under a head of 30 ft. The transmission line voltage is to be 35,000, stepped down to 23,000 in the city. Altogether the scheme will cost nearly a million dollars.

The double tracking of the C.P.R. throughout the British Columbia section is contemplated, the probable cost being about £1,250,000; such an undertaking, it is reported, would not have been thought of for many years to come, but for the fact that the Panama Canal is approaching completion. Activity is also apparent, for the same reason, on other trans-Continental lines.

A Toronto morning paper points out that the financing of the great works in hand, or about to be undertaken, by these railway companies has been rendered much easier owing to the beneficial effects which it is recognised the canal will have on the trade of British Columbia. The following sentence from an editorial in the paper referred to is worth quoting:—"It will be the policy of that Government" (*i.e.*, the Provincial Government of British Columbia) "to keep railway freights low enough to favour British Columbia ports for Western Canada's incoming and outgoing merchandise. British manufactured goods will be shipped to such centres as Regina and Edmonton by way of the Panama Canal and the ports of Vancouver and Prince Rupert. The lower through freight rates will give British manufacturers a new advantage in the competition for the market of Western Canada."

Reference was made recently in these notes to the fact that a deputation from New York State was investigating the operations of the Hydro-Electric Power Commission of Ontario. It is now reported that this Commission may be the pattern for similar public enterprises in the States. The Association of Mayors of the State referred to has endorsed the Ontario policy, and has asked the State Legislature to work on similar lines. The Conservation Commission of Oregon is also considering how to promote a similar undertaking.

The event of the week in Toronto has been the visit of the British manufacturers who arrived in Canada recently. Although the object is to, if possible, enter the Canadian market, thus constituting themselves competitors of the Canadian manufacturers already on the spot, the latter have extended every courtesy to the visitors. Toronto itself gave them a civic welcome, and they were invited to locate factories in the "Queen City," and were also informed that the city would do everything in its power to assist them by supplying any desired information and giving them every facility it could. Everywhere they are being received with open arms.

The visitors, although they have as yet seen only Eastern Canada, are greatly impressed with her resources and the future possibilities of trade. The representatives of some firms have already decided to recommend that a factory or works should be established here, while others are evidently prepared to consider the matter seriously.

In some quarters it would appear that present practice and fashion, which are mainly based on American ideals, militate against the British manufacturer; these factors have to be reckoned with, as the average Canadian is very conservative, and is little or no more inclined to depart from what he has been used to all his life than the average Britisher, who is supposed to have a special reputation of his own on this point.

The repeated strikes in the British labour world are going to be a very serious thing for home firms; already one hears that over here people wonder whether it will be worth while to send an order to Great Britain; they ask themselves when the goods are likely to be delivered should another strike occur. What a pity that the British workman is so blind to this aspect of affairs!

The Hydro-Electric Power Commission of Ontario is still, like a well-known whisky, "forging ahead"; every month fresh applications for power are being made by towns and villages. Starting with 13 municipalities taking power, some 18 months ago, there are now 29 being supplied, and many others anxious to participate in the scheme.

Rules, having for their object the minimising of the life and fire risks connected with electrical work, are now being drafted, and a chief inspector has been appointed to organise inspection work in all the municipalities throughout the province.

The work of this department, if efficiently carried out, should prove a boon in this country where, from an electrical standpoint, life is regarded far too cheaply. One is glad to find, for example, that the Commission has very wide powers in relation to overhead wires, as it can order all such as are considered to be a menace to the public safety to be placed underground. One has only to see the wires in any large town here to realise that the linemen take their lives in their hands whenever they climb a pole; accidents and death to such men are of very frequent occurrence.

The Commission is also going to erect at once a large building to serve as a testing laboratory and stores, for supplies which will be bought in bulk by the Commission and retailed to the municipalities.

Next week a demonstration is to be given for the benefit of the farmers in a certain district, to show them the multiplicity of uses to which electricity may be applied on a farm.

It has been decided to spend £35,000 on electric light and power machinery, and £16,000 on extensions to the distribution system at Saskatoon, Saskatchewan.

The city of Edmonton, Alberta, has recently placed orders for a 2,000-KW. turbo-alternator, a 750-KW. D.C. generator direct-coupled to a steam engine, and a 425-H.P. three-phase motor.

So far as the writer is able to judge at present, the opportunity of the British manufacturer lies in motors of fair size, generators, and switchboards, rather than in accessories, small motors, &c., though there are possibilities even in the latter items. Unfortunately, it is doubtful if home firms will ever be able to enter the field for apparatus, switchgear, &c., for the very high voltages now coming into use on this side of the Atlantic, owing to lack of opportunity of gaining practical experience with pressures of 100,000 volts and upwards.

A field which is likely to develop over here is the use of sub-stations with transformers and the necessary switchgear put out in the open air and merely fenced round to prevent people from getting shocks, thus saving the cost of a building where this is not essential to the satisfactory operation of the sub-station. Several such stations are in operation in the United States at the present time.

512, Continental Life Building, Toronto.

CORRESPONDENCE.

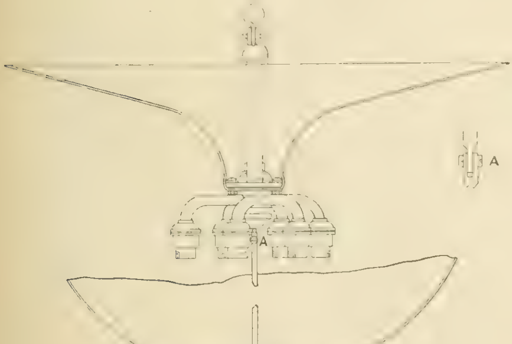
Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Indirect Lighting.

The article and correspondence which have appeared in your issues of June 14th-28th are of considerable interest at present, as this system of lighting is now more widely adopted.

Having been one of the first firms to introduce this system for metal-filament lamps, we venture to suggest that the best type of fitting is one designed to combine a certain proportion of transmittted light with reflected or indirect light.

The quality of the glass in the opalescent shade used in such fittings is of the greatest importance in securing efficiency and adequate diffusion. It must not be too dense, so as to absorb much light, but still dense enough to screen the lamps from view and give a soft, diffused light, without any glare. The disadvantages of the latter have been fully pointed out by "Whistlefield."



When dealing with candle-powers of 300 to 600, as now in demand, it is essential to arrange the lamps in a vertical group of three to six.

In our experience it is impossible to rely on ceilings and walls for efficient reflection in all cases. They can be designed and decorated to give an ideal system of indirect lighting, but in practice they are often of colours which absorb light instead of reflecting it.

By the design adopted in the "Adnil" fittings (shown herewith), the illumination is made largely independent of the ceiling and walls, a large conical reflector of diameter 16 to 21½ in. being permanently used. This acts in conjunction with the opalescent shade referred to, and the required foot-candle illumination can be arranged to be uniform over large spaces with maximum efficiency.

A central indirect light fitting, with lamps screened by an opalescent shade, as used in the Adnil system, is preferred by many on account of its being more sightly in appearance than a metal lower shade, as used by some manufacturers for purely indirect lighting.

The various arrangements proposed by your correspondents are ingenious adaptations of standard material, but do not provide for high candle-power so as to compete with indirect-light arcs, and for such cases would apparently be more costly than special fittings as above.

The "Adnil" fittings have now been installed in many of the largest works in the country, and to suit the most varied requirements of illumination.

Adnil Electric Co., Ltd.,
S. G. Leven, *Manager.*

London, E.C., *July 2nd*, 1912.

Publicity.

We have read with interest the article under the heading "Some Second Thoughts on Publicity," which appears in your issue dated April 26th, and, bearing on this subject, it may interest you to know what has been done in the direction of publicity by the Sydney City Council, at the instigation of Mr. H. R. Forbes-Mackay, the chief electrical engineer, in order to popularise and extend the use of electricity along the routes of new mains. This takes the form of a 26-page illustrated pamphlet, in which a great deal of useful information in respect to the relative costs of driving machinery by different methods is set out in tabular form by Mr. G. A. Julius B.Sc., M.E., who also contributes the introductory matter.

The managers of several local factories operating their plant by means of electricity supplied through the Council's mains were interviewed, and their experiences are given, together with photographs of electrically operated machinery.

Works inspected and reported on include those of builders, box-makers, timber yard, cordial factory, flour-milling company, a large drapery establishment, printing works, &c.

Under separate cover we have pleasure in sending you a copy of "Power," which is the title of the pamphlet referred to. This is published by Mr. Critchley Parker, of the *Australian Mining Standard, Engineering and Electrical Record*, for the Sydney City Council, and is intended for free distribution within the area covered by the Council's mains.

Critchley Parker.

Melbourne, *May 29th*, 1912.

An Objectionable Clause.

From "Fairplay's" first letter I gathered he wanted the contractors to combine to except the objectionable clause from their tender. By so doing (if the clause was knocked out) it would leave the contractors in the position that is now held by the Trade Unions Codlin or Short. That is how it appeared, I feel sure, to the majority of your readers.

"Fairplay" now comes out as an upholder of Trade Union rates and conditions, and admits that all labour is underpaid. Then, according to "Fairplay," if wages rise the trade of the country goes abroad, &c. What a blessing it would be if no wages were paid at all, then, evidently, this country, or any other for that matter, would capture all the work of the world! Then we find, according to "Fairplay," that whenever, through the efforts of Trade Unions, wages have risen, unemployment has been more rife. In the same breath "Fairplay" tells us that "No thinking man would deny the good done by Trade Unions in the past in bettering the lot of the workers." Both statements cannot be right. Which is true?

"Fairplay" goes on to tell us we are petted and pampered; we have grown mighty in the land. Just so; that is the reason that one sees so many advertisements in the "Wanted" columns of the Review. Then "Fairplay" goes on to tell the world that my organisation is weak. Possibly so, in London; but from the rush to join that has been going on recently, that statement will soon be a statement only. His next gem, "That the E.T.U. is one which *most* of the best men in the trade ignore," is false, and I challenge him to prove it in London even. I maintain that the majority of the best men in the trade in London are now in the ranks of the Electrical Trades Union. A large number of our members at present do not consider it advisable to wear their hearts on their sleeve. It might mean the sack if some of their masters, fair contractors I think they are called, got to hear of it.

The last part of " Fairplay's " article is rare and refreshing. My followers, is fine, and although up to the present I have not been appointed "sole arbitrator," most workmen (and, I suppose, workmen, equally as much as contractors, have certain rights), would rather the E.T.U. be the judge than some contractors that we wot of. In reading the correspondence on this matter one of our members remarked, "'Fairplay' is clever: Mr. Collins is easy." I trust neither gentleman will take that as flattery or insult.

It is apparent to the merest outsider that Mr. Collins's tirade against Trade Unionism answers itself. I have re-read Mr. Collins's first letter, and it certainly is most convincing. I can quite understand his suggestion for the total abolition of anything, in any clause, appertaining in the slightest degree to Trade Unions. Yes, Mr. Collins, I should most certainly think it a crime if a contractor made a " mistake " in the rate of wages paid, the same sort of crime as if you discovered one of your workmen taking home a coil of wire by " mistake." Both are robbery, and the sentence should be the same in each case.

For the benefit of your readers generally, and Mr. Collins in particular, I should like it to be generally known that the Electrical Trades Union is not permeated with Socialistic rot, but is an organisation that is out to raise wages and better conditions for the men employed in our industry. I have just heard that this particular contract has been placed, and the objectionable clause remains; and I trust that the contractor will act up to the letter of his contract. Then there will be no friction between my society and himself. If, however, he attempts to " rob " his workmen, then it is within the bounds of possibility that one of the sole arbitrators may be

W. J. Webb.

London, S.W., *June 29th*, 1912.

THE NON-FERROUS METALS EXHIBITION.

Although the title of this Exhibition did not appeal very strongly to the electrical engineer, there were many exhibits of more or less direct interest to him. The Exhibition, however, fell very far short of what it might have been; it was largely confined to products, whereas there was great scope for the display of processes, in every stage from the reduction of the ore to the finished article, and it is to be regretted that the opportunity was not more fully utilised.

Amongst the exceptions to the foregoing remarks were the **Rapid Magnetting Machine Co., Ltd.**, who exhibited several of their latest types of machines for removing magnetic particles from "non-ferrous" substances. The rotary machines have been described in our pages; they are intended for dealing with materials containing large quantities or large pieces of iron. A new type of separator has recently been introduced for cases where the percentage of iron is small, but must be completely removed. It consists essentially in a succession of iron bars fixed transversely in an inclined shaking trough, and partly covered with brass plates, which, however, allow the iron bars to form shallow steps; the material to be sorted is fed from a hopper over a shaker feed tray into the shoot, the inclination of which can be varied to suit the material. As the stuff slides slowly down the shoot, the iron bars, which are magnetised from below, arrest the magnetic particles, and these are pushed over the front of each step, clinging to the iron, while the non-magnetic material passes over the top of the step. As there are a great many bars, it is almost impossible for a particle of iron to escape contact with one or other of them, so that the iron is very thoroughly eliminated. The iron collected is discharged at intervals into a bucket by stopping the feed and switching-off the current, the operation taking only a few seconds. The machine exhibited can deal will 40 to 60 cwt. of brass turnings per day of 10 hours, with a current of 3 amperes at 110 volts.

Messrs. Thermit, Ltd., had a stand, at which they showed a variety of metals and alloys produced by the alumino-thermic process, which yields products uniform in quality, and absolutely free from carbon. They showed also a number of interesting welds effected by the Thermit process, cut in halves to show the completeness of the welds; broken cylinders, shafts, and other castings and forgings can be repaired by this means. The process of welding steel tram-rails was demonstrated by a miniature cinematograph, with a screen about 15 in. × 18 in., which formed a very effective and interesting exhibit. We understand that all such welding is done under the direct supervision of one of the company's permanent staff of welders. The company claim to be welding 90 per cent. of all tramway trackwork in this country, and recently, as the result of comparative tests, have secured the L.C.C. tramway welding contract, having already welded 20 miles of track for the Council.

Messrs. George Jones, Ltd., Birmingham, showed some electrically-driven rolling mills of substantial construction; **Messrs. Dugdill's Patents**, Failsworth, had a stand of their patent fittings; **Messrs. James Booth & Co., Ltd.**, Birmingham, showed a great variety of sections of extruded brass and copper, including turbine blades and commutator segments, while the allied firm of **Samuel Booth & Co.** showed electric light fittings. **The British Aluminium Co., Ltd.**, **Messrs. H. Erhardt & Co.** (tinfoil manufacturers), and **Messrs. Locke, Lancaster, & W. W. & R. Johnson & Sons, Ltd.** (lead and litharge merchants), showed their respective manufactures; Duralumin made a noteworthy exhibit at the stand of **Messrs. Vickers, Ltd.**, and the **Sulphalium Co.** also had a stand of their products. Ribbon metals and strip solder were shown by the **British Lead Co.** Switch-plates were shown by **Mr. James Smithies**, of Wilmslow, and wire-drawing machines were in operation on the stand of **Messrs. W. H. A. Robertson & Co., Ltd.**, Bedford. Copper and brass tubes and numerous other manufactured metals were well represented.

ELECTRICAL ACCIDENTS IN 1911.

The annual report of the Chief Inspector of Factories and Workshops to the Home Office, issued last week, contains the report of the electrical inspector, Mr. G. Scott Ram, which is given in abstract below:—

TABLE I.—Accidents at Electrical Generating Stations and Sub-stations in 1911.

The small figures relate to fatal accidents, and are included in the principal figures.

Description. (1)	Public supply stations and electric railways and tramways. (2)	Other stations. (3)
Non-electrical :—		
At engines, pumps and generators ...	18	4
At boilers and steam plant	39	6
At coal-handling plant	18^{1}	3
Falls	76^{5}	8^{1}
Struck by falling bodies	28	—
Miscellaneous	91^{1}	17
Total	270^{7}	38^{1}
Electrical :—		
At switchboards when engaged in ordinary routine work—mostly due to faulty design of apparatus or to mistakes on the part of the switchman.	12	5
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors.	27[illegible]	2
Cleaning, repairing, or other handling of switchboards supposed to have been made "dead"—		
Skilled persons ...	3^{1}	—
Unskilled persons ...	—	—
Adjusting brushes & cleaning commutators	9	3
Miscellaneous	12	1
Total	63^{1}	11

The number of mechanical accidents is about the same as in the previous year, and calls for no special comment. The number of electrical accidents was somewhat greater—74 against 58 last year—the number of fatalities, 4, being the same. With few exceptions the causes of the accidents were similar to those which I have described in detail in former reports. In working on a dead portion of a high-tension switchboard, adequate screening of adjacent live conductors is not always provided. In one of these cases the man received a shock and severe burns from a 6,000-volt system. He was rendered insensible, but was brought round by artificial respiration, and was able to return to light work in about six weeks. In another similar case, the man was killed outright on a 20,000-volt system. Screens were actually provided in this case and were lying on the floor unused. The actual work in hand was upon some apparatus about 2 ft. or 3 ft. from the floor. There were live conductors above, about 8 ft. 6 in. from the floor. It was overlooked that in reinstating the apparatus a man might climb on to a part of it, and so be within reach of the live conductors.

Several accidents occurred in cleaning extra-high-tension switchboards. In one case—in a sub-station—a cell had been made dead and the door opened for cleaning. A second door was then opened before the conductors had been made dead. The cleaner went into the second chamber and received a shock between his hand and neck. A heavy short-circuit occurred, bringing out the circuit-breaker at the generating station. The man was badly burned and was rendered insensible, but was brought round by artificial respiration, and was able to return to work in a few weeks. In another case, in a generating station, the switchboard was arranged in two sections so that either could at any time be made dead for cleaning or other work, but was not otherwise subdivided. There was an interconnecting switch at the end of one section, but not screened off. This switch could have been made dead by means of isolating switches in the gallery below, but this had not been done, and it was therefore live on one side. The man who was cleaning, who was also a switchboard attendant, touched this switch, and although severely injured by shock and burns, his right arm having to be amputated at the shoulder, he escaped with his life. In subsequent legal proceedings, the responsibility for the accident was held to lie with the injured man himself for going into the chamber while the interconnecting switch was alive. In another case, a man was cleaning insulators with exposed conductors at extra-high-pressure close by. He was severely injured, but not killed. In another, a sub-station attendant received a shock at extra-high pressure, apparently through his own fault in not making sure whether the current had been switched off at the generating station end of the line before starting to clean the apparatus. Another high-tension accident occurred to a man working in a switchboard cell, and appears to have been due to the stupidity of the man in charge in allowing the pressure to be turned on before the work was completed. In another case, a "competent" man was fixing a guard at some high-tension apparatus with wire. As might have been expected, the loose end made contact with a live conductor. In the second fatal case a competent and experienced man appears to have forgotten that the oil switch which he was examining was live, and touched one of the terminals. It is remarkable that of the above nine accidents on high-tension or extra-high-tension alternating systems, only two had fatal results.

Several accidents occurred through men making short circuits on direct-current medium-pressure systems. Some were due to the omission to take any kind of precautionary measures. Thus, ordinary engine room spanners were used in several cases to tighten up nuts at the backs of switchboards, no precautions by screening or otherwise being taken, the spanner being applied to a live nut on one pole, and bare bus-bars or other conductors on the other pole being only a short distance away—less than the length of the spanner. The extraordinary thing is that such things are done by switchboard attendants of experience. Much of the blame often, however, lies with the employers or their responsible engineer in not providing special insulated spanners or other forms of temporary protection in view of work on live conductors becoming necessary. In one case, two assistant engineers proceeded on the above lines to tighten up a live nut on one of the main connections behind the bus-bars at the back of the switchboard, and produced the inevitable short circuit. They were both burned, but not very badly. The short circuit apparently produced a surge with probably a big rise in the pressure on the breaking of the short-circuit current, with the result that a flash-over occurred at another part of the switchboard several feet away, at a place where the positive and negative conductors on a marble panel were barely 1 in. apart without any insulating division between. The normal difference of pressure between these conductors was 580 volts, and although this would be a long way below that necessary to start an arc between conductors in air, it might conceivably do so without difficulty if dirt or dust were allowed to accumulate on the surface of the marble. There is no doubt, however, that on the breaking of a very heavy current such as would be caused by a short circuit on a station switchboard with 2,000 or 3,000 KW. behind it and with no circuit-breakers on the generators, a very great momentary rise in pressure might occur. On 550-volt traction switchboards it has been proved that the operation of a feeder circuit-breaker on heavy overload may produce a momentary rise of pressure of over 10,000 volts. The design of the switchboard, with the main conductors placed so closely together, was obviously at fault, as even under normal conditions accidental short circuit might be readily brought about, and the mere cleaning of the surface of the marble between the conductors would be a hazardous undertaking. The above accident had a very unfortunate sequel a few hours later. The switchboord attendant noticed that at the place where the arcing-over had occurred, there was a slight discharge going on across the marble between the positive and negative conductors. This may have occurred through a film of copper having been deposited on the marble at the time of the flash-over. He reported the sparking to the station superintendent, and while the latter was looking at it, it again developed into a flash-over or short-circuit, with the result that the superintendent was so severely burned that he died within a few hours.

Under the next heading, the fatal accident occurred to an experienced man who was about to do some work in a cell of a single-phase high-tension switchboard. The system had one pole earthed, and the switchboard was a single-pole one. The cell contained an oil switch for a generator. The switch was connected directly, and not through isolating switches, to the ring bus-bars of the switchboard. The bus-bars were, however, provided with a number of disconnecting links in order that any circuit might be isolated by removing the link on each side of the point where it connected with the bus-bars. The man had removed the links on each side of the connection to the switch at which he was intending to work. Unfortunately the system of disconnecting links had not been adhered to when extensions had been made. A generator placed at a later date in another engine room had been connected to the same part of the bus-bars. The removal of the two disconnecting links did not, therefore, disconnect the second generator from the switch cell in question. This second generator happened to be at work, and although it was connected to the bus-bars through an oil switch, the man appeared to have forgotten the arrangement of the connections, and omitted to pull out the switch. He consequently opened the door of the switch cell of the first generator, thinking it was all dead, and received a fatal shock. The accident appears, therefore, to have been in part attributable to the connection of the subsequent generator with the bus-bars not having been carried out on the same lines as those of the other circuits. The design of the switchboard was such that the connections could not be readily traced. It is important with all such switchboards, where the connections are not visible or obvious, that a diagram of the connections should be hung up in the switch room for ready reference before any work is undertaken. A useful precaution adopted in many stations is also recommended, namely, that a second competent person should check the position of the switches and isolating links before any work is commenced.

Of the miscellaneous accidents, several occurred to unskilled persons, and were due to lack of proper supervision. Four occurred on extra-high-tension systems, and were remarkable only because the injuries did not prove fatal.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.-H. Residence Holophane Reflectors.

A new line of reflectors has been devised by the British Thomson-Houston Co., Ltd., of Rugby, for use in private residences. They are made on the same principles of light control and distribution as the standard stiletto type reflectors, so that a high degree of efficiency is obtained. At the same time, however, due regard has been given to the æsthetic side of the question. As a result these reflectors not only give excellent lighting effects at night time, but they also have a permanent decorative value.

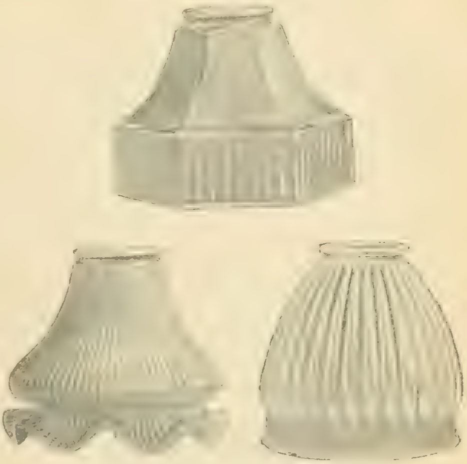


Fig. 1.—B.T.-H. Residence Reflectors.

The residence Holophane reflectors are made in a number of different patterns, to suit every class and period of electric-light fitting. Some of the shapes are shown in the accompanying illustrations. In every case they have been designed, not only to appear beautiful and to give efficient lighting results, but also to hood or cover the lamp, so that the brilliant filament is not directly visible. The effect given by one of these reflectors with a lighted Mazda lamp inside it is that of a uniformly brilliant surface, throwing out light equally from every point.

The "Stove System" of Electric Ironing.

In many clothing workrooms it is the custom to use solid irons heated on a gas stove. When internally-heated irons are introduced to these rooms it is often found that the cords or tubes, that carry the current or gas to the irons, are inconvenient, and interfere with the use of the irons. In several of the big West End establishments, and in many other factories, the "hot-point" electrically-heated irons made by Messrs. Eastman & Warne, of 241, Acton Vale, W., have been installed on the "stove" system, and have been found to be highly efficient. Each gas stove is replaced by a substantial shelf covered with fireproof material. A group of three to five ironclad contact-boxes is fixed to the wall by each shelf, and so arranged that when the irons are stood on the shelf they slide into the box and are heated up by current passing through windings inside the irons.

The "hot-point" irons made for this system have automatic loadings; *i.e.*, they attain their proper working temperature very rapidly, and then automatically cut down the current consumption to a very small amount. They hold practically as much heat as solid irons of the same weight; they can, therefore, be used for quite a long time without requiring to be heated up again.

Careful tests of the hot-point irons arranged on this system in comparison with ordinary solid irons heated on a gas stove have shown a saving in running cost of 40 per cent. The further advantages of freedom from risk of fire, increase in amount of work done, and reduction of labour troubles are additional to this saving.

A Lightning-Conductor Bridge.

The testing of lightning conductors is often done with the aid of induction coils and telephones, on account of the electrolytic character of the earth connection. An apparatus recently constructed by Messrs. Dr. Paul Meyer, A.G., of Berlin, to the design of Prof. Ruppel, is mainly intended for facilitating the test in the hands of unskilled persons. Its main feature is an oscillating switch A, fig. 2, which by mechanical oscillations converts direct current into alternating current. This does away entirely with the induction coil. The oscillating switch consists of a tuned steel spring, which alternately applies the positive and negative terminals of a battery to the branches of the bridge. The frequency of the alternating current thus produced is about 17 cycles per second, which suffices even for work on electrolytes, as borne out by tests at the Reichsanstalt.

FIG. 2.—OSCILLATING SWITCH.

This also allows the telephone to be replaced by a sensitive galvanometer, suitably damped and fitted with a light system which is set vibrating by the alternating current. Instead of a galvanometer deflection, the amplitude of vibration thus gives the reading. The use of a galvanometer, which ensures far greater simplicity and rapidity than a telephone, constitutes a considerable advantage of the new arrangement.

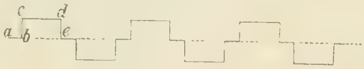


FIG. 3.—ALTERNATING-CURRENT OSCILLOGRAM.

Details of the oscillating switch and its mode of working will be inferred from fig. 2: A is the steel spring oscillating between the two contacts C and C_1, which are connected to the two terminals of a battery. Two diagonal points of the Wheatstone bridge are connected on one hand to the spring A, and, on the other, to the middle of the battery, the galvanometer G being applied to the two other diagonal points. The number of periods as well as the shape of the curve of the alternating current generated by the switch can be adjusted by varying the position of the weight K.

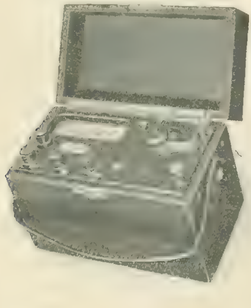


FIG. 4.—"MULTIMETER" RESISTANCE BRIDGE.

In fig. 3 is shown an oscillographic record of the alternating current thrown into the branches of the bridge, the frequency being 17. The broken line *a b c d e* corresponds to half a period, the amplitude of the switch spring being near its maximum. As this amplitude decreases, the section *a b* of the zero line is lengthened and *c d* is shortened. The current curve agrees with the pressure curve if the resistances in the circuit are free from inductance. These curves are very regular and well suited for measurements

The oscillating spring A is set working mechanically by causing a rod to strike it as an ebonite button is pressed down. The battery circuit is closed at the same time. The battery is only used during the actual measuring process, that is to say, only so long as the contact button is in its lowermost position. The apparatus can be used for direct-current measurements by pressing down the button only until the spring is just touched. The same ebonite button serves for displacing the sliding contact.

The "multimeter," as the apparatus is called (fig. 4), is equipped with two standard resistances, giving ranges from 0·1 to 20 ohms and from 2 to 500 ohms respectively. Readings are taken in ohms; the apparatus comprises two scales, of which, however, only the one adjusted for is visible.

Helsby Wireless Detectors.

The demand for a reliable detector of the crystal type has led the AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., of Milton Road, Edge Lane, Liverpool, to design the instrument shown in section in fig. 5. It consists of a brass disk with a large hole in the centre, carrying six crystal cups C, in which the crystals are fixed by means of a special fusible alloy. The disk is held up against a flanged nut on a spindle by the springs D, and can be rotated and moved sideways so as to bring any part of any crystal into contact with the point B; the pressure of contact can be adjusted with the greatest precision by means of the screw A and the arrangement of opposing springs shown in the figure. The makers find that crystals of galena of a particular formation give the best results, provided that the pressure of contact is extremely light, and this end is readily attained with the Helsby device. Double headgear receivers wound for use with the detector are made by the company, as well as standard "quenched-spark" apparatus.

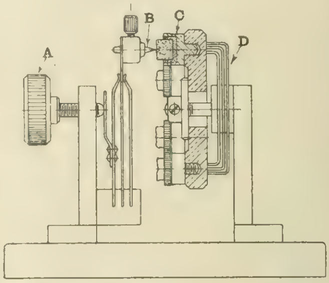


FIG. 5.—HELSBY WIRELESS DETECTOR; SECTION.

COMMUNICATION WITH RAILWAY TRAINS.

ON Friday last a demonstration of the "Railophone" and its recent developments was given on the Stratford-on-Avon and Midland Junction Railway, by Railophones, Ltd., in the presence of a large number of representatives of the Press, railway engineers and others, including a deputation from French railways which is at present investigating British methods. We gave a brief account of the system as it then stood in our issue of April 28th, 1911; at that time, while it was proved possible to communicate with moving trains by telephone—*i.e.*, the "Railophone"—it was not yet practicable to actuate signals or effect any other mechanical movement on the train by inductive transmission. A special relay, however, was then in process of evolution, in the hands of Mr. H. von Kramer, the inventor of the Railophone, and Dr. Gisbert Kapp; this relay has now been developed to a high degree of perfection, and was employed in the demonstration last week. The principle employed is one familiar to wireless telegraph engineers: it is that of building up, by resonance, a cumulative effect which eventually attains sufficient amplitude to close a local circuit; that accomplished, there is, of course, no limit to the mechanical operations which may be performed with the aid of a sufficiently powerful storage battery or other electric generator, and electromagnetic mechanism.

At the same time, as the relay can only be actuated by accurately timed impulses of a given frequency, the irregular vibrations due to the motion of the train on which it is carried, or of trains past the signal-box in which it is installed, are powerless to affect it, and thus a very formidable difficulty is overcome. The relay is, indeed, the heart and soul of the system; telephonic and wireless communication with moving trains is not a novelty, but the performance of mechanical movements with unlimited power by inductive transmission to a moving train is, we believe, unique. Naturally so difficult a problem was not solved at the first attempt, and we understand that 25 experimental models were made before satisfactory results were attained; relay No. 26, however, proved a success, and many relays have since been constructed on the lines of this design.

In broad outline, the system comprises an insulated wire laid underground alongside the railway track and connected to the apparatus in the signal boxes and at stations, and a pair of coils wound on frames round a coach, one for sending and the other for receiving, connected with the apparatus mounted in the coach —preferably the guard's van. No change-over switch is necessary when passing from sending to receiving, or *vice versa*. The apparatus carried on the train consists of a 24-volt storage battery (which may be that used for lighting the coach), the detector, an electric hooter, and a magnetic device for applying the ordinary automatic brakes, as well as telephonic and telegraphic instruments. At fixed stations or signal boxes electric gongs take the place of the hooter, and apparatus can be installed to operate signals, &c., with the aid of local batteries.

The demonstration was carried out with the aid of Dr. Silvanus P. Thompson, F.R.S., who received a message from Mr. Russell Willmott, general manager of the railway, on board a moving train, and transmitted a reply. Dr. Thompson also repeatedly stopped the train at a distance by applying the brakes, simultaneously sounding a hooter on the train. A variety of other demonstrations was given, including the following :—A train was run at full speed into a section against a semaphore signal set at danger ; by the *automatic* operation of the system the train was immediately pulled up by applying the brakes, and an alarm signal was sounded at the signal box.

A train was given "Line clear" by semaphore, but the signal was cancelled and the train pulled up by the signalman.

A train entered a clear section ; the signalman left his post, and failed to replace the signal at "danger," whereupon the train automatically restored the signal, locked the lever in the signal-box, and recorded the fact against the signalman.

Assuming that fog prevailed, a train was automatically stopped in front of a signal and prevented from entering the section, until the signalman had released the brakes and sounded the hooter on the train three times as a signal to proceed.

A fast train followed a slow one into a section against the danger signal ; both trains were automatically pulled up.

Two trains started in opposite directions on the same line of rails ; when both arrived in the same section, the brakes were automatically applied and both trains stopped.

All these operations were performed with perfect success. Communication with the train by telephone or telegraph was at all times possible, and audible signals could be, and were, transmitted from the signal cabin to the train and from the train to the cabin at will. The underground wire is divided into sections of lengths corresponding to the signal sections comprised in three groups :—The main section, of 1 to 10 miles or more ; the restoring section, and the clearing section, the last two being each about 100 yards long. The position of a train can, if desired, be indicated continuously by coloured lamps in the signal box, and the danger signal behind a train is automatically locked, so that the signalman cannot give "line clear" while the train remains in the section. In fact, as we have said, any desired movement or indication can now be effected, thanks to the "K.K." resonant detector.

At a luncheon which followed the demonstration, Dr. S. P. Thompson, proposing the health of Mr. H. von Kramer, referred to the conservatism of railway engineers, but pointed out their dependence upon new inventions. In his reply, Mr. von Kramer said he had demonstrated only the cardinal principles of the Railophone ; he left the application of those principles to the railway engineers, whose requirements could now be fully met by the manufacturers. He had been asked what would happen if some part of the installation were to fail ; any such failure would give an automatic signal, as a small current was constantly maintained throughout the circuit, the interruption of which was at once indicated. His system was intended not to supersede, but to be superimposed upon, the existing methods of signalling ; the detector, which was the key to the problem, was as reliable as any other relay. Mr. H. Raynar Wilson, the well-known signalling engineer, said he had been very much surprised at what he had seen. He believed they were at the beginning of a revolution in railway signalling, and had taken particular interest in cab-signalling systems during the past year ; but of all that he had seen, there was certainly none that excelled that developed by Mr. von Kramer.

In view of the complete success of the demonstration, the capabilities of the Railophone system cannot be questioned ; it did all that was claimed for it. But the technical solution is not always the end of the struggle, and perhaps the greatest difficulties remain to be overcome, in persuading railway managers to make use of the facilities thus provided by Mr. von Kramer and his colleagues. They, no doubt, are well aware of the fact, and while we tender our congratulations on their present achievement, we wish them good luck in their coming campaign. It may be pointed out that the first practical application of the electric telegraph was to the working of railways, and the telegraph, now indispensable, was then a far greater innovation than the Railophone is in these days of enlightenment. The prospects of success, therefore, are not unfavourable.

Deed of Assignment.—Mr. A. Meadows (W. A. Meadows & Co.), electrical engineer, Percy Street, Hanley.—Creditors of the above should send in particulars of their debts or claims, &c., to the trustee under the deed, Mr. R. E. Clark, Albion Street, Hanley, by July 8th.

BUSINESS NOTES.

Private Arrangement.—Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.—An adjourned meeting of the creditors in this matter was held on Tuesday last at the Cannon Street Hotel, E.C., when Mr. E. C. Pegler, F.C.A., the liquidator of the company, presided. It will be remembered that the first meeting was adjourned at the instance of a number of creditors, although the liquidator expressed the opinion at the time that an adjournment of a meeting was not in order, as he was advised.

In opening the proceedings of the meeting on Tuesday, the Chairman said that he had called the second meeting without prejudice as to whether an adjournment was in order or not. Proceeding, he said that since the last meeting he had been served with a summons by one creditor. This took the form of an originating summons, and it pressed for his (Mr. Pegler's) removal as not being a fit and proper person to occupy the position of liquidator, and it requested the Court to make such order as it might think fit. This summons had not been taken out in connection with Sec. 188, but was under another section which empowered the Court in the event of a voluntary liquidation taking place to remove a liquidator and appoint another person in his place. Such, said Mr. Pegler, was the present position of affairs, and he had entered a defence to the summons. Before proceeding further, he would like to know whether any creditors present desired to ask him any information with reference to the company's affairs.

In reply, a creditor asked for information in regard to the agreement which had been entered into between the Globe Electric Co. and Mr. Weinert. The chairman said that his recollection was that there were two agreements, one a prior agreement which was subsequently dispensed with in favour of another one. In reply to another creditor, the chairman said that the creditor who had issued the summons was Mr. Weinert, and the Electrical Co., Ltd., had also instituted proceedings. At this juncture a creditor suggested that in view of what had been said, the representative of Mr. Weinert might perhaps tell the meeting what the position was so far as his client was concerned. The representative of Messrs. Michael Abrahams & Sons, solicitors, thereupon said that the position at the last meeting had been that he had informed those present that an important question existed in this liquidation, and that was with reference to certain debentures which had been issued. Having regard to the importance of this matter, he had suggested without, of course, casting any aspersion whatever upon Mr. Pegler, that he ought not to be liquidator of the company, bearing in mind that he was Receiver for the debenture-holders as well, and he hoped that the creditors would emphasise their view of the matter in the same way. Since the former meeting he had taken the advice of counsel, and on that he had taken out an application for the removal of Mr. Pegler as liquidator, and for the appointment of somebody else in his stead. In his summons he had not suggested who should be liquidator, but this no doubt the creditors present would determine, and if they did so, he should in that case, when this summons came on, inform the Court of what the creditors had resolved to do. To some extent the trade creditors might consider Mr. Weinert's position as not being exactly identical with their own. He thought, however, that an independent liquidator in this matter was absolutely imperative. The speaker also referred to the Armorduct Co., who, he said, were alleged to have a claim in the present liquidation. The Chairman, replying, said that the matter as it affected the Armorduct Co. was really a set-off, and they figured on both sides, but there was a net balance against the Armorduct Co. In the course of the discussion which ensued, it was stated that there was another important question, and that was that just before the liquidation the Armorduct Co. took over a portion of the business of the Globe Electric Co., and the speaker said he was informed that no consideration had been paid to the Globe Co. The Chairman said that, as he understood it, this was not so. The gentleman who had made the assertion thereupon said that the information had come to him from his own client, and it had also been contained in a circular sent out on May 31st to the trade.

The Chairman, interposing, said the Armorduct Co. had made him an offer for the rights in the Globe lighting patents, this offer having been made to him as Receiver. Mr. Schmahl, Mr. Atkinson and the Globe Co. were all registered as the joint owners of these patents. Mr. Weinert's solicitor said he did not want to judge the matter there, but he certainly thought that the question of an independent liquidator should be settled, and he thought Mr. Pegler might himself be rather pleased to relinquish his present position.

The solicitor to the company, addressing Messrs. Michael Abrahams & Co.'s representative, asked whether he seriously suggested that the liquidator of the Globe Co. had no claim against his client, because if so, he thought it was an extraordinary proposition. Mr. Weinert's solicitor replied that what he suggested was that the claim against the Globe Co. was for a substantial amount of something like £3,000 odd, and that in regard to any alleged claim which the Globe Co. had against Mr. Weinert, that, so far as he knew, had never been formulated. The solicitor for the company said that whatever might be the merits or the demerits of this claim, he thought that it would be agreed that the matter was one for independent investigation, and he would at once say that so far as the appointment of an additional liquidator was concerned, Mr. Weinert was in duty bound not to have anything whatever to do with it.

The Chairman said that his view was that the creditors should pass whatever resolution they thought fit and proper, and then act on it afterwards.

A solicitor in the room thereupon said that he was in the position of a judgment creditor who would very much like to get his money. It appeared to him that the present liquidator was Receiver for the debenture-holders, and in that capacity some difficult questions might arise. A question might crop up as to the validity of the debentures, and then the position would be that the liquidator would have to challenge these debentures, and would have to take an action against himself as being in the capacity of Receiver. Now, it was obvious that this would not do at all. They were now told that someone had issued a summons to move for another liquidator, but it seemed to him that another liquidator might be appointed to act with Mr. Pegler, and he would suggest Mr. Corfield.

Mr. Scholey said that undoubtedly it would be more harmonious if Mr. Corfield were associated with the present liquidator, and for the reason that the Receiver now possessed practically all the assets, and nothing could be derived by the creditors unless the Receiver was friendly. If this business was realised quickly the result would be bad for the creditors; but if, on the other hand, it were realised with due regard to the creditors' claims, there might be something in it. As to Mr. Weinert's action, he did not think that concerned the trade creditors one iota. In any case, he thought that any liquidator who now took on the liquidation of this company would be in a most unenviable position.

The solicitor for the company then said that, speaking on behalf of Mr. Pegler, that gentleman would be pleased to have anybody nominated with him as liquidator. There was undoubtedly a good deal in what had been said by creditors as to the position which the liquidator in this matter should occupy, but he could only tell them that in regard to this company there was no desire to conceal anything, and all the facts would be put before the creditors. Some question had been raised as to the constitution of the debentures, and these facts likewise could be gone into. If the desire was to appoint someone jointly with Mr. Pegler, then the latter would be only too pleased to act with him.

In the result, a resolution was passed nominating Mr. Corfield as joint liquidator with Mr. Pegler, and a committee of inspection was appointed, consisting of the representatives of Ships' Carbons, the Sloan Electrical Co., and Messrs. Francis A. Perryn

Correction.—With reference to our notice respecting the contract for the electrification of the South-Eastern Railway Co.'s shops at Ashford, Messrs. Tyler & Freeman inform us that the British Westinghouse Co. received this contract, and that they are acting as sub-contractors to the latter for the wiring work only.

Change of Address.—The offices of the Wakefield Corporation Electricity Department have now been removed to new premises, and all communications should be addressed to the City Electrical Engineer, Old Town Hall, Crown Court, Wakefield.

Eastern Canada.—The Imperial Trade correspondent at Toronto (Mr. F. W. Field) writes that one of the outstanding features of the year has again been the establishment of branch plants in Canada by United States firms. In this connection, particular attention is being paid by United States manufacturers of agricultural implements, who appear to be making Ontario the manufacturing centre for their Canadian business, with distributing houses in Western Canada.

There is a likelihood of some electric railway construction being undertaken in Ontario during the coming year. Probably in the next few years marked activity will exist in this direction, as there is a disposition to build electric radial lines from the suburban towns and villages to the large centres of population.

General conditions in Ontario during the past year were satisfactory and the crop was an average one. Many additions were made to manufacturing plants, a greatly increased output was recorded, and there were numerous cases of inability to cope with the demand for goods. The factories, on the whole, are well equipped with modern machinery and are making headway in efficiency and economical production. Developments along these lines are expected during the coming year. Mr. Field adds that a large number of catalogues of British firms were received by him during the year 1911, and were distributed as desired by their senders. He suggests, however, that business returns are not likely to be secured in this way.

The Imperial trade correspondent at Quebec reports as follows: Electric wire and fittings are imported from the United States because they conform with the standards set by the Canadian underwriters, but there does not appear to be any reason why British manufacturers could not provide similar grades if they wished to compete for this trade. Artistic shades of most expensive qualities for electric lamps are imported from Austria in very considerable quantities.

Judging from instances which have been brought to notice, the German system of delivery through representative firms is popular, and the practice of many United States firms of frequently sending expert salesmen, well supplied with well got-up catalogues, to prospective buyers, often secures orders, irrespective, to a certain extent, of the comparative values of the goods. There appears reasonable grounds for expecting that large contracts will be let and considerable work done in the Quebec district during the next two years. The Government have decided to build large new immigration buildings of a permanent character. The long-discussed graving dock will probably be decided upon and a contract for its construction entered into. Proper accommodation for the grain and other trans-continental traffic, including elevators and freight-handling machinery, will have to be provided in anticipation of the completion of the Trans-Continental Railway. A car ferry will probably be required to transfer the cars of the Trans-Continental Railway across the river during the interval between the completion of the railway and the completion of the bridge, possibly five years later. Provision for the repair of naval vessels will also have to be made at some point on the St. Lawrence, possibly at Quebec. Several new railways are also either under construction or in contemplation in the vicinity of Quebec.—*Board of Trade Journal.*

Bankruptcy Proceedings.—George Edward Hervey, gas and electrical engineer and ironmonger, 24, Susan's Road, Eastbourne.—The Receiving Order herein was made on the debtor's own petition, and, according to the accounts filed, the gross liabilities amount to £268, of which £242 is expected to rank for dividend. The assets are estimated to produce £80, less £16 for preference claims, leaving a deficiency of £177. It appears that the debtor started business in 1907 in partnership with another, they having a joint capital of £45. The partnership was dissolved in March, 1910, the partner receiving £50 as his share, the debtor since continuing the business alone. The business has declined very considerably lately, owing to depression in the building trade. The failure is attributed to the lack of capital, depression in trade, bad debts and depreciation of stock. The debtor's household furniture was sold in May last for £50, in order to pay off an overdraft at the bank which was secured by a relative. The business has been closed, and the stock and loose fittings removed for sale.

A. G. Adamson, electrical engineer (late 22, Christopher Street, Finsbury Square, London).—July 17th is the last day for receipt of proofs for intended dividend, by the trustee, Mr. C. Mercer, 14, Bedford Row, London, W.

Trade Announcements.—Messrs. Samuel Deacon and Co., advertisement agents and contractors, have removed to No. 7, Leadenhall Street, E.C., nearly opposite their old premises, which have been acquired by a large insurance company.

Mr. Arthur P. Haslam, asks us to state that his telephone number, and that of the Westminster Tool and Electric Co., has been changed to "City 54."

Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, E.C., have arranged to act as representatives in this country for the Tool Steel Gear and Pinion Co., of Cincinnati, Ohio, whose products are widely used on electric tramways and railways in the United States.

The Forest City Electric Co. has removed to Clegg's Court, Chapel Street, Salford.

Book Notices.—"Studies in Radioactivity." By W. H. Bragg. London: Macmillan & Co. 1912. Price 5s. net.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 6. June, 1912. New York: The Institute. Price $1.00.

"*Bulletin* Mensuel, de la Société Belge d'Electriciens." Vol. XXIX, No. 4. April, 1912. Brussels: Emile Bruylant.

"*Bulletin* of the Association des Ingenieurs Electriciens." May 6th, 1912. Liége: The Association. Price 6 fr.

"*Journal* of the Institution of Municipal Engineers." June, 1912. London: The Institution. Price 1s.

"*Journal* of the United States Artillery," with "Index to Current Military Literature." Vol. 37, No. 3. May-June, 1912. Fort Monroe, Va.: Coast Artillery School Press.

"*Proceedings* of the Physical Society of London." Vol. XXIV, Part IV. June 15th, 1912. London: *Electrician* Printing and Publishing Co., Ltd.

Liquidations.—Simplex Superheater Co., Ltd.—This company is winding up voluntarily, with Mr. C. A. M. Buckley, 40, Tweedy Road, Bromley, Kent, as liquidator.

Caribbean Anglo-Colombian Cable Co., Ltd.—A meeting is called for August 2nd, to hear an account of the winding up from the liquidator, Mr. A. R. Bennett.

Catalogues and Lists.—The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Pamphlet No. 118, of 12 pages, dealing with the electric driving of machine tools, and illustrating a number of drilling machines, lathes, shears, punch, circular and cold saws, driven by Union D.C. or three-phase motors.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—28-page pamphlet (No. 5·18) containing an admirably illustrated account of the Siemens "G5" watt-hour meters for direct or alternating circuits. Instructions for use are given, with diagrams of connections, and illustrations clearly showing how the renewal of parts is carried out.

Messrs. Rose Bros., 38 and 39, Beech Street, Barbican, London, E.C.—56-page fully illustrated catalogue, giving brief particulars and prices of a variety of small electrical manufactures, including the following: Pocket, hand and torch electric lamps of many types, cycle lamps, battery reading lamps, watch stands, decorative table lamps, "Schmidt" dry cells, "White Star" dry cells, battery lamps, ignition and lighting accumulators, medical coils, small motors, motor-car accessories, electric bells, &c.

Messrs. W. A. Walber & Co., 38, Victoria Street, London, S.W.—Illustrated pamphlet concerning their machine tool department, giving a list of the principal types of machines made by their principals:—Scriven & Co.; Ward, Haggas & Smith; J. Beardshaw and Son, Ltd.; Clifton & Baird, Ltd.; and Clark's Machine Tool Co. (1907), Ltd.

The Century Electric Co., St. Louis, U.S.A.—Bulletin No. 18 (48 pages), in which appear excellent illustrations and full particulars of the Century single-phase self-starting motors.

THE BRITISH ANTI-VIBRATION AND NOISE CO., LTD., 105, St. Vincent Street, Glasgow.—24 page pamphlet entitled "The Isolation of Vibration and Noise," in which the subject is dealt with in an interesting manner in respect to electrical machinery, Diesel plant, shafting, printing presses, shearing and other machinery. The firm manufacture a number of different materials for use in machinery isolation, as follows: Iron-framed natural cork for heavy foundations; resilient plates, for placing under girders, rail chairs and sleepers, and for pads under railway carriage and tramcar bodies; patent anti-vibration isolators for all classes of machinery; and "Silence," a material specially made for surrounding noisy machines, telephone boxes, and gear cases.

THE AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Milton Road, Edge Lane, Liverpool.—New pamphlet describing, with diagrams, the Helsby wireless detectors and headgear receivers, and giving prices of same.

THE BOSCH MAGNETO CO., LTD., 40-42, Newman Street, London, W. Two pamphlets (16 and 12-pp. respectively) containing descriptions, accompanied with detailed diagrams, of the Bosch patent force-feed lubricators, type "A C" (from two to eight feeds) provided with sight feed, and type "L" (from four to eight feeds) specially designed for very large stationary and marine engines, and a statement of their advantages. The firm are now constructing lubricators arranged with from 1-16 feeds, also with double tanks for supplying both cylinder and ordinary lubricating oil.

MESSRS. BAXENDALE & CO., LTD., Miller Street, Manchester.—Catalogue of 56 pages containing profusely illustrated particulars, with price information, of a great variety of electric bells, bell pushes and plates, indicators, batteries and accessories, medical coils, speaking tubes, and lightning conductors. Several pages are occupied with connection diagrams for bells. In many cases prices have been reduced. A separate 8-page list (No. 21,651) shows, and states prices of, electric fans of a number of types, table fans, lampholder fans, battery fans, porthole, exhaust and ceiling fans, also speed regulators.

MESSRS. OZONAIR, LTD., 96, Victoria Street, London, S.W.—New edition of their catalogue No. 1, "Ozonair Apparatus for General Purposes," containing illustrations, prices, and other particulars, of Ozonair portable generators for purifying the air in rooms of from 3,000 to 12,000 cb. ft. capacity, for connecting to supply circuits or to portable accumulators. These apparatus are made in a variety of patterns, for standing on the table (horizontal or vertical current of ozonised air); for fixing on the wall; with medical fittings, &c. The consumption varies from only 10 watts to 130 watts, so that they can be connected to any lampholder or plug. The catalogue also contains interesting information regarding the nature of ozone, and the many public and industrial purposes to which the firm's apparatus can be applied.

MESSRS. JULIUS SAX & CO., 24A, High Street, New Oxford Street, London, W.C.—Supplementary illustrated list of eight pages, giving prices, &c., of a number of electrical accessories, including wall plugs, tumbler switches, candle fittings, adaptors, automatic plug switches, wood blocks, &c.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—New pamphlet, No. 21B of 20 pages, dealing with their medium size self-contained type continuous-current dynamos and motors. The list opens with a specification of various types (protected, semi-enclosed, totally enclosed, and mining), and later gives the ratings and efficiencies of the different frame sizes at standard voltages for protected, semi-enclosed, and totally-enclosed machines. Special attention may be drawn to the Peebles standard mining type motor, which is the outcome of many years' experience of the conditions prevailing in mines. Approximate weights and dimensions of all machines listed are stated.

MESSRS. ECLIPSE ELECTRIC CO., 6, Cambridge Road, Great Crosby, Liverpool.—Leaflets giving prices, &c., of "Harvey" electric vacuum cleaners, and "Whipple" electric tire pumps.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, London, E.C.—Eight-page price list No. 352, relating to the B.T.-H. "Eye Rest" system of indirect lighting, illustrating every type of "Eye Rest" fitting, and giving reproductions of eight photographs of interior lighting on this system, including examples of residence, hotel, office, theatre, ball-room, and picture gallery illumination. Full information respecting prices, reflector types, and finishes is given, together with instructions for ordering and conditions of sale and delivery. Examples of the system can be seen at, and copies of the list obtained from, Mazda House.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—The company has just issued the eighth edition of its new full catalogue of telephonic and electric bell manufactures. It consists of about 160 pages, bound in strong stout covers, containing illustrations, brief particulars, and prices of a large variety of items—about 1,200 in all—including Parlyphones, "Twencen" domestic telephones, "Primax" automatic interphones, secret conversation interphones, a large selection of telephones and signalling apparatus for use in mines, central battery instruments and switchboards, traction telephones, military railway and other portable sets, electric blasting machines, pushes, bells, relays, syrens, indicators, fire alarms, medical coils, batteries, wires, insulators, &c. The revised prices which came into force on July 1st are given in the list. The frontispiece consists of an illustration of the firm's works at Dagenham, Essex, and internal views appear of several of the principal departments, of which we recently gave an illustrated description. The catalogue includes a full range of diagrams of connections, and a telegraphic code.

For Sale.—The City Electric Lighting Department, Leeds, has for disposal a quantity of metal, and copper wire. Messrs. P. Huddleston & Co. will, on Tuesday, July 9th, at Dalling Road, Hammersmith, sell by auction a large quantity of electrical apparatus. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Accrington.—The Electricity Committee has had under consideration an application from the Albert Mill Co. for a supply of current to drive the company's mill in Victoria Street, the estimated consumption being 200,000 units per annum. The Committee acceded to the request on the following terms and conditions, viz., the price to be ·525d. per unit, this price allowing for not exceeding 5 per cent. of the consumption for lighting purposes, with the usual condition as to fluctuation in the price of coal. Period of supply, five years. The consumer to be entitled to any reduction of the scale of charges made at any time for similar supplies and quantity of consumption.

Aberdare.—The U.D.C. has decided to apply for a loan of £12,000 for developing the electricity works in order to provide current for lighting at Aberaman and other parts of the district, and power for the proposed tramways.

Arnside.—The Traders' Association is endeavouring to raise funds for lighting the front by electricity for six weeks during the season in accordance with the suggestions of Mr. T. Wilkinson, electrical engineer.

Birmingham.—The City Council has approved of the recommendation of the Electric Supply Committee that the cost of works authorised by the Council at Dale End, Harborne and Aston Manor sub-stations, be increased to the extent of £688.

Bourton-on-the-Water.—The ratepayers here have decided by 68 votes to 9 in favour of an electric supply scheme by means of overhead lines submitted by the Rural Electric Supply Co., who offer to supply current at not above 8d. per unit. The Stow-on-the-Wold R.D.C., in whose area Bourton is situated, has assented to the company applying to the B. of T. for a licence.

Bradford.—The balance-sheet of the Corporation Electricity Department for the year ended March 31st last shows a profit of £8,052, as compared with £8,980 in the previous year. The total income amounted to £119,892, as against £118,100. Sales of current, other than for tramways, increased by £4,610. During the year current was supplied to the tramways department at 1d. per unit, as against 1⅛d., a reduction which represented no less than £5,000 to the electricity undertaking. The total capital expenditure to March 31st last was £825,038, against which there is a present debt of £498,000, which is less than the debt last year by £9,000, notwithstanding the expenditure during the year of £25,000 on extensions.

Clacton-on-Sea.—The electrical illumination of the sea front was inaugurated on Saturday. Twenty arc lamps, each of 3,000 C.P., have been installed by Messrs. Johnson & Phillips, Ltd.

Continental Notes.—SWITZERLAND.—The hydro-electric works at Augst-Wyhlen, which have been established by the city of Basle in conjunction with the Rheinfelden Power Transmission Co., are now approaching completion after work extending over four years, and are to be brought into operation in the ensuing autumn. The works are situated between the Swiss village of Augst and the Baden locality of Wyhlen, where the river Rhine forms the frontier between German Baden and Switzerland. A large dam has been built across the river at the joint expense of the two parties interested, the cost being put at £200,000, whilst the hydro-electric plant on the Baden bank belongs to the Rheinfelden Co., and that on the Swiss bank to the city of Basle. There are 10 openings in the dam of a width of 56 ft., which can be closed by heavy iron gates of a height of 30 ft. By the raising and lowering of the gates the water level above the dam is maintained, except in periods of high water, at the same height of 880 ft. above the sea level throughout the year. During low water the Rhine delivers about 300 cb. m. of water per second at Wyhlen, but this rises to 5,000 cb. m. at times of high water. The height of the dam corresponds to the useful fall at which the turbines work, and amounts to 27½ ft. at low water; the fall is 21½ ft. with average water, and is still 20½ ft. in the favourable period of summer, when the flow of the river is 1,200 cb. m. per second. The gates, which weigh from 90 to 95 tons, are suspended by chains, and are raised in 20 minutes by means of electric motors of 50 H.P., although they can be elevated by hand. Both installations are of the same type, each being arranged for 10 Francis turbines of from 1,600 to 2,000 H.P. The total normal output in each case is 15,000 H.P. measured on the turbine shaft. The output decreases to from 20 to 30 per cent. below the normal in periods of low water, and also in times of high water, in consequence of the large reduction in the fall. In both cases the deficiency has to be met by reserve steam plant; the reserve for Basle is located in the city itself, whilst the Rheinfelden company has erected steam plant on the Wyhlen bank in the immediate vicinity of the turbines. If all the 10 turbine units were simultaneously in operation under normal water conditions, each would have to yield 1,500 H.P. As, however, it must be possible to stop individual turbines for repairs, &c., without reducing the total output, and as the fall largely varies, the performance of each unit has been fixed at 1,600 to 2,200 H.P. in order to secure full utilisation of the plant. Each of the four wheels of each turbine unit has, therefore, to produce from 400 to 500 H.P. The turbines are outside the machinery house, and the dynamos are arranged directly on extensions of the turbine stages, and have a speed of 107 R.P.M. The energy from the Swiss plant is transmitted at 7,000 volts to transformer stations in Basle, and that produced by the Baden plant can be raised to 40,000 volts in the transformer station combined with the before-mentioned reserve steam station.

SPAIN.—La Compagnie d'Energie Electrique du Centre de l'Espagne, which has lately been formed in Paris, will take over the existing electricity-generating stations at Valdepenas and Manzandres, and will also put down a new plant to utilise the water power of the Ruidera falls.

RUSSIA.—The Second Department of the Council of Empire has formally endorsed a resolution of the Cabinet for the granting of a concession for 75 years for the utilisation of the water powers of the Caucasus and the transmission of electric power at high tension throughout that region, to a British engineer, Mr. Stewart, with powers to transfer his rights to a foreign company.

Croydon.—The T.C. has applied to the B. of T. for permission to supply current in bulk to the County of London Electric Supply Co., Ltd., the undertakers under the Croydon Rural E.L. Order, 1905.

Devonport.—The T.C. has received from the L.G.B. sanction to a loan of £9,983 for extensions to the buildings and plant at the electricity station.

Eastbourne.—The B. of G. has decided to have the pumping plant at the workhouse well worked by electricity, which will be supplied by the Corporation, and cost from 2½d. to 3d. per hour.

Eccles.—The Town Clerk of Eccles has been instructed to write to the Town Clerk of Salford, informing him of the Committee's readiness to consider any proposal which may be made by the Salford Tramways Committee as to the price to be paid for electrical energy for the tramways.

Farnworth.—The Lighting Committee has decided to adapt 30 of the ordinary street lamps for incandescent lighting, and as a result of a conference between the Lighting and Electricity Sub-Committee it has been agreed to discontinue the arc lamps throughout the town.

Haslingden.—Several applications having been received from owners of mills in the Helmshore district for a supply of electricity for power purposes, the Tramways and Electricity Committee has resolved that the whole question of erecting a high-tension cable from the electricity works to Helmshore be referred to the chairman and vice-chairman, and that the latter be requested to report fully thereon to a subsequent meeting.

Heybridge.—The P.C. has entered into a contract with Messrs. May & Butcher for public lighting by electricity. This will supersede oil lamps, and current will be supplied from the firm's power station.

Hull.—The gross revenue of the electricity department for the last year amounted to £67,773, an increase of over £6,300; working expenses amounted to £35,768, leaving £32,005 gross profit, and after meeting financial charges, a net profit of £6,067, which was carried to reserve. The unappropriated balance of the later fund amounts to £14,206—some £36,000 having been applied for capital purposes. During the year approximately 13 million units were generated, and nine million sold; the maximum demand was 5,970 KW. The works cost was ·77d. per unit (a slightly higher figure than in 1911, attributed to special circumstances); the total working cost was ·96d., and the overall cost per unit 1·64, or the same as in 1910-11. The engineer, Mr. Bell, is of opinion that progress in the future will be considerably greater than during the past.

Ilford.—The U.D.C. has decided to improve the lighting between Scrafton Road and Hunter Road, Ilford Lane, by replacing 13 arc lamps with bunch lights of 400 C.P.

Kirkcaldy.—Treasurer Kilgour states that the Corporation electricity undertaking showed a loss for the year of £239. The extra cost of coal due to the strike was about £700, and the output of the undertaking had also been diminished through the same cause. The tramways showed a surplus for the year of £1,324.

Leicester.—The T.C. proposes to apply to the B. of T. for an order extending the area of electricity supply to the parishes of New Parks, Oadby, Evington, Humberstone and Birstall. The application will be considered at a special meeting of the Council on July 30th.

London.—BETHNAL GREEN.—The Electricity Committee reports that in October last the Council decided to engage the services of Mr. J. F. C. Snell to prepare a scheme for electricity supply, upon which tenders could be invited by the Council. He advised that before he proceeded further, inquiry should be made from the Borough Councils of Hackney, Poplar, Shoreditch and Stepney, and also from the City of London E.L. Co., the Charing Cross Co., the County of London E.S. Co., the London E.S. Corporation, and the South London E.S. Corporation, as to the terms and conditions upon which they would be willing to supply electricity in bulk to Bethnal Green. Also that alternative quotations should be invited for a direct current and a three-phase alternating-current supply. Mr. Snell estimated a minimum sale of 1,000,000 units per annum from the commencement of a supply. At the present time over 300,000 units are supplied from the public mains in the borough. After considering the proposals, Mr. Snell advised the purchase of high-tension alternating three-phase energy from Stepney B.C., and that the Council should transform it to a lower pressure for general distribution. At the same time it would also be available in the form in which it was obtained. If the tender of the Stepney Council were accepted, it would be necessary to erect two sub-stations in the borough, each of which would contain, to begin with, transformers aggregating 750 KW., and be adequate for an increased accommodation of 2,000 KW. Mr. Snell advises that a sale of only 500,000 units a year at the very low average receipts of 2·028d. per unit, will enable the undertaking to pay its way after the payment of interest and sinking fund on the capital outlay. That is to say, less than 200,000 further units are required in addition to the consumption already supplied (300,000). Acting upon the recommendation of Mr. Snell, the Town Clerk was requested to negotiate with the Stepney Borough Council as to whether that authority would be willing to undertake the administration of an electricity undertaking in the borough. This, the Committee had ascertained, the Stepney Council would undertake. The Committee did not anticipate there would be any difficulty in effecting a satisfactory agreement with Stepney for the purpose of giving effect to the recommendation of Mr. Snell, that the Stepney Council should work the undertaking on behalf of Bethnal Green, with a view to enabling the latter Council to afford a supply of electricity at the lowest possible cost. The Committee recommends that the Council accept the proposal of the Stepney B.C. for a supply of electricity in bulk to Bethnal Green on the extra-high-tension three-phase system for a period of 15 years, at a charge, in accordance with a sliding scale, of £3 per KW., and 0·25d. per unit; that the Council adopt a three-phase four-wire system of distribution of electrical energy in accordance with the recommendation of Mr. Snell; and that, subject to the completion of the proposed agreements, application be made to the L.C.C. for sanction to raise a loan of £21,420 for the inauguration of the undertaking as recommended.

WOOLWICH.—The Electricity Committee reports having considered the report of Mr. J. F. C. Snell on plant extensions necessitated by the increased load and by future increased demands. After dealing in an exhanstive manner with the whole situation, Mr. Snell makes the following recommendations: (*a*) "That an extension be made at Globe Lane station of 3-1,250 (or 1,500) KW. turbo-alternators with the necessary extra boilers and extension of buildings; that the building extensions should be made at the south end of the present station, and water-tube boilers with marine casings, underfeed stokers, &c., be adopted; and that a properly designed circulating system for the condensers should be laid down with rotary strainers and change-over suction and discharge pipes." (*b*) "That application be made to the L.C.C. for a loan not exceeding £50,000 for the above purposes." Having given the matter careful consideration, the Council has decided to carry out the works recommended. In connection with the acceptance of the tender of Messrs. Mirrlees, Bickerton & Day at £10,175 for the supply of two 340-KW. oil sets a short time ago, Mr. Snell being unable to advise at present the installation of oil sets, the Council has rescinded its resolution accepting the tender.

ST. PANCRAS.—The gross income on revenue account of the electricity undertaking for the year ended March 31st last, amounts to £85,214, which is an increase of £3,845 over the previous year. After paying all working expenses, repayment of loans, interest, &c., and providing for accrued charges, a profit remains on the year's working of £12,436, this being a decrease of £766 on 1911. To this profit the balance of £4,328 from last year is added, increasing the balance to credit of net revenue account to £16,765, of which the sum of £4,000 is to be retained as a working balance. Regarding the reserve fund, the balance in hand at the commencement of the year was £40,517, to which is added £947 for interest on investments during the year, which makes a total credit of £41,465 in the fund at the end of the year. This balance is represented by cash at the Council's bankers and £20,439, the balance of the loan advanced to the capital account. The capital expenditure payable out of loan during the year was £10,639, which has been incurred in the provision of mains, machinery, services, &c. The revenue derived from the sale of units at 3d. per unit amounted to £27,025, while £44,633 resulted from the sale of units at 6d. per unit, and under, to 3d. per unit. The cost of generation amounted to £28,028 as against £26,950 in 1911.

Manchester.—The annual report of the Corporation electricity department shows that the sales for 1911-12 totalled over 93 million units. The year's trading resulted in a net surplus of £28,319, of which £24,500 goes to the relief of the rates. Sales of current showed an increase of over £30,000. The downward trend of the cost of production, however, was seriously arrested by the high prices paid for fuel during March, and the effect on the supply caused by exceptionally unfortunate breakdowns of plant. The working expenditure, exclusive of depreciation, showed a rise from £189,026 to £215,895 last year.

Perth.—On receiving an assurance that under the Loch Ericht Water and Power Bill, it is now simply proposed to take water from the River Ericht, use it for power purposes, and again discharge it into the river, and that a clause to this effect will be inserted in the Bill, the Town Council has withdrawn its opposition to the measure.

Rochford.—The B. of G. on June 25th considered a recommendation from a Committee in favour of the installation of an electric lighting and heating system at the workhouse at an estimated cost of £6,320, and the matter was adjourned for two weeks. The scheme has been prepared by Messrs. Dolby and Williamson, of Westminster.

Sevenoaks.—The U.D.C. has provisionally consented to the following terms being inserted in the transfer of the E.L. order to Messrs. Crompton & Co., Ltd. :—Public street lighting, maximum price 2d. per unit ; interior lighting of public buildings, maximum price of 4d. The Council has asked Messrs. Crompton & Co. to agree to pay all charges up to £450, and to give security for costs which may accrue from this date in the event of the transfer not being effected by reason of the proposed company not being formed, or of its falling through.

Southborough.—The U.D.C. has granted the Tunbridge Wells T.C. permission to lay lighting cables from Broomhill along Speldhurst Road for the purpose of supplying current at Speldhurst. The Council is to consider the advisability of applying for a provisional order for electric supply.

Southgate.—The offer of the North Metropolitan Electric Power Supply Co. has been accepted for the lighting of Green Lanes main road for a period of five years.

Stalybridge.—On Friday last Mr. T. C. Ekin held a L.G.B. inquiry into the application of the Joint Board for sanction to borrow £31,850 for electricity purposes. It was stated that the plant required was a 3,000-KW. turbine and condenser (£8,500) ; steam, exhaust and water piping (£600) ; switchgear and cable connections (£700) ; three Lancs. boilers (£1,800) ; superheaters (£850) ; boiler house buildings (£1,500) ; three mechanical stokers (£450) ; conveyor and coal bunkers (£500) ; boiler and pipe covering (£150) ; boiler seatings (£350) ; economiser (£750) ; feed pumps, pipes and valves (£700). Mr. Blackmore stated that they would have to make application shortly for further plant, and he asked the Inspector if he would consider the advisability of amending the application to the L.G.B. for two plants instead of one.

The Inspector said he took it that application would be for £9,800, which would bring the application up to over £40,000.

Sunderland.—A L.G.B. inquiry was held on June 26th, before Mr. H. R. Hooper, into the application for sanction to borrow the sum of £37,200 for the extensions of plant and mains, and the renewal of mains in connection with the electrical undertaking. Mr. G. D. Duncan, the assistant town clerk, said the application was made on account of the pleasing renewal of activities in the shipbuilding and engineering world. The largest item in the amount to be borrowed, it was stated, was from £20,000 to £22,000 for new plant. Some of the new plant was required for Dunning Street station, which was used as a stand-by. In reply to a question, the Inspector was informed that it was two or three years since steam was up at Dunning Street, and he said he thought they ought to consider whether they should not supersede certain of the plant at Dunning Street. He then turned attention to the loans on plant which is now superseded, and Alderman Bruce (chairman of the Electricity Committee) said he hoped the Board would bear with the Council a little longer. The Inspector said the Board could not make exceptions between local authorities. Alderman Bruce said there were exceptional circumstances with regard to Sunderland during the last three years. They depended very largely for their consumption of power upon shipbuilding and engineering industries, and it was a matter of notoriety that for two years the shipbuilding industry was doing nothing. Under these circumstances, they found it very difficult to make both ends meet, and during this same period they paid a considerable sum out of revenue for alterations at Dunning Street station by substituting motor-driven for steam-driven plant. The Inspector pointed out that the Council was applying for sanction to make fresh capital expenditure obviously for the purpose of superseding plant for which it had already made capital expenditure, and the L.G.B. would not sanction two loans for the same plant. If one plant superseded another they must meet the cost out of a reserve fund, or from revenue in a proper way. Alderman Bruce: Unfortunately, we have never been able to do it out of reserve funds. The Inspector added that they had had plenty of time to find out that the plant would not last as long as the period of the loan, and they ought to have put by money for that contingency. Many other authorities had done that. Alderman Bruce later asked whether the L.G.B. would grant a short loan for the superseded plant, and the Inspector said they would grant a loan for three years. At the conclusion of the inquiry, Alderman Bruce asked that the Board might give a decision as quickly as possible, because manufacturers were anxious that the new plant should be installed. The Inspector said so far as the evidence went, it appeared clearly that the additional plant was very desirable, and he should be prepared to advise the Board accordingly.

Tripoli.—Following on the occupation of the district by Italy, a central station for the supply of electrical energy for lighting and power purposes has been established in the town of Tripoli. The plant, which has been put down by an Italian syndicate, was supplied by Messrs. Tosi, of Legrano, La Sociétá Italiano Largen and Wolff, of Milan, and La Sociétá Tecnomasio Italiano.

Wednesbury.—A new departure is about to be made with the electric light undertaking, judging from a statement made by Alderman Griffiths (chairman) at a meeting of the T.C. on Monday. The alderman said that in February a resolution was agreed to by the Committee that new engines should be purchased at a cost of £3,500, but shortly afterwards they thought it wise not to carry out the resolution in its entirety. He intimated now that it was the intention of the Committee shortly to bring forward a new scheme for making extensions on a new site, which would be on the canal or railway, or both, although the present station would still be useful for stores, offices and for generating purposes.

Worksop.—The U.D.C. has received from the B. of T. permission to utilise overhead wires for supplying current to outside portions of the district.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the monthly meeting of the Corporation the question of a universal penny fare over the tramway system, which had been adopted at the previous meeting, again came up for discussion, and after an animated debate the proposal was negatived by a small majority. A motion was subsequently passed fixing the tramway fares at the present rate for the ensuing year.

Continental Notes.—AUSTRIA.—As will, perhaps, be remembered, a French financial syndicate is in competition with a group of Vienna banks in regard to the proposed conversion of the Vienna City Railway and the construction of new underground electric railways. The electrical firms associated with the Austrian banks in question are the Siemens & Halske Co., and the A.E,G., of Berlin, whose engineers have submitted a report on the subject for the guidance of the banks in their negotiations with the Vienna Traffic Commission. According to the scheme prepared by the Berlin companies respecting the City Railway, only the lines serving the requirements of the interior of the city would be transformed, the total length being 20 miles. A mixed service of locomotives and motor-cars would be introduced, with overhead conductors ; the expenditure is estimated at £1,250,000, and the work would mostly be completed by the end of 1914. As far as the projected underground railways are concerned, the scheme provides for the construction of three lines during the initial period of the work with a total length of 8½ miles, and of two further lines with a total length of 4·2 miles in the second term of construction. The outlay on the former is said to be computed at £5,000,000. The underground lines would be narrow gauge, so that an interchange of traffic with the City Railway would be out of the question, and the supply of direct current for working them would be furnished by the municipal electricity works which would have to erect sub-stations for the purpose. The report expresses the opinion that if the capital already invested in the City Railway is left out of consideration, the present deficit on working would disappear after the inauguration of electric traction and the opening of the underground lines, and that interest and redemption on the new capital would be earned after a few years' working. On the other hand, it is estimated that a period of from 15 to 20 years would elapse before the underground lines would be able to yield 4½ per cent. on the capital expenditure. These assumptions have induced the Vienna banks to inform the Traffic Commission that it will only be possible to raise the capital for the underground lines if the interested corporations—State, city and province—agree to make a corresponding contribution towards the work. The French financial group, however, regards the prospects as being more unfavourable in the case of the city railway, and a considerable contribution is also required if the work is to be undertaken. The estimates of the Berlin companies provide for the grant of a concession for the whole network for 90 years, and exemption from taxation for a period of 25 years.

It is proposed to adopt electric traction on the railway between Meran, Bozen and Mals, in the Tyrol.

RUSSIA.—A scheme has been brought forward for the conversion to electric traction of the St. Petersburg junction railways in connection with the projected transmission of power from the rapids of the Walchow, to which reference was recently made. The experiments are to be carried out at the cost of the State, as the Ministry for Railways has adopted a sympathetic attitude towards the scheme, which contemplates the use of H.T. alternating current.

Conway.—The promoters of the Vale of Conway Light Railway have decided to apply to the Light Railway Commissioners for powers to enable them to extend the line from Trefrew to Gwydyr, to make a deviation from the original route at Llanbedr, and to abandon about 9 miles of the intended railway.

Coventry.—The T.C. has applied to the B. of T. for a loan of £220,538 for the purchase of the tramways undertaking.

Doncaster.—The Light Railway Commissioners will on July 19th hold an inquiry into the application of the T.C. for an order for extending the Corporation tramways.

Glasgow.—The tramway department's accounts—published recently in the REVIEW—were confirmed and passed at the last meeting of the T.C. In presenting the budget, the convener, Bailie W. F. Russell, speaking of the doubling of the halfpenny stage, said that the introduction of that innovation had brought the numbers buying penny tickets down by 50 per cent., while it sent up the number of half-penny passengers by 100 per cent., resulting in their carrying at the rate of 50 million extra passengers in the year. That had led to a considerable amount of congestion, and the overcrowding had probably led to a considerable increase in the number of accidents reported. That state of matters should improve every day now, as the 50 new cars in course of construction would be available for traffic very shortly. As regarded the current year's revenue and expenditure, they would require to watch things closely, because with reduced fares they were now sailing pretty near the wind. If trade kept good and traffic continued as it had done lately, he had no doubt they would be able to persevere with the extended halfpenny fare, and have a surplus to hand over to the common good as large as the present (£52,067). He did not anticipate any big extensions of route. A matter which had engaged the attention of the committee was the adoption of "pay-as-you-enter" cars, the development of which was being closely watched. Replying to a question, Bailie Russell stated that the local tramway strike cost the department £8,000, of which £6,000 was estimated as loss of revenue and £2,000 as other expenditure incurred in bringing the strike to an end. The coal strike involved an extra £5,000 in the price of coal, representing the purchase of between 10,000 and 11,000 tons.

Halifax.—The Tramways and Electricity Committee proposes to fit up 20 tramcars with top covers, at an estimated cost of £92 in respect of each car.

The borough engineer has been instructed to reconstruct the tramway track from Free School Lane to the terminus at Skircoat Green, at an estimated cost of of £2,890.

Keighley.—The Corporation last week decided to suspend the issue of penny return tickets on the tramways for a period of three months—except on Saturday afternoons and Sundays—and to divide the routes into six sections, halfpenny tickets being issued for any two consecutive sections. Ald. Midgley, in criticising the proposal, expressed fear that the tramway system would thus become a losing concern. He concluded, however, by intimating his intention to vote in its favour, and hoped the scheme would be a success, though he had his doubts.

Luton.—The T.C. has applied to the B. of T. for an extension of time until August 11th, 1914, for completing the works authorised by the Tramways Order, 1905.

South Africa.—At a meeting of the Blomfontein T.C. on June 7th, a resolution was adopted for a railless traction system, for which it has been decided to ask the authority of the ratepayers for £76,000.

Sunderland.—The annual report of the Corporation Tramways for the year ended March 31st last shows a total revenue from traffic of £67,871, compared with £58,889 for the preceding year. The total expenses were £38,955, and there was a gross profit of £29,278. Bank interest brings this up to £29,687. Of this £7,263 is absorbed by interest on capital, and £22,152 is carried to the appropriation account. The repayment of loans accounts for £9,880, £6,018 is devoted to renewals, and after meeting several small items, £5,000 is left for the relief of the rates. The average working expense per car-mile, including power, was 7·95d. During the year nearly 17 million passengers were carried, and 1½ million car-miles run.

At a meeting the other day in connection with the Sunderland District Electric Tramways, the Receiver (Mr. Chas. Eves) stated that it was of the utmost importance that a supply of new cars be provided at the earliest possible moment, as many of the present cars were obsolete and worn out. It was also mentioned that a portion of the track would have to be relaid at an estimated cost of £5.000 per mile.

TELEGRAPH and TELEPHONE NOTES.

The International Radio-Telegraphic Conference.—On Friday the delegates to the Conference were conveyed to Falmouth by special train as the guests of the General Post Office, and on Saturday they visited the great wireless Marconi station at Poldhu. Messages were received from Canada and the U.S.A., and dispatched to Italy, Spain and Portugal. The station is being greatly extended in generating capacity, and has been equipped with receiving apparatus, which was not formerly provided. On Sunday the delegates proceeded by steamer up the River Fal to Truro, whence they returned by train to London. On Tuesday the delegates were entertained at dinner by the President and the British delegates, on behalf of the Government.

Siberia.—The telegraph rate to the whole of Russia in Asia (Siberia and Bokhara) is now 4½d. per word, instead of 1s.

Uruguay.—The law establishing compulsory installation of radio-telegraphy on board all passenger vessels arriving at Uruguayan ports will come into operation on July 15th.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—July 29th. (*a*) Additional plant at the generating station; (*b*) construction and equipment of tramways and railless system for the U.D.C. See "Official Notices" to-day.

Algeria.—Algiers.—The Chamber of Commerce of Algiers has been authorised to acquire for the ports of Algiers and Agha 24 portable electric cranes and four cranes worked by mechanical motors.

Ashton-under-Lyne.—July 30th. One 400-KW. motor-generator, one fuel economiser, two boiler feed pumps, coal elevator and conveyor and ash elevator, for the Corporation. See "Official Notices" to-day.

Australia.—Western Australia.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" June 21st.

New South Wales.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" to-day.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

July 30th.—Steel rails and track fastenings for Municipal Tramways Trust, Adelaide. Mr. W. G. T. Goodman, chief engineer and general manager, Hackney Road, Adelaide.—*Australian Mining Standard.*

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Austria.—Podgorze.—Supply of a 250-H.P. engine and boiler plant, dynamos, leads, accumulators, and a switchboard for the projected extension of the municipal power station. Particulars at the Municipal Bureau.

Birkenhead.—July 8th. Two 750-KW. mixed-pressure steam turbines and D.C. generators, with condensing plant, &c., and nine superheaters and interconnecting steam pipes, for the Corporation. See "Official Notices" June 21st.

Bridgend.—July 9th. 325-KW. steam engine, alternator, and accessories, for the U.D.C. See "Official Notices" June 28th.

Brighton.—July 8th. Electric light installation, Stanford Road Schools, for the T.C. Messrs. T. Simpson & Son, 16, Ship Street, Brighton.

Carnarvon.—July 10th. Electric plant, wiring, &c., of the existing main and other workhouse premises and of the new infirmary buildings now in course of erection, for the B. of G. Mr. R. L. Jones, architect, 14, Market Street, Carnarvon.

Dublin.—July 18th. Transformers, for the Corporation. See "Official Notices" to-day.

Dundalk.—July 8th. Materials and stores for the U.D.C. Electricity Department. See "Official Notices" June 28th.

Dunfermline.—Electric lighting work for new Opera House, at Dunfermline. Mr. J. D. Swanston, architect, Kirkaldy.

Eccles.—July 15th. Slack (5,000 tons a year) for the Corporation electricity works for two years. Borough Electrical Engineer, Cawdor Street, Patricroft, Eccles.

Enniscorthy.—July 17th. Continuous-current motor, for the District Asylum. See "Official Notices" to-day.

Halifax.—July 9th. Coal (14,000 tons) for the Corporation electricity works. W. M. Rogerson, borough electrical engineer, Foundry Street. (Returnable deposit £5.)

London.—Islington.—July 24th. One 3,000-KW. steam turbo-alternator, with exciter, condensing plant, switchgear, piping, &c., for the B.C. See "Official Notices" June 14th.

July 22nd.—The Howard Smith Co., 33, Cornhill, London, E.C., are inviting tenders for the following:—One 350-KW. Rateau mixed-pressure turbine; one 350-KW. three-phase alternator; one surface condensing plant, together with electrically-driven pumps; two 30 ft. × 8 ft. 3 in. Lancashire boilers. Specifications and forms of tender on application.

H.M. Office of Works.—July 18th. Arc lamp carbons for two years. See "Official Notices" to-day.

July 9th.—The Commissioners of H.M. Works and Public Buildings are inviting tenders for the erection of Victoria New Telephone Exchange, Mr. J. Rutherford, 22, Carlisle Place, London, S.W.

Manchester.—July 9th. Corporation Tramways. (*a*) Tramcar trucks: and (*b*) Motors and controllers for tramcars. Mr. J. M. McElroy, general manager, 55, Piccadilly, Manchester.

July 16th.—Permanent way special track work for the Corporation Tramway Committee. Mr. J. M. McElroy, general manager, 55, Piccadilly. (Returnable deposit £2 2s.)

Newcastle-under-Lyme.—July 15th. 1,000 yd. of V.B. mains, for the Corporation. See "Official Notices" to-day.

New Zealand.—August 16th. Electric motor and induced fan for Christchurch City Council. Tenders to City Surveyor. Deposit £5. Copy of specification can be seen at Board of Trade Commercial Intelligence Department, London, E.C.

Nuneaton.—July 16th. One electrically-driven turbine type boiler feed pump, &c., for the Corporation. See "Official Notices" to-day.

Partick.—July 9th. Cables for the Burgh Electricity Department. See "Official Notices" to-day.

Pembroke.—July 15th. Electric lighting and other works in connection with 43 dwellings for the working classes at Beatty's Field, Ball's Bridge. Mr. S. L. R. Price, electrical engineer. Plans, &c., at Town Hall, Ball's Bridge, Pembroke, Co. Dublin. Tenders to Chairman of Housing Committee.

Rotherham.—July 8th. (*a*) Tramway stores and materials for a year for the T.C., and (*b*) Electricity meters. (*a*) Tramways manager; (*b*) Borough electrical engineer.

Salford.—July 25th. Electric light, telephone and fire alarm installations at the Union Infirmary, Hope, Pendleton, for the B.G. See "Official Notices" to-day.

South Africa.—PIETERMARITZBURG.—July 29th. One steam turbine with tandem generators, switchboard and condensing plant for the Corporation. *South African Mining Journal*.

Spain.—July 31st. Electric lighting, for 15 years, of the town of Merida. Full particulars are given (in Spanish) in the *Gaceta*, which may be seen at the Commercial Intelligence Branch of the Board of Trade, E.C.

Tenders have lately been invited by the municipal authorities of Santa Otalla (province of Huelva) for the concession for the electric lighting of the town during a period of ten years.

Uruguay.—MONTE VIDEO.—July 13th. Tenders are called for the supply of 24 electric transporters for the port. Particulars, Ministry of Public Works.

Walthamstow.—July 19th. Extra-high-tension and low-tension cables, for the U.D.C. See "Official Notices" to-day.

CLOSED.

Accrington.—The Corporation has accepted the tender of Messrs. Glover for the supply of electric cables for Clayton-le-Moors, at £3,414.

Australia.—According to the *Australian Mining Standard*, the following contracts have been placed:—

Victorian railways:—

Cast-iron pipes and fittings for electric light station, £337.—The Atlas Co. of Engineers Pty., Ltd.
Truck material for electric street railway cars.—Noyes Bros. (Melbourne) Pty., Ltd.
8 miles electric wire, £119.—W. T. Henley's Telegraph Works Co., Ltd.
8 miles electric wire, £114.—Noyes Bros.
8 miles cable, at £24 10s. per mile.—British Insulated and Helsby Cables, Ltd.

MELBOURNE.—Postmaster-General's department

Five common battery switchboards, 100 lines, at £57 each, £285.—J. Bartram & Son Pty., Ltd.
Jacks and plugs, £55.—British Insulated and Helsby Cables, Ltd.
40 tons hard-drawn copper wire, 300 lb. per mile, at £84 4s. per ton, £3,368.—British Insulated and Helsby Cables, Ltd.
32,000 porcelain insulators, pattern A, at 5·39d. each, £719; 120,000 porcelain insulators, pattern B, at 2·16d. each, £1,080; total contract, £1,799.—Theodore Zwicker & Co.
2,200 dry cells, at 2s. 4d. each, £257.—A. J. Sage & Co.
100 calling devices, £130.—Automatic Telephones (Australasia), Ltd.

Department of Home Affairs —

Installation of electric light service at Fort Scratchley, Newcastle (N.S.W.), £369.—Joseph Bakewell, Newcastle.

SYDNEY.—Postmaster-General's department

17 miles 50 chains of cable, telegraph, lead-covered, paper insulated screened, 25 conductors, 50 lb. per mile, in 220-yard lengths, at £277 per mile.—Siemens Bros. Dynamo Works, Ltd.

ADELAIDE.—Postmaster-General's department:—

Relays, duplex repeaters.—British Insulated and Helsby Cables, Ltd.

Birkenhead.—The Tramways Committee has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., London, for the supply of six cars (with bodies built by Messrs. Hurst, Nelson & Co., Ltd.,) each seating 60 passengers, for the sum of £4,374.

Belfast.—The B.C. Electricity Department accepted the following tenders:—

Whipp & Bourne.—Extra H.T. switchgear.
Bertram Thomas.—Switchboard extensions.
Johnson & Phillips, Ltd.—Car-shed panels.

Bristol.—The B. of G. has accepted the tender of Messrs. Collings Bishop, Ltd., Cardiff, for electric light at Stapleton Workhouse, at £890. Fourteen firms tendered, the highest quotation being £1,648.

The Docks Committee of the T.C. on Monday accepted the tender of Messrs. Johnson & Phillips, Ltd., for cable for the shed cranes, and that of Messrs. Siemens Bros. & Co., for crane connection boxes.

Bray.—The following tenders were received by the U.D.C. for the electricity works:—

[illegible]

Diesel Engine Co. [illegible]	£1,734
Mirrlees, Bickerton & Day [illegible]	1,841
Willans & Robinson	1,947
Diesel Engine Co. (135-kw. set)	2,263
Cole, Marchant & Morley ..	[illegible]
British Westinghouse Co. (118-kw. set)	2,544

Section 2.—[illegible]

Herbert Morris & Co.	(accepted) £128	[illegible]	£140
J. Smith	[illegible]	[illegible]	160
Pickerings, Ltd ..	182	[illegible]	[illegible]
S. Whiteley ..	183	[illegible]	[illegible]
Vaughan & Son	184	[illegible] ..	170
J. Carrick ..	194	J. Thompson	192

Chester-le-Street.—The B. of G. has accepted the tender of Mr. G. H. Armstrong for motor machinery for the Workhouse laundry, at £56.

Coventry.—The Management Committee of the Coventry and Warwickshire Hospital has accepted the tender of Messrs. Waygoods, Ltd., for an automatic electric lift.

Eastbourne.—A contract for elevators for the Corporation electricity works has been placed with Messrs. Ed. Bennis & Co.

Erith.—The U.D.C. has accepted the tender of Messrs. Allen & Simmonds, Ltd., for repairing No. 4 engine at the electricity works, at £182.

Grimsby.—The Borough Education Committee has accepted the tender of Messrs. E. H. Buck & Co., Ltd., of Manchester, for electric light fittings at Victoria Street Schools, at £83.

Haslingden.—The Committee of the Bury Road Baptist Church has placed the order for the electric lighting of the church and the electric blowing of the organ with Mr. A. M. Cramp, of Haslingden.

Hull.—The Tramways Committee of the T.C. has accepted the tender of Messrs. Bolling & Lowe for steel tramway rails (manufactured by the Phœnix Co., of Hamburg), at £7,969.

Japan.—The *Daily News* states that an important Japanese contract has been obtained by Messrs. Dick, Kerr & Co., Ltd., from a Japanese hydro-electric power company. It is described as probably the largest order for water-driven alternators which has been placed in this country. The order covers six alternators, each of 7,775 K.V.A. capacity.

Keadby.—The Great Central Railway Co. has accepted the tender of Sir Wm. Arrol & Co., Ltd., of Glasgow, for a lifting bridge, electrically operated, over the river Trent at Keadby.

Leyton.—The U.D.C. has received the following tenders for the supply of ·75 double concentric cable:—

Aubert Grenier & Co. ..	£1,230	Johnson & Phillips, Ltd	£1,180
Brit. Ins. and Helsby Cables ..	1,133	Siemens Bros. & Co.	1,131
Elec. Eng. and Equip. Co.	1,102	**Standard Cable Manufacturing Co., Ltd.** .. (accepted)	1,052
General Electric Co., Ltd. ..	1,247	R. R. Todd	1,060
W. T. Henley's Telegraph Works Co. ..	1,150	Union Cable Co. ..	1,201
W. T. Glover & Co.	1,100	Western Electric Co.	1,350

The tender of Bertram Thomas has been accepted, at £105, for the supply of an additional feeder panel to the switchboard.

Llandudno.—The U.D.C. has accepted the tender of Messrs. Thomas Parry & Co., of Mold, for from 4,000 to 5,000 tons of slack for the Electricity Works, at 9s. 9d. per ton.

London.—L.C.C.—The Fire Brigade Committee received the following tenders for electric light wiring and fitting at Shooter's Hill fire station:—

A. Hawkins & Sons ..	(accepted) £171	Barlow Bros. & Co...	193
Pinching & Walton	180	J. Bryden & Sons	252

The Horsfall Destructor Co., Ltd., having intimated its inability to enter into the necessary contract for the provision of sand crushing and drying plant, at £651, fresh tenders were invited as below:

Mechan & Sons, Ltd. ..	(accepted) £1,211
Edgar Allen & Co., Ltd.	1,269

The Highways Committee received the following tenders for guards for shafting, &c., at the Greenwich generating station:—

Rownson, Drew & Clydesdale, Ltd. ..	(accepted) £374
St. Pancras Ironworks Co., Ltd.	388
Hunter & English, Ltd.	546

A contract has been entered into with the Morgan Crucible Co., Ltd., for brushes for electrical machinery for the year 1912-13.

BERMONDSEY.—The tender of Messrs. Myers, Rose & Co., Ltd., has been accepted by the B.C. for a 12 months' supply of Shipley peas coal at 16s. 3d. per ton, subject to the firm agreeing to supply 3,000 tons, the Council to have the right to order 20 per cent. up or down on that quantity.

WOOLWICH.—The following tenders have been accepted by the B.C.

C. A. Parsons & Co.—Renewing [illegible] of No. 3 turbo-set at Woolwich Works, £98.
Yorkshire Copper Works, Ltd.—Renewal of condenser tubes to Nos. 6 and 7 engines at Plumstead Works, £116.
Willans & Robinson, Ltd.—One 1,500-kw. turbo-alternator, £4,782.
Siemens Bros. Dynamo Works Co., Ltd.—Sub-station switchgear, £305.
Ferranti, Ltd.—Sub-station switchgear, £205.

ST. PANCRAS.—The B.C. Electricity and Public Lighting Committee reports having received the following tenders for two

1,000-KW. motor-generators for the Tavistock Place sub-station and the King's Road generating station :—

Crompton & Co.	£4,696
General Electric Co.	5,102
Electric Construction Co.	5,372
Bruce Peebles & Co.	5,410
Brush Electrical Engineering Co.	5,600
Siemens Bros. & Co.	6,348
Dick, Kerr & Co.	6,516
British Westinghouse Co.	7,026
British Westinghouse Co. (alternative rotary at 500 revs.)	6,510
British Westinghouse Co. (alternative rotary at 373 revs.)	6,900
British Thomson-Houston Co.	7,800

The chief electrical engineer advised the Committee that having regard to the amount of floor space occupied, the interchangeability of plant and the elasticity and simplicity in operation of the set offered by Messrs. Bruce Peebles & Co., he considered their offer the most suitable for the Council's purposes. This offer includes £50 for a D.C. starter and also £50 for tests on site, but he states that as four of the firm's machines are already in use at the Council's electricity stations, the test on site will not be necessary, nor is the D.C. starter required, so that their offer will be reduced to £5,310, and he recommends that the firm's tender at this price should be accepted. He further points out that all the tenderers except Messrs. Bruce Peebles ask for modifications either in the arbitration clause or in the general conditions. For these reasons the Committee states, although the offer in question is not the lowest received, it agrees with the engineer's proposal that it should be accepted.

The tender of Messrs. J. H. Beattie & Co. has been accepted for annual supplies of the following coals to the Electricity Department :—20,000 tons Mansfield best slack, 14s. 2d. per ton ; 2,000 tons Staveley large slack, 15s. 2d. ; 8,000 to 9,000 tons Nuneaton D.S. nuts, 15s. 2d.

Luton.—Messrs. E. Bennis & Co., Ltd., have received an order for mechanical stokers and self-cleaning compressed-air furnaces for the borough electricity works.

Margate.—The T.C. received the following tenders for electrically-driven sewage pumps :—

Rees Roturbo Manufacturing Co., Ltd.	(accepted)	£295
Sun Patent Evaporator Co., Ltd.		262
Marshall, Osborne & Co.		281 or 282
British Electric Plant Co., Ltd.		308 or 330

Plymouth.—The tender of Cory Bros. & Co., Ltd., for 8,000 tons of coal, at 14s. 6d. per ton (1s. per ton above present contract) was accepted by the Electricity Committee.

Ramsbottom.—The U.D.C. has accepted the tender of Messrs. Dawson & Manfield, of Manchester, for a refuse destructor and steam disinfector, at £3,800.

Salford.—The following tenders have been accepted by the T.C. :—

J. Lomax, Kendal & Co., Ltd.—Installation of electric light at Nashville Street School, £133.
Walter Scott, Ltd.—750 tons Sandberg steel tramway rails, £7 15s. per ton.
John Smith (Keighley), Ltd.—10-ton engine room travelling crane at electricity works, £290.
Browett, Lindley & Co.—Reboring three high-pressure cylinders and making and fitting complete three new high-pressure pistons fitted with restrained piston rings, £50.

The following tenders have also been accepted for an annual supply and delivery of high-speed electric motors :—

General Electric Co. (approximate value of contract), £568.
Horace Green & Co., £219.
Electric Construction Co., Ltd., £31.
Phœnix Dynamo Manufacturing Co., Ltd., £49.

Southampton.—The tender of the Union Cable Co., Ltd., has been accepted by the T.C., at £134, for the supply of 1,600 yd. of high-tension cable. Three other tenders were received at prices ranging from that accepted to £182. The tender of Messrs. Myers, Rose & Co., Ltd., has also been accepted for a supply of 500 tons of Pinxton coal at 20s. 9d. per ton for the generating station ; as has the tender of Messrs. Dinham, Fawcus & Co., Ltd., for 250 tons of Bolsover coal at 20s. 11d. per ton. For the supply of 1,120 yd. of 1 in. cable and 190 yd. of 1·5 in. cable, the tender of Messrs. William Rickard, Ltd., has been accepted, at £706 and £64, respectively.

Wallasey (Cheshire).—The contract for mechanical stokers and furnaces for the borough electricity station at Liscard has been given to Messrs. Ed. Bennis & Co., Ltd.

Walthamstow.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £411, for a low-tension switchboard.

Worcester.—The Infirmary Committee has accepted the tender of Mr. H. J. Harding, of Worcester, for electric lighting work at the infirmary, at £125, and for telephonic installation, at £27.

York.—The B. of G. has accepted the tender of Messrs. T. H. Cabey, Ltd., of South Shields, for materials for extending the telephones and fire alarms at the Workhouse, at £73.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, July 26th. At 7.30 p.m. At the St. Bride's Institute, E.C. Discussion on "Condensers : Their Construction and Efficiency."

NOTES.

Census of Production.—The second census of production, under the Census of Production Act, 1906, will be taken in 1913 in respect of production carried on in the present year. The schedules to be issued to manufacturers and others for the purpose of this census cover, in the main, the same ground as those for the first census. The instructions have been simplified, and the majority of the schedules have been reduced from eight pages to four pages of somewhat larger size. In certain schedules, particulars are now required of the total make of important semi-manufactured products such as yarns, pig-iron, steel ingots, &c., whether further worked up by the makers or not. By arrangement with the Home Office, the particulars of the numbers of persons employed will also serve as the ordinary return required for 1912 under Sec. 130 of the Factory Act, and manufacturers will thus be saved the trouble of making two separate returns. Small firms employing not more than five persons besides the employer, on making a declaration to that effect on the schedules issued to them, will be exempted from the requirement to furnish returns. At the present time, the schedules are being issued in draft to Chambers of Commerce and Trade Associations in order to afford them an opportunity for the consideration of the details of the information required before these are finally settled. The schedules on which manufacturers will be required to make their returns will not be sent out until the beginning of next year.

Legal.—FITTON *v.* MUIR.—An application was made at the Manchester County Court on Tuesday, before Judge Mellor, K.C., by Mr. Brocklehurst, on behalf of John Fitton, of Victor Street, Lower Broughton. Messrs, Muir were the defendants. The case arose out of an unusual event which occurred at Strangeways, Manchester, at the works of Wm. Muir & Co., engineers and machine tool makers, and the application was made under the Workmen's Compensation Act. Plaintiff's case was that on March 4th he was following his employment as a crane driver for Messrs. Muir, when he stumbled, and his left hand touched an unprotected "live" wire attached to the crane. He received a shock to the left hand and arm, and they were numbed for about half-an-hour afterwards. The arm had been flung violently backward when the shock occurred, and it caught against the crane. Later he found he was unable to lift the arm, but he continued working under great difficulties until he went to the manager and reported the accident. This was on March 8th, and the manager told him he ought to have reported the matter earlier. That, Mr. Brocklehurst said, he understood, was something on which the defence relied for their answer to the claim for compensation at the rate of 13s. a week. Another point of the defence (said Mr. Brocklehurst) was that the locomotor ataxy which came on subsequently was due not to the accident but to natural causes. In that connection he mentioned that the plaintiff was an old Rugby footballer, who had played 20 years ago for the Broughton Club. He had always been in very good health, and it was a remarkable thing that he should contract locomotor ataxy almost immediately after the accident took place. There had been no trace of it before, and as to the health of his family, his father died when he was 74, and his mother was older, and still living.

Plaintiff in his evidence denied Mr. Wingate Saul's suggestion that his arm had been wasting and getting weaker before the accident. It was all right until the accident.

Judgment was eventually given for the defendants.

The First A.C. Railless Trolley.—The first alternating-current railless trolley in the world is being shown in working order on a tar macadam road, by the Gesellschaft für Gleislose Bahnen Max Schliemann & Co., at the Electrical Exhibition of Leipzig. This is an electric-'bus travelling on a strip of tar macadam 100 ft. in length, which has been rolled on an existing uneven stone pavement 6 cm. in thickness, after scratching out the joints as far down as possible. The 'bus is operated by a 1,000-volt single-phase commutator motor of 15-H.P. output, at 1,200 R.P.M. and 50 cycles, started and controlled by shifting the brushes. The motor drives the rear axle through a double cardan shaft and a worm gear of 10 : 1, and the rear wheels by an elastic clutch. The form of current, the voltage and the use of a repulsion motor constitute decided novelties in this connection. The rubber tires are guaranteed for 20,000 km., but 40,000 km. have been reached in actual operation, corresponding to a cost of ½d. per km. The vehicle is lighted by metal-filament lamps. The speed is 20 km. per hour, the average consumption being ½ KW.-hour per kilometre.

London Labour Troubles.—A meeting of waterside and other manufacturers in the London district was held on Wednesday at the London Chamber of Commerce Building in Oxford Court, to consider the position of London manufacturers owing to the lightermen's strike.

Will.—Mr. John Dodd, late chairman of Platt Bros. and Co., Ltd., of Oldham, left £228,100 gross and £222,380 net personalty

Institution Notes.—Institution of Electrical Engineers.—The annual conversazione of the Institution of Electrical Engineers was held on Thursday evening, June 27th, at the Natural History Museum, South Kensington. The guests, who included a number of the delegates to the International Radio-Telegraphic Conference, numbered about 1.250, and were received by the president, Dr. S. Z. de Ferranti, and Mrs. de Ferranti, and the Council of the Institution. Among those present were :—Lord Justice Buckley, Sir John Gavey, Col. Sir T. H. Holditch, Sir Walter Howell, Prof. Jackson (president, American I.E E.), Sir Alexander Kennedy, Major W. A. J. O'Meara, Sir Henry Tanner, Sir Cecil Trevor, Dr. J. H. T. Tudsbery, Sir Edward White, and many other distinguished guests. The string band of the Royal Engineers performed in the Central Hall, and the Royal Windsor Glee Singers in the Shell Gallery, and the function passed off with the usual success.

Institution of Mechanical Engineers.—The balloting list of new members to be submitted to the general meeting on the 30th inst., we should think, breaks the record ; it contains the names of no fewer than 206 candidates for admission or transfer—35 to the class of Members, 117 to that of Associates, and 54 to that of Graduates. Is it the spectre of examination that looms in the background of the near future ?

Annual Outings.—The staffs of the Urban Electric Supply Co., at Dartmouth and Newton, held their annual outing on June 20th, the party, numbering upwards of 30, journeying by motor from Newton to Bovey Tracey, where breakfast was partaken of. The run was then continued to Chagford, where a halt was made, and upon arrival at Okehampton, dinner was provided at the Plume of Feathers, Mr. G. E. Smith, the engineer and manager, occupying the chair. Subsequently a cricket match was played between the two staffs on the Okehampton cricket ground, through the kind permission of the local club, the Newtonians winning by two wickets and eight runs. Later the journey was resumed to Crediton, where tea was served. On the return journey the party passed through Exeter, and remained for a while at Chudleigh for supper.

The Fuller Electrical and Manufacturing Co., Walthamstow, had their annual outing on Saturday, June 29th, when a party of 29 went to Clacton-on-Sea. After a morning bathe in the sea, the company were early ready for the repast, which was served at 12 o'clock at the Clifton Restaurant. Tea was served in the grounds attached to the restaurant.

The International Electric Co., of Kilburn, held their annual outing on June 29th. Close upon a hundred of the employés and staff took part. Yarmouth was reached soon after ten o'clock. The party assembled for lunch at the Granville Hotel, with Mr. H. R. Roose in the chair. The usual toasts were given, and the continued success of the I.E.C. was referred to by the chairman. A short musical programme served to while away the time during a shower.

Astor Gift to "Mackay-Bennett" Crew.—According to the New York *Times*, Capt. Larnder, of the cable steamer *Mackay-Bennett*, which recovered a large number of bodies of victims of the *Titanic* disaster, including that of Col. John Jacob Astor, has received from Mrs. Astor, his widow, and Vincent Astor, his son, as proof of their appreciation of the work of the crew of the *Mackay-Bennett*, $2,000 for distribution in gratuities to those who assisted in any way in the work of recovery.

Forced Vibrations.—An interesting letter from Prof. J. Perry appeared in *Nature* last week, on the subject of forced vibrations, pointing out that the amplitudes of 'forced vibrations are greatest when the forcing influences are in tune with the natural vibrations only if there is no damping ; when damping or corresponding loss of energy takes place, the statement is not correct. It is an important matter for persons concerned with telephony or wireless telegraphy ; for instance, the tuning of the antenna should be readjusted when the sender becomes the receiver. Prof. Perry gives various examples, worked out, to illustrate his point.

Veritys' Derbyshire Climbing Club.—On Saturday last the members of the above club trekked to Edale, and, under the direction of Chief Guides Ride, Landon and Knowles, ascended Back Tor, climbed over the Ridge to Mam Tor, ascended the chain, and then went over the Winnats, descending to the Speedwell Caves ; there they took boat and covered the underground waterway to the Main Cavern, where the source of the wells was negotiated. After the subterranean exploration, the party dined at the George Hotel, Castleton. In the evening a visit was paid to Peveril of the Peak's Castle, and then to Hope, where the party joined the homeward train, after a very enjoyable climb.

Fatality.—An inquest was held at Willington Quay-on-Tyne on June 28th respecting the death of David Carrot, 31, who was killed at the Willington Foundry. Ralph Stevens, an electrician, stated that the deceased was employed as a labourer and spare craneman. On June 26th he learned that the deceased had fallen from an electrically driven crane on to a "live" wire which was carrying an alternating current at 440 volts. The current could be cut off, he explained to the Factory Inspector, by drawing out the fuses controlling the crane supply, and also by the switch which controlled the whole of the machinery in the works. Ralph Paton said he and deceased were assisting in erecting a new crane. It was necessary to move the existing crane, and Carrot went up to do this. Witness saw him move the crane and leave the cage. The next moment someone shouted an order for the fuses to be drawn. Witness looked up and saw Carrot standing on a girder, grasping the electric wire with his hand. The fuses were drawn, and deceased at once fell to the ground, and fractured his skull. He died immediately afterwards. Other evidence having been given, the jury returned a verdict to the effect that deceased was killed by a fall from an electric travelling crane, and recommended that a separate switch should be provided to control the crane alone.

Coal Cutters on Rails.—It frequently occurs in colliery practice that where mechanical coal cutters are adopted, these machines are mounted so as to run on rails which have to be laid on the floor of the working place. These tracks are necessarily of a temporary nature, and in some situations the use of rails has proved productive of considerable trouble owing to the fact that a large amount of time is taken in laying the rails and many of the joints between the various sections prove bad. The result of this is that as the cutter passes over these joints it shows a very great tendency to come off the rails, and the difficulty of getting heavy machines of this nature back again in a more or less confined space can easily be imagined. Cases have been known where up to two hours of valuable time have been absorbed in doing work of this description. Another point with regard to this method of working is that as these rails are very often laid in a slipshod manner, the undercut is very likely to be irregular. In some cases it has been known to vary from 4 ft. 6 in. to 6 ft., and this varying depth of undercut seriously interferes with clean and regular working. The use of skids obviates all this trouble, as there are no rails to lay and there is, of course, nothing for the machine to slip off. The depth of the undercut is regulated in an easy and sure manner by a side rail which runs along the props, and in addition to these advantages, it is found that the machine is not so liable to slew as the type which runs on a rail track. For these reasons a skid possesses advantages which should be considered by the colliery engineer.

Appointments Vacant.—Two prime cost clerks, for the Hackney B.C. Electricity Department (£90 and £105 respectively) ; station superintendent for the City Electricity Department, Carlisle (£120). See our advertisement pages to-day.

Electricity Works Table.—We regret that the undertaking of the Rawtenstall Corporation, which also supplies Bacup with electricity in bulk, was inadvertently omitted from our list. On the other hand, the Folkestone District E.L. and P. Co. should be deleted, having been absorbed by the Folkestone Electricity Supply Co., Ltd.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At a smoking concert held on Friday last, the staff of the Hull Corporation electricity department presented Mr. H. Bell, the city electrical engineer, whose marriage was recently announced in our columns, with a set of silver spoons in case, suitably inscribed. The presentation was made by Mr. J. F. Magoris, the chief assistant electrical engineer, who referred to the high esteem in which Mr. Bell was held, and the good fellowship existing throughout the department. Mr. Bell suitably responded, and his health was toasted with musical honours. An excellent programme of music and song was rendered during the evening.

The Kingston-on-Thames T.C. has increased the salary of Mr. P. C. Simpson, of the electricity works staff, from £3 to £3 10s. per week, with a further increase to £4 on April 1st, 1913. He is to have charge, under the electrical engineer, of the work both outside and inside the central station.

Mr. Winterhalder, second assistant engineer and mains superintendent at the Kingston-on-Thames Corporation Electricity Works, has secured an appointment at Rio de Janeiro.

Blackburn General Purposes Committee has had under consideration the proposal to increase the salary of Mr. P. P. Wheelwright, borough electrical engineer, from £500 to £700, by increments of £50 a year. The Labour members offered strenuous opposition, but the recommendation was carried. The opposition, however, is to be renewed at the next open Council meeting.

On June 29th Mr. S. R. Rymer, assistant to Mr. Percy Murray, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., was married to Miss Cissie Dotchin, of Newcastle. A number of his colleagues and other friends were present.

Mr. A. W. Barham, station superintendent, Carlisle, has been unanimously appointed to the position of chief assistant at Watford U.D.C. electricity works. Mr. J. Ellis, of Llanrwst, has been appointed junior shift engineer.

General.—At a general meeting of the Royal Institution on Monday, Mr. J. S. Highfield was elected a member.

Mr. Franklin Punga has established himself as consulting engineer in Liége (Avenue Rogier 30).

It is announced in the *Times* that Major H. G. K. Wait, R.E., has been appointed Chief Instructor in Electricity at the School of Military Engineering, Chatham, vice Major Dumaresq.

The *Times* New York correspondent states that at a dinner of the American Institute of Electrical Engineers in Boston, the Institute presented Mr. George Westinghouse with the Edison Medal "for meritorious achievement in connection with the development of the alternating-current system for light and power."

Mr. William Oliver, B.Sc., A.M.Inst.C.E., of Messrs. Bruce Peebles & Co., Ltd., was married on Wednesday last week, in St. Giles' Cathedral, Edinburgh, to Miss Kate Wilson Somerville Shaw. Mr. Oliver was recently presented by his colleagues with a handsome silver salver and silver cigarette box, both suitably inscribed, to commemorate the event.

Mr. John E. Raworth, of 28, Broadway, Westminster, S.W., announces that he has just acquired the business, established in the year 1871 by the late Mr. Newnham Browne, chartered patent agent, and carried on by him and his successors at the Old Mansion House, 73, Cheapside, E.C. Mr. Raworth is retaining the offices in Cheapside, and will conduct them as a City branch of his business, under the management of Mr. C. L. Perry, who was for many years with Mr. Newnham Browne, and has had over 25 years' experience in patent and trade mark matters.

On the afternoon of Friday last, Mr. H. Chas. Gover bade farewell to the head office staff of the Edison & Swan United Electric Light Co., Ltd., with which he has been since its inception; indeed, he was connected with the business prior to the amalgamation which established the company whose name is now a household word. The whole of the managers and staff of the offices, depôts and works of the company, united in showing their respect and esteem by presenting Mr. Gover with a massive chest of cutlery and sterling silver fruit dishes. The presentation was made by Mr. John Cooper, the accountant of the company, in the presence of the head office staff. In replying, Mr. Gover, who, in company with all present, was much affected, expressed his great appreciation of the gift which he said he knew was merely the manifestation of the warm feeling which underlay it. At such a time one's feelings were almost too deep and too strong to find expression in words. When he looked round the room and saw that picture, the group of those who had been his colleagues and who had given him so willingly their assistance in all his duties, he felt it was a picture he could never forget. He had never dreamed of so spontaneous an expression of regret at his leaving the firm. He had known most of those in the room for some years, and during that time the staff of the company had gone on steadily attending to their work and their duties. There had been perfect harmony between everyone, and very few difficulties had cropped up, but the best way to go through life was to keep your eyes towards the sun of the future and not to look back to any shadows which might have existed in the past. Mr. Gover indulged in some interesting reflections on the position of wage-earners and the general condition of the country to-day as compared with those of the year 1848, when he was an apprentice.

Obituary.—An inquest was held at St. Margaret's, near Dover, last week, into the death of Mr. W. F. Nosworthy, a retired superintendent electrician of the Western Telegraph Co., who disappeared from Folkestone a few days previously. Death was shown to be due to morphia poisoning. Deceased had been in the habit of taking morphia for malaria and rheumatism contracted in South America.

We regret to record the death of Mr. W. S. B. McLaren, M.P. which occurred on Saturday last, at the age of 59 years. The deceased gentleman had been for the greater part of his lifetime very actively engaged in connection with mining, iron, textile and other industries, and among other companies with which he was associated were the Electric Construction Co., Ltd., and the Madras Electric Tramways (1904), Ltd., of both of which he was chairman.

NEW COMPANIES REGISTERED.

Lemington Glass Works, Ltd. (122,562).—This company was registered on June 12th, with a capital of £25,000 in £1 shares (15,000 6 per cent. cumulative preference), to carry on the business of manufacturers of, and dealers in, glassware for lamps, and other apparatus for use in connection with electric and other illumination, and with the generation, distribution, accumulation, supply and employment of electricity, &c., and to adopt an agreement with Robertson Electric Lamps, Ltd. The subscribers (with 100 preference shares each) are:—H. Hirst, 67, Queen Victoria Street, E.C., electrical engineer; J. Fraser, 31, Copthal Avenue, E.C., chartered accountant. Private company. The number of directors is not to be less than two or more than five; the first are H. Hirst and J. Fraser; qualification, 100 shares; remuneration as fixed by the company. Registered office, 31, Copthal Avenue, E.C.

United Carborundum and Electrite Works, Ltd. (122,569).—This company was registered on June 12th, with a capital of £100 in £1 shares, to take over the business of the Vincit Co., Ltd., to acquire and work the agency for Great Britain and the Colonies for the sale of "Carborundum" and "Electrite" products manufactured, produced, or sold by the Vienna Carborundum Co., to manufacture and sell appliances for use in the engine building, acetylene gas plant, agricultural implement, anchor, armour plate, and bicycle manufacturing and various other trades, &c. The subscribers (with one share each) are:—S. Whitman, 25, Gledhow Gardens, S.W., company director; W. T. Batteo, 179, Queen Victoria Street, E.C., company director. Private company. Table "A" mainly applies. S. Whitman signs as a director. Registered office, 70, Queen Victoria Street, E.C.

R. F. Syndicate, Ltd. (122,722).—This company was registered on June 20th, with a capital of £2,000 in £1 shares, to acquire patents and inventions connected with incandescent electric lamps, gas mantles and burners, &c., and to adopt an agreement with J. T. Robin and others. The subscribers (with one share each) are:—W. J. Willis, 35, Frederick Road, Chingford, clerk; H. Douglas, 15, East Bank, Stamford Hill, N., clerk; E. Mackenzie, Foxholme, Barron Road, Streatham, S.W., clerk; J. T. Robin, 38, Tooting Bec Gardens, Streatham, S.W., manufacturer. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

North Berwick and District Electric Light and Power Co., Ltd. (8,298).—This company was registered in Edinburgh on June 15th, with capital £7,500 in £1 shares, to carry on business of an electric light and power company in North Berwick, &c. The subscribers are:—E. A. Schafer, Marbyknowe, North Berwick, professor of physiology, 100 shares; F. Kinloch, Shipka Lodge, North Berwick, J.P., 100 shares; P. Farquharson, Westwood, North Berwick, house agent, 100 shares; J. McK. Brown, Wardville, North Berwick, chartered accountant, 1 share; W. T. Perves, 13, Albany Street, Edinburgh, civil engineer, 1 share; J. E. Ivens, Hillside, Hanger Lane, Ealing, London, W., civil engineer, 100 shares; K. A. Scott Moncrieff, Salisbury House, London Wall, London, E.C., 100 shares. The number of directors is not to be less than three or more than nine; the first are Prof. Schafer, F. Kinloch, P. Farquharson, J. E. Ivens and K. A. Scott Moncrieff; qualification, £100. Registered office, 9, East Road, North Berwick.

Listowel Light and Power Co., Ltd. (3,852).—This company was registered in Dublin on June 18th, with a capital of £2,000 in £1 shares, to carry on at Listowel the business of an electric supply company in all its branches. The subscribers are:—J. Macanley, Listowel, agent, 25 shares; P. Corridan, Listowel, grocer and vintner, 25 shares; Wm. McElligott, Listowel, auctioneer, 25 shares; Daniel J. Flavin, Listowel, chairman U.D.C., 5 shares; P. Bocen, Listowel, secondary teacher, 25 shares; John McKenna, Listowel, merchant, 15 shares; Thos. J. Walsh, Listowel, draper, 25 shares; E. J. Long, Limerick, leather merchant, 25 shares; S. J. Cantwell, 6, Fleet Street, Dublin, engineer, 25 shares. Private company. The number of directors is not to be less than three or more than seven; the first are J. Macanley, Wm. M. McElligott, E. J. Long, P. Bocen, P. Corridan, T. J. Walsh and G. J. Cantwell; qualification, £25; remuneration as fixed by the company. Registered office, Power House, Listowel, Co. Kerry.

T. Wilkinson (Arnside), Ltd. (122,064).—This company was registered on June 18th, with a capital of £3,000 in £1 shares, to take over the business of an electrical engineer carried on by T. Wilkinson at Arnside, Westmorland. The subscribers (with one share each) are:—O. W. Porritt, Torside, Helmshore, woollen manufacturer; W. F. Crowther, Union Bank Chambers, Bolton, chartered accountant; T. Wilkinson, Braeside, Arnside, Westmorland, electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are O. W. Porritt, W. F. Crowther and T. Wilkinson; qualification, £100; remuneration as fixed by the company. Solicitor, J. G. Priestwood, Arnside, Westmorland. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Canadian-British Engineering Co., Ltd. (122,775).—Registered June 24th, by Slaughter & May, 18, Austin Friars, E.C. Capital £205,000 in 200,000 7 per cent. preferred ordinary shares of £1 each, and 100,000 deferred shares of 1s. each, to carry on in Canada or elsewhere, the business of consulting, civil, naval, mining, railway, electric, gas, mechanical, and general engineers, manufacturers of and dealers in agricultural and mining implements and machinery, iron, steel, and other metal manufacturers and workers, founders, smelters, machinists, tin-plate workers, manufacturers of all kinds of metal goods, contractors for the erection of engineering works, and to adopt an agreement with Key Engineering Co., Ltd. The signatories (with one share each) are:—A. Corbett, 18, Austin Friars, E.C., solicitor; H. Pettitt, 18, Austin Friars, E.C., solicitor; L. H. Hiscock, 34, Lonsdale Square, Barnsbury, N., clerk; P. J. Hellis, 3, Merthyr Terrace, Castlenau, Barnes, S.W., secretary; D. Avory, 18, Austin Friars, E.C., solicitor; A. C. C. Hutchinson, 13, The Boltons, S.W., gentleman; R. Hill, 129, Deacon Road, Willesden Green, N.W., clerk. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are C. L. Agnew, The Pole, Northwick, Cheshire; W. H. Patchell, M.I.C.E., Caxton House, Westminster; L. Andrews, M.I.C.E., 4, Queen Victoria Street, E.C.; and W. A. Martin, 2, Toronto Street, Toronto, Ontario (managing director in Canada); qualification, £250; remuneration, £150 per annum chairman £50 extra).

Colne Valley Electric Supply Co., Ltd. (122,867).—This company was registered on June 28th, with a capital of £200 in £1 shares, to carry on the business of an electric supply company in all its branches. The subscribers are:—H. W. Couzens, 50, Queen Anne's Gate, S.W., consulting engineer, 25 shares; N. Gunn, 65, Hillier Road, Clapham Common, S.W., law clerk, 1 share; F. A. Hayward, 37, Wandle Road, Upper Tooting, S.W., engineer's assistant, 1 share; F. C. Judd, 6, Devereux Road, New Wandsworth, S.W., clerk, 1 share; H. Perkins, Osborne House, Bartholomew Villas, Kentish Town, N.W., accountant, 1 share; G. F. Baker, 141, Bennerley Road, New Wandsworth, clerk, 1 share; H. H. Vardon, 25, Victoria Street, S.W., clerk, 1 share. Minimum cash subscription 20 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are H. W. Couzens and A. L. Radford; qualification, 25 shares. Solicitors, Chas. Rogers, Sons & Abbott, 13, Victoria Street, S.W. Registered office, 50, Queen Anne's Gate, Westminster.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

M. E. Robinson & Co., Ltd. (121,625).—Particulars of £700 and £350 second debentures, created May 7th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amounts being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electrical Advertising Co., Ltd. (108,465).—Debenture dated May 23rd, 1912, to secure £132 12s. 2d. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to prior charge for £700. Holders: London and Provincial Bank, Ltd.

Penrith Electric Supply Co., Ltd. (99,764).—Mortgage dated June 3rd, 1912, to secure all moneys due or to become due from the company to Parr's Bank, Ltd., charged on land and building in Friar Street, Penrith.

Ceara Tramway, Light and Power Co., Ltd. (119,030).—Trust deed, dated May 24th, 1912, to secure £400,000 debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: British and International Investment Trust, Ltd., 6, Austin Friars, E.C.

Brilliant Arc Lamp and Engineering Co., Ltd. (119,811).—Particulars of £200 debentures, created June 4th, 1912, filed pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

John Tinsley, Ltd. (91.206).—Issue on June 5th, 1912, of £700 debentures, part of a series of which particulars have already been filed.

Electromobile Co., Ltd. (75,139).—Issue on June 12th, 1912, of [illegible] debentures, part of a series of which particulars have already been filed.

Newcastle and District Electric Lighting Co., Ltd. (28,022). Particulars of £150,000 second debentures and a premium of 5 per cent., created March 19th, and secured by trust deed dated June 6th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Freehold land and generating station at the Close, Newcastle-on-Tyne, and Lemington, and Close Banks, and company's other assets, present and future, except uncalled capital. Trustees: United States Debenture Corporation, Ltd.

A memorandum of satisfaction in full on June 4th, 1912, of debentures dated April 30th, 1907, securing £100,000, has been filed.

Engineering and Arc Lamps, Ltd. (116,030). Issue on June 21st, 1912, of £500 debentures, part of a series of which particulars have already been filed.

Corona Lamp Works, Ltd. (116,527). Particulars of £5,000 prior lien debentures created June 11th, 1912, filed pursuant to Section 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

South American Light and Power Co., Ltd. (71,446). A memorandum of satisfaction in full on June 19th, 1912, of trust deed dated March 11th, 1903, securing £50,000 5 per cent. debentures and 5 per cent. premium, has been filed.

Penrith Electric Supply Co., Ltd. (99,761).—A memorandum of satisfaction in full on May 17th, 1912, of mortgage dated September 1st, 1909, securing all moneys due from company to bankers, has been filed.

CITY NOTES.

Kalgoorlie Electric Tramways, Ltd. (W.A.).

The directors report that the gross receipts for the year ended December 31st, 1911, amounted to £41,472, as compared with £43,004 for the previous year, while the net profits earned were £11,250, against £15,199 for 1910. The directors regret that owing to the decline in the mining industry in Kalgoorlie and the absence of any fresh discoveries of importance in the district, the returns continue to decrease. The gold production for the year has not been very materially lessened, but the introduction of labour-saving appliances has, no doubt, had its effect on the number of men employed, and this in turn has adversely affected trade in the district. A considerable amount of labour agitation has also tended to disturb local conditions, all of which is reflected in the decreased traffics. The earnings for the current year show a further decline as compared with those of 1911, and the directors greatly regret that they have no option but to suspend payment of the full interest on the "B" debenture stock, which accordingly will receive interest for the half-year to June 30th, 1912, at the rate of 3 per cent. instead of 6 per cent. per annum. The directors have done, and are doing, all they can to protect the interests of the shareholders and debenture-holders, but, obviously, it is impossible for them to create traffics, when, as in this case, the traffics depend entirely on the prosperity of the town. It was hoped that the Government depôts for the trans-Continental railway would be erected at Kalgoorlie, but latest advices are to the effect that the engineers recommend placing them some miles away; should this course be decided upon no great benefit could result to Kalgoorlie as the workmen would be compelled to live at the depôts instead of in the town. The directors understand that great efforts are being made to induce the Government to erect the depôts in or near to Kalgoorlie. The engineer reports that during the year the cars travelled 621,086 car-miles, as against 624,790 car-miles in 1910, and carried 2,694,936 passengers as against 2,798,216. The earnings per car-mile in 1911 were 15·98d., as against 16·45d. in 1910, with an expense of 9·97d. per car-mile in 1911, as against 10·13d. in 1910. The expenses per cent of earnings in 1911 were 62·39, as against 61·57 per cent. in 1910. The company's rolling stock, plant, tracks and overhead lines have been kept in a satisfactory state of repair during the year. In the meantime every effort is being made to reduce the working expenses. A further amount of £5,709 of "A" debenture stock was purchased for redemption, in July, 1911, making the total stock redeemed to December 31st last £30,431. By the operation of the sinking fund, a further amount of stock will shortly be redeemed, reducing the amount of "A" debenture stock outstanding to approximately £64,000. The board record their appreciation of the work done by the whole of the staff in Western Australia during the year.

Chilian Electric Tramway and Light Co., Ltd.—The report states (according to the *Financier*) that the accounts for the year 1911 show, including £11,553 brought forward, and after placing £60,000 to renewals reserve account and £7,000 to insurance suspense account, an available balance of £80,531, out of which a dividend of 6 per cent. on the preference shares in respect of the year 1911, amounting to £39,000, has been declared. A further dividend in respect of the arrears of interest on these shares to December 31st, 1900, has also been declared, amounting to £30,175, leaving £11,357 to be carried forward.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. for the quarter ended June 30th on the ordinary shares.

Shawinigan Water and Power Co.—The directors have declared a dividend of 1¼ per cent. for the quarter to June 30th.

Globe Telegraph and Trust Co., Ltd.

Presiding at this company's meeting, held on Tuesday last week, at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., after referring to the death of the Marquis of Tweeddale and the election of Viscount Midleton to the vacancy thus created, said that the receipts were not quite so much as in the previous year, when they were the largest ever received. The total receipts for the 12 months, after deducting working expenses, amounted to £210,472 as against £211,858, or a decrease of £1,386, making with the balance brought forward £239,004. They had already distributed three quarterly dividends of 3s. per share on the ordinary shares and three interim dividends at the fixed rate of 6 per cent. per annum to the preference shareholders. Those payments had absorbed £131,085, and the directors now recommended the payment of a final dividend on the ordinary shares of 6s. per share net, which, with previous distributions, made the total dividend for the year on those shares 6 per cent., being at the same rate as last year. The amount required for this final dividend together with that of the final dividend of 3s. per share on the preference shares, absorbed £79,922, leaving a balance of £27,996 to be carried forward to the next account. Turning to the company's return from its investments the Chairman said that the dividends from the Anglo-American Telegraph Co., Ltd., showed a slight decrease. There was also a slight decrease in the receipts from their holding in the Direct United States Cable Co. of £123, due to the fact that they had disposed of some of their holding in the company. The receipts, however, were somewhat larger than they otherwise would have been, owing to the fact that the company, in conformity with the arrangements made with the Western Union Co., had decided to close their accounts and pay their final dividend three months earlier than usual. They sold those shares at a very much higher rate than they paid for them, and the profit on the transaction—£2,384—had gone to reduce the item in the balance-sheet under the heading, differences of securities realised. Their receipts from the Mackay companies had considerably increased, owing to their having increased their holding. There was a slight diminution in their receipts from the Submarine Cables Trust, owing to the fact that seven of their certificates were drawn last year. The largest falling off occurred in the case of the shares which they held in the Telegraph Construction and Maintenance Co. Last year their attention was drawn to the fact that their increased receipts on that occasion were largely due to the fact that the company had increased their dividend from 17½ per cent. to 20 per cent. This year their dividend had again dropped to 17½ per cent., which accounted for a loss under that heading of £1,105. The result was a total decrease of £2,122; but against this there was first the increased dividend from their holding in the Mackay companies of £736 and the increase in the balance brought forward of £851. Those two items together amounted to £1,587, so that the total decrease was only £535. Taking all the circumstances into consideration, he thought they would agree, especially in view of the fact that the ordinary shareholders were receiving a dividend at the rate of 6 per cent. as last year, that it was a very satisfactory state of affairs. In conclusion, he said it would interest the shareholders to know that the present value of their securities, taking the lowest market prices, showed an increase over the original cost of over £300,000.

Sir J. Denison-Pender, K.C.M.G., seconded the motion, and the report was adopted.

Standard-Waygood, Ltd., Australia.—This company, which about three years ago took over the businesses of the Standard Electric Elevator Co. and Waygood, Ltd., appears to be doing a very successful business. According to an Australian exchange, it made a net profit for the year ended March 31st of £19,972, making a total, with £10,022 brought forward, of £29,994. The profits show an increase of £2,223. An interim dividend for six months, at the rate of 10 per cent. per annum, absorbed £4,345. The directors recommend a final dividend at the rate of 10 per cent., amounting to £5,000, and a bonus of 10 per cent. for the year, amounting to £10,000, leaving £10,647 to be carried forward. The premiums on the second and third issues of capital were not brought into the account, but were used to extinguish goodwill. There is to be a new issue of shares (25,000) to shareholders at par, in the proportion of one new share to every four shares held.

Trowbridge Electric Supply Co., Ltd.—The first annual meeting was held last week, Mr. J. H. Blake presiding. The directors reported that, for the portion of the year under review up to December last, the profit and loss account showed a balance of £54. After placing £20 as a nucleus of a depreciation fund, the directors recommended that the full dividend of 5 per cent. per annum be paid upon the cumulative preference shares, and that £2 be carried to reserve for outstanding expenses, leaving £9 to be carried forward.

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter to June 30th, and a first quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax, in respect of profits for the year ending December 31st, 1912.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the five weeks ended May 31st, 1912, amounted to 1,257,608, compared with 1,105,607 units in the corresponding five weeks of 1911.

J. G. White & Co., Ltd.

THE annual meeting was held on Thursday last week at 9, Cloak Lane, E.C., Lord Arthur Butler presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., Vol. 70, page 1014), said he was sure they would share the satisfaction of the directors at the results of the past year. When they met last year, the chairman (Mr. J. G. White), who he regretted had been detained in New York, and was unable to be with them that day, stated that the outlook was encouraging. They would find these anticipations had been fulfilled, and that the net profit for the year amounted to £87,107, which, although £4,360 less than in the record year of 1911, was far greater than in any other year in their history, and enabled them, after making substantial provisions for reserves, to recommend the same dividends as last year. The cash, loans at call, and short-time loans, in other words, their quick assets, amounted to £186,746, or nearly equal to their total capital, and more than three times the total creditors. Regarding the investments, he could only say that the directors believed them to be very conservatively valued, and this course they considered prudent to adopt, although the securities were earning a very handsome return on their balance-sheet valuation. The prices received on sale of securities from the investment account during the past year confirmed the valuation, as the profits from such sales had been substantial, and no security or investment had been sold at a price below its balance-sheet valuation. The amount of investment account, £196,162, was approximately £46,000 higher than a year ago. Naturally, with the increased resources of the company from the building up of its reserves, and the increased financial business done, the amount of this account had grown, and would undoubtedly continue to grow. The dividend returned on investments amounted to 6½ per cent. on the present valuation. This was a little smaller than during the preceding year, but still he thought they would agree that it was a very good interest rate. The amount of £10,837 shown against contract retentions and works in progress did not in anyway represent the volume of works in progress; as a matter of fact, this figure covered only retentions held for uncompleted work, and should be combined with sundry debtors, &c., in one item of £72,358, to show the current working capital in the contracting portion of the company's business. This debtor item was very substantially larger than the creditor item on the other side of the account. Plant, instruments and stock of materials had been written back to £1 nominal valuation, following their usual custom. The purchase of business or goodwill was written off last year, as they would remember, and stood at the nominal value of £1. The debit side of the balance-sheet required no further comment, except perhaps to call attention to the substantial reserve accounts, amounting together to £115,000. The profit and loss balance available for allocation amounted to £83,212. The profit and loss accounts showed that the net profit on their contracts, engineering and financial work amounted to £87,246, after ample allowances for contingencies. The percentages to staff and directors who were members of staff, in accordance with agreements, amounted to £11,707, and were contingent salaries, which he trusted they would agree had been earned, in view of the substantial profits shown and the substantial dividends they were about to recommend. Regarding the distribution of profits, they had first set aside £25,000 to add to the dividend equalisation reserve fund, making this reserve now £40,000. In other words, nearly one-third of the profits earned was being retained for the present in the business. The balance permitted them to recommend a dividend (together with the interim dividend already paid) amounting to 12 per cent. on the whole of the preferred shares, and also 12 per cent. on the ordinary shares, and a further extra dividend of 10s. per share, or a total of 62 per cent., upon the ordinary shares. The amount carried forward would be increased from £19,813 to £21,212. As to the outlook for the future, he could say that business was progressing favourably, and generally the conditions in their line appeared to be improving. There was considerable new work in sight, and they looked forward to continued prosperity. This did not mean that they expected in every year to be able to pay as large dividends on the ordinary shares as on this occasion, but it meant that the company should continue to increase its business and strengthen its position, and maintain a generally satisfactory rate of return to its shareholders.

MR. JOHN B. WHITE seconded the motion and the report was adopted.

Lyme Regis Electric Light and Power Co., Ltd

THE annual meeting of the company was held at Dorset on Saturday, when it was decided to sell the undertaking to a company which is now being formed for the purpose of supplying electricity in practically all the chief towns of the county of Dorset. Mr. A. J. Woodroffe presided.

The annual report showed a profit of £372 on the year's working, and the directors recommended the payment of a dividend of 4 per cent. (free of income-tax), the balance of £194 to be carried to the depreciation and reserve account, making a total reserve of £487. The private consumers, numbering 70, took 13,945 units during the 12 months. Another 11 consumers were now being connected up, with 103 extra lights. The profits on the consumers' department had increased from £224 odd in 1911, to £352.

The directors had to report the death in February last of the company's engineer, Mr. Henry Clements. Mr. F. Cheshire, who had charge of the station during the late Mr. Clement's illness, has been engaged as the new engineer.

The CHAIRMAN dealt with the proposal to sell the company to the County of Dorset Electric Supply Co., Ltd. An offer had been made by this combine to purchase the Lyme Regis Co. at a sum of £5,500 cash, and although they might feel sorry to see the concern passing into other hands, the directors considered there were many advantages to be gained by merging it into the larger company, which should be able to work it even more cheaply than they had been able to, by having a central station. They would also be able to deal in larger quantities, and, therefore, cheaper, and there would be a supervising engineer to properly inspect the various sub-stations. Again, the shares of the combine would, of course, have a Stock Exchange quotation, which was hardly ever the case with a small company. The County of Dorset Co. was being formed for the purpose of supplying electricity for public and private use in the county of Dorset, and proposed to commence business in the following towns: Dorchester, Sherborne, Blandford, Wimborne, Swanage and Lyme Regis, and statutory powers had already been granted in the first five towns. The share capital was £75,000 divided into 75,000 ordinary shares of £1 each, the whole of which would be offered at par. Competitive tenders had been obtained for the plant and mains for the towns other than Lyme, and the lowest complying with the specifications had been provisionally accepted.

A report on the entire scheme had been obtained from Mr. W. C. C. Hawtayne, consulting engineer.

The CHAIRMAN said that to his mind the Corporation were certainly the people who ought to have taken it over, but it had been offered to them, and they had declined it. Shareholders would be paid out at par, but it was hoped that they would keep their money in the new company.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Friday, July 5th.—New York Telephone Co.—Scrip, fully and partly paid, for a further issue of £1,750,000 4½ per cent. first and general mortgage 30-year bonds (London issue).

And ordered the under-mentioned securities to be quoted in the Official List:—

Aron Electricity Meter, Ltd.—£100,000 5 per cent. first mortgage convertible debentures of £100 each (Nos. 1 to 1,000.)

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 250,000 ordinary shares of £1 each, fully paid (Nos. 750,001 to 1,000,000.)

New York Telephone Co.—Scrip, partly paid, for a further issue of £1,750,000 4½ per cent. first and general mortgage 30-year bonds (London issue).

Tramways (M.E.T.) Omnibus Co., Ltd.—Fully-paid scrip for £100,000 4½ per cent. guaranteed debenture stock.

French Edison Co.—The report of the Compagnie Continentale Edison states that the gross receipts, including interest and profits on investments, amounted to £175,000 in 1911, as compared with £154,000 in the preceding year. As net profits the accounts show the sum of £152,000, as against £134,000 in 1910, on an ordinary share capital of £400,000. It is proposed to pay a dividend of £4 4s. per share on the 20,000 ordinary shares, being the same rate as in 1910, and to pay £3 per share on the 14,000 profit shares. The increased profits from the supply of electricity afford proof of the extension of the supply in Paris, which is still undertaken by the Union des Secteurs. As from 1914, however, the Edison Co. will only be interested in the business through its holding of 20,000 shares in the Compagnie de Distribution. These shares could be divided among the shareholders, and the company could go into liquidation, were it not for the fact that this course is not permitted by the statutes, which provide that the company has to be continued until 1932 in the interest of the profit shares. In these circumstances, the directors are seeking other fields of industrial activity, but this is no longer an easy matter in the lighting branch. The company has already participated in the formation of the Société Hydro-Electrique de Lyon, which is to utilise the water-power of the Fier, Haute-Savoye, for the supply of electricity to Lyons, and negotiations in regard to other enterprises are reported to be in progress.

Cape Town Consolidated Tramways and Land Co., Ltd.—The directors' report states that after charging London administration expenses and trustees' fees, and after crediting accrued interest and transfer fees, a balance of £1,412 is shown to the debit of profit and loss account for the year 1911, making the total to the debit of profit and loss account £4,627, to be carried forward. No dividends have been declared by the subsidiary companies during the past year. While it has been possible to work the tramway at a small profit, the estate companies have been worked at a loss. This condition must of necessity continue until there is a larger settled population. The operation of the Camps Bay tramways during the year shows considerable improvement, the number of passengers carried being 78,161 over the preceding year, with a profit on working of £1,274, compared with a loss of £375. From what can be seen of the current year's working this improvement will be more than maintained.

Charles Churchill & Co., Ltd.—The report for the year ended March 31st last states that the trading profit after due provision for depreciation is £22,973. The directors propose to place to reserve £4,300 and to pay a dividend of 20 per cent. on the ordinary shares, less £1,500 interim dividend already paid, to place an additional £6,500 to reserve account, and to carry forward £2,766.

Automatic Telephone Manufacturing Co., Ltd.—The directors have declared the dividend on the 6 per cent. cumulative preference shares.

Sunderland District Electric Tramways, Ltd.

On 22th ult., at Winchester House, E.C., Mr. Charles Eves, the Receiver, presided over a meeting of the 5 per cent. prior lien bondholders and the debenture-holders, for the purpose of considering a scheme for the future conduct of the concern.

The Chairman, in proposing a resolution adopting the scheme, said it provided for the re-arrangement of the capital of the existing company, instead of the formation of a new company. The prior lien bonds would be paid off with interest to date, and in their place new prior lien bonds would be created for £300,000. Of this amount £20,000 had to be issued, and arrangements had been made for guaranteeing the same. The first mortgage debenture-holders were asked to give up 25 per cent. of their present holding, and to accept in lieu thereof first mortgage bonds. They were also asked to accept those income bonds in settlement of the two and a half years' unpaid interest which would have accrued up to the end of the present month. The total issue of first income bonds would amount to about £72,000. The holders of the second charge debentures were also being asked to accept those income bonds in part settlement of their debentures. The interest on the first income bonds would be payable out of any profits available after the payment of debenture interest, and the setting aside of £500 per annum towards the redemption of the prior lien bonds. The amount required to meet prior lien bond interest, and interest on the reduced amount of first mortgage debentures, would then be £7,100, which, together with the £500 for redemption, made a total annual fixed charge of £7,600, which was well within the present earnings of the company. The company had always been handicapped for want of adequate working capital with which to provide a large and up-to-date service of cars, and to keep the line in an efficient state of repair. It was considered that under the present scheme sufficient capital would be provided to meet those requirements. It was of the utmost importance that a supply of new cars should be provided at the earliest possible moment, the present cars, excepting some few, being either obsolete or worn out. He had found it necessary during the last few months to discontinue the running of some of the older cars, which were no longer in a safe condition, and the service had had to be reduced accordingly. With regard to the track, a large portion ran through colliery workings, and was, consequently, subject to continual subsidence. During the two years of his management, they had spent a considerable sum in repairs, and he thought he might say that the line was now in a better condition than it had been for some years past. A certain portion of the track would, however, have to be relaid, and that would involve an expenditure of about £5,000 per mile. The district was a growing one, and with an efficient service of cars the traffic receipts should gradually increase. If the scheme met with the approval of that meeting it would have to be submitted to the Court for confirmation.

Mr. R. Tayler seconded the resolution.

Replying to a question, the Chairman said the guarantors were prepared to take the new bonds at 90 per cent. They would be redeemable at par 40 years hence. He had no doubt that if any of the present shareholders would like to take up some portion of the bonds an arrangement might be made, but he would not have been able to come before them with the scheme unless he had first got somebody to guarantee to take the whole issue.

The resolution was carried unanimously.

Singapore Electric Tramways, Ltd.

The directors' report states that the accounts for 1911 show an excess of revenue over expenditure of £32,970, the profit for the year, after charging debenture interest, depreciation and royalty paid, £5,055. Tramway revenue shows an increase of £2,053; 344,155 more passengers were carried, although 75,402 fewer car-miles were run. The number of passengers carried per car-mile was 6·42, as against 6·04 in 1910. The revenue from lighting and power again shows a very satisfactory increase, being 36 per cent. higher than 1910, and 88 per cent. higher than 1909. Notwithstanding that the company has during the past three years made a net profit of £7,034, after providing for debenture interest, depreciation and royalty, thus reducing the debit on profit and loss account to £9,183, the possibility of the payment of regular dividends on the present capital is rather remote. In the opinion of the board the tramway undertaking stands at too high a figure in the books of the company, or, in other words, the capitalisation of the company is much in excess of the value of the assets, and when the dividend stage, to which the progress of the company justifies the board in looking forward, is reached, the rate of distribution on the present capital would necessarily be very low. The directors recently instructed the general manager, Mr. J. H. Garratt, to make a valuation of the undertaking and plant, and this valuation Mr. Garratt reports by cable to be £425,000. In view of this the board recommends that the 400,000 shares be reduced from £1 to 7s. 6d. each.

Sir Frank A. Swettenham presided on 25th ult. over the annual general meeting of the company held at the offices, 19, St. Swithin's Lane, E.C.

In moving the adoption of the above report, he said the debenture liability had been reduced by £3,000, debentures to that amount having been bought by the company. The tramway undertaking stood at £689,055, as against £699,328 in the accounts for 1910. There had been small additions on capital account for buildings, for a stone-breaking plant which would reduce the cost to the company of metal for road-making, and a small installation in connection with a direct supply of current to Government House. In regard to depreciation, they had not written down the plant at the full rates suggested by the general manager, but this year the better working results had enabled them to increase the figure by about £900, to £12,477, which was a very substantial amount. The accounts again showed an appreciable increase in receipts, both from the tramway and from the sale of energy for lighting and power, and, as in the past two years, they were again in a position to point to the improvement in the net result of the working of the undertaking. The year 1909 was the first period in which they were able, after deduction of debenture interest, depreciation and royalty, to show a surplus, the profit for that year appearing in the accounts as £134. In 1910 the balance was again on the right side, showing a surplus of £1,843, and for last year in respect of the accounts now in their hands, the profit was increased to £3,318. The expenses for power and maintenance and repairs were higher than those for the preceding year. The increase in the case of power was due to fuel and to slight increases under other heads. As regarded maintenance and repairs, the expenditure under permanent way exceeded the figure for the previous year by about £2,000. Each year it was necessary to repair or relay considerable lengths of the track, and in order to minimise as much as possible the costs under this head in future years, more solid work was being put in than was provided for in the original tramway contract. The traffic expenses were lower by £425. The ratio of total expenses in Singapore to receipts was 51·17 per cent. as against 52·88 per cent. for the previous year, or a decrease of 1·71 per cent., making a very low percentage. Electric lighting was becoming increasingly popular in Singapore and he had no doubt that this popularity would continue. The company continued very fortunate in regard to its staff. For the satisfactory results to which he had referred they were indebted to the able management of their general manager, Mr. J. H. Garratt, and those working under his direction. For some time past they had been able at the general meetings favourably to compare the years under review with the preceding years, and he thought they might now regard the business of the company as established on a firm foundation, and this brought him to a convenient time for referring to the two resolutions which were included in the notice convening the meeting. Although the company had reached the stage when it could meet all its charges out of revenue, and show a small profit, the directors were of opinion that, if the company was to take its place with dividend-paying commercial concerns, the shareholders should consent to a reduction of the share capital. Although depreciation amounting in all to £64,854 had been written off the cost of the tramway undertaking, the latter still stood in the books of the company at over £689,000. Feeling that this capitalisation was much in excess of the value of the company's assets, they recently instructed the general manager to make a valuation of the company's undertaking and plant, and this valuation the general manager put at £425,000. They, therefore, recommended that the shares of the company be reduced from £1 to 7s. 6d. each, which would have the effect of writing off £250,000, or five-eighths of the share capital. They believed that this course would be in the interests of all the shareholders, and it would undoubtedly bring the company nearer the dividend-paying stage. The second resolution had reference to the borrowing powers of the company. As they were aware, the original debenture debt was £350,000, and the borrowing powers under the articles of association admitted of borrowing up to the nominal amount of the capital. If, therefore, the resolution reducing the capital to £150,000 was passed, it would be necessary to alter the borrowing powers to a fixed sum, which they put at "£350,000" instead of the expression, "the nominal amount of the capital."

Sir Charles Petrie, J.P., seconded the motion, and the report was adopted.

At a subsequent meeting, the resolutions reducing the capital were adopted.

German Electrical Companies.

The *Elektra Gesellschaft, of Dresden*, realised gross profits of £39,000 in 1911, as compared with £23,000 in the previous year. After placing £8,000 to depreciation, as against £2,500 in 1910, and making other allocations, the accounts show net profits of £29,000, as contrasted with £18,000. It is intended to make a distribution of 6 per cent. on the share capital of £225,000, this comparing with 5½ per cent. in 1910

The accounts of the *Continentale Ges. für Elektrische Unternehmungen, of Nuremberg*, indicate that £14,000 has been placed to the reserve fund for the renewal and capital redemption of works under the company's management, and £4,100 to the legal reserve fund. Having made these and other appropriations, the net profits are returned at £84,000 for 1911, as against £76,000 in 1910. The directors propose the payment of a dividend of 5 per cent., as contrasted with 4½ per cent. in the preceding year.

The *Ges. für Elektrotechnische Unternehmungen, of Munich*, which has been unable to pay any dividends for several years past, reports a fresh loss for 1911, which increases the total deficit to £49,000, or nearly one-half of the ordinary share capital of £100,000. Apart from owning and working supply stations, the company became interested in an Austrian railway enterprise, in which heavy losses have been incurred. It is now proposed to reconstruct the company by reducing the share capital in the proportion of five shares to one, and to ask the shareholders to make an additional payment of 25 per cent. on the reduced shares, which would then be converted into 6 per cent. cumulative preference shares.

The report of the *Elektricitäts Ges. vorm. W. Lahmeyer & Co.*, whose dividend announcement of 5 per cent. for 1911 has previously been reported, states that all the works and companies under the management of the company experienced a favourable development during the year, and the prospects for the new financial year appeared to be satisfactory. The latter statement was confirmed at the recent general meeting, when it was mentioned that the degree of employment at the Felten & Guilleaume works, in which the company holds shares of £600,000, was also very good. It will be remembered that the Lahmeyer company exchanged shares of about £1,050,000 for new shares in the Bank for Electrical Enterprises of Zurich two years ago.

The *Deutsche Pope Lampen A. G. at Aix-la-Chapelle*, in reporting on the second year's operations, states that only four months could be regarded as the actual working period, as the greater part of the machinery was only delivered in the course of the year. The business organisation had stood the test and had rendered possible the rapid introduction of the Pope lamp, whilst the oversea trade had developed and would presumably further advance. On the other hand, the movement in prices had been in a downward direction. The accounts for 1911 show, including the loss in the year of formation, a total deficiency of £4.400 to be carried forward. Owing to the uncertainty regarding the course of prices the company has been induced to take up other manufactures, partly on its own account and partly in agreement with firms engaged in allied branches of trade.

Aluminium Corporation, Ltd.

Mr. S. G. Bibby, deputy-chairman, presided on Monday, last week, at Salisbury House, E.C., over the second ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Elec. Rev., Vol. 70, page 1014), dealt briefly with the items in the balance-sheet, and said that when the present company was formed the directors rather anticipated a time of stress, and to assist them in this it was arranged that the preference stock should not become cumulative for the first two years. The wisdom of this view had been amply demonstrated by the unforeseen difficulties which had been experienced during the past year. First, it was found necessary to render the inside of the walls of the Eigiau dam with cement; this, though not a very costly operation in itself, created a difficulty which was of real importance, for it called for the complete emptying of the lake at a period of the year when the rainfall was at its lowest, and consequently held up the manufacturing operations until it was too late for the works to make up the leeway. In fact, in the earlier part of 1911 there seemed every prospect of the actual running expenses of the company being covered. Serious difficulties were also experienced in the transport of material to and from the works, and to meet these, a wharf had to be erected on the river at Dolgarrog, a steamboat purchased, a short railway line constructed, and extra stores erected. Then the price of aluminium in the market was depressed to such an extent that it was quite impossible for any newcomer like themselves to make any contracts which would show a reasonable profit, while further difficulty was experienced in the carbon factory, which naturally made the task of showing a satisfactory result almost impossible. The actual loss on the manufacture could not be described as a heavy one, and was caused by the fact that for months they had to keep a staff quite out of proportion to their production of metal. During the year very serious difficulties were experienced in connection with the housing of their workmen, there being no cottages in the neighbourhood of the works. This difficulty had been got over by their chairman coming to the rescue and providing funds, which enabled a builder to erect some 20 model cottages immediately at the gates of the works. Later in the year, when they were able to get into active work, the known deficiencies of the carbon works erected at Wallsend by the old company became acute, and once again the chairman came forward with the financial support necessary to lift the company out of a very difficult and unsatisfactory position. There could be no question that the consolidation of their carbon and metallurgic manufacture at Dolgarrog would be of the very greatest service, but, in addition to that, the funds that Mr. Clark had provided would enable the company to erect a regenerative gas furnace of the most modern type, which would place the company upon a basis for the economical manufacture of the metal equal to that held by the best of the other manufacturers. Had they desired, a great deal of the expenditure which had appeared under the heading of profit and loss account could have been treated in other ways, but the directors had laid down a rigid line that every section of the works should be maintained in the very highest state of efficiency out of revenue, and they therefore had not thought it necessary this year to make any provision for depreciation; they felt sure that if any of the shareholders cared to visit and inspect the works they would cordially agree with the statement which he made, that the various sections of the plant were being taken care of in the most careful manner possible. With regard to the future, he had pleasure in confirming the statement made in the report that there appeared to be every prospect of the present improved market price of aluminium being maintained, and they would forgive him if he did not enlarge upon this statement. Since the close of the accounts the works had steadily maintained their output, and while they did not anticipate reaching during the present year the fullest tonnage that it was possible for their machines to deal with, they were justified in saying by the tonnage obtained in the first half of this year that the total would be a satisfactory one, giving every promise of a full output next year. The question of costs in the manufacture of such a highly scientific product as aluminium was of the greatest importance, and this item was receiving the directors' most careful consideration. The bauxite mines, in France, had been very carefully developed in such a way as to give the maximum output at a minimum cost; in fact, he might say that no other company had a bauxite deposit which they could work as economically as they were doing, and when certain storage accommodation (which was at present in hand) had been erected at the port of shipment, they anticipated that this, the first step in their process, would be placed in a position second to none. At the bauxite refining works, Hebburn-on-Tyne, of which the company held five-sixths of the shares, manufacture had now been in full swing for a sufficient time to bring the plant into balance, and it was anticipated that the close of this year would show that works put in a sound and satisfactory position. At Wallsend, the works which at present existed had always been an incubus to the company, and would be closed in the early future, and the old metallurgical works had been let upon lease, so that another relief had been afforded the company. At Dolgarrog they were now in a very satisfactory position; the old difficulties of transport, caused by the geographical position of the works, had been overcome, the company's raw materials and manufactured goods being dealt with at the port of Conway, and conveyed up the River Conway to the wharf at the company's works by their own steamer, where the raw materials were handled on an electric tramway right into the works. The power house plant had given the utmost satisfaction, additional storage accommodation had been provided, and active operations were at present in progress for the building of the new carbon works, while accommodation for their workmen had been provided. In fact, when certain work at present in hand was completed, they would be able to claim that they had a model installation capable of turning out metal of the highest grade in sufficient quantities, under the new conditions, to give a return which would at least justify the reconstruction.

Mr. Robertson Lawson seconded the motion.

Mr. Hughes asked why three of the directors had resigned; how much aluminium had been actually made; what value the board attached to the Wallsend site; and how much the chairman had advanced to the company. He also called the attention of the board to a report in a French paper of a new invention for the brazing and soldering of aluminium.

Mr. F. E. Andrews remarked that the report proved the wisdom of the advice he gave that the company should have accepted the offer to sell their assets to another company instead of reconstructing.

The Chairman said that when Mr. Clark, the chairman, advanced the money to the company he made it a stipulation that two directors should retire from the board, while Mr. Stennett retired, for reasons of his own. The chairman had advanced £20,000 to the company and held second debentures for the loan. The question of what aluminium they had made would, he hoped, be answered satisfactorily in next year's report. He could not say what value they had put on the Wallsend works. If they had accepted the offer to buy the assets of the company the shareholders would have got nothing.

The report was adopted.

Bombay Electric Supply and Tramways Co., Ltd.

Sir Charles Ollivant (chairman) presided on Tuesday last week at the offices of the Electrical Federation, Kingsway, over the annual meeting of this company.

In moving the adoption of the report (see Electrical Review, Vol. 70, page 1016), the Chairman first referred with regret to the death of Sir Edward Sassoon, who was the chairman of the company from its formation. His colleagues had done him the honour of electing him as chairman, probably because of his intimate acquaintance with Bombay, and it was his firm belief that the successful administration of the company's undertaking would be to the convenience and interest of the citizens of Bombay, whose interests he from long association had at heart. The board were glad to be able to present a record of steady and continuous progress. They had increased their gross revenue by £19,900, as compared with the previous year, at an increased cost of only £3.600. Whilst, therefore, their gross revenue had increased in the proportion of 9·11 per cent., their net revenue had increased in the proportion of 16·88 per cent. This would be regarded as satisfactory, particularly as evidence of the attention directed to the control of the working expenses. The net receipts aggregated £113,580, and after deducting the interest on the debenture debt, amounting to £35,718, there remained £77,861, to which had to be added £11,748 brought forward, making an available total of £89,610. The preference dividend paid in August, with the accrued interest to December, absorbed £35,993, leaving £53,616, which the directors recommended should be dealt with by placing £16,700 to the depreciation account, £6,531 to the sinking fund, £5,000 to the general reserve fund, and by appropriating £18,000 to the payment of a dividend at the rate of 3 per cent. per annum, thus leaving £7,385 to be carried forward to next year. The revenue from the tramways branch of the undertaking had again shown considerable extension, which was helped by the influx of visitors into Bombay in connection with the Royal visit. The traffic for the first five months of the present year continued to show a satisfactory growth. No extensions had been made to their lines but the subject of further extensions, which must greatly depend on local developments and corresponding street improvements, was receiving careful attention. The working of the two-car trains had proved of such value in dealing with the rush hours' traffic, that it had been decided further to augment their number by the provision this year of eight new trains, and it was intended that these should be delivered by November 1st. The proportion of operating expenses to the gross revenue of the tramway branch worked out at 47 per cent., which was exceedingly favourable. It was the more satisfactory in view of the low scale of fares in force in Bombay, averaging only 1 anna, or 1d. per passenger carried. The total receipts from the electricity supply section of the business amounted to £76,530, against £66,920 for the previous year, while the working expenses were £18,264 compared with £13,897, so that the increased revenue of £9,608 had been earned by an additional expenditure of £4,366. In connection with this expenditure it must be borne in mind that the transfer of the load from the old Wari Bunder power station to the new Kussara station took place in the second half of the year, and for several weeks it was necessary to keep both stations connected with their mains whilst the reliability of the new plant was being proved, and as could be understood that added to the costs. As soon as the new plant at the new station was in efficient working order, the transfer of the plant from the old to the new station was taken in hand, and its installation had now been practically completed. During the year several small extensions to the mains were carried out in the populous portions of the city within the old town of Bombay. In consequence of the conservative habits of the bulk of the people, it had taken some time for them to arrive at an appreciation of the advantages of electric supply, and for some years their development in this direction moved but slowly, and their field of exploitation was mainly restricted to the more European centres of business and the residential districts. It was satisfactory to be able to say that now there was a decided change in this respect, and inquiries and applications for supplies were increasing rapidly from traders and others in the heart of the town. Several further extensions of their mains had been undertaken in response to this demand and the increasing revenue from these would, he was confident, make itself felt in the returns they would submit next year. Side by side with this development of supply, he was glad to inform them that the working of their new power house had effected a considerable reduction in their generating costs. In the first two months of the current year the cost per unit delivered showed a reduction of 22 per cent. on the costs of the same two months last year, and as their load increased the fixed costs of generation would of course show a progressive decline. In the year under review they secured 697 new consumers, representing an increase of 40 per cent. on the previous year, and taking a supply equivalent to 41,733 lamps of 8-C.P., being an increase of 20 per cent. Contracts had recently been entered into with the Bombay, Baroda and Central India Railway Co. and with the Findley Mills Co. for a supply of power. During the year the capital expenditure amounted to £86,698. Of this, £81,389 represented expenditure in the electricity supply branch, chiefly in connection with the construction and equipment of their new power station. The amount of £4,122 was expended in connection with the tramways, mainly for new rolling stock. The investments were taken in the balance-sheet at their cost price, viz., £42,480, and the average yield obtained exceeded 4½ per cent. He wished to testify to the services rendered by the staff, especially during the anxious period of the Royal visit, when much arduous work devolved upon them, both in connection with the illuminations and the heavy tramway traffic. A telegram had just reached him from Bombay, showing that in the first five months of the present year the gross earnings showed an increase of 13·12 per cent., as against an increase of 8·7 per cent. in the first five months of last year over the corresponding period of the preceding year.

Mr. E. Garcke seconded the motion, and the report was adopted without discussion.

Direct United States Cable Co., Ltd.

The meeting of this company, held on Tuesday last week at Winchester House, E.C., was presided over by Mr. E. M. Underdown, K.C., who, after remarking that the dividend proposed had already been paid in order to meet the wishes of the Western Union Co., said that they now had no direct concern in the working of the cable—their duty was simply to maintain and repair it. The traffic was dealt with by the Western Union Co., who collected all the revenue and discharged the expenses. They received the rental set out in the lease, and that for the nine months to March 31st amounted to £45,426. Adding to this, the interest and dividends on the reserve fund investments, the total revenue amounted to £62,436. Out of that they had to pay the cost of repairs to the cables, income-tax, and consulting electrician's fee, amounting together to £12,160, leaving a balance available for dividend of £50,276. The dividend and bonus at the rate of 5 per cent. per annum for the nine months, which was the highest that under the lease they were permitted to pay without the assent of the Western Union Co., absorbed £42,876, and the balance of £7,399 had been transferred to the reserve account. After charging all the expenses in connection with the negotiations resulting in the lease, which were necessarily somewhat high, and reserving the sum of £10,803, which they had to pay the Western Union Co., on the determination of the lease, the balance of the reserve fund was well in excess of half-a-million, the exact figure being £509,128. Last December the main cable was interrupted in the mid-Atlantic, and its repair would naturally involve considerable expense. It was impossible to undertake the repair in the winter, but at the latter end of last month the cable ship *Faraday* sailed for the position for the purpose of effecting the repair. They had had news that she was on the position, and there was sufficient equipment of cable on board to enable her to do all that was necessary in the way of repairs. He might say that the Western Union Co. had given very considerable evidence of their desire to carry out the terms of the lease in the most liberal manner. He learned that the traffic receipts had been well maintained, and they knew that the Western Union Co. were quite satisfied: in fact, he saw the chairman recently, and he expressed himself as very much pleased with the relations that existed between them, and acknowledged that they had only done what they ought to in protecting the interests of their shareholders. They were quite satisfied with the arrangements that had been come to with them and the Anglo-American Co., and they, on their part, were perfectly satisfied, too.

The Hon. T. H. A. E. Cochrane seconded the motion, and the report was adopted.

Electro-Metallurgy in Switzerland.—The report of the Société Electrométallurgique Paul Girod, of Neuchatel, records net profits of £15,000 in 1911, as against £2,000 in the previous year. After placing £4,000 to depreciation the balance has been carried forward. The report states that the increase in the net profits was partly due to the setting in operation of the St. Gervais works. Various technical advances were made in important branches of manufacture, and an understanding was proceeding in regard to securing stability in the sale prices for alloys. The effect of the syndicate for ferro-silicon was only slightly noticeable during the year, although the company has assured its position in the syndicate, and has utilised a large amount of power for the production of ferro-silicon. During the year the company made 7,000 tons of alloys, as compared with 5,000 tons in 1910. At the recent meeting reference was made to the proposed reorganisation of the undertaking, the rapid development of which has rendered it necessary for considerable banking credit to be obtained. Owing to the decline in the prices of alloys during the past two years, and the difficulties encountered in starting the steel works, the idea of raising additional capital by the issue of new shares and bonds has had to be abandoned. A Franco-Swiss financial group now proposes to form a new company with an ordinary share capital of £480,000 to take over the Neuchatel company, and also to issue bonds of £320,000. The organisation of the new company is to be arranged so as to permit also of the absorption of the Compagnie des Forges et Aciéries Electriques Paul Girod, in which the Swiss company is largely interested. The holders of ordinary shares in the Société Electrométallurgique will only receive £10 shares in the new company for their present £20 share.

STOCKS AND SHARES.

Tuesday Evening.

In spite of the fact of its being July, some of the markets concerned with Electrical stocks and shares are still active enough, more particularly those connected with what we call, for want of a better name, the Latin-Canadian group. Here there is still very considerable activity—a little patchy, perhaps, but, on the whole, a good deal more than might be expected from the season of the year and the apathy of the investor so far as other markets are concerned.

Home Railways, after being flat, have experienced a mild recovery. It would almost seem that there is some mysterious character taking the heart out of holders, for it is difficult to lay the whole blame of the selling to the door of the labour troubles that still bother the body industrial. Indeed, the stocks of the great trade lines of the country are amongst those which hold their prices with a fair amount of tenacity, the depression being most noticeable amongst speculative issues, such as Brighton Deferred and some of the Underground stocks. District have gone back 2¾, Metropolitans 3½. Central London Deferred shed 3, but rallied 5, and the Preferred stock has gone back a point. The Ordinary is 2 higher. City and South London slumped to 35, but recovered more than its loss, being ½ up on the week. Great Northern and City Preferred are unchanged, notwithstanding the advertisement which the Company received the other day when traffic was practically suspended for a couple of hours owing to a slight accident.

Underground Electric issues have hardened, and the income bonds rose a point after their fall. Much discussion continues to rage around the position of the various securities connected in one way or another with the London General Omnibus Co., and speculation goes on merrily enough in the Underground Electric 1s. shares, which have been fluctuating between 13s. 9d. and 15s. 9d., being now, this Tuesday evening, about midway between these two figures. British Electric Traction 7 per cent. Preference has given way, and London United Preference at 5⅜ are ⅛ lower, the Debenture stock at 75½ being *ex* 2 per cent. dividend. A large number of other stocks are also quoted *ex* dividend in our lists this week.

The Electric Supply market is very firm, without fresh business developing to any material extent. Charing Cross came into some demand at 4$\frac{11}{16}$. Bournemouth and Poole Ordinary are only buyers, and on the basis of 10½. In connection with this, attention may again be drawn to the misleading character sometimes assumed by Stock Exchange quotations in the Official List. It is a thousand pities that the Committee do not see their way to fix some sign by which it would be seen at once from a price that there were only buyers or only sellers in the market for the time being. It is a reform that could be easily carried out, and one which would prove of great value, both to brokers and to their clients. City Lights have not recovered from their recent dulness, the Ordinary being quoted at 18 middle and the Preference at 16. Hove shares are 10s. up at 7½.

In the Latin-Canadian group, as already mentioned, business is animated enough. Speculation centres principally around Mexico Trams, Rio Trams, Mexican Light and Power and one or two others; but in all the issues there is a steady volume of trade going on. Rio Trams touched 160, dropped to 151, and then rallied to 156 after the announcement of the proposed amalgamation between this undertaking, the Sao Paulo Tramways, and Sao Paulo Electric Company. A new holding concern, called the Brazilian Traction, Light and Power Company, Ltd., has been incorporated to do the deal, and at first the Stock Exchange was inclined to regard the transaction as distinctly favourable. Then people began to ask what the Sao Paulo Electric Company was, and inquired about the market in its shares. When it became evident that little information was available, and that there was no market whatever, the sceptical began to ask whether the proposed amalgamation was a quiet way for marketing the shares of the Sao Paulo Electric Company; and on the consideration that, after all, the Rio Tramways might not benefit greatly by the deal, the price dropped, to go ahead later. Sao Paulo shares from 252½ have fallen back to 240½. Mexico Trams are 2 points lower on the week, the shares being affected by the movements of the Tramway group; but Mexican Light and Power, after sprinting to 102, eased off to 97½, still showing a rise of a point. The Preference, on the other hand, from 112½ have gone back to 110½. Montereys are steady, without change. Montreals have risen 6 points, and Shawinigan Water remains at 144. Lively dealings in Mexican Northern Power bonds put up the price to 77 at one time, and at the moment it is 74, *ex* the dividend of 2½ per cent. deducted last Monday, while the shares have reacted to 29.

Kalgoorlie Electric Trams "A" Debenture is down 3, and the 6 per cent. "B" Debenture 8½ on the report. The directors state that owing to a decline in the company's earnings, they have no option but to pay interest on the "B" Debenture stock at the rate of 3 per cent. only, instead of the full 6 per cent.

The feature in the Telegraph market has been a big rise in National Telephone Deferred stock, the price at one time jumping 10 points to 153, and reacting but slightly from this. The Third Preference have also come into prominence again, and smaller speculators are buying these, because it is argued in some quarters that holders of the Third Preference will do better, at the present price, out of the result of the arbitration than proprietors of the Deferred stock. What there has been up to the present in the arbitration proceedings to cause the prices to fluctuate so substantially, it is a little difficult to see: but a small clique of speculators is at work, and one of their aims apparently is to make the market look as volatile as possible.

Marconis, after being comparatively steady during the last week or two, have braced up again, and show advances. The old shares hardened to 6¼, while Americans rose to 1 3/16, Canadians to 25s. 6d., with Spanish rather a dull market at 25s. The American and Eastern groups are firm, without showing any particular characteristics. A good many issues are *ex* dividend, the deductions in several cases being already partially recovered.

The mention of *ex*-dividend markings serves as a reminder of the remarkably high yields obtainable from certain stocks and shares in the list of electric manufacturing companies. Reference to the price-lists overleaf shows that Aron Ordinary are paying at the rate of 8 per cent. on the money, while on Brush Second Debenture 11¼ per cent. can be obtained, on Crompton Debenture 7½ per cent., and so on. It is a truism, of course, that the higher the yield, the greater the risk. General Electric Preference have again risen 10s. on the top of their 17s. 6d. advance of last week, the price having hardened to nearly 11. The Rubber market, after being upset last week by the advent of the Synthetic Products Co., Ltd., took a sharp turn for the better when the actual prospectus was out. It does not require a very careful examination of this document to see that, commercially speaking, the latest synthetic production is not in the least likely to compete with the raw material, for at all events, several years to come.

Chili Telephone Co., Ltd.—The directors' report to March 31st, 1912, states that the aggregate number of subscribers at all centres at the end of the year was 11,647, a gain of 1,728 for the year. The gross revenue in Chile from all sources in 1911-12 was $2,307,818, an increase of $266,620. The expenditure in Chile was $1,136,970, an increase of $160,400. The net income in Chile from all sources was $1,170,847, an increase of $106,220. The average rate of exchange for the year was 10·49d., as compared with 10·90d. in the previous year, giving a decrease for the year of 0·41d. Converted into sterling at these rates, the income figures just given are £51,210, showing an increase of £2,853. The liquid assets and liabilities in Chile on March 31st, 1912, were valued at 10½d., the current rate of exchange on that day, the same rate at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £3,225 brought from the previous year, is £52,185, of which £23,942 has been carried to reserve. An interim dividend of 3s. per share, less income-tax, was paid on January 16th last, and the directors now recommend a final dividend of 5s. per share, less income-tax, leaving a balance of £3,382 to be carried forward.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 3rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£24 15	..
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£25 10	..
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3⅛d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3⅛d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	70/-	5/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3⅜d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	£5 inc.
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	1d. inc.
c ,, Tube (brazed)	,,	11¼d.	½d. inc.
c ,, ,, (solid drawn)	,,	10d.	¼d. inc.
c ,, Wire, basis	,,	9¼d.	..
c Copper Tubes (brazed)	,,	1/0⅝d.	½d. inc.
c ,, ,, (solid drawn)	,,	1s.	½d. inc.
g ,, Bars (best selected)	per ton	£94	£2 dec.
g ,, Sheet	,,	£94	£2 dec.
g ,, Rod	,,	£94	£2 dec.
d ,, (Electrolytic) Bars	,,	£81 10s.	10s. inc.
d ,, ,, Sheets	,,	£99 10	..
d ,, ,, Rods	,,	£88	10s. inc.
d ,, ,, H.C. Wire	per lb.	10¼d.	..
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/7	..
h Gutta-percha, fine	,,	-	..
h India-rubber, Para fine	,,	4/9	1½d. inc.
j Iron Pig (Cleveland warrants)	per ton	54/1	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 15s. to £19	5s. inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8	5/- dec.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	⅛d. inc.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£208 to £209	..
n ,, Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Monterey Railway, Light and Power Co.—The annual report of this company for the year ended December 31st, 1911, states that the effect of the disturbances in Mexico during the year 1911 has not been so great in Monterey and its immediate neighbourhood as it has been in other parts. On the other hand, the general situation in the Republic has tended to restrict business development and travel in Monterey and in the State of Nuevo Leon, as well as in the other States of Mexico. Notwithstanding this (says the *Times* abstract of the report) the total net earnings have increased, although the earnings from the railway service have shown a slight decrease over the corresponding earnings of the previous year. The gross income was $506,984, less debenture interest, $289,997; dividend on preference stock, $25,000; surplus, $191,987. The profit and loss account shows a total surplus of $573,162 gold. The directors have considered it advisable to begin the creation of a reserve fund, and have, therefore, passed to the credit of reserve from the surplus the sum of $150,000.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share *	Dividends for 1910.	1911.	Closing Quotations July 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	9¾ — 10¼		5 2 3
Do. 4½ % Pref...	10	4½	4½	[illegible] — 10		4 1[illegible]
Do. Second 6 % Pref. ..	10	6	6	10¾ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100 xd	..	4 10 0
Brompton & Kensington, Ord...	5	10	10†	8¼ — 8¾	..	5 11 3
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 — 100	..	4 0 0
Charing Cross, West End & City	5	5	5	4¾ — 5	..	5 0 0
Do. 4½ % Cum. Pref... .	5	4½	4½	4¼ — 4¾		4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 [illegible] 0
Do. Do. 4 % Deb... ..	100	4	4	91 — 93	..	4 3 4
Chelsea, Ord.	5	5	5	4[illegible] — 4[illegible]		5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 — 100 xd	..	4 10 0
City of London, Ord.	10	7	8	17 — 19		4 4 3
Do. 6 % Cum. Pref.	10	6	6	15 — 17		3 10 7
Do. 5 % Deb.	Stock	5	5	117 — 121 xd		4 2 [illegible]
Do. 4½ % Second Deb. ..	100	4½	4½	99 — 102 xd	..	4 8 3
County of London, Ord... ..	10	5	6	10 — 1[illegible]		5 [illegible] 6
Do. 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	10[illegible] — 10[illegible] xd	.	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 — 103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	[illegible] — [illegible]		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6	4¾ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	91 — 97	..	4 12 9
Hove	5	9	9	7¼ — 7¾	.	5 1[illegible] 3
Kensington & Knightsbridge, Ord	5	9	9	7½ — 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 8
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2½	1¾ — 1[illegible]	..	4 5 6
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3½ — 4	..	6 1 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4½ — 4¾ xd		4 17 1
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 — 102 xd	.	4 [illegible] 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	85 — 87	+ 1	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	94 — 96 [illegible]	..	4 13 [illegible]
Newcastle on Tyne 5 % Pref., Non Cum.	5	5	5	4¾ — [illegible]	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	.	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11 xd	..	5 9 1
Oxford	5	7½	7½	6¼ — 6¾	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8½	..	5 14 3
Do. 7 % Pref.	5	7	7	6⅞ — 7⅜		4 15 0
Do. 3½ % Deb.	100	3½	3½	82 — 8[illegible]	..	4 2 4
Smithfield Markets, Ord. .	5	Nil	2	1⅜ — 1⅞	..	..
South London, Ord.	4	5	5	[illegible] — [illegible]	+ ¼	5 18 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101 xd		4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1[illegible] — 1[illegible]	.	6 1 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	+ 1	4 10 0
Urban, Ord...	£3	5	..	½ — ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½ — 3		3 6 8
Do. 4½ % First Mort. Deb...	100	4½	4½	86½ — 88½	+ ½	5 1 8
Westminster, Ord.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5¼ xd	..	4 7 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share *	Dividends for 1910.	1911.	Closing Quotations July 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Adelaide, 6 % Pref.	5	6	6	5½ — 5¾	..	5 2 2
Calcutta, Ord.	5	8½	8½	7¼ — 7¾	..	5 11 6
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 1[illegible] 3
Calgary Power, 1st Mort. Bds.	100	5	5	95 — 97 xd		5 3 1
Canadian Gen. El. Com. ..	$100	7	7†	112 — 116 xd	..	6 0 8
Do. 7 % Pref.	$100	7	7	1[illegible] — 124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	[illegible] — [illegible]	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91½ — 93½	..	6 [illegible] 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84 xd	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	..	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ¼	.	Nil
Do. 6 % Pref.	1	6	6	[illegible] — [illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 — 106 xd	..	4 14 4
Madras, Ord.	5	..	..	2 — 2½	— ½	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105 xd	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91 xd	.	5 10 0
Mexican Lt. & Power, Common	$100	4	4	96 — 99	+ 1	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 — 112	— 2	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	98½ — 100½	..	4 19 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power ..	$100	7	8	217 — 222	+ [illegible]	3 1[illegible] 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 — 250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 — 114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 — 103 xd	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	142 — 146	..	3 8 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	109 — 111 xd	..	4 10 1
Do. 4½ % Per. Deb.	Stock	4½	4½	104 — 106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	98½ — 100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90 — 92 xd	..	5 [illegible] 8
Victoria Falls Power, Pref. ..	1	Nil	11¾d.	[illegible] — [illegible] xd	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ — 107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share *	Dividends for 1910.	1911.	Closing Quotations July 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Amazon Telegraph	10	Nil	4†	7¼ — 7¾	..	[illegible] 3 3
Do. 5 % Deb. Red.	Stock	5	5	96 — 98 xd	+ 1	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	147½ — 149½ xd	+ 1	5 7 0
Do. Collat. Trust	$1000	4	4	94 — 96 xd	+ ½	4 3 4
Anglo-American Telegraph ..	Stock	8¾	8	65 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	110 — 111	+ ¼	5 8 1
Do. Def...	Do.	80/-	80/-	25[illegible] — 25[illegible]	..	5 16 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½ — 104½	..	4 16 2
Chili Telephone	5	7	..	7¾ — 8	..	4 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	82 — 84 xd	+ 1½	4 15 3
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable ..	10	4½	5	7[illegible] — 7[illegible]	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100 xd	.	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	130 — 133	..	5 5 3
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	76½ — 78½	— 1	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	99 — 101	..	3 19 3
Eastern Extension	10	7	5†	12¾ — 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 — 101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 — 100	..	4 0 0
Globe Telegraph and Trust ..	10	5⅞	6†	10¾ — 11¼ xd		5 6 8
Do. 6 % Pref.	10	6	6	12¾ — 13¼ xd	..	4 10 7
Great Northern Telegraph ..	10	18	18	27½ — 28½	..	6 6 4
Indo-European Telegraph ..	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common ..	$100	5	5	88 — 91	..	5 10 0
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	6[illegible] — 6[illegible]	+ [illegible]	3 3 3
Do. 7 % Cum. Partic. Pref.	1	16	17	5⅜ — 5⅝	+ ⅛	3 0 4
Monte Video Telephone, Ord...	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
National Telephone, Pref. ..	Stock	6	6	101 — 104	+ 1	..
Do. Def...	Do.	6	6	151 — 153	+ [illegible]	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	6[illegible] — 6[illegible]	+ [illegible]	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	99¼ — 100¼	+ ¼	4 9 9
Oriental Telep. and Elec. ..	1	8	8	1[illegible] — 1[illegible]	..	4 13 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1¼	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	88 — 90 xd	+ 1	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100 xd	..	8 18 5
Reuter's	8	5	5†	11¼ — 11¾	..	3 8 0
Submarine Cables Trust ..	Cert.	6	6	127 — 130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 — 101 xd	+ 1¼	4 9 1
United River Plate Telephone	5	8	8	7[illegible] — 7[illegible]	..	5 1 7
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5¾ xd	..	4 11 0
West Coast of America	2½	2½	2½	1[illegible] — 1[illegible]	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99 xd	+ 2	4 0 10
West India and Panama Teleg.	10	1¼	½	2[illegible] — 2⅞	..	1 14 9
Do. 6 % Cum. 1st Pref. ..	10	6	6	10¼ — 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs...	100	5	5	100½ — 102½ xd	..	4 17 7
Western Telegraph, Ltd. ..	10	7	6†	13 — 13½ xd	..	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98 xd	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 — 103	..	4 7 5

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* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/16 — ½	..	Nil
Do. 5 % Pref.	1	5	5	21/32 — [illegible] xd	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 92 xd	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	40 — 44	1	..
Do. 5 % Perp. Deb.	100	5	5	93 — 97	..	5 3 1
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84		5 7 2
Central London Railway, Ord.	100	8	8	77 — 79	+2	3 16 0
Do. Pref.	100	4	4	83 — 85	—1	4 14 3
Do. Def.	100	2	2	76 — 78	+2	2 11 3
Do. 4 % Deb.	100	4	4	100 —102 xd	..	3 18 5
City & South London, Ord.	100	1½	1⅝	37 — 38	+ ½	4 5 6
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1903	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10¾ — 11¼	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅝ — 1⅞	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	6	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	6 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78 xd	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83 xd	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97 xd	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5½ — 5¾	½	..
Do. 4 % Deb.	100	4	4	74 — 77 xd	..	5 4 0

NAME.	Stock or Share. *	Dividend for 1910.	1911.	Closing Quotations July 2nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1⅜	1⅞	60 — 60½	—3½	3 2 0
Do. Surplus Lands	100	2¾	2⅝	67 — 69	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	.	3 18 8
Metropolitan District Ord.	100	Nil	..	39 — 39½	—2¾	Nil
Do. 6 % Deb.	100	6	6	142 —144 xd	+1	4 3 4
Do. 4 % Deb.	100	4	4	94 — 96 xd	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 9
Do. 4½ % First Pref.	100	3¼	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	6	13/16 — 1	..	6 0 0
Do. Def.	1	Nil	..	⅛ — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	[illegible] — [illegible]	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75 xd	..	5 6 8
Underground Elec. Railways	10	..	..	4½ — 4⅝	+ ⅛	Nil
Do. 4½ % Bonds	100	4½	4½	98 —100 xd	..	4 10 0
Do. 6 % Income	100	1	1½†	88 — 90	+1	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞ — 3⅜ xd	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	78 — 82 xd	..	5 9 9

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5 1/16 — 5 [illegible]	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 15/16 — 5 [illegible]	..	5 6 0
Do. 4 % Deb.	100	4	4	94½ — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	99½ — 101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb.	100	5	5	102 —104 xd	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11⅛ — 11⅝	..	5 3 3
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½ — 98½ xd	..	5 1 6
Brisbane Trams Invt., Ord.	5	8	8	7 — 7⅛	.	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102 xd	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	135 —140	..	5 14 4
Do. Pref. Ord.	100	6	6	118 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	107 —110	..	4 11 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102½—104½	..	4 6 2
Calcutta Trams, Ord.	5	6	7	6½ — 6[illegible]	..	5 5 8
Do. 5 % Pref.	5	5	5	4[illegible] — 5[illegible] xd	..	4 1[illegible] 9
Do. 4½ % Deb.	100	4½	4½	99 —102 xd	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝ — [illegible]	..	..
City Buenos Aires Trams (1904)	5	5	5	5[illegible] — 5[illegible]	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102 xd	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 2
Kalgoorlie Elec. Trams	1	Nil	..	[illegible] — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	89 — 90	3	5 11 1
Do. 6 % B Deb.	100	5	6†	47 — 52	—8½	..

La Plata Elec. Trms, Ord.	1	..	..	½ — ¾	..	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	15/16 — 1 3/16 xd	..	5 1 1
Do. 5 % Deb.	100	5	5	91½ — 93½ xd	..	5 4 9
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102 xd	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	89½ — 92½ xd	..	5 8 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	128½—130½	—2	5 7 3
Do. Gen. Con. 5 % Bonds	..	[illegible]	5	98½—100½	..	4 19 6
Do. 6 % Bonds	100	6	6	102 —104 xd	..	5 15 6
Para Elec. Rlys. & Lt., Ord.	5	10	10	6⅞ — 7¼	..	6 18 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102 xd	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5¼ — 5¾ xd	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99 xd	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	152 —154	—1½	3 5 4
Do. 1st Mort. 5 % Bonds	..	5	5	103¾—104¾ xd	..	4 15 6
Do. 5 % Mort. Bonds	100	5	5	99 —100	..	5 0 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	238 —243	—12	4 2 4
Do. 5 % 1st Deb.	$500	5	5	105 —107	.	4 13 6
Singapore Trams, 5 % Deb.	100	5	5	82½ — 85½	+2½	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	+1	5 1 0
Un. Elec. Trams Monte Video	5	6	7	5⅜ — 5⅝ xd	..	5 19 2
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛ xd	..	5 11 7
Do. 5 % 1st Deb.	100	[illegible]	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½—106½	..	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	[illegible] — [illegible] xd	..	8 0 0
Do. 6 % Pref.	1	9	6	[illegible] — 1[illegible] xd	..	7 7 8
Babcock & Wilcox	1	26	28	3½ — 3¾	..	..
Do. Pref.	1	6	[illegible]	1[illegible] — 1[illegible]	..	4 0 0
B.I. & Helsby Cables	5	10	10	7¼ — 8¼	..	6 1 3
Do. Pref.	5	6	6	6¼ — 6¾	..	4 9 0
Do. Deb.	100	4½	4½	101 —103 xd	+2½	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref.	3	Nil	..	[illegible] — [illegible]	..	Nil
Do. Deb.	100	4	4	58 — 61 xd	1	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	.	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80 xd	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	35 — 40 xd	..	11 5 0
Callender's Cable	5	15	10†	10½ — 11¼	¼	6 13 4
Do. Pref.	[illegible]	5	5	4⅞ — 5½ xd	..	4 17 7
Do. Deb.	100	4½	4½	98 —100 xd	..	4 10 0
Castner-Kellner	1	17½	20	3[illegible] — [illegible]	+ 1/16	5 6 8
Do. Deb.	100	4½	4½	104 —108	+1½	4 10 7
Crompton & Co.	[illegible]	Nil	Nil	½ — [illegible]	..	Nil
Do. Deb.	100	5	5	56 — 60 xd	..	7 11 6

Dick, Kerr	1	5	..	27/32 — 31/32	..	5 3 1
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 10 10
Edison & Swan, A, £3 paid	5	Nil	..	[illegible] — [illegible]	..	Nil
Do. fully paid	[illegible]	Nil	..	1⅝ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	[illegible]	66 — 70 xd	..	5 14 4
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	Nil	2½†	¾ — 1	..	5 0 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5½	5	10 — 11 xd	+ ½	4 10 11
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	[illegible]	15	10†	11¾ — 12¼	..	6 0 0
Do. Pref.	5	4½	4½	4 13/16 — 5 3/16	..	4 6 9
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	10	..	7½ — 8½	..	..
Do. Pref.	10	[illegible]	5	9½ — 10½ xd	..	4 17 7
Telegraph Construction	12	20	10†	32⅞ — 34½	..	6 17 0
Do. Deb.	100	[illegible]	[illegible]	98 —100 xd	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY, 1912.

The May returns of electrical business show a satisfactory increase alike in exports, imports and re-exports, as compared with the preceding month's figures.

Thus the exports reached £428,655 in value, as against £403,328 in April, the former figure, it is true, including a bulky telegraphic export. The imports reached a total of £206,301, as against £198,038 in the preceding month, while the re-exports at £30,806 were more than £2,300 in advance of those for April.

The above export total compares with a monthly average of £384,000, approximately, during 1911; similarly the imports total compares with a 1911 monthly average of £206,000 approximately.

Machinery exports during the month showed a considerable decline, as compared with April, this being true in a lesser degree as regards cable exports. Some improvement was, however, shown in most of the other sections of the exports.

On the other hand, machinery imports rose during the month to over £100,000 in value, and telegraphic imports were doubled, while the cable imports fell away by half.

The premier position amongst this country's customers for the month fell to Canada, due to a large telegraphic purchase, while Japan's high total was due to activity in telephonic matters, as was the case in April.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephones and apparatus and electric clocks.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,445	2,852	158	81	75	143	3,519	672	243	137	320	641	10,286
Germany	1,886	1,958	19	...	746	...	1,003	31	4	130	.	...	5,777
Netherlands, Java and Dutch Indies ...	562	1,175	467	16	29	60	271	231		...	590	..	3,401
Belgium	329	1,868	179	...	137	175	2,531	340	15	209	1,007	162	6,952
France	1,201	73	1,225	111	69	3	9,494	1,227	14	68	107	28	13,623
Portugal	243	12	...	88	...	30	21	8	20	...	110	82	614
Spain and Canary Isles	488	778	22	79	...	418	7,897	60	...	...	...	.	9,742
Switzerland, Italy and Austria-Hungary ...	391	33	89	12	30	...	2,219	1,053	107	124	334	1,368	5,760
Greece, Roumania and Turkey	33	252	140	...	132	7	251	...	291	...	103	1,913	3,122
Channel Isles, Gibraltar, Malta and Cyprus...	49	15	49	64	102	22	65	17	3	...	89	255	730
U.S.A., Philippines and Cuba	359	...	63	145	...	...	889	..	177	31	227	624	2,815
Canada and Newfoundland	1,349	4,231	1,020	2,193	...	3,657	13,274	436	241	12	447	36,477	63,337
British West Indies and British Guiana ...	220	227	340	31	75	99	335	...	...	11	43	15	1,396
Mexico and Central America	79	...	7	...	...	43	262	...	1	...	717	169	1,216
Peru and Uruguay	98	16	32	20	...	18	517	20	456	...	327	1,884	3,418
Chile	383	101	217	109	27	1	1,691	...	47	59	141	6,394	9,153
Brazil	774	1,317	579	522	142	532	3,184	2,075	302	71	1,941	2,840	14,279
Argentina	1,847	8,038	1,079	857	324	575	5,634	3,427	1,468	290	2,283	614	26,436
Colombia, Venezuela and Bolivia	8	33	4	223	...	8	265	9	112	...	...	2,508	3,170
Egypt and Persia	900	473	89	142	...	146	504	198	801	...	64	330	3,647
British West Africa and St. Helena... ...	91	206	18	23	16	...	195	...	133	...	30	324	1,036
Rhodesia, O.R.C. and Transvaal	2,687	1,158	618	4,288	...	911	3,332	...	2,124	61	1,380	247	16,806
Cape of Good Hope	1,528	5,164	306	938	35	190	2,740	410	3,172	28	276	887	15,674
Natal	875	4,677	1,319	506	81	92	2,348	...	177	24	26	427	10,552
Zanzibar, Brit. E. Africa, Liberia, Mauritius and Aden	193	142	51	728	...	228	162	16	78	24	407	2,090	4,119
Azores, Madeira and Portuguese Africa ...	137	457	49	103	...	...	319	275	87	...	86	163	1,676
French African Colonies and Madagascar ...	...	...	...	11	...	...	29	...	...	...	...	198	238
China and Siam	1,556	1,384	875	1,893	20	194	605	...	475	...	314	236	7,552
Japan and Korea	2,060	22,589	373	58	...	2,934	7,765	1,612	216	...	12,228	3,205	53,040
India	118	7,426	6,625	2,089	516	2,083	6,628	3,510	1,293	236	652	779	34,005
Ceylon	398	270	232	114	22	52	1,251	12	93	4	48	52	2,548
Straits Settlements and Fed. Malay States	311	1,519	131	97	...	892	986	...	118	...	165	351	4,570
Hong Kong	1,151	145	201	411	...	229	371	...	285	59	41	446	3,339
West Australia	263	755	127	356	385	42	259	155	48	11	138	764	3,303
South Australia	101	1,419	63	...	...	336	1,620	4	1	29	6,728	...	10,301
Victoria	1,572	4,825	1,581	1,831	...	67	3,003	239	1,333	...	2,702	8	17,161
New South Wales	2,562	8,710	378	1,333	57	207	13,607	767	708	...	515	376	29,220
Queensland	576	236	63	242	...	147	1,079	2,643	85	8	693	891	6,663
Tasmania	83	...	8	30	...	...	...	...	...	...	..	...	121
New Zealand and Fiji Islands	1,175	2,722	735	922	...	343	2,180	5,362	320	...	1,720	2,328	17,807
Total, £	30,084	87,286	19,531	20,966	3,020	14,917	104,547	24,889	15,028	1,906	36,387	70,096	428,655

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephones and apparatus and electric clocks.	Telegraphic cable and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	652	...	...	100	...	12	4,807	360	636	...	7,594		14,161
Germany	1,718	4,981	1,577	15,216	3,850	1,809	71,727	12	2,294	4,107	18,866		126,157
Holland	...	...	17	227	502	...	55	330	...	...	232		1,363
Belgium	314	1,531	59	7	20	68	1,412	152	54	782	6,211		10,610
France	...	18	1,136	1,319	610	155	557	...	1,498	3,145	1,248		9,686
Switzerland	193	1,528	102	19	47	...	1,286	...	8	16	738		3,937
Italy	17	3,515	...	...	...	...	2,021	...	...	...	1,640		7,193
Austria-Hungary	...	1,504	...	353	122	...	...	...	15	362	85		2,441
United States	3,701	1,358	677	264	1,232	53	12,055	9,380	63	45	1,575		30,403
Total, £	6,595	14,435	3,568	17,505	6,383	2,097	93,920	10,234	4,568	8,457	38,189		205,951

Additional imports: Spain, carbons, £350.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephones and apparatus and electric clocks.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above ...	23,046	690	...	622	287	...	5,202	...	336	467	156		

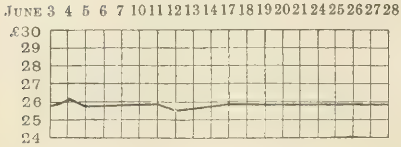
TOTAL EXPORTS: £428,655. TOTAL RE-EXPORTS: £30,806. TOTAL IMPORTS: £206,301.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

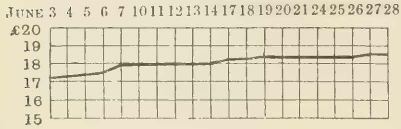
METAL MARKET.

Fluctuations in June.

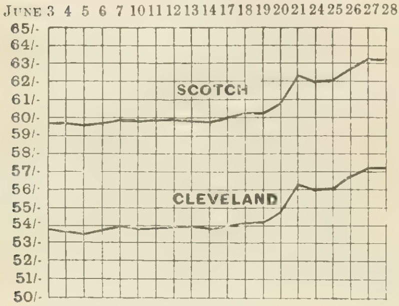
SPELTER (G.O.B's.)



LEAD (ENGLISH).



IRON.



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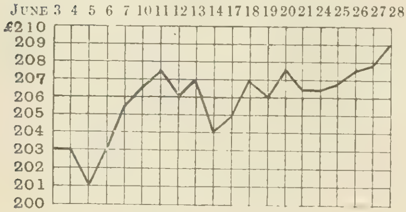
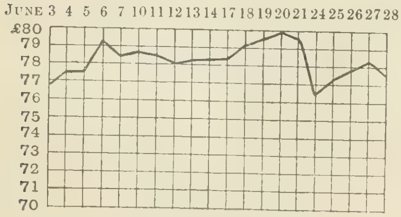


COPPER (G.M.B's.).



AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—VI.

THE conditions of employment in the Melbourne tramway system were next inquired into. Mr. Mitchell, a trackman, said he had recently received an increase from 7s. 6d. to 8s. per day. The claim asked for 10s. per day. Horse-car drivers wanted 60s. per week of 48 hours. Under the Carters' Board award they were to receive 50s. for a week of 52 hours. It was stated that the company's Act stipulated for a 48 hours' week, but that until the Union drew attention to the fact they worked a 54 hours' week. Mr. Simmons, an engine driver at the company's power house, stated that his ordinary pay was £2 14s. per week, and that with half-time extra for Sunday work, it amounted to £3 per week. He wanted 14s. per day, or £4 4s. per week of 48 hours.

Mr. O'Shea, a shed foreman, who received 10s. per day, claimed 14s. per day. A night foreman receiving £3 per week, asked for 14s. or £4 4s. per week of 48 hours. An engine driver who, after 25 years' service, received £4 per week, thought he ought to get £5. A lamp trimmer receiving £2 2s. per week of 48 hours, wanted £2 14s. A car washer getting £2 per week, thought he ought to get as much as a car cleaner. A shunter getting £2 2s. 6d. per week, wanted £2 14s. Mr. Greenough, a tunnel cleaner, paid at present £2 a week, claimed £4 4s., but could give no satisfactory reason to account for the difference. A conductor claimed that the present method of occasional employment called "battling" should be abolished, and that at least a fortnight's holiday on full pay should be given. Some time was then taken up in examining a witness who stated that he lived in a house owned by the company. Originally he had free quarters, but since a wage board determination which awarded him 45s. a week, rent had been charged on such a sliding scale that the extra due to him under the award for higher pay and overtime was deducted for rent.

The case of the workers on the Ballarat system then came under consideration. Mr. Pringle, for many years borough electrical engineer at Burton-on-Trent, is the manager of this undertaking. The claims made were very general, and resembled in substance those already referred to. Conductors received 5s. 4d. per day, and motormen 6s. 8d. per day; they wanted 11s. per day and a fortnight's leave of absence per annum on full pay after 12 months' service. It was admitted that Mr. Pringle made no difference in his attitude towards unionists or non-unionists, but still the men pressed their claim for preference to be given to men belonging to their organisation. Reference was then made to a case in which it was alleged that the Melbourne Tramways Co. had brought pressure to bear on one of their receivers to induce him to resign membership of the men's union.

The men were then asked whether they expected a full day's pay in the case of a car breaking down as it was leaving the station, and there was no further work for the driver and conductor. The men's reply was "Yes," as the breakdown was not their fault.

The men asked for further time to complete their preparations for showing the serious rise in the cost of living which had recently taken place, and it was agreed that a later opportunity should be given for this to be produced. One of the men's witnesses, a conductor on the Essendon tram service, was seriously pressed as to the practicability of enforcing the whole of the men's claims. He admitted that it was largely a question of resources, as the cost of working under the proposed conditions would be very high. Asked how he would find work for all the workers so as to abolish split turns, he was quite unable to do so.

A further instance of the impracticability of some of the claims was afforded by the appearance of Henry Burton, a youth of 18, receiving 31s. per week for boiler cleaning after 7½ months' experience. He claimed 12s. a day, or £3 12s. a week. The Judge pointed out at once the inconsistency of asking 12s. a day for a youth after a few months' experience and 11s. a day for a motorman or conductor after as many years.

This practically closed the men's case, except the submission of proof as to the cost of living. The Prahran and Malvern Tramway Trust tried to get the case as against themselves dismissed, on the ground of there being no dissatisfaction on their system, but the Judge intimated that it would have to go on. They then called their chief inspector, who stated that he considered the present rates of pay—8s. 4d. per day for a fortnight of 96 hours—sufficient. There was no general discontent, though, no doubt, the men would like the 11s. per day asked for.

Barrow-in-Furness Lighting.—At a recent meeting of the T.C., it was decided that the electrical engineer should replace 13 arc lamps in Abbey Road, Ramsden Square and Duke Street by 50 100-volt lamps suspended from the tramway span wires, in a similar manner to that adopted in the greater portion of Abbey Road. Six "Beacon" flame lamps, which had been used experimentally in Dalton Road, were ordered to be retained, and three other lamps were ordered to be replaced by "Beacon" flame lamps.

Keighley Lighting.—A statement submitted to T.C. last week showed that it was considered that the approximate surplus on the last year's working, though only £3, was satisfactory in view of the coal strike and serious water shortage. A working cost on the year of ·39d. per unit, in comparison with ·75d. in 1910, represented a saving of nearly 50 per cent. Total expenditure of ·55d. per unit was compared with neighbouring municipal undertakings' figures of ·52d. at Leeds, ·82d. at Halifax, and ·95d. at Shipley. Were it not for heavy debt on original plant, the department would show a net profit of about £2,500, but at present something like that amount was paid in interest and sinking fund on plant which was of no use at all.

THE SWANSEA CONGRESS OF THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

We look always to the T. and L. R. Association to provide a satisfying programme at its annual meetings, and we have not yet been disappointed.

It is true that the papers which were read at the Congress held on June 27th and 28th do not, as a whole, contain very much that could not be recognised by anyone who is gifted with a particularly retentive memory; but, in our opinion, they are none the worse on that account.

The tramway industry is now well established upon principles which have remained unaltered for some years, and even in practical working details there has been little movement to record; but there are many aspirations still unreached, many abuses still unremedied; and many tramways which have not risen to the current standards of excellence. Therefore, papers which may not be more than a digest, and a re-iteration, of facts and opinions already accepted by the higher or more alert intelligences of any industry, serve nevertheless a most useful—nay, an indispensable—purpose, by bringing before all of us in an authoritative and permanent form, a concentration of many scattered publications.

In the absence of the Hon. Arthur Stanley, M.P., chairman of the Association, who should have presided at the Convention, the chair was occupied by Mr. Harry England, the vice-chairman, and right well did he carry out his duties. Terse and to the point, he did not waste words for the mere sake of talking, nor did he omit anything which could have had any practical bearing upon the position he held. The able manner in which he presided over this important gathering, which officially, and excluding local guests, numbered 177, will not readily be forgotten by those who took part in the meeting.

The organisation, too, which from beginning to end of the Congress, with its many social functions, showed a master-hand, may, we assume, be credited mainly to the urbane and ever courteous secretary, Mr. de Turckheim, whose duties were anything but a sinecure, and to him, to Mr. James, and the Association we offer our hearty congratulations on a success which, but for the part played by the Clerk of the Weather on the first day, would not have offered a single excuse for a grumble on the part of even the most hardened and cynical misanthrope.

Mr. A. H. Pott's contribution to the proceedings was the first in order, length and importance. It was a very fair and temperate comparison of the public value of tramways, 'buses and railless cars, and it may serve to revive again (if that be necessary) the crusading spirit which has fought so strenuously, and, withal, so unavailingly, against the pressure of restrictive legislation.

The tenour of Mr. Pott's argument is that there is a place in the sun for all three systems of road traction; that the limitations of each system are defined with some clearness; and that without unfair handicapping the tramway would show to more advantage against the 'bus than it does under present conditions.

It is well that all of us should recognise the fact which has been patent for some years that the development of the motor-'bus is not going to be retarded simply because it may be disagreeable to a number of tramway owners. The history of the motor-'bus has been one of surprisingly rapid development in the face of considerable difficulties, and we should be the last to begrudge the pioneers their meed of praise. At times, no doubt, the champions of the motor-'bus have seemed to exceed the limits of fair controversy in their efforts to anticipate facts; but, speaking generally, they have fought well, and they cannot be blamed for turning to their own use any of the laws and regulations which have hampered the full and proper development of tramways.

We notice with surprise that the Board of Trade, in the 1911 Report of the London Traffic Branch, has taken some pains to prove the motor-'bus superior to the tramway with respect to cost, without giving due weight to the arguments of the other side, although we should hesitate to go so far as Mr. Pott in surmising that a certain basis of comparison was taken to enable this conclusion to be reached.

Tramway owners have raised, and still maintain, the most strenuous objection to the clauses which saddle their undertakings with the cost of maintaining all but the margins of the roads, and they are, undoubtedly, more than a little sore that motor-'buses in direct competition are exempt from such liability. The petrol tax was designed to provide a fund for the improvement of roads, and owners of 'buses contend that this tax is equivalent to the burden on the tramways. The Board of Trade states that a comparison on these lines between the London General Omnibus Co. and the L.C.C. tramways gives the following results:—

L.G.O. petrol tax = 0·009d. per seat-mile
L.C.C. rates on track = 0·008d. ,,

thereby demonstrating that if anyone is treated unfavourably it is the 'bus owners.

We want to know, with Mr. Pott, why the seat-mile basis was adopted, when obviously the car-mile is the proper divisor as road repairs are under consideration. The figures have a very different appearance if the car-mile is used:—

L.G.O.	0·312d. per car-mile
L.C.C.	0·589d. ,,

In arriving at an approximate comparison of working costs for tramways and 'buses, Mr. Pott considers that he has a right to omit the rates paid on track work with the exception of rails, and to reduce the permanent-way renewals and paving repairs in the same manner; while on the other side he deducts the petrol tax. Without these adjustments the comparison reads:—Tramway, cost per car-mile, 8·02d; 'bus, cost per 'bus-mile, 7·460d. Having made the adjustments, the comparison becomes:—Tramway, 6·97d.; 'bus, 7·16d.

We must remember that however equitable these adjustments may be, they serve only at the present time the purpose of giving us all a brick to throw at the Legislature; and the fact remains that Mr. Pott's figures prove that the motor-'bus can, under favourable conditions, be run at a lower working cost (including interest on capital) than the tramcar, and that is not a thing which many of us were prepared to admit before. We may as well state here Mr. Pott's estimates of capital cost:—Tramways, £7,000 per car, or £21,000 per mile; 'buses, £1,350 per car, or £4,000 per mile. All that must be very gratifying to the exponent of the beauties of transit by motor-'bus, but there is another side of the picture, of which the tramway enthusiast can make full use.

In the first place, the comparisons have been drawn on the basis, we understand, of a five minutes' service.

Secondly, Mr. Pott has assumed, "in many instances," that the traffic conditions in the streets of London are typical of traffic conditions in towns generally.

Thirdly, the motor-'buses have been assumed to run over streets equal to the lightly graded, well-paved London streets.

Fourthly, the ratio of *fatal* accidents in London during 1911 as between motor-'bus and tramcar, based on the same number of vehicles, was 6 : 1.

Lastly, the bodily and mental comfort of a ride on a tramcar is said to be in excess of that experienced upon a 'bus. That is the only point put forward in favour of tramcars, which is entirely a matter of opinion, and it is included merely for what it is worth.

Evidently it is easier now to write an article favourable to motor-'buses than it was five years ago; and, as we said above, the owners are to be congratulated upon the very great success which has attended their efforts, but Mr. Pott is doing a public service by placing in our hands a compact and well-reasoned indictment of the laws which have permitted the expenditure of £75,000,000 upon tramways and light railways, but refuse legitimate protection to that enormous capital sum when competitors arise who are not hampered and restricted at every turn.

If the margin of profit on the working of tramways were abnormally large we could not expect in these anti-capitalist days to arouse much popular sympathy; but the reverse is notoriously the case; and, while the tramway owners are not so mean as to wish their competitors to be loaded with vexatious and costly burdens, they do plead that a juster balance may be granted by the removal of unique burdens from their own shoulders.

There is something very wrong when the following tale can be told :—

There are cases where the local authority is not the road authority, but receives a contribution towards the maintenance of roads from its County Council. Therefore, when a tramway is laid, the C.C. is relieved by the Acts under which the tramways are constructed of a contribution to road maintenance proportionate to the area occupied by the tramways, and local authorities are now discovering that it may be better where a single track is laid to augment the car service by running railless cars over the tramway route rather than double the track. (Mr. Pott's paper.)

That is humorous enough in its way, but, from the point of view of the public, and altogether apart from the interests of tramway owners, it indicates the existence of an evil which ought to be remedied.

Mr. Pott thinks that traction by trolley 'bus (unsuitably styled "railless traction" as a distinction) falls into a position midway between trams and 'buses, being more flexible and mobile than a tramway, but less so than a 'bus. He puts down the capital cost at £1,670 per 'bus, or £5,000 per mile of railless route ; and he estimates the working cost (20 to 30 vehicles) at 6·06d. per 'bus mile. He has made use of all available statistics in arriving at these figures, but it would be well not to take the working cost too much for granted until the system comes into more general use.

Mr. Pott believes that the trolley-'bus system is most suitable for extending transit beyond a tramway terminus, provided the road is good, and that a minimum service of 15 minutes can be maintained.

We suggest that the real intention of the Light Railways Act is more likely to be carried out by means of a system such as the trolley 'bus than by steam or electric tramways, or motor-car and lorry services. Attention should be paid to this solution of the former's chief trouble.

Our attitude in relation to the whole question of tramways, motor-'buses and trolley 'buses can be summed up shortly.

Under existing conditions, new tramways cannot be constructed with hope of reasonable profit, therefore the greatest possible use should be made of the motor-'bus or of the trolley-'bus, according to circumstances, by the tramway owners themselves ; but, in view of the great hardship caused to existing and heavily capitalised, immovable, tramways by comparatively unrestricted, lightly capitalised, and removable motor-'bus undertakings, Parliament should be moved to reduce the handicap to a more equitable figure.

(*To be continued.*)

The Tramways and Light Railways Association held its annual Congress at Mumbles on Thursday and Friday of last week. The pier pavilion had been placed at the disposal of the Association for the purpose, and about 150 members were present.

In the absence of the chairman (the Hon. Arthur Stanley, M.P.) the chair was excellently filled by Mr. Harry England (the vice-chairman), who was supported by members of the Council, the Secretary (Mr. A. de Turckheim), and other officials.

Mr. Tegetmeier, as chairman of the Swansea Improvements and Tramways Co., at the outset extended to the members a hearty welcome.

In opening the Conference the Chairman said he thought it would be their wish that the papers should be practically taken as read, and the discussion be begun almost at once.

Mr. A. H. Pott, M.Inst.C.E., chief engineer of the Metropolitan Electric Tramways, Ltd., then introduced his paper on "The Respective Value of Tramways, Motor-'buses and Railless Traction as Means of Transport."

Mr. Pott explained that the figures of cost were based very much on London figures, but he had tried to bring up the cost of railless traction and motor-'buses to the same standard, and if they increased the one they must increase the other, and *vice versâ*. The question of legislation, however, he regarded as the most important part of the paper.

Mr. Clough (Bury) said the paper was largely based on conditions which only existed in the metropolitan area. Referring to the capital costs, which the author stated were calculated on a five-minute service, if they had to consider the respective values of the various means of transport, it would not be in districts where the five-minute service could be run, but in sparsely-populated districts ; and instead of representing the cost of the tramway at £21,000 per mile, he thought Mr. Pott ought to have taken the cost of a single track. If, as the author said, it was necessary to take steps to make tramways more profitable and to approach Parliament for the purposes he named, they must be prepared with a reasonable scheme. He could not agree with the author when he said that none of the expense of street widening should go against the tramways. After having been allowed to lay rails in the public streets with the object of cheapening the cost of working their tramways, could they seriously suggest that they should be entirely relieved from their obligations in order to place them in a better position to compete with the later means of transport ? It was an interesting fact that at a more recent date than horse traction, and when companies were seeking permission from local authorities to construct steam tramways, one of the strongest arguments then used was that companies would keep a large proportion of the main roads in repair and that the lines would be rated. As regarded the class of paving, in the provinces they had not suffered in the same way, but a good case could be made out for some assistance in meeting the extra expenditure which in recent years had fallen upon tramways owing to the excessive wear and tear of the tramway paving by motor vehicles, which conveyed over the tramway paving a great weight of goods which had been diverted from the railways. Often alongside the rails there were patches of paving which had sunk a couple of inches, invariably caused by water getting under the rail and the underbed of the paving being pumped out. If the road authority had to repair the paving, what would be the use of it unless the rail repairs were carried out at the same time ? If they were to secure an alteration of Clause 28 of the 1870 Act they must be prepared with a workable scheme.

In the paper the author gave the cost of power for railless traction as 0·66d. per car-mile. Were they to understand that the energy per car-mile was 34 per cent. less in the case of railless traction than in the case of a tramway ? Rubber tires were given at a penny per car-mile. At the Dublin Conference in 1910 Mr. Pott stated that tires for railless traction would cost anything from 1½d. to 2½d. per car-mile, and he (the speaker) agreed with this opinion. It was important to know that those figures for railless showing the total of 6·06d. per car-mile were only estimated, and he thought the author was wrong in his conclusion that, provided only a 15 minutes' service was justified, the best travelling facilities could be given by railless traction. They now knew that the working of the railless traction system at Leeds had cost more than the figure given by Mr. Pott, and that at Bradford the total cost had been 7·626d. per car-mile. He contended that to give a 15 minutes' service, even under present legislation, a tramway could be run cheaper than the railless system.

Alderman Ivey (West Ham) said that Mr. Clough, in the comparisons he made, quite forgot that in 1910 Mr. Pott was dealing with the cost of tires generally all over the country, whereas he was now dealing with it from the metropolitan standpoint. He agreed, however, with Mr. Clough that if there was any need for a further provision of transport they had far better use a few motor-'buses than go in for railless traction. The best thing to do was to try the motor-'bus of the very lightest character, and build up their traffic so that in time they would need, and would have, a proper tramway. He thought the only duty that ought to be saddled on the tramway was as Mr. Clough said—though not in so many words—the maintenance of the rails, joints and foundations ; the rest should be put on the highway authority. The Bill that had been introduced would, he hoped, become an Act of Parliament such as tramway managers could use to some advantage.

Mr. J. B. Hamilton (Leeds) thought he had never looked over a paper which contained more thoroughly-reasoned and well-balanced views than those Mr. Pott had presented, and he generally agreed with his conclusions. In London the motor-'bus had the very obvious advantage of the centre portion of London, in which there was a feeding point which made it impossible for tramways to compete on anything like the same conditions. Tramways were an impossibility in the centre of London. Moreover, the motor-'buses were enabled to go further out, and therefore at both ends of the route the tramways were enormously handicapped. But this did not obtain in provincial towns, and for that reason the comparison was not very conclusive on the general question. The motor-omnibus under exactly the same conditions would be an unsuccessful competitor. He agreed with Mr. Clough that those who felt the pinch should bring forward a definite scheme as to what portion, if any, of the road making should be borne by the public transport undertaking, whether a tramway company or a municipal undertaking, and some thoroughly established views could be put in a concrete form with which they might possibly knock at the Parliamentary door for some redress. Wherever a motor-omnibus could go through narrow streets, it was equally possible for the mobile railless car to go. Where an infrequent service was required, the very first essential was reliability, and he did not consider that the motor-omnibus was anything like sufficiently reliable in an infrequent service for those in charge of public transport facilities to depend upon it. He could assure Mr. Clough that the cost of energy in the case of railless traction was not 34 per cent., but 50 per cent. less than in the case of a tramway, and he could show him a contract with a notable firm, in which the contractor gave 1d. per car-mile for rubbers for railless traction. He gave the figures to Mr. Pott, and they were actual figures, and not supposition. In the case of the motor-omnibuses, beyond the published statements, they knew no more than what they did before, and he hesitated very much to advise any tramway man who desired to feed his system to consider the motor-omnibus until more definite facts came before him. The installation of railless traction put in at Leeds had worked with entire satisfaction. It was not put there with any idea of financial return, but to serve a district of the city which the Corporation thought it necessary to provide for, and it had amply and thoroughly fulfilled that want at the very lowest possible cost

Alderman Rodgers (Newcastle) said Mr Hamilton spoke about the reliability of the railless trolley as compared with the motor-bus. Was that Mr. Hamilton's true experience in Leeds? At another conference Mr. Hamilton stated that the cost was 6·20d. and 6·47d., and he admitted at that conference that that did not include his proportion of management expenses. They had a statement with regard to Bradford at the same time. The cost of the railless trolley there was 7·26d. Even at that he did not think they had got to the bed rock bottom of the cost of the trackless trolley. Messrs. Tilling & Co., who had had 3¼ years' experience of the new electric motor-'bus, had scrapped 300 of their old 'buses and were going to replace them by 300 electric motor-'buses, and their cost was 6¾d. per c.m. inclusive of everything and scrapping the 'buses in five years. He thought that that was a very satisfactory state of affairs. They had adopted the motor-'bus in Newcastle. They tried to get the powers for the railless trolley on two routes and for motor-'buses as well. The Parliamentary Committee would not let them run the railless trolley outside their own area unless they undertook to pay for the road maintenance, and the result was it had to go out of their Bill. They got the powers for the motor 'bus for the same route without any road maintenance being mentioned at all. The capital oharges of their motor-'buses was £850 per 'bus, and they saved the £1,250 per mile of overhead equipment. They had been running four weeks and doing excellent service.

Mr. Hamilton, with regard to the figures given for railless traction, explained that the circumstances were different. In Leeds their working expenses were calculated on an effective speed of 8½ m.p.h., whereas in Bradford, it was only 5½ m.p.h. The cost of the vehicles was exactly the same, but Mr Spencer's figures included a certain proportion for management and other expenses. But his own figures were equally correct.

Mr. Sidney E. Garcke (London) said the comparison between the costs of the motor-omnibus and railless traction in Table A was not quite fair. They had had only a short experience of the railless traction, and the probability was that sufficient time had not elapsed to enable them to arrive at a proper figure for wear and tear. He thought ·66d. rather low for power, and he could not see why the maintenance of the railless trolley car should be materially less than for the motor-omnibus. He saw no reason why the administration, insurance and other charges should be so much lower in the case of the trackless trolley—he thought they would be higher; and in regard to accidents, why should one be put at ·400d. and the other at ·10d.? He also thought Mr. Pott had put down the interest on capital for the motor-omnibus out of proportion to the others. He put the motor-'bus at £1,350, but £1,000 was ample. He brought the motor-omnibus total to just over ¼d. higher than that for the trackless trolley, and said that if that was the only difference he felt that the motor-omnibus held its own, because it had the advantage which could not be strictly shown in figures and being sent on different routes. Those interested in tramway enterprise should treat the motor-omnibus seriously, and tramway companies should be first in the field to establish motor-'buses in their districts outside their areas.

Mr. George Balfour (London) suggested the addition of two columns to the tables, one bringing the cost of the omnibus operation up to the same basis as the tramcar as regards capacity, and another bringing railless traction up to the same basis as the tramcar. In other words, if they multiplied the cost for railless traction by two, they then had something like a true comparison with the cost they had in the first column. The whole question was how many people could be carried for a given amount of money, and it was idle to compare the cost of a trackless trolley with that of a tramcar carrying 50 people, for at once they found the cost was out of all proportion. On the question of road widenings and road maintenance, in his view as long as they were rated on the present basis they should be entirely relieved of all costs of road maintenance except in so far as the upkeep of the paving immediately adjoining the rails. Mr. Clough mentioned that it was quite impracticable to separate the item of maintaining the paving on either side and between the rails, but he might tell him that he (Mr. Balfour) had had it in operation. They paid the municipal authority a lump sum and took the responsibility of maintaining the paving on either side of the rails. He thought the most important change that they ought to try for was that they should be rated on the hereditable things only, but if the present system of rating continued the difference between the two methods should be applied entirely to the cost of maintaining the road.

Mr. White (Grimsby) said he had been working motor-'buses at Grimsby for the last four years. He found from experience that the maintenance of the engine costs about twice as much as that of the chassis. Sixty per cent. of his rubber tires had given him as much as 20,000 to 22,000 'bus miles, and, therefore, the cost per 'bus of 1d. was certainly ample. He thought the item of 0·3d. for maintenance of bodies was too high. His insurance on his motor-'buses was £20 per 'bus as compared with £16 per car, third party risk. And, therefore, that item should be considerably reduced. He agreed with Mr. Balfour that the costs should have been per passenger mile and not per 'bus mile, because the tramcar naturally carried relatively double the number of passengers compared with either the moter-omnibus or the railless trolley. In Grimsby they preferred the motor-'bus to the railless trolley.

The Chairman then closed the discussion, and, in reply to a vote of thanks,

Mr. Pott explained that the object he had in view was to bring forward the point that more legislation was really required to help the tramways, but the discussion had turned chiefly on the relative merits of the railless traction and the motor-omnibus. The omnibus figures were correct, and not estimated, but as regarded tramways, they were estimated on certain London undertakings.

Mr. Clough then read a paper on the use of car meters.

Mr. A. A. Blackburn (Belfast) said that in Belfast they had a most complete system of instruction for both motormen and conductors, and it must not be forgotten that conductors played a very important part in saving current. Their methods depended entirely on keen, efficient road supervision. They now found many undertakings investigating troubles that should have been discovered long ago, and would have been had engineers had the problem to contend with. Apart from making grants of money to both motormen and conductors, they had recently introduced a profit-sharing system, in which all tramway employés received an equal share.

Mr. W. H. Edwardes (Atherton) said it was a debatable point whether a bonus system for workmen was desirable. They (in South Lancashire) paid their men a good wage—some people considered it rather too high—and such men ought to do their work properly and efficiently without any offers of bonus. Mr. Clough said car meters were of very little use unless there were bonuses for the lowest consumption, but he could not agree with him. A bonus system, no doubt, induced a man to save more current than he really should. It was a most difficult matter for the manager to hit on the happy mean of current consumption. Personally, he considered car meters essential, and he could not understand the manager who thought otherwise.

Mr. R. Humphries (Birmingham) said that if a system was capable of a reduction in units per car-mile from 1·8 to 1·2, he would be very chary of placarding such a result to prove what a horrible state it must have been in before. Car meters were not the secret of success in every way. Mr. Clough said: "In seeking to eliminate all waste, you will bring your cars up to such a state of efficiency that in addition to a reduced energy bill, you will have a large saving from secondary causes which will amply repay you." It did not take a meter to find that out. Overhauling and periodical inspections carefully done in the shops were the proper methods. He took it that at least 90 per cent. of the benefit a meter of any kind had on a car was to teach a motorman how to coast, and a very simple device he had had attached on the 200 cars under him was the clock meter, which was much used on the continent. They were fixed up at a cost of 10s. per car, and by their use they had got down, he took it, to bedrock economy. On the Birmingham and Midland system they had got down from 1·4 to 1·2 units per c.m. on one, and on the other from 1·4 to 1·3. And if the car system was looked after thoroughly and the plant overhauled, that was as much economy from the motorman as one could expect, if the men were doing their duty to the passengers on the line. He remembered a case of three meters in a station that were all going fast, and when overhauled and standardised, there was 25 per cent. difference in the reading to what it was before. There were many directions where economy could be effected other than in car meters. In outlying lines where feeders had been cut down to a minimum, there was a good deal of energy lost and it would pay for a little capital to be invested in feeders.

Mr. Dugdale (Oldham) said his energy consumption used to be 2·5 units per car-mile; to-day it was 1·7; and that had all been brought about by taking statistics and watching each man in his energy consumption. It had also assisted him in finding out the cars that were taking the most current. Those were put on one side and overhauled piecemeal thoroughly. During this financial year they had a saving of £700 already on energy consumption, and last year with their bad cars they saved £760.

Mr. Tegetmeier (Swansea Tramways Co.) said the question of car meters was a very important one, and the companies he had been connected with that had adopted them had never seen any reason to regret doing so. He considered car meters an essential addition to a tramway undertaking. The Swansea service was a difficult one to work owing to the considerable gradients and very frequent stoppages, and they had very big and crowded cars. The energy consumption was 1·44 units per car-mile, which was reasonable certainly compared with what had just been said. The consumption was now 1·21, thanks to the introduction of car meters. He thought bonuses were unnecessary, and he would almost say they were somewhat degrading to the men.

Mr. E. E. Sharp (Messrs. Venner & Co.) said that on the question of bonus, he had gathered experience from a large number of undertakings, and, generally speaking, he thought bonuses had been rather a failure. The trouble was that those who did not get bonuses made their voices heard. The leading makers offered to put meters on cars for six months, and if they did not prove satisfactory to take them back. That seemed an answer to every objection. Mr. Clough seemed to think that everybody now had meters, but he was wrong, and the worst sinners were the bigger systems. Mr. Blackburn, he thought, had not taken into account the cost of the inspection, and that when the car was going through the shops the car was useless. That represented money value, and if they had a meter they could find out what was the matter on the first day. Mr. Humphries had also discovered a cheap system, but he did not know whether he knew that that system on the Continent was very nearly dead, whilst as regarded the 10s. arrangement, of course they could not buy a decent clock for that sum. An inspector could not be on every car, whereas a meter could be.

The Chairman here closed the discussion, and moved a vote of thanks to Mr. Clough for his paper.

Mr. Clough, in reply, disagreed with Mr. Blackburn that it must have been inefficient management before the meters were introduced. It was not the regular annual overhauling that he referred to so much as to the little things that crept in each night and took the "juice" the next day. It was then they saw the difficulty of inspection, and it was in those little alterations of the car that the meter would show what was wrong. If Mr. Humphries, with his 10s. instrument, could bring the figure down from 1·4 to 1·2, he was just the gentleman who could do with a good meter—he would save 30 or 40 per cent.

This concluded the first Congress sitting.

LUNCHEON ON THE PIER.

At the invitation of the chairman (Mr. Tegetmeier) of the Swansea Improvements and Tramways Co., the members of the Association sat down to an excellent luncheon, provided in the pier pavilion. Mr. Tegetmeier presided, supported by the Mayor of Swansea (Mr. E. S. Protheroe) and little Mayoress (Miss Mildred Protheroe), Sir Griffith Thomas, Chairman of the Swansea Harbour Trust, Mr. England and others.

The toast of "The Tramways and Light Railways Association" was submitted from the chair, and MR. TEGETMEIER said it was appropriate that the Conference was being held in Swansea, where the relations that existed between the Tramways Co. and the Corporation (which owned a portion of the undertaking) were of such a cordial and harmonious character.

The toast was heartily received, and MR. ENGLAND responded, making reference to the benefits derived from such assemblies and thanking Mr. Tegetmeier and Mr. D. James, the local manager, for their efforts to make the congress successful and enjoyable.

In consequence of very wet weather an afternoon drive was abandoned, and instead, the members were entertained with a concert in the pavilion, by the "Brownies."

In the evening the Mayor and Corporation of Swansea entertained the members to dinner at the Hotel Metropole. The Mayor presided, and during the evening Councillor H. J. Rodgers (Newcastle) and Alderman Brown (Leeds) paid a warm tribute to Swansea's hospitality to the Association.

(To be continued.)

LEGAL.

PERFECTA SEAMLESS STEEL TUBE AND CONDUIT CO., LTD., *v.* G. E. TAYLOR & CO.

ON Friday the Court of Appeal, composed of Lords Justices Vaughan Williams, Fletcher Moulton and Buckley, had this case before them. The plaintiffs appealed from a judgment of Mr. Justice Pickford at Birmingham.

MR. ATKIN, K.C., for the appellants, said that Mr. Justice Pickford gave judgment for the defendants for the sum of £162 on their counterclaim with costs. The plaintiffs, a Birmingham firm, sued the defendants, electrical engineers, of London, to recover £403 for goods sold and delivered. The defendants said that in respect of 81,000 ft. of the metal tubing supplied, £97 was overcharged, the plaintiffs having, as was asserted, charged a higher price than the contract price. Defendants further said that the plaintiffs had failed to deliver 26,700 ft. of tubing, and that, in consequence, they had had to buy on the market, involving an additional expenditure over the contract price of £64, and for this sum they counterclaimed. Defendants admitted liability for £241, and the dispute at the trial was whether the plaintiffs were entitled to an additional £97, and whether the defendants on their counterclaim could recover £64. Finally, the learned Judge gave judgment for the defendants on the counterclaim for £162, which was manifestly wrong, because the plaintiffs had never been paid the £97.

MR. JOY, for the defendants, agreed that the form of the judgmen was wrong, and that if the plaintiffs did not persist in their claim for £97, the judgment must be rectified by reducing it by that amount.

MR. ATKIN said that being so the only real point between them was the construction of the contract. The plaintiffs were manufacturers of steel tubing, and the defendants electrical engineers, who entered into contracts for the installation of electric light, and so on. On January 16th, 1910, the defendants gave an order to the plaintiffs, which was accepted by their London manager, "for the supply of solid drawn tubes required during the year 1910." The plaintiffs' contention was that that contract did not give the defendants an unlimited power to buy any quantity of tubes, but that all they were entitled to order were tubes which they required for use in their business during 1910.

MR. JUSTICE PICKFORD took the view that the contract was limited to the defendants' requirements during 1910, and the controversy between the parties was whether the tubes in question were required for use in 1910. From time to time the defendants sent in specifications and the plaintiffs delivered in accordance with those specifications some 160,000 ft. of metal tubing from January to November in 1910. In December there was due for delivery, and was in fact delivered, a further 44,000 ft. On December 6th, 1910, defendants sent in two specifications amounting together to 87,500 ft., to be delivered within 21 days. Plaintiffs, in reply, wrote that they could not see their way under the circumstances to undertake the supply of the tubing as they did not consider that the goods could be required for use during the remaining days the contract had to run.

LORD JUSTICE BUCKLEY: I suppose the price of tubing had gone up?

MR. ATKIN: Yes, my Lord.

LORD JUSTICE MOULTON: A prudent contractor when he gets a job guards himself against rise in price by buying material for the job.

LORD JUSTICE BUCKLEY: Is the only point between you whether "required" means "required for use during the year" or "required for use for an impending contract?"

MR. ATKIN: Yes. My submission is that goods required for use in 1911 did not come within the contract, and that, therefore, the plaintiffs were not under an obligation to supply them.

Without calling upon counsel for the respondents,

Their Lordships dismissed the appeal with costs subject to rectification of the figures by reducing the amount of the judgment on the counterclaim from £162 to £64.

FOSTER BROS. *v.* ELECTRIC CONSTRUCTION CO.

IN the King's Bench Divisional Court on Friday, Mr. Justice Ridley and Mr. Justice Bucknill had before them, in the Civil Paper, the appeal of plaintiffs in the action Foster Bros. *v.* Electric Construction Co. from the decision of Judge Howard Smith, on the counterclaim in the action. The plaintiffs were Messrs. Foster Bros., of Birmingham, and the defendants the Electric Construction Co., of Wolverhampton.

MR. WARD said the present appellants were the plaintiffs in the action, in which they sued for the balance due on a contract to supply certain fittings for a barometric condenser at the works of the Wolverhampton Corrugated Iron Co., Ltd. The defendants admitted the claim, and counterclaimed for damages for alleged breach of contract. They alleged that the plaintiffs had contracted to supply a pump for the barometric condenser. On this point, the learned Judge found for the defendants, and awarded them £14 15s. The plaintiffs did not supply pumps, and this was known to defendants. The original contract had been for the supply of a jet ejector, which did not necessitate a pump, and when the matter was altered, new specifications had to be submitted for the barometric condenser, which did not include a pump. In the work, which cost £171 3s., was provision for an exhaust pipe, and on that supplied by the plaintiffs was a T joint, to which was attached a drain cock. It was necessary in order to work this that a pump should be placed over the drain cock. But plaintiffs did not supply these pumps, and it was not in the specification. The defendants said in the County Court, "You agreed to supply us with a proper installation, but we found we had to provide this pump, and we charge you with breach of contract in not supplying that."

MR. JUSTICE BUCKNILL said apparently if a round instead of a sharp bend had been provided, the pump would have been unnecessary.

MR. WARD said this was not provided for in the specifications, and in fact it was not part of the plaintiffs' trade to supply pumps.

Counsel pointed out that, in the jet ejector condenser, the plaintiffs contracted to supply a complete installation. In the second contract, however, they were more careful, and only contracted to supply the pipes and certain accessories, and an automatic trap was not included. In the Court below, said Counsel, he wanted to call Mr. Foster, but, from what the learned Judge said, he (Counsel) thought Mr. Foster would not be believed, so he called no evidence.

On the last point, MR. STURGE, for the respondents, said the learned Judge never refused to hear the witness, and he never said he would not believe the witness if called.

The COURT said the witness should have been called in the Court of first instance. The Court could not send the case back for further inquiry. On the general matter, their Lordships agreed with the finding of the learned Judge on the evidence before him.

The appeal was dismissed, with costs.

TRAMCAR ACCIDENT CLAIMS.

THE hearing concluded on June 27th at the Durham Assizes, before Mr. Justice Eldon Bankes and a special jury, of the action brought by Miss Sarah Pym, dressmaker, of West Hartlepool, to recover £150 damages for personal injuries from the South Shields Corporation.

Mr. Meynell was for the plaintiff, and Mr. Scott Fox, K.C., and Mr. Simey for the defendants. The case was heard at the previous Assizes, but the jury then disagreed.

MR. MEYNELL, for the plaintiff, said complainant undoubtedly received somewhat severe injuries by reason of her fall from the defendants' tramcar. The issue was whether that fall was due to the negligence of the defendants, or whether, as the defendants alleged, it was caused by Miss Pym attempting to get out of the tramcar while it was in motion.

In the result, the jury found for the plaintiff for £145 damages.

BEFORE Lord Hunter and a jury, in the Court of Session on Friday, the trial was concluded of an action by Mrs. Catherine Gibb, widow, against the Edinburgh and District Tramways Co., for £2,000 in respect of personal injuries. The pursuer alleged that the lower part of her skirt was caught by a vertical stay on the right side of the car, or became jammed between the main stay and the body of the car. She was, in consequence, thrown violently to the ground and dragged for some distance along the causeway on her face, and a wheel of the car passed over her left leg, the injury necessitating an amputation. She contended that it was the duty of the defenders to have had both the vertical stay and the main stay guarded, but this they failed to do. The defenders denied fault, and pleaded contributory negligence. There was no necessity for any such guards as the pursuer suggested (they contended), and the introduction of such would be both impracticable and dangerous in view of the construction of defenders' cars. A model of a cable car, provided by the company, was produced.

Mr. James Bennett, of Edinburgh, said he had seen the projection at the foot of the vertical rod on the car, which was concerned in the accident, and he considered it quite possible that a woman's dress might be caught by the projection. A car with such a projection was not safe. The effectual way to obviate an accident of this kind would be to put on a screen. There would, however, be one little inconvenience in this, in that it was sometimes necessary to push back cable tramcars with crowbars, and if a screen were erected it would be in the way. As a result of his inspection of various types of cars, he had come to the conclusion that the need for protecting the space below the cars and between the bogies was becoming more generally recognised than it used to be, and while Corporations like Newcastle, Blackpool and Burnley had gone in for providing side screens, others had got over the difficulty to a large extent by protecting the inner faces of the bogie wheels. If such precautions had been taken by the Edinburgh Tramway Co., the accident to Mrs. Gibb would have been prevented. Cross-examined, Witness admitted that apart from the present action and another, he had never known of any accident alleged to have been caused by a projection on the side of the Edinburgh tramcars. He was not a member of the Tramway Association, and was not aware that that body had never discussed the question of side guards. With one exception, the Witness continued, he had not seen any type of car with so much unguarded open space as the Edinburgh cars had.

Mr. A. H. Campbell, Corporation engineer, gave it as his personal opinion that some side guard was necessary for the Edinburgh cars. Replying to Lord Hunter, he said he had never known of any accident occurring through the absence of the side guard.

Mr. R. W. Hogarth, consulting, mechanical and electrical engineer, was of opinion that some fencing was required for the space from the front to the rear wheels. He saw no difficulty in applying to the Edinburgh cars the same principle as that adopted in connection with the Liverpool cars.

Mr. G. W. Crawford, consulting engineer, Edinburgh, said that last year Edinburgh cars killed as many people as the cars of Glasgow, Aberdeen, Leith, and Dundee put together. In Glasgow the cars ran at a much higher speed, went about three times as far, and carried four times as many people as the Edinburgh cars. This line of evidence was disallowed by the Judge.

For the defenders, Mr. Andrew Wilson, Edinburgh, said the Edinburgh car was much safer than any he had seen in respect of the tendency to touch or catch clothing; there was no projection to touch the clothing of a person standing near the car. Witness described experiments he had carried out, and which he held proved that there was no sucking-in influence exerted by a car as it passed, and he could not see any possible way in which a skirt could be entangled.

Mr. Benjamin Hall Blyth, chairman of the company since 1894, gave it as his opinion that it was impossible that there could be suction at the front or side of a tramcar. The vertical stay at the side of the car constituted no danger at all. The side guard suggested by the pursuer would project 2½ in. from the body of the car, and would cause a real obstruction, which might be a danger to the public. The directors of the company had taken the best advice available, and their only anxiety was to find out something better than they had got at present.

Mr. C. W. Shepherd, manager of the company, spoke of the money spent by the company in experimenting in lifeguards. His attention having been called to the statement that it was impracticable to fit the guard to a car, the manager explained that it was impracticable to guard the whole of the side of the car.

Mr. H. E. Blain, tramway manager of the borough of West Ham, and President of the Municipal Tramways Association, said he thought accidents would be aggravated by the presence of side guards.

The jury returned a unanimous verdict in favour of the Tramway Co.

North Metropolitan Electric Supply Co. Summoned.

The North Metropolitan Electric Supply Co. was summoned at Highgate Police Court on June 26th, before Sir Alfred Reynolds, for that they being occupiers of a certain factory within the meaning of the Factory and Workshops Act, 1901 and 1907, to wit, the sub-station at Woodberry Grove, Finchley, were guilty of an offence against Sec. 18 of the Regulations of 1908 made for the generation, transformation, and distribution and use of electrical energy that when work was being done by A. R. Shapcot on the switchboard, the switchboard was not so arranged that work could be carried on without danger. The second summons charged the company with employing a person not being an authorised person or competent person over 21 years of age, to undertake cleaning, such being work where technical knowledge or experience was required.

Mr. Hunter Gray prosecuted, and Mr. Bodkin defended.

Mr. Gray said the first summons had regard to the proper protection of an electric installation so as to prevent injury or loss of life. This case was at the sub-station at the North Finchley tramway station, and as a result, he alleged, of the non-compliance with these rules and regulations, a boy of 18, named Arthur Reginald Shapcot, was killed by an electric discharge. Finchley was a sub-station. The pressure at which the current came in was 10,000 volts. Before it was used for tramway purposes it was transformed down to 500 volts. Mr. Gray explained the switch arrangement. The wire in the vicinity of the isolating switch was covered, but as it passed through the current transformer it was surrounded by porcelain tubing which should meet and cover the rubber wires. It did not, however, and there was a little bare place. On March 25th Shapcot was working under a man named Styles, cleaning and standing on the oil cell, when his body came into contact with the bare part of the conductor, and he was killed. Styles, who set the youth to do the work, observed him most of the time. It was suggested that Shapcot should have done all the work from the right-hand box, but he (Mr. Gray) thought that they would find from the dimensions that he could not have done it. On the other hand, he could have been on the box with absolute safety if the isolating switch had been open. It was not open. It would have been still safer had the whole been disconnected, which could have been done. That was one provision made by Rule 18D. The whole thing could be made dead, or if it were going to be made dead in sections, it must be divided or screened off, so that no carelessness would cause anyone to be hurt whilst working there. He should have said that this was the three-phase system, and anyone would get about 6,000 volts. In this case there were neither permanent nor removable screens or divisions. Rule 28 provided that no person except an authorised person or a competent person should undertake any repair, extension, cleaning or such technical work. This youth was 18 or 19 years of age, and had been with the company 9 or 10 months. He was not an authorised or competent person over 21 years of age.

Mr. Thos. Geo. Styles said Shapcot worked under him, and witness understood that he had had training at Tottenham Institute. Once in three weeks, the switch limits were cleaned. Shapcot was told to work at the switch cells on the right. The oil cells were about 6 ft. high and the distance between the two oil cells was about 2 ft. 6 in. After Shapcot had cleaned the right oil cell, he went to the left oil cell, and the accident happened there. The isolating switch was closed, and there were no screens. The pressure limits were cleaned every week, but he only did it once in three weeks. It was always done at night, and each man had to have an assistant. Witness was quite satisfied to have Shapcot as his assistant.

Mr. Bodkin produced a scale model, which was shown to the Bench, being placed on the dock. Witness said Shapcot could have stood on the girders or angle bars or right on top of the bus-bar coverings with perfect safety. For any work he had to do it was not necessary for him to be anywhere but on the right-hand range and the top of the bus-bars. At the inquest, the jury exonerated witness from all blame. Witness thought that Shapcot was able and competent to do the work that he was set to do He did not know how he got across to the left-hand cell, and witness thought it was partly a matter of speculation as to whether it was easier to get across by stepping over or by getting down, crossing to the left-hand cell, and climbing up again.

Mr. Ram, Home Office Inspector, said he had visited the station. He could get across under the bus-bars from one oil switch to the other with ease. A person standing on this particular oil switch would be in reach of the bare piece of wire.

Mr. Bodkin said he was pursuing that subject because Shapcot had probably been out of the line of vision of Styles just before the accident. Had he stepped across the cells he would not have gone out of the line of vision, and therefore, he (Mr. Bodkin) believed that he got down and got up again on the other side. That concluded the case against the company. Mr. Bodkin said that the prosecution affected the methods adopted by numerous other electrical power supply companies in different parts of the kingdom. This was the first time that either of those regulations had been discussed, and the Highgate justices had another opportunity of breaking fresh ground in law. They had to assign a reasonable interpretation to the regulations, and he did not hesitate to say that they would have great difficulty in interpreting them. Mr. Bodkin went on to argue that it was the duty and liability, solely and entirely, of the workmen, and from the beginning to the end the employer was not mentioned in the regulation. It was the workman who was forbidden to undertake the work, unless he was an authorised or competent person. He (Mr. Bodkin) submitted that Shapcot was an authorised person for he was selected by the company, or their representative, to perform certain duties, and those duties were to do this cleaning under the direction of Styles, about whom no question was raised at all. What Shapcot did was practically to deliberately move the screen, if there had been one, to get into what he thought was a more easy position for cleaning.

Mr. Percy M. Hunt, engineer in charge of the sub-station, cross-examined, said the sub-station had two feeders. He admitted that the one main could easily have been made dead.

Mr. Gray: And you could still supply your tramways?—Yes.

Mr. Gray: I put it to you, he was not in such a convenient position to clean one side of the limit resistance from the left-hand side as he would be if he were working from the other side?—He could clean the whole easily from the left-hand side.

In answer to Mr. Bodkin, the Witness said that in his opinion the provisions in force complied with Regulation 18.

Mr. Arthur Hy. Pott (engineer-in-chief to the tramway company): He thought the arrangement of the apparatus complied with the regulations. It was perfectly possible to clean the carbon resistance from the top of the bus-bars, or by sitting astride on one of the angle irons. That was absolutely safe. By putting a division between the right-hand series of cells, and the cells on the left hand, he thought they were complying with the regulations.

He considered Shapcot capable of doing the work allotted to him. Witness pointed out to Mr. Gray that it was possible to make one of the mains feeding the station dead, but he pointed out that the other main might break down, and the result of that would be that the trams would be stopped, and the lights go out.

Mr. Ruthven Murray, engineer-in-chief to the Power Co., also gave evidence.

Sir Alfred Reynolds, in giving the decision of the bench, said: We consider that the occupiers are liable, and also say that Shapcot, in our opinion, was not an authorised person. On the summons against Rule 18 we fine the defendant company £25, and we give costs of £5 5s. On the summons under Rule 28 we make a nominal fine of 40s. and the Court costs.

British Westinghouse Electric and Manufacturing Co., Ltd., v. Underground Electric Railways of London, Ltd.

The House of Lords on Monday last concluded the hearing of an appeal by the plaintiffs in this action from a decision of the Court of Appeal (Lords Justices Vaughan Williams, Buckley and Kennedy) in December last. The previous hearing was reported in the Electrical Review for December 8th, 1911.

The question arose with reference to certain turbines and generating machinery supplied by the plaintiffs in connection with the supply of electricity for the defendants' railway plant. The matter went to arbitration, and a motion was made to a Divisional Court (Justices Pickford and Lush) in June of 1911, to set aside the Arbitrator's award. The Court feeling bound by a previous decision of the Divisional Court upon certain points of law that had been submitted, dismissed the motion

By a majority of the Court of Appeal, that decision was upheld, and the House of Lords now reserved judgment.

The Telephone Arbitration.

(*Continued from Vol. 70, page 1067.*)

Mr. Danckwerts, K.C., said the counsel for the Postmaster-General had intimated that the figures given on the previous day by Mr. Goddard would not be taken as proved unless the gentlemen who helped in their preparation were called. That would involve the appearance of about 100 witnesses, all of whom were now employed in the Post Office.

His Lordship said the Court had indicated that opportunity should be given to a representative of the Post Office to go into all these matters with the persons who prepared the tables. The Postmaster-General would then know what particular facts he desired to be proved.

Mr. Danckwerts acquiesced in that course, and said he would ask the Solicitor-General to give instructions for such investigation to take place speedily.

The Solicitor-General said he did not desire to put the other side to the trouble of calling 100 witnesses. If he were informed of the names of the gentlemen who had carried out the investigation, he would see that the necessary inquiry was made.

Sir Alfred Cripps said that there was so much to be done outside the Court that he would ask the Commission not to sit on the Monday following.

This request was granted, it being supported by the Solicitor-General.

In the course of a subsequent discussion on the claim with regard to the freight charges for the carriage of plant, &c., from the manufactories, it was admitted that the company had made a mistake respecting the main rates charges, and his Lordship said that meant a reduction of about £30,000 on one item.

Mr. Frank Gill, the engineer-in-chief to the company, was then recalled to give evidence on the question of the freight charges. During the course of his evidence, Sir A. Cripps said that in connection with these charges there was a difference between the company and the Post Office of only 1d. over a very large area.

Mr. Goddard was recalled for cross-examination, and was examined with regard to a figure of £4,404,000 which was given as expenditure on plant for a period of six years. A table was put in by the company showing that the total expenditure on capital account for the period 1895 to 1910 was £11,085,070, and on revenue account £15,340,255. Witness calculated that £504,000 was the average cost of plant for one year.

Sir J. Simon: Is it not the company's case that the figures in their books for capital expenditure are not true because they have charged to revenue account what really ought to be charged to capital account?—That is so.

Therefore the figures in your books should be larger?—Quite so.

Do you think, then, £504,000 for one year is a fair figure to take to arrive at your percentage for plant cost for a year?—I am afraid I cannot answer that question.

With all your desire to assist the Court by your knowledge, cannot you say whether or not the figure of £504,000 is within a quarter of a million of a fair average for one year's plant cost?—I think it is.

Counsel asked witness to take the six years' capital charges from 1905 to 1910-11. Having added up this total, witness said it came to £5,080,247.

The Solicitor-General: That is so. Now, you see in the year 1905 the figure for plant cost was £30,000 short of £1,000,000; in 1906 it was over £1,000,000; in 1907 it was over £1,000,000, and in 1908 it was over £750,000.—Witness agreed with these figures.

Sir J. Simon: Do you still say, then, that £504,000 was a fair figure to take as a year's average cost for plant?—It all depended on the period which was taken.

Do you agree with me that a substantial part of the expenses do not vary?—Yes.

And if you take that part, do you not see that the percentages you seek to produce are all false, if you have taken an abnormally low year of plant cost?—Yes, if I have done so.

Do you or do you not agree that you have taken an abnormally low year?—No; I do not think I do. It depends whether I am to be confined to the six years' average. If I am, my answer is "Yes, I have taken an abnormally low figure," but I do not think, upon the 11 years' construction, which is the period upon which the company's claim is based, that the £504,000 is an abnormally low figure.

Then we will test that answer. Take the figures for the five years before 1905: the total cost for that period amounts to £3,477,000, giving a figure of £8,557,249 for the 11 years. Now, if you divide that, you will see that the average cost per year works out at £778,000?—That is so.

Therefore, the substitution of 11 years for six years does not help you out of your difficulty. Do you now agree that the figure of £504,000 is abnormally low?—Witness eventually agreed that the figure of £504,000 would probably turn out to be a lower figure than was actually the case. Of course, witness added, there was the additional cost of line repairs to be considered.

Accepting witness's last answer, the Solicitor-General asked him to take the six years' cost of plant construction and line repairs added together?—Witness agreed that the total under the two heads for that period amounted to £5,643,500.

Sir J. Simon: Now, if you divide that by six you get a year's average of £940,600?—That is so.

But the yearly average according to your figures is £734,000. Is that not also an abnormally low average?—If one is wrong all are wrong. Later witness explained that the figures, he had now been informed, were only estimates.

The Solicitor-General next dealt with a figure of £80,578 which was included in the capital account under replacement charges. He submitted that that figure should really be a great deal more, and proceeded by an enormous number of complicated queries to witness to try to analyse the way in which the figure was arrived at. Eventually this became another matter to be left over, with a view to the experts on both sides investigating it out of court.

Respecting the figures given for replacements, it was arranged that certain items under that head should be gone into by the accountants for the respective parties, and a table prepared.

Sir Alfred Cripps said if that were done he hoped to be able to complete the company's case by the end of the next week.

Mr. Goddard's cross-examination having concluded, Sir Alexander Kennedy gave evidence in support of Mr. Gill's figures. With regard to tendering for a large contract, witness said that a contractor who had to raise several millions would have to incur interest on the borrowed money as well as the expense of raising the loan. That would all come within contractors' charges. Continuing, witness said that Mr. Gill's estimate of 30 years for the life of underground armoured cables was, in his opinion, rather short. Twenty years for vulcanised rubber cables was reasonable. He had put down a cable of that description 25 years ago, and when it was taken up recently it was found to be perfectly good. In reckoning for depreciation, allowance had to be made for scrap value.

Mr. Danckwerts: It has been suggested that the cost of maintenance increases with the life of the plant?

Witness: I do not think that is really true in respect of the greater part of telephone plant. In the matter of poles and wires, for instance, there is no increased maintenance. Either the pole is there doing its work or it is not. Cases of switchboards and portions of plant, where, on the face of things, a question of maintenance would come, have been allowed for by reason of the fact that the parts which require maintaining have been taken at extremely short lives—2½ and 3 years. Of course, if questions relating to revenue were allowed to come into the matter, he would point out that the company's plant in most cases had a greater earning capacity than was the case when it was put down. For instance, a pole when it was put up might only carry 10 wires, but after five years it might be carrying 30 wires. He understood, however, that such revenue considerations were barred from the valuation.

(*To be continued.*)

The Horsfall Destructor Co., Ltd.—Owing to very heavy litigation in connection with thrashing machines sent to the South of Europe to the order of an English firm, which resulted unfavourably to the company, the latter found itself unable to meet its obligations, and a few weeks ago Mr. A. W. Wyon was appointed receiver and manager on behalf of the debenture-holders. We are authorised to state that Mr. Wyon is carrying on the business at Atlas Works, Pershore, and that he is making arrangements for the carrying out of any destructor contracts entrusted to the firm, with the assistance of a well known and very strong firm of contractors. The services of the skilled staff of the company are available, and it is hoped at no distant date to re-establish the concern on a substantial basis.

Patent Application.—Application has been made for restoration of patent No. 23,725 of 1907 for "A new or improved recording mechanism for engine-room telegraphs and the like," by Oswald Dean.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following is the list of contributors for the six months ending June 30th, 1912 :—

d Ferranti, S. Z.de ..	£10	10	0
s Berry, Skinner & Co. .	1	1	0
l s Electromotors, Ltd. ..	2	2	0
m Anderson, A. Bruce	2	2	0
s Ferranti, Ltd.	5	5	0
m Bishop, O. H.	1	1	0
s Ruberoid Co. .. .	1	1	0
s Samuelson, G. B. ..	2	2	0
s Ashton, H. M. .	0	5	0
l s *Electrical Engineer* ..	10	10	0
m Courtenay, Sir Irving ..	5	5	0
s Pilkington Bros. ..	1	1	0
s Hunt, R., & Co. ..	1	1	0
m Alston, W. W. ..	0	10	0
m Kapp, Dr. Gisbert .	1	1	0
d Moul, H. E. .	1	1	0
s Stolzenberg Patent File Co. ..	1	1	0
m Baugham, A. H. .	0	10	6
s London Electric Firm	1	1	0
d Indestructible Cable Co.	1	1	0
m Barkham, C. ..	0	10	6
d Morris, Alex. ..	0	10	0
s Venner & Co.	1	1	0
s Chaplin & Co.	1	1	0
d Thacker, F. C.	0	10	6
s Tudor Accumulator Co.	2	2	0
m Marshall, E.	0	10	6
s Home & Rowland ..	1	1	0
d Pollard, Wm., & Co. ..	0	10	6
d Farmer, R. H.	0	10	0
d Waddie & Co. . ..	0	10	6
d Eller, E. W.	0	10	0
d Cook, A. G. H. .. .	0	5	0
d Brown, R. ..	0	2	6
d Stagg & Robson ..	1	1	0
d Hardy & Padmore	0	10	6
d Mosers, Ltd. ..	0	10	0
d D. P. Battery Co.	0	10	6
d Nixon, J., & Sons ..	0	5	0
m Kaye, H. Neville	0	5	0
m Swinton, A. A. Campbell	2	2	0
s *Electricity* ..	1	1	0
d Internat. Trade Exhibit.	5	5	0
m Ireland, A. J.	1	1	0
d Battison, W. A.	1	1	0
d Assersohn, D. ..	0	10	6
s Essex Accumulator Co.	1	1	0
s Rawlings Bros. .	2	2	0
s Price, E. L., & Co.	1	1	0
s Carless, Capel & Lennard	1	1	0
s Wiggins & Co.	0	10	6
s Crapper & Co.	0	10	6
d Spencer, Sir Ernest ..	1	1	0
d Bond, W. G. A.	1	1	0
d Burton, Col. H. ..	1	1	0
m Fletcher, J. Y. ..	1	1	0
m Wolfe Barry, Sir J. ..	2	2	0
m Devonshire, Jas. ..	2	2	0
d Birmingham Light Co.	1	1	0
s Whitehouse, Wm. ..	0	10	6
d Cranmer & Cheshire ..	1	1	0
d Atlas Carbon & Battery Co.	1	1	0
d Taylor, Tunnicliffe & Co.	1	1	0
d Kiesow & Co.	1	1	0
d Henderson & Walker ..	0	10	6
d Mehne, J. G.	1	1	0
d Barwell, Jas., Sons & Co.	0	10	6
d Peach, J. C.	1	1	0
m Madgen, Wm. L. ..	1	1	0
d Quitman, Carl	1	1	0
d Watlington & Co., Ltd.	0	10	6
d Carbon Paper Supply Co.	1	1	0
s Sloan Electrical Co. ..	2	2	0
s Conradty, C.	3	0	0
s Unwin Bros.	1	1	0
s Crampton & Sons ..	0	10	6
s Cantie Switch Co., Ltd.	1	1	0
d Taylor, C. E.	5	5	0
s Lind & Co.	1	1	0
s Griffiths Bros.	2	2	0
d Champion, C. H. ..	0	5	0
d Whitfield Tan Co. ..	0	10	6
d Putney, Samuel, Ltd...	0	5	0
d Plumtree, J. S.	0	10	0
s Jandus Arc Lamp Co...	2	2	0
d Wardroper, A. K. ..	0	2	6
d Blundstone, S. R. ..	1	1	0
d Fells, J. M.	1	1	0
s Straus, G., & Co. ..	2	5	0
s Jaeger Bros.	1	1	0
d Atkinson, Llewellyn B.	1	0	0
s Hornsby, Richd., & Sons	1	1	0
m Esson, W. B.	2	2	0
m Wallis-Jones, Regd. J.	1	1	0
d Hooper, John P. ..	5	5	0
s Berridge, Geo., & Co. ..	2	2	0
d Von Chauvin, G. ..	2	2	0
s Blackburn, Starling & Co.	2	2	0
s Thompson, W. P., & Co.	1	1	0
s Manifold Printing Co.	1	1	0
s Percy Lund	0	5	0
s Sterling Tele & Elec. Co.	3	3	0
m Burney, Guy	2	2	0
s Concordia Elec. Wire Co.	3	3	0
s Ward & Goldstone ..	3	3	0
d Middleton, V. G. ..	1	1	0
m Koettgen, C.	5	5	0
s Davidson & Co., Ltd. ..	1	1	0
m Kingsbury, J. E. ..	2	2	0
s Preece, Cardew & Snell	2	2	0
m Davenport, W.	1	1	0
s Digby, Thos.	5	5	0
s Tegetmeier, C. G. ..	1	1	0
d Ollivant, Sir E. C. K. ..	2	2	0
d Rainsford, T.	1	1	0
d Lundberg, A. P., & Sons	1	1	0
d Potter, W. and J. ..	1	1	0
d Plutte, Scheele & Co. ..	1	1	0
m Baker, G. T.	1	1	0
s Croggon & Co., Ltd. ..	1	1	0
d Hill Jones, T. ..	£1	1	0
d Holmes, F. J. ..	1	1	0
d Farmiloe, T. & W., Ltd.	1	1	0
d Becker, R., & Co. ..	1	1	0
d Spies Bros. & Co. ..	1	1	0
d Foster, Cawson & Co. ..	1	1	0
d Locke, Lancaster & Co.	1	1	0
d Berthold, A., & Co. ..	1	0	0
d Anonymous ..	0	10	6
d Hewetson, H., & Co. ..	0	10	6
d English Bros.	0	10	6
d Bolton, Geo., & Son ..	0	10	6
d Rogers, S.	0	10	6
d Brundle, F. H.	0	10	6
d Groves, J. & N.	0	10	0
d Gilson, D., & Co., ..	0	10	0
d Fenner & Alder, Ltd.	0	10	0
d Bishop, S. & C. .	0	5	0
l s Gray, Jas. Hunter .	10	10	0
d Heilbut, Symons & Co.	5	0	0
d Symington, Wm., & Co.	2	2	0
d Alden, A. H., & Co. ..	1	1	0
d Meyer, Arthur .	1	1	0
d Teleg. Cons. & Main. Co.	5	5	0
d Pugh, Ed., & Co. ..	1	1	0
s Begg, F. Faithfull	1	1	0
s Marryat & Place ..	2	2	0
l m Sutton, G.	10	10	0
d Morse, Sydney . .	2	2	0
d Lax, Herman Strasse ..	1	10	0
m Waterhouse, L. M.	1	1	0
s Sugden & Hextall	1	1	0
d Barr, Moering & Co. .	1	1	0
d Hill, Fredk., & Co. ..	0	10	6
d Saltrick, Ada	1	1	0
d Cook, W. W. . ..	1	1	0
m Hammond, Robt.	1	1	0
d Ellison, Geo.	1	1	0
s Holophane, Ltd.	2	2	0
s Bates, W. A. .	0	2	6
d Icke, J. R.	0	2	6
d Meyer, Arthur & Co. ..	5	5	0
m Judd, Walter	1	1	0
m Schmahl, W. .	2	2	0
d Marchant, H. F. ..	1	1	0
d Dwyer, T. L. ..	1	1	0
d Dow, J. .. .	1	1	0
d Spear, F. B. ..	1	1	0
d Jeary, W. C. ..	1	1	0
d Plummer, J. S. B.	1	1	0
d Tong, G. E. . ..	1	1	0
d Goddard, J. P.	1	1	0
d McDougall, Jas., Ltd.	1	1	0
d Spicer & Pegler .	1	1	0
d Armorduct Mfg. Co. ..	3	3	0
d Sun Electrical Co. ..	5	5	0
s Beaver, A. G.	1	1	0
d Ritchie, T. E. . .	0	10	0
d Charles & Dible..	1	1	0
d Glaholm & Robson .	0	5	0
d Eck, Justus	2	10	0
d Garbe Lahmeyer & Co.	2	0	0
d Hartmann & Braun ..	2	0	0
d Körting & Mathiesen ..	5	0	0
d Avery, John H.	0	10	6
d Leftwich, A.	0	10	0
d Schumann, Miss, and Assistants	0	13	0
d Herr, Miss H. .. .	0	5	0
s Lynen, R...	2	2	0
d Buck & Hickman ..	1	1	0
s Leaf, H. M.	1	1	0
d Crump, Frank, & Co. ..	2	2	0
d Moulton, Rt. Hon. Lord Justice F.	1	1	0
s Willcox, W. H., & Co...	2	2	0
d Krausse & Auerbach ..	2	2	0
d Union Cable Co. ..	2	2	0
d Goulding, T. W... ..	2	2	0
d Thurnauer, L.	2	2	0
m Lichtenstein, P. ..	0	10	6
l s General Electric Co. ..	15	15	0
l m Hirst, H.	10	10	0
d Byng, E. G.	5	5	0
d Byng, L. G.	5	5	0
d Railing, M.	5	5	0
d White, S. D.	1	1	0
m Rawlings, W. R. ..	1	1	0
m Mason, A. V.	1	1	0
d Pirelli, Alberto	2	2	0
d Broacha, Sir S. B. ..	5	5	0
d Chalk, Walter	1	1	0
d Wolf A.	0	10	6
d Bevis, H.	1	1	0
d Shepperd, J.	1	1	0
s Lundberg, A. P., & Sons	2	2	0
m Hoare, W. H.	0	10	6
m Thomson, A.	0	10	0
m Kaye & Neville	0	5	0
d Huddleston, J. Snow ..	1	1	0
s Concordia Elec. Wire Co. (Staff)	1	1	0
s Benson, W. A. S., & Co.	0	10	6
s Handcock & Dykes ..	1	1	0
d Brit. Ever-Ready Elec. Co.	2	2	0
m Wild, L. W.	1	1	0
s Reid, Ed. J.	1	1	0
m Trotter, A. P. . ..	1	1	0
s Pope's Elec. Lamp Co.	1	1	0
s Crompton & Co... ..	2	2	0
m Hughman, R. W. ..	1	1	0
m Kolle, H. W.	2	2	0
s Lawton, John, & Sons ..	1	1	0
d Electrical Engineers' Ball, Committee of..	20	0	0
l s Brit. Thomson-Houston Co. .. .. ,.	10	10	0
s Espir, Fernand	1	1	0
s British Traders' Assoc.	3	3	0
m Clothier, H. W... ..	0	10	6
m Lawrence, A.	0	10	0
d Hawkins Bros. & Co.	1	0	0
l m Prestige, J. Theo., jun.	10	10	0
s Clark, E. J.	1	1	0
m Hay, G.	1	1	0
d Pilkington Bros. ..	0	10	6
d Kidd, G. W.	0	10	6
d Gill, A. B.	5	5	0
s Traun, Dr. Hein., & Sons	2	0	0
d Traun, Dr. Hein., & Son	1	0	0
d Moseley, D., & Sons, Ltd.	3	3	0
d Harburg & Vienna I.R. Co., Ltd.	2	2	0
d Pirelli, Ltd.	2	2	0
s Hurst, A., & Co. ..	2	2	0
d Nettlefold & Sons, Ltd.	2	2	0
d Cookson & Co.	1	1	0
d Wallach Bros., Ltd. ..	1	1	0
m Baldwin, J. H.	0	10	0
s Wiggins, F., & Sons ..	1	1	0
m O'Meara, Major W. A.	1	1	0
s Kearsley, Robt., & Co.	1	1	0
s Green, F. A.	1	1	0
s Brimsdown Lamp Works	2	2	0
m Morton, P.	0	10	6
m Hawes, F. B. O. ..	1	1	0
l m Hawes, F. B. O. ..	10	0	0
d Ashton, H. M., Ltd. ..	0	5	0
d Ormiston & Sons ..	8	8	0
d Brit. Elec. & Allied Mfrs.' Assoc. .	25	0	0
s Wilson, E. C.	0	10	6
d Falk, Stadelmann & Co.	5	5	0
d Anderson, John, & Sons	2	2	0
d Gillespie & Beales ..	1	1	0

The letter coming before each of the names signifies the following:— *m*, Member; *s*, Subscriber; *d*, Donor; *l m*, Life Member; *l s*, Life Subscriber.

PARLIAMENTARY.

Bingley Tramways.

On June 25th and 26th Sir J. Compton Rickett's Select Committee of the House of Commons considered the Tramways Provisional Order Confirmation Bill, which, amongst other orders, confirmed the Provisional Order granted by the Board of Trade to the Bingley Urban District Council authorising the construction of a tramway through the urban district of Bingley, and connecting with the tramways of the Bradford Corporation.

Mr. Dillon, who appeared for the promoters, explained that the tramway would be just over 3 miles long, and at Shipley it would connect with the Bradford Corporation Tramway, and provide a means of communication between Bingley and Bradford. The only opposition came from the West Riding County Council, who asked that certain roads should be widened, and the promoters, whilst agreeing that these roads required widening, contended that a large portion of the cost should be borne by the County Council.

Mr. H. Bottomley, surveyor to the Bingley District Council, estimated the cost of the tramway at £11,000, after allowing for the sale of purchased land.

Mr. C. J. Spencer, general manager of the Bradford Corporation Tramways, said the tramways would be worked by the Bradford Corporation as part of their system.

Other evidence having been given in support of the Bill, the surveyor to the West Riding County Council was called by Mr. Wedderburn, and he urged on the Committee that a large share of the cost of the proposed widenings should fall on the Urban District Council.

The Committee passed the Bill, subject to the condition that the cost of widening Cottingley Bridge should be equally divided between the County Council and the Urban District Council of Bingley. With regard to the widening of Rushworth Corner, they fixed that the County Council should contribute two-thirds and the U.D.C. one-third; and that the cost of widening Main Street should be borne as to one-fourth by the County Council and three-fourths by the District Council.

Electric Tramways (London).—Mr. Kellaway asked the President of the Local Government Board what was the total amount, and the amount per vehicle, paid last year in rates (1) on the track; (2) towards road making and maintenance; (3) toward cost of road widenings, by the London County Council tramways and the motor-omnibus companies, respectively, in the administrative county of London.—Mr. Burns, in reply, said he was informed by the London County Council that in the year ended March 31st, 1912, the amount paid by them in rates on the track of their electric tramways was £98,526, being £84 per car in use; that the estimated charge for road-making and maintenance was £120,000, or £102 per car, and that the amount paid towards the cost of road widenings was £23,030, or £20 per car. He had no information as to the rates paid by the motor-omnibus companies. Rates were not assessed on movable property.

Illumination Standards.—Mr. Watt asked whether it was the intention of the Home Secretary to appoint a Committee to inquire into the question of illumination standards; if so, would he say when it was to be appointed, of how many it would consist, and whether he would see that a Scottish member was put on it. Mr. Ellis Griffith said it was the intention to appoint a Committee, and its constitution was now under consideration. The Committee would be a Committee of experts, and questions of the representation of particular parts of the country, or particular industries, would not arise. He could not give any further details at present.

Lighting of the House of Commons.—Sir Daniel Goddard asked the Hon. Member for St. George's-in-the-East, as representing the First Commissioner of Works, whether the First Commissioner of Works would consider the possibility of substituting a modern system of gas lighting for the illumination of the House, which, whilst increasing the illumination, would greatly reduce the present cost and be far more economical than electricity; whether the present system had been in use for at least 40 years, and was now obsolete; and whether the experiments reported to have been made were experiments with electricity only, and not with gas, under the improved conditions of modern lighting.—Mr. Wedgwood Benn replied that after consideration it appeared that incandescent mantles could not well be used, by reason of the draught from the ventilating fan, and no experiments had been made with them. The present system of lighting had been in use, with slight changes, for rather more than 40 years.

Metropolitan District Railway Bill.—This Bill came on June 25th before the Unopposed Bill Committee of the House of Lords, and was ordered to be reported for third reading.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,036. "Electric starting and regulating switches." G. O. Donovan. June 17th. (Complete.)

14,056. "Turbo-field magnets." R. A. Holbech and A. Rolfe. June 17th.

14,063. "Means for automatically illuminating advertisements in electric trains and the like." R. H. Morgan. June 17th.

14,087. "Mercury switches and arrangements for starting electric motors by means of the same." Siemens Schuckertwerke G.m.b.H. (Convention date, June 21st, 1911, Germany.) June 17th. (Complete.)

14,083. "Switches or switch arrangements for use in electrical circuits." F. Broadbent. June 17th.

14,115. "Electric measuring instruments." British Thomson-Houston Co., Ltd., and F. Holden. June 17th.

14.120. "Automatic electromagnetic cut-outs." P. Wessel and T. Gysler. June 17th. (Complete.)

14,143. "Electric welding." A. L. Johnson. June 17th. (Complete.)

14,157. "Armoured electric cables." Callender's Cable and Construction Co., Ltd. and C. Pipkin. June 17th.

14,164. "Electric induction heater or furnace." A. Helfenstein. (Convention date June 16th, 1911, Germany). June 17th. (Complete.)

14,178. "Electrical means of volatilising metals and the direct rapid conversion into compounds of a finely divided state." E. M. Bailey, W. Plews. H. F. McDowell and T. Middleton. June 18th.

14,187. "Incandescent electric lamp cap." J. Wilson and W. Henderson. June 18th.

14,188. "Electric lampholder." J. Wilson and W. Henderson. June 18th.

14,189. "Braided wire electrical resistances." A. B. Soar. June 18th.

14,190. "Electric resistances." W. F. Jones. June 18th.

14,202. "Miners' electrical safety lamps." W. Thomson and J. H. Rothwell. June 18th.

14,216. "Protection for telephone wires." G. H. Jones. June 18th.

14,224. "Automatic electrical announcer." A. J. W. Munden and J. M. Muir. (Convention date, November 29th, 1911, New Zealand.) June 18th. (Complete.)

14,225. "Electrically operated announcer." A. J. W. Munden and J. M. Muir. (Convention date, January 29th, 1912, New Zealand.) June 18th. (Complete.)

14,236. "Commutating devices for dynamo-electric machines." M. Debi. June 18th. (Complete.)

14,251. "Sparking plugs." G. Farina. June 18th. (Complete.)

14,267. "Carbon electrode for electric furnaces." Planiawerke Akt.-Ges. fur Kohlenfabrikation. (Convention date, July 21st, 1911, Germany.) June 18th. (Complete.)

14,270. "Electric switches." H. Leitner. June 18th.

14,271. "Electric switches." A. C. Whish and British Electric Transformer Co., Ltd. June 18th.

14,280. "Magnetic and gyroscopic compasses." E. H. Clift. June 19th.

14,306. "Terminal mounting and cord-gripping means for electric lampholders, adaptors, or the like." G. St. J. Day. June 19th.

14,317. "Telephone sub-station switching systems." W. Aitken. June 19th.

14,318. "Telephone exchange systems." W. Aitken. June 19th.

14,339. "Ships' compasses." L. F. Fuchs. June 19th. (Complete.)

14,354. "Method of utilising electric current for heating purposes." W. R. Rawlings. June 19th.

14,365. "Magneto-electric machines for combined ignition and illuminating purposes on motor road vehicles." F. R. Simms and Sims Magneto Co., Ltd. June 19th.

14,370. "Protection for telephone wires." G. H. Jones. June 19th.

14,378. "Electric measuring instruments." British Thomson-Houston Co., Ltd, and A. P. Young. June 19th.

14,385. "Miners' safety lamps of the electric type." J. L. Hudon. June 19th.

14,389. "Method of increasing the frequency of alternating-currents by means of static transformers." H. Sefton-Jones. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) June 19th.

14,390. "Method of and apparatus for the production of alternating currents of high frequency." H. Sefton-Jones. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) June 19th.

14,396. "Control and use of series-wound dynamo-electric machines." H. F. Haworth and Thomas Transmission, Ltd. June 20th.

14,460. "Electric fuses or cut-outs." H. R. Schultz. June 20th.

14,466. "Electromagnetically-controlled gas valves." Compagnie du Gaz Electrique. (Convention date, April 17th, 1912.) June 20th. (Complete.)

14,514. "Combined windmill and dynamo-electric machinery." J. A. Leeming. June 21st.

14,516. "Arc lamps." Korting & Mathiesen Akt.-Ges. June 21st. (Complete.)

14,560. "Means for obtaining two separate and opposite drives from a single electric motor." H. T. Holmes and J. Kemp-Welch. June 21st.

14,563. "Automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) (Addition to No. 7,093, of 1910.) June 21st. (Complete.)

14,564. "Electromagnetic relays." Siemens Bros. & Co., Ltd., and W. H. Grinsted. June 21st. (Complete.)

14,576. "Electromagnetic indicating instruments." W. J. Davis and C. E. Hunter. June 21st.

14,583. "Controlling apparatus for electric motors." The Hon. R. C. Parsons. June 21st.

14,635. "Electric fittings." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 22nd.

14,639 "Dynamos, rectifiers, turbo-generators." J. Lecoche. June 22nd.

14,653. "Electrically-controlled signals for use in determining temperature." A. McNab. June 22nd. (Complete.)

14,654. "Methods of drawing fine wires of refractory metals." K. Farkas. (Convention date, June 23rd, 1911, United States.) June 22nd. (Complete.)

14,655. "Incandescent lamps with drawn metal wire filaments." K. Farkas. (Convention date, June 23rd, 1911, United States.) June 22nd. (Complete.)

14,658. "Signal installations for supervising the relative positions of turntables or other rotating stations." Siemens Bros. & Co., Ltd. (Siemens and Halske Akt.-Ges., Germany.) June 22nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Electric Furnaces. M. Ruthenburg. 28,126. December 3rd. (May 30th, 1911.)

1911.

Transmitter for Telephone and other Sound-transmitting Instruments. E. C. R. Marks. (Webb.) 16,955. July 24th.

Apparatus for the Adjustment of Oscillation Circuits of Wireless Telegraph Transmitting Stations. G. C. Dymond. (Gesellschaft fur Drahtlose Telegraphie.) 17,149. July 26th.

Electric Pocket Lamps. A. P. H. Pouteaux. 17,281. July 28th.

Electric Switches. H. J. Furneaux and W. B. Rock. 17,502. August 1st.

Electric Switches for Use with Timing or other Predetermining Mechanism. H. P. Allison and H. J. Arnold. 17,788. August 4th.

Telephones. B. Gwozdz. (Convention date not granted. Addition to No. 11,234 of 1911.) 17,900. August 5th.

Certain Kinds of Fittings for Electrical Conduits. J. W. Brooks and A. E. Read. 18,301. August 23rd.

Systems of Electric Distribution. British Thomson-Houston Co. (General Electric Co.) 19,260. August 28th.

Circuit Arrangements for Automatic Telephone Systems. Siemens and Halske Akt.-Ges. 19,645. September 4th. (October 12th, 1910.)

Telephonic Apparatus. E. A. Graham. 22,634. October 13th.

Means of Jointing and Bonding between Lead Covered or Lead Covered and Armoured Electric Cables, and Cast-Iron, Wrought Iron or Mild Steel Sleeves or Joint-Boxes. R. B. Mitchell and F. J. Cooper. 22,818. October 17th.

Means for Varying the Inductance of Electric Circuits. G. Schieferstein. 23,283. October 21st. (Patent of Addition not granted. Divided application on No. 12,978 of 1911. May 30th.)

Automatic Regulators for Electric Welding Apparatus. Ges. fur Elektrotechnische Industrie. 23,943. October 28th. (October 29th, 1910.)

Method of Manufacturing Electric Steel Castings. G. Fisher and B. Schudel. 27,377. December 6th. (December 7th, 1910.)

Lighting of Motor-Driven Vehicles by Electricity. H. Leitner. 27,482. December 7th.

Electric Distribution Systems. J. Bijur. 28,391. December 16th. (December 21st, 1910.)

1912.

Joints for Electric Conductors Entering Vacuum Apparatus. Y. Sakai. 38. January 1st. (January 7th, 1911.)

Circuit Arrangements for Connecting a Trunk Line Telephone Exchange with the Subscribers of a Local Automatic Exchange. Siemens Bros. and Co. (Siemens & Halske Akt.-Ges.) 528. January 6th.

Manufacture of Dies for Wire-Drawing and the Like. British Thomson-Houston Co. (General Electric Co.) 536. January 6th.

Construction of Electrical Accumulator. P. Marino. 2,575. January 31st.

Memorials to the "Titanic" Engineering Staff.—The Institute of Marine Engineers is promoting a memorial to the engineering staff of the *Titanic*, every member of which lost his life whilst keeping the pumps and electric light going to the last moment. Only those who have been through the mill can realise the splendid courage and devotion of these men, who, taking no thought for themselves, and obedient only to the call of duty, steadfastly remained at their posts, knowing as they must have done that the great ship was doomed. There is no case on record where British engineers have failed in their duty on a sinking ship; but this instance is marked by the exceptional magnitude of the disaster. The engine-room staff consisted of no fewer than 35 persons, of whom 6 were classed as electricians—namely, Messrs. Peter Sloan (chief), A. S. Allsop, H. Jupe, A. P. Middleton, A. G. Irvine and W. Kelly. No finer staff of engineers ever went to sea, and we commend their memory to our readers. A special issue of the *Journal* of the Institute of Marine Engineers contains portraits and biographical notices of them all, and contributions to the Memorial Fund may be sent to the Secretary, 58, Romford Road, Stratford, London, E. A memorial is also to be erected on the banks of the River Mersey; a strong Committee has been formed, and contributions may be sent to Mr. A. J. Maginnis, the chairman, 10, Drury Lane, Liverpool. It is intended that the fund shall provide also for the erection of memorial tablets or other records in other seaports.

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REGULATING WIRELESS TELEGRAPHY.

THE International Radio-Telegraphic Conference, which opened in London on June 4th, was formally closed on Friday, July 5th, after the signing of the amended Convention. The programme of serious business and social events which the delegates have successfully overcome has been a strenuous one—so strenuous, indeed, that the departure of some two or three delegates for their respective countries was delayed owing to indisposition. The Government, public departments, and wireless companies vied with each other in making the stay of the distinguished foreign visitors a pleasant and memorable one, and we do not think that there is any exaggeration in the claim so freely made during the past month, that wireless telegraphy is an important factor in international friendship. The bitter jealousies between public officials and factions supporting rival interests found no voice during the Conference, and it is sincerely to be hoped that the last has been heard of a rivalry which boded no good for anybody. How striking is the contrast between the Conference which has just closed and its predecessors of 1903 and 1906, both of which were shrouded by the grey mist of suspicion and jealousy! Whatever may have been the motives of the German Government when they summoned the first two conferences, there can be no question as to the benefit which has resulted. The fear that the bondage of official regulations imposed upon wireless telegraphy in the early stages of its development would have the effect of hindering and delaying the introduction of improvements has been shown to be groundless, and the pioneering wireless company has not only not suffered the injurious effects which it was prophesied would befall it, but has progressed in a way which even its most sanguine supporters could not have foreseen. It is only fair to acknowledge that the present stage in the development of wireless telegraphy is largely due to Mr. Marconi and his company, whom everyone will most heartily congratulate upon having safely weathered the early failures and discouragement which beset their path. In spite of the removal of restrictions and the freedom of competition throughout the world, the Marconi Co. controls 80 per cent. of the mercantile telegraph business of the world, and alone carries on a long-distance shore-to-shore wireless telegraph business.

A full report of the proceedings in connection with the International Conference just closed has not been published, and we doubt whether we are likely to see anything in the nature of such a report. At a later date no doubt we shall be in possession of the complete amended Convention. In the meantime, an interim statement has been issued by the Post Office, which indicates that some important changes have been made in the regulations which will considerably affect the future of wireless telegraphy, and will not only go far to render its use universal, but will help to secure greater efficiency.

The vexed question of intercommunication between ships fitted with different systems has been most satisfactorily disposed of, and although the regulations, if ratified by the respective Governments, do not take effect until July 1st, 1913, it is pleasing to note that the Marconi Co. intend to put the new conditions into immediate operation, without waiting until that date. The United Kingdom and the British Dominions, with Italy and Japan, have hitherto opposed the principle that ships must accept messages from other ships, whether or not they use the same system of wireless telegraphy. This objection has now been removed, with the approval of all countries. The decision, however, of the greatest importance has been the unanimous resolution by the delegates to recommend to their Governments immediate legislation for compulsory wireless telegraphy on board all sea-going vessels, both passenger and cargo.

Compulsory wireless has already been adopted in some countries—notably, in the United States of America, where the law came into operation on July 1st, 1911, and seems to have worked very smoothly. The Commissioner of Navigation recently pointed out that there were 488 ocean passenger steamships departing from United States ports equipped with wireless, compared with 370 such vessels before the Act took effect. This increase is perhaps not wholly due to the law, but partly to the appreciation by owners of the economies in dispatch, and facility in securing pilots and loading berths, made possible by the use of wireless. Moreover, the demands of the public travelling by sea on small steamers have impelled owners to equip their vessels with wireless telegraph apparatus.

The International Conference has passed a resolution providing that ships in future will be required to possess an auxiliary source of power able to work the wireless apparatus for at least six hours. This provision is well calculated to render more effective the service of wireless telegraphy in cases of distress at sea, but it is not altogether new, for apart from the United States law to which we have just referred, the Marconi system makes provision for the installation of an auxiliary source of power, which is independent of the ship's plant.

The Conference has taken steps to lessen the danger of distress calls going unheard, by laying down rules for attendance on the wireless apparatus in various classes of ships. The necessity for a provision of this kind was driven home by the lamentable *Titanic* disaster, when it appeared that there were vessels in the immediate vicinity efficiently equipped with wireless apparatus, but unable to receive the distress call in consequence of the sole operator carried on board being off duty. The obvious means of avoiding such difficulty is the provision of a continuous watch on board ship, but in many cases it would be an expensive matter to employ two operators on the smaller ships. The Conference has recognised this, for a permanent watch will be required only on ships of the first class, and in this case two fully qualified operators at least must be carried. On ships of the second class, where a permanent watch is not considered practicable, the operator must listen during the first 10 minutes of every hour. It must strike the reader that this provision is entirely impracticable, inasmuch as it appears on the face of it to require the operator to leave his bed and attend on duty during the first 10 minutes of every hour of his rest. What is intended, no doubt, is that one of the junior officers of the ship, or some member of the crew, will be trained to receive a certain signal—the distress signal—and that during the first 10 minutes of every hour he will listen for this particular signal. This seems a decidedly common-sense regulation, which there should be no difficulty in carrying out, and should serve admirably until the production of a suitable audible signal.

Mr. Marconi, in his evidence before the *Titanic* Court of Inquiry, pointed out that he had been considering means for making the wireless apparatus ring a bell, and thereby give a warning that a ship in danger needed assistance. In order to make such a system effective, given that the apparatus is all right, it would be necessary to alter the regulations of the International Convention so as to enable the danger signal to consist of, or be accompanied by, a "long dash," as it is called, an impulse or sequence of waves which will last for a period of 15, 20 or 30 seconds. This would cause a bell to give a prolonged ring, like that given on shore by a fire alarm, and that would be a signal to denote that a ship required assistance. So far as we can judge from the brief statement issued by the Post Office, there is nothing in the amended regulations to allow such a thing to be done.

The operators on every ship are now specifically placed under the authority of the captain. Hitherto, the position of the operator has been an anomalous one, for he has generally been an employé of the wireless company, and only nominally under the control of the captain.

It is satisfactory to note that the delegates agreed that it would be premature to attempt to lay down regulations for long-distance service between land stations, and it was expressly laid down at the Conference that each country remains free to organise services of this nature as it thinks best, the only principles adopted being that interference between different stations must be avoided as far as possible, and that differences in the system of wireless telegraphy employed must not be a basis for refusing intercommunication. We do not think that we are over-sanguine in predicting that, in the normal course of events, long-distance shore-to-shore communication will be the chief question to be discussed when the next Conference is held in Washington in 1917.

Organisation in Electrical Undertakings.

Electrical undertakings have by this time settled down into a standard method of working. A constant interchange of managers and assistants, who move from one place to another in order to improve their prospects, is always going on, and what a man has learned in one concern he takes with him and introduces, with the necessary modifications, into his new post. Years ago it could be said with truth that, as regards organisation, some dozen or so of stations had considered the matter, and the rest were floundering about as best they might. Nowadays, however, a new man can almost get a system cut-and-dried for him by manufacturers of office furniture. This fact may account for the woeful depletion of the audience on the occasion of the reading of Mr. Shaw's paper recently, before the I.M.E.A.

In the discussion which followed, several speakers laid stress upon the number of persons shown in Mr. Shaw's skeleton diagram, and some of them evidently had misgivings as to the outcome of organisation on these lines. Of course, many of the duties shown separately can be—and are—advantageously combined in one person. Small undertakings contain many examples of individuals whose functions are nearly as various as those of the immortal Pooh-Bah. By following out such a system, however, the chief knows how to sub-divide any office or post when the duties at first attached to it get beyond one man's capacity. Thus, it is possible to build up an undertaking from a small affair of a few hundred kilowatts to the size of some of the mammoth concerns of the United States, maintaining all the time that continuity of system and policy which is so desirable.

Mr. Shaw refers to the desirability of interchange of labour between sections of the mains department. With the co-operation of the surveyor's department, this interchange, chiefly of unskilled labour, can be carried to a much further extent, and it has a useful tendency to ensure the labourers a certain constancy of employment.

He also emphasises, very rightly, the necessity for looking after a consumer, after his installation is connected to the mains, just as carefully as he was looked after while he was still what Mr. Shaw calls "a prospect"; if this is not done, he is only too likely to take his complaints to the gas authority, where he gets attention.

We think Mr. Shaw must be poking fun when he suggests that the lack of sign business in this country is due to æsthetic reasons. Signs can be, and frequently are, made beautiful and artistic, and the chief reasons against their adoption have been, so far as we can judge, the arbitrary regulations of the street authorities and the curious reluctance of electric suppliers to grant an economic rate of charge for their supply. Signs have an excellent diversity factor, especially when they are of the flashing variety, and are mainly used off the peak. We do not see any reason why the majority of undertakings should not supply signs at 2d. per unit.

Coalite.

The annual meeting of Coalite, Ltd., which should have been held in March, was held in London last week under the chairmanship of Mr. A. M. H. Walrond. This company, it may be explained, owns the foreign patents relating to the Coalite process. The non-success of the original process, as worked at Barking and other places where it has been tried, has drawn this company into the morass of difficulties, which have so far proved the natural inheritance of "Coalite" management and finance. The delay in holding the meeting, it was explained by the chairman, had been due to the desire to present to the shareholders the results of the lengthy practical trials of the improved process now being operated by the "Eticoal" Syndicate, to which reference was made at the last annual meeting of the British Coalite Co. (see Electrical Review of April 12th, 1912). Unfortunately, owing to the difficulties caused by the Coal and Dock Strikes in the spring of the present year, the three months' trial run of the new battery of coking ovens which have been erected by the "Eticoal" Syndicate at Barking was delayed, and this battery has only now been at work a fortnight, carbonising 35 tons of coal per day. It is recognised that no final judgment upon the value of the new process can be based upon such a short trial run, but Mr. Hermann Clarke, who is in charge of this new development of the original Coalite process, is quite satisfied with the results of the trial so far, and it is intended at an early date to ask Sir William Peat to examine and report upon the new process and plant. The chairman of "Coalite, Ltd.," stated that the modified "Coalite" process was developing on the lines of the well-known coke-oven processes, and that it was hoped Sir William Peat's report would prove that the modified Coalite process was superior to any coke-oven process now in operation, and that it would produce a household fuel which was absolutely smokeless. The gist of this statement is in its relation to the value of the patents now held by "Coalite, Ltd.," and Mr. Walrond was only repeating what is self-evident when he stated that "our success and our ability to deal with our foreign patents rests on the 'Eticoal' Syndicate proving a commercial profit."

The balance-sheet and profit and loss account of "Coalite, Ltd.," contained little to raise the hopes of the shareholders, and it is certain that if the favourable expectations of the value of the "Eticoal" process are not fulfilled, the investors in "Coalite, Ltd.," and also in the British Coalite Co., must be prepared for very heavy losses in connection with their investments in these two companies. As stated in our last reference to "Coalite" in this journal (see Electrical Review of April 12th, 1912), our criticism has been directed not against "Coalite" *per se*, but against the bad management and doubtful finance that have marked the history of the various companies connected with it. We shall be only too pleased if Mr. Hermann Clarke, who is now managing director of the "Eticoal" Syndicate, and those who are associated with him in the direction of the various Coalite companies, can pull these out of the morass in which they have been embedded for a considerable time.

Mr. Walrond stated in his closing remarks at the meeting of "Coalite, Ltd.," that Mr. Hermann Clarke was really the motive force behind the Coalite process at the present moment; and it will be a notable achievement if this gentleman can rehabilitate the various Coalite companies in the eyes of the public, and is able to present to their shareholders balance-sheets which show a surplus instead of the repeated deficit to which they have for so long been accustomed.

L.C.C. Contracts.

At a recent meeting of the London County Council, new Standing Orders, to form part of contracts entered into by the Council for the supply of various classes of goods and the carrying out of engineering and building work, were agreed to. These regulations are the recommendation of a Committee which has been considering the subject for some time. They aim at ensuring that contractors to the Council pay fair wages and recognise standard hours of labour, and, so far, they are worthy of general acceptance. Hitherto the difficulty has been in so framing the clauses that they achieved their object without unduly penalising the employer on the one hand, or serving as a mere lever for obtaining new concessions by the workmen on the other. The old clauses were open to these objections, and from time to time we found it necessary to criticise them on this account. The new regulations have evidently been subjected to careful revision, irritating and unnecessary words have been omitted, and in their present form there is little to which any first-class firm need object.

Lists of firms able to supply various classes of goods, who are willing to abide by these regulations, are to be kept, and specifications will be sent to them as goods are needed. Applications to be placed on these lists may be sent in at any time and will receive careful attention. Where Trade Union rates of pay and conditions of labour are generally recognised by employers and workers, these must be adhered to. In other cases, the Council will prepare and have open to reference at its offices, a list of minimum wages and conditions which must be held as binding. These lists will approximate to the conditions of working under the best employers. If work is sublet, it must be subject to the approval of the Council, and the main contractor is still to be held responsible for compliance with the regulations. A copy of the regulations is to be posted in the contractor's works, and if cases of underpayment or other breach are brought to the notice of the Council, the latter reserves power to pay the workers the difference and deduct the sums thus disbursed from any account due to the contractor.

Trouble with the Trolley Head.—The trolley head is probably that part of an electric tram-car which is exposed to the severest treatment and roughest wear experienced in electric traction running equipments, and the wear is especially evident on a car where the pole is not getting enough tension. In such cases the contact between the trolley wheel and the overhead line is not very secure, as in some cases the line has to be higher at one point than at another, especially where bridges or other overhead obstructions have to be negotiated on the route. Where this is the case special instructions are usually issued to the motorman to go slowly, but unless very careful attention is exercised in supervising the running of the cars, it frequently happens that the motorman will rush his car under a bridge without thinking of the possible damage which may ensue. Under such circumstances it is more than likely that the trolley head leaves the overhead track and the trolley pole jerks upward, and on such occasions it is very possible that the trolley head may become broken. In one case where this sequence of events occurred the pins and cotters came out of the trolley head, and before the car could be started again it was of course necessary to get the wheel on again in some temporary fashion. It was found that the pin was broken, and at first sight it looked as if the car would have to be towed or pushed to the depôt by means of another car. One of the men on board, however, happened to have a long wood screw in his pocket, and this was put through the fastening in place of the pin and tied round with wire so as to construct a make-shift repair. This was sufficiently good to enable a successful trip home to be made, but care should be taken on tramway systems that the trolley heads are not subjected to undue strain by reason of high-speed running by the motorman at inconvenient points. Moreover, an examination of the pins on the trolley heads will often be found worth while, as although it is preferable to make these of steel, it will be found that oftener than not they are of ordinary iron, case hardened to resist wear. For this reason the above note may be useful in calling timely attention to a fault which may easily dislocate the running of a tramway system.

THE PRODUCTION OF PIG-IRON IN THE ELECTRIC FURNACE.*

Extensive experiments have been carried out from time to time in Scandinavia with a view to rendering commercially practicable the reduction of iron ore in an "electrically-fired" blast furnace. The coal supply of these countries being poor, and, on the other hand, large quantities of cheap electric power being available, the subject has become of particular importance, and further investigation was decided upon by the "Jern-Kontoret," an association of Swedish ironmasters. They erected a powerful reducing plant at Trollhättan, the site being particularly suitable by reason of its proximity to the large hydro-electric station, and as regards transport facilities. The results recorded in this article cover experiments and investigations which lasted six months, and terminated in June, 1911.

Principles Governing the Design of the Furnace.—The following special considerations had to be carefully taken into account in the design :—

1. Working with high temperatures produced electrically, means must be taken to obviate current losses through the linings of the furnace, particularly because the materials in question increase in conductivity with the rise in temperature.

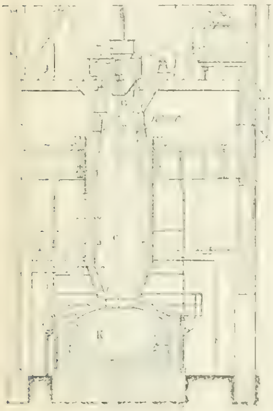
Fig. 1.

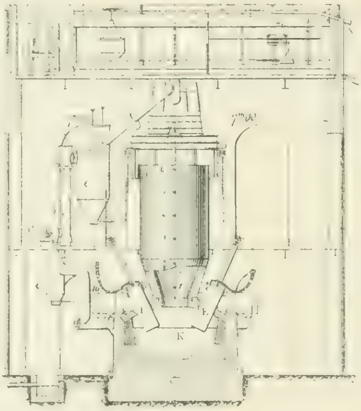
Fig. 2.

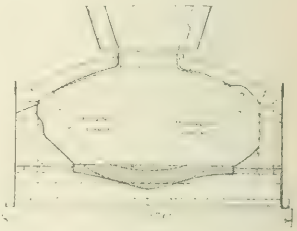
Fig. 3

2. The construction must make allowance for decrepitation of the walls due to the intense heat and the contact with the charge.

3. The hot substances in the hearth must not exert pressure on the electrodes, as, in such a case, only very low voltages could be employed. This would, of course, necessitate excessive dimensions of electrodes and connections.

4. The combustible material does not "burn" in the ordinary sense of the word ; therefore, to obtain uniformity in the quality of the products, the hearth must be made of large dimensions and must also act as a mixing chamber.

In order to fulfil these conditions, the hearth (K in figs. 1 and 2) is made in the shape of a large crucible with a domed cover. The electrodes pass through this dome but do not come into actual contact with the hot substances in the hearth. The body is so designed that the descending substances discharge into the hearth as through a cone, leaving a clear space above the level of the slag, and surrounding the electrodes. The usual method of regulating the heat by raising or lowering the electrodes, for constructive reasons cannot be adopted here, and for the first time the heat regulation has been achieved by independent regulation of the voltages on each of the two phases of the current employed.

Construction of the Furnace.—The furnace is designed to produce 7,500 tons of pig-iron during 11 months of the year, or about 23 tons per diem. The following data were established as basis for calculation :—

(*a*) 1 cb. m. of wood charcoal weighs 150 kg.

(*b*) To produce 3 kg. of iron, 1 kg. of charcoal is required.

(*c*) 1 kg. of pig-iron can be obtained from 1·725 kg. ore.

(*d*) Specific gravity of ore employed = 2·5 kg./cu.dcm.

(*e*) Half of the mineral charged will fill the interstices between the pieces of charcoal of the same charge.

(*f*) The daily amount charged is 1·55 times the cubic contents of the furnace.

To produce 23 tons of pig-iron under these conditions, 51 cb. m. of wood charcoal must be mixed with 7·9 cb. m. of ore—say 59 cb. m. in all ; this, divided by 1·55, gives a capacity of 38 cb. m. capacity for the furnace, divided roughly into 13 cb. m. for the hearth and 25 cb. m. for the body.

The building which contains the furnace covers a piece of ground 24 m. × 15½ m. The overall height of the building is 21 m. and the height from the ground level over the throat of the furnace is 13·7 m.

The furnace is composed essentially of two parts, the body C and the crucible or hearth K.

The boiler-plate shell of the former varies in thickness from 10 mm. at the top to 12 mm. round the cone ; it also carries all the iron supports for the fire-brick lining. The whole structure is supported on two girders by means of an octagonal channel-iron framework riveted to the shell. Thus the weakest part of the furnace, the dome of the crucible, is relieved of all stress and independent expansion is possible for each of the essential parts. The joint between them is made with sand. The maximum internal diameter of the lining is 450 mm., tapering to 360 mm. at the throat. The charging cone is actuated by a 2½-B.H.P. motor, and the charges of ore and charcoal are raised to the charging stage by a 16-H.P. motor.

The crucible hearth or melting chamber rests on a solid concrete bed, and like the body is encased in boiler plate, which here is 15 mm. thick. At the point where the weight of the dome is taken, the shell is reinforced by a steel band having a section of 200 mm. × 18 mm. The lining of refractory material is covered with magnesia bricks, and the floor of the hearth is formed of magnesia bound with tar. Fig. 3 shows the original section of the hearth, and its appearance after six months' working.

Four electrodes (E, figs. 1 and 2), two to each phase of the two-phase current used, pass though asbestos-packed gas-tight openings in the dome, making an angle of 65° with the horizontal. Each electrode is made up of four pieces of carbon, has a total section of 660 × 660 mm. and weighs 1,300 kg. The average loss in weight by burning away is 5 kg. per ton of iron produced, but to this must be added an equal amount rendered unfit for any further use. Outside the crucible the electrodes pass through copper water jackets. Connection with the cable leads is made by cast-steel terminals, which clamp the cables to the carbons.

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* Translated from *Le Génie Civil.*

A quantity of gas extracted at the throat is drawn through a dust screen by a centrifugal fan, and is blown again into the space which exists between the molten mass and the dome. Four adjustable twyers or nozzles are used to distribute this gas, being arranged at intervals of 90° apart round the crucible. This supply of waste gases into the crucible serves a double purpose: the gases are heated up in the crucible, and give off the absorbed heat as they pass into the upper zones, thus materially assisting the reduction; further, they cool the dome, and thus prevent its too rapid destruction. With gases at 200° C., and containing equal volumes of CO and CO_2, 70 cb. m. per minute at a pressure of 325 mm. water gauge are blown into the crucible by the 8-H.P. electric fan. There are the usual fittings for drawing off the slag and the iron.

Electrical Equipment.—The supply is three-phase at 10,000 volts, and is transformed to two-phase current with a pressure variable in each phase from 50 to 100 volts. From the transformers the energy is led to the furnace by four leads, each lead consisting of six copper strips 200 mm. × 8 mm. in section. Each strip, again, is connected to eight cables, each having 185 sq. mm. section; thus 48 cables having a total section of 8,800 sq. mm. are connected to each electrode.

Electric measuring instruments of various kinds are supplied, including platinum and platinum-rhodium pyrometers.

The current varied between 3,000 and 18,000 amperes, with a pressure variation of between 50 and 100 volts per phase. The power used varied considerably, the load ranging from 300 to 2,000 KW.

Conclusion and Results.—Three series of experiments were made by Messrs. Leffler & Nyström, of the "Jern-Kontoret," in the six months referred to, and the results are tabulated below:—

Number of experiment		I.	II.	III.
Mean primary load, KW.		1,319	1,717	1,680
Mean secondary voltage	Phase I	65·2	75	81·9
	Phase II	65·9	83	88·2
Mean secondary amperes	Phase I	13,731	13,564	11,922
	Phase II	13,416	11,817	10,406
KW.-hours per ton cast		2,296	2,481	2,241
" " "	useful work	1,454	1,686	1,595
" " "	losses ...	842	795	646
Efficiency, per cent....		62·33 %	67·96 %	71·77 %
Losses	Transformer losses ...	1·83 %	2·74 %	2·12 %
	Secondary losses (including leads)	3·31 %	3·83 %	3·03 %
	Absorbed by cooling water	6·53 %	6·57 %	6·53 %
	Radiation and other losses	26·00 %	18·90 %	16·55 %
		100 %	100 %	100 %
Calorific value of waste gases per cubic metre		2,786 cal.	2,892 cal.	2,544 cal.
Of this 80 % only can be utilised ...		2,230 cal.	2,315 cal.	2,035 cal.
Consumption of charcoal in hectolitres per ton cast		25·02	23·88	21·66

The average consumption of charcoal in other furnaces is 62·8 hl. per ton.

In conclusion, it is interesting to note that the most serious incident in the six months' work was an explosion in the crucible due to the rapid descent into the molten mass of a quantity of powdered ore which had not been thoroughly dried.

Ottery St. Mary Lighting.—At a meeting on the 4th inst. of the U.D.C., a letter was read from Messrs. J. & W. Purves, of Exeter, giving the Council notice of their intention to apply in the autumn to the B. of T. for a provisional order to enable them to supply electricity to consumers within the urban district of Ottery St. Mary. Mr. Luxton said they had already approved the plan of Mr. Coleberd, who had been given permission to erect standards, &c. The turbines had already been fixed, the power station pretty well built, and the standards would be ready by the end of the week. He thought the Council ought to oppose this application, as the town did not want two sets of electric light works. He moved that "the B. of T. be informed that the Council have already given permission to Mr. E. R. F. Coleberd to install electric light throughout the town, and they strongly oppose the application of Messrs. Purves for a provisional order." Mr. Pratt thought they should add that the Council acceded to Messrs. Purves's application some time ago on condition that the work was carried out within 12 months. That, however, was not done. The suggestion was adopted.

THE SWANSEA CONGRESS OF THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

(Concluded from page 36.)

Mr. Clough read a short but useful paper upon the results which can be and ought to be obtained from car-meters.

It is more than three or four years since there was considerable controversy over the type of meter best suited for tramway conditions, and two years before that hardly anyone thought it necessary to install meters at all, except perhaps for an occasional test. Now, as Mr. Clough said, the man who would try to argue against the meter as an essential portion of the equipment of every car, is too much behind the times to be worth troubling about.

Meters are used primarily to classify the motormen, and while this is being done economy in energy is being obtained with an unaltered service; but quite apart from increased personal efficiency the expenditure on meters may be justified by the higher efficiency of the rolling stock, with longer life and lower repair charges. While some saving can be made almost surely by merely putting the meters on the cars, a great deal more attention, thought, and trouble are necessary if anything like the highest possible results are to be got.

Mr. Clough thinks that the men must have a direct monetary interest in any saving for which they are responsible, and probably every tramway manager agrees with him, but, unfortunately, the word bonus to a Trade Unionist of the new school is as distasteful as medicine to a child, as he has a fixed idea that what is sauce for the goose must be poison to the gander. However this may be in a trade, it does not hold with relation to energy saving on a tramcar, and it is hoped that the men's leaders will have an opportunity of reading Mr. Clough's clear and sound reasoning on this point. A bonus to stimulate output in a workshop, says he, may be bad Trade Unionism, because thereby, five men may be able to do the work of six, and the sixth would be thrown out of employment for the sake of a bonus to the luckier five; but this objection cannot be raised against a bonus for saving materials, as thereby no one is dispensed with, hours are not reduced, and Trade Unionism is unhurt. In fact, if the cost of running the cars is lessened, it is likely that more car-miles will be run by more men. Unfortunately, efficiency itself is *anathema* to the extreme Trade Unionist; and there is an undisguised tendency to regard actual waste, whether of time or of materials, as the right thing, so long as the employer is hit. We do not imply that such a truly immoral feeling is to be found in the general mind of tramway employés, but it is evident enough in other directions, and it is too much to hope that it will not spread.

However that may be, the fact remains that Mr. Clough has managed to reduce the cost of energy per car-mile within two years by the extraordinary amount of 25 per cent., and he regards this as the best proof of the soundness of his own bonus system.

Certain men and cars are allocated to each section, and every section is considered separately with reference to awards. Every man, by rotation of duties, goes through the same running as every other man, and in addition to first and second prizes, there are consolation prizes for all who have a figure per car-mile *which is less than the actual average for the period.* In addition to these prizes, the man on each section who has the lowest figure per month, gets a monthly bonus of 5s.

This scheme of maintaining the interest in the competition seems to be the best devised so far, and it must be simple enough to work, and very easily grasped and checked by the men themselves. The fault of many bonus schemes has been that they have not appealed strongly to the men. Either they have been too complicated; or they have not been worth while for any but the very best, or, perhaps, they have got stale.

Mr. Clough regrets that not more use is made of the meters to check car condition. "A wasteful car is more expensive than a wasteful motorman," and we know, from his own records, how bad the latter can be. Obviously, if a simple record is kept for each car of the units per car-mile, it is the easiest thing in the world to see when a car ought to be put into the repair bay. Probably the men who are working under a fair bonus system, and are therefore keenly interested in it, will do a good deal towards weeding out expensive cars, for their own sakes, but no respectable tramway should allow matters to stand there, especially as the end of all this sort of thing is less cost and greater ease of mind.

Mr. W. Thom, in his short paper on "Track Maintenance," gave some useful data of rail wear. He endeavours to replace the rails on his lines according to curve: that is to say, he has constructed curves showing the relation between life and car-tons, derived from the experience of good many years; and having once adjusted this curve to suit the conditions of any particular section, it is not necessary to trouble about gauging extensively to ascertain depth of wear.

It is a fact well known, that much rail wear arises from causes outside the cars themselves, and it is easy to believe, therefore, Mr. Thom's *dictum*, that heaviest car service gives the best results in rail wear. For instance, his curve of life ($\frac{5}{16}$ in. maximum wear) and car-tons shows about 23 years at the rate of 100,000 car-tons *per annum*, but nearly 10 years at the rate of 1 million car-tons *per annum*.

The effect of rail composition is well shown incidentally :—

	C.	P.	Mn.	S.	Si.	Wear in 7 years.
Best rail on route	·50	·0595	·50	·22	·186	0·1875 in.
Worst ,,	·53	·111	·580	·041	·093	0·47 ,,
Average ,,	·42	·064	·450	·029	·190	0·125 ,,

We agree with Mr. Thom that rail corrugation should be dealt with when it first appears, but we hope that he is wrong in thinking that recurrent corrugation must continue to be cut, like a cancer, out of the rail head.

This practice always seemed to be so drastic as to amount to barbarism, and we should be very sorry to think that all the research work which has been done on the causes of corrugation has produced no better cure than this. If it has, however, the fact did not come out in the discussion of this paper.

Mr. H. M. Howard read a paper on the P.A.Y.E. tramcar, setting out all its advantages when used in the U.S.A. and Canada, under the single-fare system. Nearly 15,000 of these cars are in use, so the scheme must be good, but the paper gives us no clue to the solution of the multi-fare problem, which is up against the P.A.Y.E. car in this country. All we are told is that a solution has been found.

The Congress resumed on June 28th at the Mumbles Pier, Mr. H. England again presiding. A paper on "Track Maintenance" was read by Mr. Thom.

Mr. A. A. Blackburn (Belfast) said that about 4½ years ago in Manchester he made a suggestion to use a double drive—with pinions on each end of the armature shaft. Since then they had equipped 50 or 60 cars, and the results had been more than they expected. The flanges were absolutely equal both on the inner and the off side, which was a very important factor, so far as maintenance of the tire was concerned. They got a much steadier drive, and generally they were perfectly satisfied with the extra expense that it had entailed. They had at Belfast very little corrugation indeed. The sub-soil was very bad at Belfast; if they got 18 in. or 2 ft. below the surface, they were into a bog.

Mr. J. B. Hamilton (Leeds) thought Mr. Thom was perfectly right in his method of determining what amount of work a rail had done before its life expired. They could not possibly calculate it in years; they had to consider the frequency of the service. He could not follow Mr. Thom in his optimistic view that they might possibly get 30 years of life from the rail, even by his most ingenious methods of closing up. The rails themselves were not the cause of their greatest expenditure. In Leeds it was their sub-structure-concrete foundations, and wherever they found joints beginning to pound, the elimination of that one portion at the head of the rail did not remove the trouble, because if they examined a little further on they would find that the surface of the concrete was abraded, and that necessitated a thorough and careful supervision of their sub-structure and concrete foundations. He felt sure that it was best to make a thorough overhaul of the permanent-way in regard to the foundations and have new rails of a greater length. He thought it was for them, as tramway operators with experience as as to the results, to insist that they got the composition in the rails which they thought best. An improved specification should first be devised, and as a member of the Engineering Standards Committee on Rails, he might say that that Committee was engaged upon the matter, and would welcome any hints or suggestions as to the best composition of rails. The section of the rail was also engaging their attention.

Mr. A. J. Panton (Liverpool) said with reference to Mr. Thom's remarks as to the machine that would plane the rail and dish out the groove at a cost of probably 3d. per foot, he had obtained data, and was quite sure that the cost per foot with "inadequate" arrangements worked out at about ¼d. and not 3d. They all knew that corrugations could be removed by grinding, but they invariably returned.

Mr. Clough (Bury) said it was just as important to the local authority as to the companies to know the life of rails, because the local authority must make provision for renewals in addition to the sinking fund payments, because the period allowed for the repayment of the loans was always far in excess of the life of the rails. On the Bury system, the wear of the rails was gauged year by year and calculated on the present service, and the date fixed when each renewal would require to be relaid. On the whole system, this averaged out to a 15-years' life. Each year a fixed amount was placed to the renewal fund, so that, by the time the rails required renewing, sufficient money would have been accumulated for the purpose. His impression was that it would pay him far better to buy new rails and use the old ones in making up his track, after cutting off the ends. A 30-years' life for a tramrail was to him an entirely new figure, and it would be of interest to hear under what extraordinary conditions a rail would last so long. On the Bury system, long lengths of corrugation had been removed by means of flat emery blocks rubbing on the rails; he knew many large systems where this simple and inexpensive device was relied upon to keep the rails free from corrugation, and it certainly never cost them at Bury 3d. per foot.

Mr. George Balfour said they were replacing at the present time in the City of Carlisle; there the rails had been laid between 12 and 13 years, and at the present moment they showed no appreciable wear, and so far as he could judge, had at least another 20 years' wear in them. On the question of corrugation he felt firmly convinced that the whole matter was in the chemical composition of the rails, and until they could get that set right, they would not get rid of it. By adopting a heavier section throughout, probably 100-lb. rails with heavy fish plates, they would get over a considerable amount of the difficulty.

Mr. A. H. Pott (London) said, what Mr. Thom obviously meant was that they should be able to calculate their renewals for at least 30 years. The company in which he was engaged had drawn out renewal work for about 15 or 20 years, and every year they corrected that by gauging; the corrections were very small, and so they were able to keep very close to the time for renewals. If they allowed their repairs to run down they would have to renew earlier. It was a little premature to say that either double gear or proper composition would cure corrugations; nobody had yet solved the corrugation problem. For taking out corrugations there was nothing like a file.

Mr. Dugdale (Oldham) agreed that the principal upkeep of a rail was in the joint. Last year he persuaded his Committee to allow him to put in inset pieces. They had adopted this now for 12 months, and had had remarkably good results from it.

Mr. F. W. Ketley (Norwich) said at Norwich the track was 12 years old, and it had an extremely light 65-lb. rail. There were 19½ miles of track, and it was entirely welded with Falk joints throughout. There were roughly 40,000 joints, and over the whole of the track there were not more than 300 bad joints, and there had never been a broken one.

Mr. Humphries (Birmingham), Mr. Coutts (Paisley), and Mr. White (Grimsby) continued the discussion, and Mr. Thom was thanked for his paper.

Discussing Mr. Howard's paper on "Pay-as-you-Enter Cars," Mr. Edwardes (South Lancashire) said there were many advantages in the "pay-as-you-enter" system, the chief being, no doubt, the saving of mis-fares, with probable decrease in the number of accidents at the rear of the cars. At present he failed to see how the "pay-as-you-enter" system could be adopted in this country, where they had differential fares and stages, and where they used top-deck cars. If an inspector got on to a car with the zone system working, and found a passenger had been over-riding, who was he to blame? In his district they had a great many colliers, and they were very fond of over-riding; if they were going to summon every collier who over-rode in Lancashire, they would have their hands full.

Mr. Coutts (Paisley) said, supposing the difficulty of differentiating fares was got over, how were they going to check over-rides? It was no good catching passengers as they left the cars. The writer of the paper had said that many of the accidents occurred through the conductor being off the platform. He agreed, but to get over that he thought an evil greater than the number of accidents was proposed to be introduced. He asked the conference to imagine the hanging up of the cars on the "pay-as-you-enter" system when there were about 100 people waiting, and said that giving change on such days would also be a tremendous business. The services instead of being improved would be hindered, because under the present system the conductor was able to collect the fares as the cars travelled along. At Aberdeen they were favourably situated as there were very few fares.

Mr. Tegetmeier said he had recently had an opportunity of travelling through Canada and the States, and was very much impressed with the ease and smoothness with which the cars were worked under the "pay-as-you-enter" system; but in every case there was a uniform fare, and they were single-deck cars, whilst the passenger was educated up to carrying the nickel fare in his pocket. A tramway official on the Montreal system, who had had experience in this country, said that with differentiating fares and top-deck cars it was out of the question.

Ald. Ivey (West Ham) who had also seen the system in the States, declared that the system was not universal in America. If they went to the States to-day they would see that they were now a long way behind Great Britain; in fact, Great Britain could be proud of its street car traffic. How would Mr. Howard suggest controlling the traffic on the London County Council cars with their many overlapping stages and upper-deck cars, and the class of people who gathered in them?

Mr. Laing (Blackpool) asked how he would deal with a Blackpool holiday crowd not knowing where they wanted to go on the pay-as-you-enter system?

At the invitation of the Swansea Harbour Trustees, the members were afterwards entertained to luncheon at the Hotel Metropole, Swansea, Sir Griffith Thomas (chairman) presiding.

After lunch an enjoyable drive into the Gower peninsula took place, the weather now being beautifully fine.

In the evening the members were entertained to a banquet held at the Langland Bay Hotel, by the British Electrical Federation, Ltd., Mr. Emile Garcke, the President, took the chair, and he was supported by the Hon. Arthur Stanley, M.P. (chairman of the Association), Lord Glantawe, the Mayor of Swansea, Mr. E. G. Protheroe, Mr. John Williams, M.P., Sir Robert Morris, Bart., Sir Griffith Thomas, Mr. Harry England and others.

Ald. Ivey (West Ham) gave "The Houses of Parliament," to which Lord Glantawe replied.

The Chairman gave the toast of "The Tramways and Light Railways Association," and expressed his most sincere thanks for the excellent work which the Association had done on behalf of the whole of the tramways of the country. He wanted to say a few words on the conclusions that he had drawn from the discussion on the relative merits of various forms of traction. He did not despise the important details that were discussed, but there were certain broad principles that ought to be considered in connection with those matters that were in advance of the details. There was a pyschological moment when they could with advantage legislate and deal with the principle, and now was the time to consider what they ought to do for the best development of the transit service of this country—whether by means of the tramway, the motor-omnibus or railless traction—and having decided what their duty was, at a very early stage, to see that they received adequate consideration from Parliament for the promotion of that form of traction which was most suitable to the industry with which they were concerned. Mr. Pott, who was thoroughly qualified in every aspect of the question, stated that they wanted more legislation to help the tramways. He advised them not to depend upon broken reeds. What he wanted to say was, "Don't let us waste our energies in the hope that we can get impartial legislation for tramways as against other forms of traction." Mr. Pott also said that, given any particular route or district, there was one system which was better adapted for it than another. He thought that that was an absolutely correct view of the situation, and it pointed to this—that there was an essential monopoly in the provision of public service in the matter of transit. They could not have two tramway systems on any route. Neither could they have two railless systems or two motor-omnibus systems in the same district. And in the same way it was clearly proved by analysis and examination of any particular route that it may be more suitable for one form of traction than another. It seemed to him that what they needed was not more legislation in favour of the tramways, but some measure by which they could get those rival interests properly adjudged and decided upon, instead of its being left to Imperial methods—a process of trial and highly uneconomical method. They wanted an intelligent, authoritative and thoroughly impartial body to decide what was the right system for particular districts, what should be the speed of the cars, what (if it was a tramway) should be the gauge, whether or not they should have top-deck cars, and what, if any, should be the contribution made to the community in respect of repairs and maintenance of roads. They had to acknowledge as an established fact that public utility had become a matter of private enterprise, and it was their duty as reasonable men to recognise all its conditions, and to do the best under the circumstances to see that the capital which had been expended, either by municipalities or by companies, was not needlessly wasted by fruitless and unnecessary opposition. However distinctive might be the interests of the ratepayers, of the shareholders, and of the customers, if they analysed the situation deeply, they must come to the conclusion that, essentially from the point of view of the wealth and material comfort of the nation, there was no essential difference between them. Therefore, it was only a matter of adjustment between those respective rights and interests. And then, again, they wanted some impartial authoritative body which would decide when they were quarrelling about petty details. They wanted more co-operation, more action in common, so as to avoid unnecessary waste on the part of the community. Competition was necessary in certain cases. The struggle for existence was the only means by which they advanced. But the struggle for existence was really only necessarily confined to the lower orders, and as man developed and intelligence advanced, he found methods of avoiding the exceedingly expensive and uneconomical method of competition. A good deal of the competition which they saw in their commercial and industrial affairs was unnecessary, and could be avoided by talking things over calmly. What he had been leading up to was this: That they did not want a Board of Trade to regulate the speed of the tramcar, and the police authorities or the Home Office to regulate the speed of the motor-omnibus. The present system was absolutely absurd, and it was a disgrace to the Legislature, and to everyone who was concerned in the proper regulation of the affairs of the country. Why should they not have one body, which could regulate the speed of the omnibus and the speed of the tramcar, and consider what was fair to each, instead of separate bodies, which regulated those matters without consideration to other interests? They had had many discussions about the advisability of a Traction Board for the whole country. He knew there were serious objections to it, but what he appealed to them to do was to consider in that Association, and in the Municipal Tramways Association, whether it was not advisable to agitate and to work together with a view to the establishment of a joint authority, which would adjust those matters. There was no reason whatever that he could see, why the companies, the municipal associations, the Tramways and Light Railways Association, the Roads Board, their Automobile Associations, and the Institution of Electrical Engineers, should not all combine to impress upon Parliament and the Government the desirability of providing some authority that would avoid wasteful expenditure of capital all over the country.

The Hon. Arthur Stanley, M.P., responded, and before sitting down presented, on behalf of the Association, Mr. de Turckheim, the popular secretary, with a handsome marble clock as a mark of the esteem in which he is held by the members. Mr. de Turckheim suitably responded.

Mr. H. England proposed the toast of "The British Electrical Federation," and the Chairman, in reply, paid a warm tribute to Mr. Tegetmeier and Mr. David James for the admirable way they had carried out the arrangements for the visit of the Association. Mr. Tegetmeier and Mr. James responded.

A vote of thanks to the chairman concluded a most enjoyable evening.

PROCEEDINGS OF INSTITUTIONS.

Electric Furnaces and their Application in the Manufacture of Steel.

By Hans Nathusius, Dr.Ing. (Friedenshütte).

Abstract of paper read before the Iron and Steel Institute, *May*, 1912.)*

The principal advantage of the arc furnace consists in the ease with which the heating of the charge can be regulated to any desired temperature from above by electric arcs directed upon the slag which covers the metal bath. This method of heating, combined with other advantages of the electric furnace—such as a neutral atmosphere in the melting chamber and absolute purity of the heating agent—has made possible the production of reactions between the slag and the metal with respect both to oxidation and reduction which it was impossible to obtain with the resources previously available.

The idea occurred to the author that it might be possible to combine the advantage of the arc furnace (good heating of the slag) with the advantage of the induction furnace (heating in the charge itself), and thus to avoid the disadvantages of both systems.

The induction furnace is only to be recommended when it is a question of a melting process, and when its otherwise serious defects are not prohibitive. Notwithstanding its higher thermal efficiency, the working of an electric furnace is too costly to enable it to be used ordinarily for a melting-down process. For purely economical reasons the less perfect, but cheaper, gas-fired furnace is preferable for this purpose. On the other hand, for a process of refining metal already melted, the arc furnace is particularly well adapted. To produce reactions which depend on the reciprocal action of the slag and the metal, it is requisite to have a very hot slag, and to be able to work with fluid masses of slag in large quantity. This cannot be done in the induction furnace, and the arc furnace alone lends itself to such operations. In finishing the charge, however, the steel has to be alloyed with other metals, and must remain quiescent for a period. For this purpose heating by an ordinary electric arc is less favourable. The reactions take place only within the bath; the slag has ceased to react, has become neutral, and serves now only as a protecting cover.

It is, however, impossible to make use of an arc furnace for one part of the process and an induction furnace for another. The difficulty can only be met by means of a combined arc and resistance furnace.

In the author's furnace the charge is heated on the surface by several electric arcs, so distributed that the heating is effected as equally as possible.

From the drawing it will be seen that the furnace is circular in form. Small furnaces up to 6 tons capacity are tilted on trunnions resting on vertical supports (in the same manner as converters), and larger sized furnaces have rockers resting on rollers (like tilting open-hearth furnaces and mixers).

The characteristic of the furnace, as illustrated, is that it has three carbon electrodes above the surface of the charge which project through the roof into the furnace, and three, or a multiple of three, bottom electrodes of mild steel rammed in the hearth. No regulating devices or other electrical apparatus, such as transformers or motors, are attached to the furnace itself. The furnace is purely a metallurgical apparatus, and all operations may be performed without risk of burning a motor or transformer, or exposing a regulator to dust.

The carbon electrodes, which require continuous adjustment, are suspended by cables from overhead runways. When tilting the furnace the electrodes are drawn up.

The lining of the furnace may be either basic or acid, and the roof is built of silica bricks. In a basic furnace the bottom and the side walls are lined with dolomite and tar rammed in the usual way. Approximately 100 heats may be obtained under one roof when only cold metal is charged, and nearly double that number when hot metal is charged. The fact of the current flowing through the bottom increases its durability considerably, for it is well known that a thorough burning at high temperature is the best security for a high degree of refractoriness.

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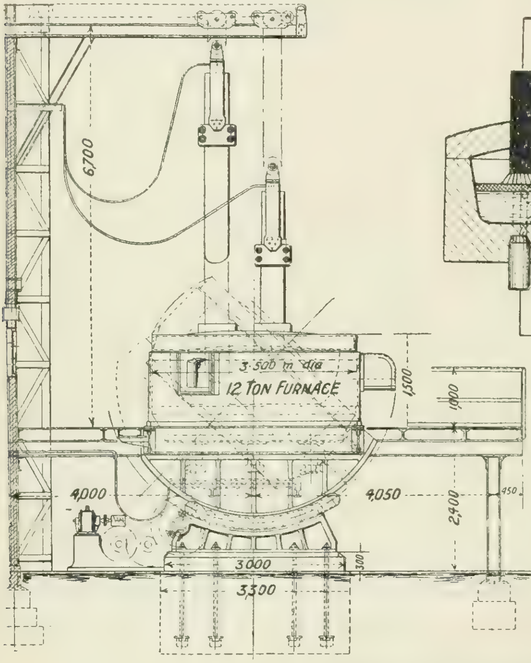
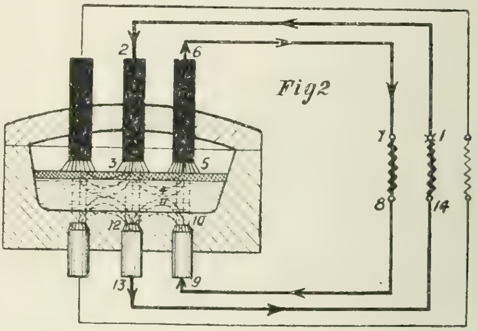
* See also illustrated article in the Electrical Review, April 5th, 1912.

The current employed is three-phase, of any convenient frequency. Different systems of connection are employed according to the particular requirements of the furnace. In fig. 2 it will be seen that there are three surface carbon electrodes which are connected to the outer terminals of the secondary windings of the furnace transformer, and three bottom electrodes connected to the three inner terminals of the secondary coil. The three inner terminals of the transformer are obtained by separating the windings at the neutral point, where the three secondary windings of an ordinary three-phase transformer are connected. By this means the neutral zone is transferred to the bath itself, and the current must gravitate from all points of supply towards this neutral zone. In other words, the current, though supplied from a single source only, is forced to flow not only between the upper and bottom electrodes, but also between any upper electrode and any bottom electrode. It is thus possible, with a single source of current, to heat the charge in all parts, provided that its resistance is sufficiently high, or that the current is strong enough to produce sufficient heat in the charge when the resistance is low.





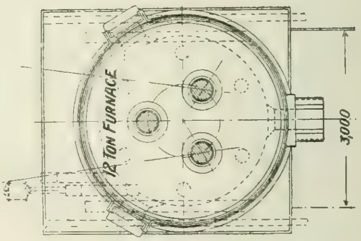


Fig. 1.—Elevation and Plan of Nathusius Furnace.

Experts have expressed doubt as to whether any current flows through the bottom electrodes or even between the bottom electrodes of this furnace. In fig. 2, in which (in two phases) the course of the current, flowing from the outer terminal (1) of the secondary winding of Phase I, is indicated by arrows and numbers, it may clearly be seen that it is impossible for the current to return to the starting point if it passes only between the surface electrodes. Hence, with this connection, no closed circuit can be established through the surface electrodes only. Since the neutral point is disconnected and transferred to the bath, a circuit can only be established when an equalising current flows through the bottom electrodes as well as through the upper electrodes towards the neutral zone in the bath. Since there is a fall of potential between any two electrodes, and since the electrodes are all mutually in conductive connection through the metal bath, there must be a flow of electricity between the upper electrodes and also between the bottom electrodes.

The current flowing between the bottom electrodes may be strengthened by inserting a booster transformer. By this means the heat produced by the bottom electrodes may be regulated from zero to any desired maximum, just as the arc-heat may be regulated by lifting or lowering the carbon electrodes. By using the booster transformer in connection with a pressure regulator, the power delivered at the upper as well as at the lower electrodes can be regulated to any desired degree. The regulation is based on changing the voltage, is independent of the actual resistance of the current, and is effected by the use of a double push-button without disturbing the working of the furnace and without switching the transformer out; it is also independent of the main transformer.

For the melting down of ferro-alloys electric furnaces may prove highly useful in large iron and steel works. For this purpose the arc-resistance furnace has special advantages.

This process has been used for more than a year at Friedenshütte in Upper Silesia, using an arc-resistance furnace of 2 to 3 tons. The furnace is in continuous operation, and is employed to melt down ferro-manganese for use in the basic Bessemer converter. The gain obtained by this process amounts generally to 0·35 shilling net per ton of steel, and has at times risen to over 0·4 shilling. It is based on the saving of ferro-manganese, which amounts to about 30 per cent. of the former consumption when using cold ferro-manganese. The saving is effected by the taking-up of all the molten ferro-manganese into the bath, and the losses in the slag are eliminated. The molten ferro-manganese reacts much more vigorously, and a smaller quantity is therefore required to produce the same reducing effect as a larger quantity of cold ferro-manganese. Lastly, ferro-manganese which has crumbled to powder through storage for a long time may be used without disadvantage, whereas formerly it was considered valueless.

The cost of the former method of heating the ferro-manganese in a reverberatory furnace was 4s. 2d. per ton, and that of the present melting-down process in an electric furnace is 19s. 1d. By saving 30 per cent. on the former annual consumption of 3,300 tons of ferro-manganese, the gross saving amounts to £8,208 15s. This is a considerable saving in less than one year, due to the introduction of the electric furnace.

But even if the costs of energy, ferro-manganese, and other items were such that there would be no net saving, it would nevertheless be of advantage to erect an electric furnace for the process. By the use of molten and somewhat overheated ferro-manganese important improvements are obtained in the quality of steel, and the working is facilitated.

Platinum in Russia.—Special legislation is about to be enacted for the regulation of the manufacture and sale of platinum in Russia. It is proposed to forbid the export of raw platinum abroad, and to confine its refining exclusively to Russia. Penalties for theft and trading in stolen platinum are also imposed. The question of the creation of a monopoly for platinum refining remains unsettled.—*Revue Industrielle.*

Benn Friction Clutches.—We understand that in response to a request by the Museum authorities, the Unbreakable Pulley and Mill Gearing Co. are presenting a finished Benn friction clutch, complete, to be included in the permanent collection at South Kensington. The clutch shell is cut away so as to show the construction and action of the levers and toggles used to create the necessary driving torque, and at the same time lock the clutch both in and out of gear. This appliance is now being manufactured in nine different countries, and it is anticipated that by the end of the present year clutches representing 1,000,000 h.p. will be in use.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Sentinel" Surplus Steam Valve.

The use of storage reservoirs for low-pressure steam, in conjunction with turbines taking the exhaust steam from reciprocating engines, has become widely extended during recent years. In some cases, as, for instance, in connection with winding gear or rolling mills, the supply of exhaust steam is irregular and occasionally much in excess of the capacity of the reservoir and turbine, and the excess steam has to be automatically by-passed to atmosphere. Messrs. Alley & MacLellan, Ltd., of Sentinel Works, Polmadie, Glasgow, have devised for this purpose the valve illustrated in section herewith, for which patents are pending. The valve body is bolted to the storage tank by the bottom flange, and the main valve D is normally held closed to slightly above the working pressure by two adjustable springs, of which one is seen in the figure; it opens with any excess of pressure. A governor is also provided, which ensures wide opening and prevents chattering. Pressure steam from the tank is admitted by the pipe A under the valve B, which opens when the pressure rises above normal, admitting steam above the piston C. This assists the main valve to open. When the pressure falls slightly below normal, B closes and, the steam above C escaping through the pipe F, the main valve D is allowed to close. The resistance to the flow of steam is slight, and the valve, being guided on a central spindle, cannot jam. The parts are readily accessible, and easily adjusted.

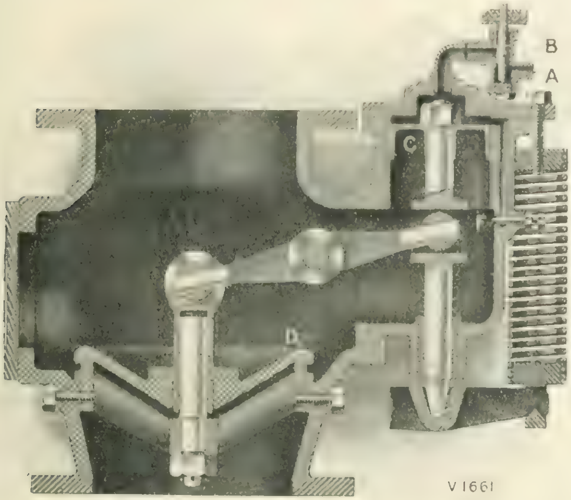


Fig. 1.—"Sentinel" Surplus Steam Relief Valve.

Emery and Disk Grinder.

Messrs. B. R. Rowland & Co., Ltd., of Climax Works, Reddish, near Stockport, have recently supplied a number of machines like the accompanying illustration (fig. 2), consisting of a combined emery and disk grinder. The disk is 12 in. in dia., and is turned with a spiral groove on each face. The emery wheel is 10 in. in dia × 1½ in. wide, and is mounted on the makers' improved doveta safety plates. A massive adjustable rest is fitted to the emery wheel. The bearings are of the self-lubricating type, fitted with adjustable bushes, the length of the bearings being five times the diameter. The motor is of 2½ h.p., totally enclosed, suitable for 220 volts direct current, and a totally enclosed starter is mounted on the front of the machine; the speed of the set is 1,900 revs. per minute.

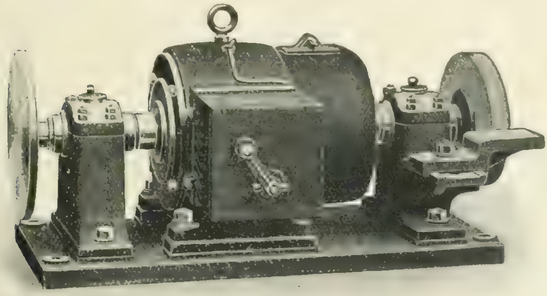


Fig. 2.—Combined Disk and Emery Grinder.

Semi-Indirect Lighting.

The British Thomson-Houston Co., Ltd., have recently produced a line of semi-indirect lighting fittings, which fills the gap between direct lighting with prismatic glass reflectors and indirect lighting on the "Eye-rest" system. These fittings are supplied in two patterns, of slightly different shape. One is intended for single lamps, and the other for clusters of four or six Mazda lamps. The reflector bowls are made of a specially prepared opal glass, which transmits a small proportion of the light, but throws most of it on to the ceiling, whence it is reflected evenly over the room. The opal glass of which the bowls are made has a very low coefficient of absorption, and the light waste, which is a very general objection to semi-indirect lighting, is avoided. The visibility of the light source (at a greatly reduced brilliance) gives a more familiar aspect to the installation, and satisfies those who require a slightly luminous appearance.

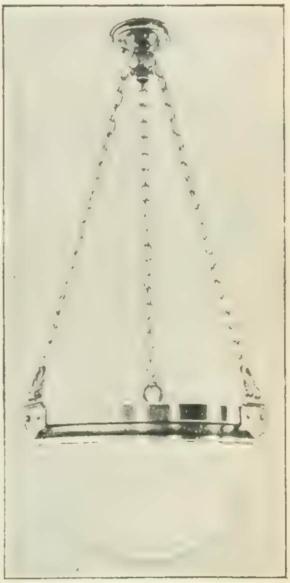


Fig. 3.—B.T.-H. Semi-indirect Fitting.

Variable-Frequency Machine.

The Crypto Electrical Co., of 155, Bermondsey Street, S.E. are putting on the market a new machine for supplying alternating currents with a wide range of frequency, as the result of a large number of inquiries received from people who supply A.C. apparatus but, owing to the enormous variety of voltages and frequencies in use in Great Britain, are unable to test it. The generator is intended also for all cases where variable periodicity is required, for such purposes as wireless telegraphy, &c. It is possible with their device (which they have protected) to obtain a variation in frequency of 1 to 4, and under certain conditions 1 to 6 without an unreasonable increase in speed. The chief feature of the machine is that it is possible to increase the frequency from 1 to 4 with a speed increase of only 1 to 2.

Auto-Transformer Starters (Drum Type).

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, S.W., have recently introduced a line of auto-transformer starters, which, like the firm's star-delta switches, are of the controller type, with renewable copper contacts acting under the influence of strong coil compression springs.

The springs are shunted so that they do not carry current, and the switch generally has been designed to require the minimum of attention.

The insulation is of moulded mica throughout, and the transformers are three-phase, built up with the best armature iron stampings, with tappings giving 40, 60 and 80 per cent. of the line voltage.

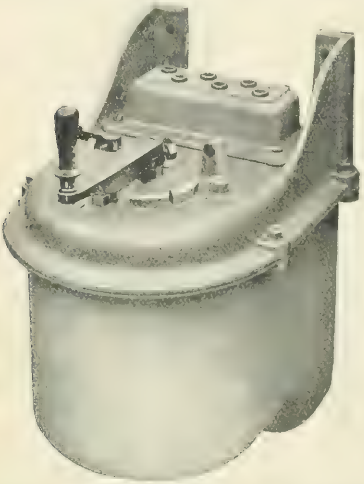


Fig. 4.—Oil-immersed Auto-Transformer Starter.

Our illustration, fig. 4, shows an oil-immersed starter, while fig. 5 shows the interior of the switch with transformer. A non-oil-immersed but totally-enclosed starter of similar type is made by the firm, and automatic releases can be fitted.

In each case the motor is completely disconnected from the line in the "off" position, so that a separate main switch is not required; moreover, "full on" cannot be reached without a pause in the "starting" position, although the switch cannot be left in the latter position.

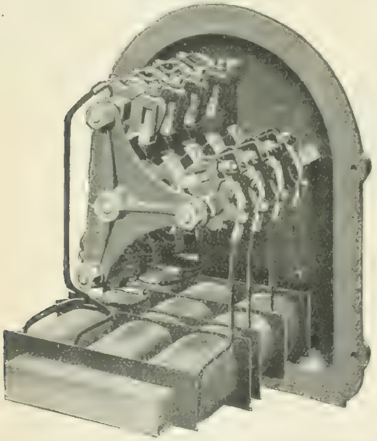


Fig. 5.—Interior of Starter, showing Transformer.

The oil-immersed switches can also be rendered flame-proof with 1½-in. machined metal-to-metal joints, and are supplied in sizes from 5 to 150 h.p., the totally-enclosed type being constructed up to 75 h.p.

Residence Reflectors.

Referring to the reflectors illustrated in this column in our last issue, Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, N.E., inform us that these types of reflector have been listed by them for a long time past, two of the designs being illustrated in their leaflet H2 of April, 1911, for use with tantalum lamps.

G.E.C. New Type Wall Plug.

We illustrate in fig. 6 a new design of weatherproof wall plug, which the General Electric Co., Ltd., has brought out to suit Home Office requirements. It is made in capacities from 5 to 100 amperes, and is constructed especially to withstand the rough usage which such apparatus meets in docks, railway sidings and workshops. The insulation is of impregnated hard wood, and the knife contacts are self-aligning. A terminal is provided in the plug for an earth wire, and an aperture allows inspection at the point where the earth wire enters its terminal, as required by the Home Office Rules. An automatic grip catch prevents the plug from accidentally dropping out, and when the plug is withdrawn dust is kept out of the socket by a spring cover.

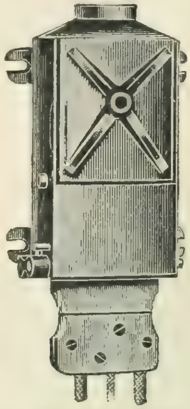


Fig. 6.—G.E.C. Weatherproof Wall Plug.

A Model Induction Furnace.

In the *Zeit. fur Elektrochemie* Messrs. Fr. Fichter & G. Oesterheld describe a neat little transformer, as illustrated, which they have constructed for demonstrating, during lectures, the principle of electric induction furnaces. The rectangular magnet core, cut out of transformer sheet, has a cross-section of 80 × 80 mm., and comprises two halves, secured by an arrangement of bolts. Two magnetising coils are used, each being wound with 40 turns of copper wire 3 mm. in diameter. A small terminal board permits of making various connections, the windings of one of the two coils being subdivided in the centre for the purpose. Between the two coils, and insulated from them by asbestos cardboard rings, is placed the secondary winding, consisting of a copper ring 10 mm. in cross-section, and of 130 mm. internal diameter. On connecting the 80 turns to a.c. at a pressure of 110 volts, the copper ring is heated to a bright red in 1 to 2 minutes, the load being 30 amps. The instrument can, of course, also be used as a laboratory transformer.

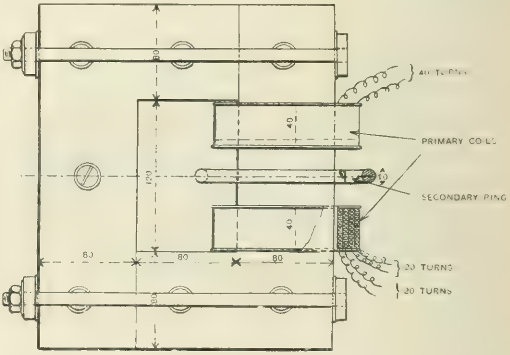


Fig. 7.—Model Induction Furnace.

The Multi-Meter.

Referring to the device described in our last issue for measuring the resistance of lightning conductor earths, &c., the Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, W.C., inform us that they are the sole selling agents for the instrument in this country, and point out that the "Multi-meter" can be used not only as a resistance bridge, but also as an ammeter or voltmeter, and (in conjunction with a magneto-generator supplied separately) as an insulation testing set, it being, in fact, a "Universal Testing Set."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Timber Preservation.

We have read with interest the article by Mr. W. Manktelow on the subject of timber preservation, in your issue of June 28th. As regards creosoting, it is stated that this process is costly and that the wood is left in a more or less objectionable state. These remarks may apply to the older processes of creosoting, but they certainly do not apply to the new Rueping process of creosoting. By this process the cost is very considerably decreased, and the wood is left dry and clean.

As regards the value of Aczol as a preservative, we are not competent to express an opinion, but we venture to suggest that something more than a few years' test is necessary to obtain conclusive evidence of its reliability as a preservative. We may mention incidentally that a life of more than 40 years has been obtained from creosoted piles in a jetty in the north of England. We could give other instances to show the great value of creosote as a preservative.

In making any estimate of the cost of preservative treatment, it is essential that the guaranteed life of the timber should be taken into account. That is really the determining factor in all cases where the choice of more than one form of treatment can be given.

Richard Wade, Sons & Co., Ltd.
CHRISTOPHER WADE, *Managing Director.*

Hull, *July 8th*, 1912.

Railway Cab-Signalling.

I have read with great interest Mr. Dammond's article on railway cab-signalling. I am entirely in agreement that the clear signal must be absolutely positive, and every failure must give the danger indication. But as it is equally necessary from the traffic point of view that every clear indication must be picked up, I am rather at variance as to the superiority of the rotating contactor.

I believe that he will find in practice that as the rotating contactor does not give such good contact as a rubbing one nor so efficiently clean the ramp rail, a stronger pressure will be necessary than for a rubbing contact, and with a suitably designed contactor, as in the Brown-Mackenzie system tried on the Great Central Railway, the sliding contact can be kept so light that the total pressure is of a quite small value. Since the slightest lift gives danger, this is a positive system, and has proved itself absolutely reliable.

H. A. Dupre.

Sutton, *July 2nd*, 1912.

An Objectionable Clause.

On dissecting the E.T.U. letter in your last issue, one cannot help remarking, "What a weak organisation!" When a man becomes a member of it he has to keep quiet, as he dare not make it known to the contractor he is working for. Mr. Webb talks of the majority of the best men being in the ranks of the E.T.U. Does not Mr. Webb mean the majority of the men in the "Old Brigade?" Then we have Mr. Webb's simile—a contractor paying a fair rate of wage, and a dishonest workman stealing cable. I should like to take Mr. Webb a little further in his logics, and ask him if he would punish a member of the E.T.U. who, when the contractor was away, sat about half the day hanging the job out? I suppose, according to Mr. Webb's reasoning, this is quite right.

We next hear that the aims of the E.T.U. are not Socialistic; then why do they want to be sole arbitrators in disputes which probably will not concern them? I suppose the E.T.U. only look after the interests of their own members? And providing the contractor employs non-Unionists and complies with the rate of pay, what have the E.T.U. to do in the matter? No, the real idea of the *objectionable clause* is to force non-Unionists employed on this work to take up a Union ticket. Trade Union leaders have an erroneous idea of what Socialism really is.

The objectionable clause remains, yes, to save the faces of the Socialist Guardians; but it has lost its sting, and I venture to predict that we shall not be troubled with it again.

Why have we not had the threatened new rules and rates of pay hurled at us? Is it because Mr. Webb is fully aware that his organisation is a weak one, and comprises very few of the best workmen, or is he pondering over the recent Transport Union fiasco?

Percy D. Collins,
Electrical Contractor.

Wimbledon, *July 8th*, 1912.

Deterioration of Traction Field Coils.

A serious item of expenditure on the renewal side of any electrical tramway undertaking is undoubtedly due to the deterioration of field coils, and the question, therefore, arises as to the cause, and the best method to adopt to overcome this defect.

The insulation on field coils at present in use consists either of a double covering of cotton, or of a covering of asbestos and cotton combined, the ends of the wire after winding being carried to a metallic connector, soldered on to the coil, to which the field leads are attached.

The purely cotton-covered wire will not on traction coils stand a high temperature for any length of time, even if the coils be impregnated, and although the coils wound with asbestos and cotton covering combined give much better results, deterioration takes place in both cases, and the coils have to be taken out, scrapped or rewound, in many cases before a useful life has been attained.

The present methods of dealing with these defective coils are as follows:—(*a*) To clean and re-insulate the same wire, re-wind and impregnate the coil; (*b*) to adopt the American system, *i.e.*, scrap the old field coils and build new ones.

The first method is not satisfactory. The other certainly gives the best results, for the time being, but it does not get at the cause of the trouble; neither does the method of some manufacturers of impregnating new coils after winding, although giving a solid coil, with a high insulation resistance, arrest for any length of time the deterioration which undoubtedly sets in.

After careful examination I have, therefore, come to the conclusion that the fault is due to the metallic connectors to which the ends of the coils are attached. As previously explained, these connectors are soldered on to the coils after winding, and immediately the temperature of the coils exceeds the melting point of soft solder, no matter how well these may have been fitted on, we get a loose joint in the connector, thus rendering the copper plate which is riveted to, and sweated on to the brass casting for the field leads, defective. We then get a field or fields with bad connections, the result being that, instead of working under normal conditions, they get unduly heated, perishing all the insulation on the wire, and thus rendering them useless.

To overcome this defect, I would suggest that the present connectors be dispensed with, and that after winding and insulating the field coils, the inside and outside leads of wire be taken direct to terminals fitted in a suitable place on the inside of the motor case (the exact position to be decided upon after examination of the respective cases). If this were done, there would be no possibility of any loose connections on the coils, and providing the coils are accurately wound and insulated with the highest quality of insulation, we should obtain perfect coils in which the temperature would be always equally distributed; the life of the coils would be greatly increased, and the cost of renewing the electrical equipment, owing to the present deterioration of the coils, would be reduced to a minimum.

That this is correct in theory is partly shown by the designers of the Witting motor, who, however, failed at the very point where they should have gone forward, by having a soft solder joint to connect up their coils.

In short, I have satisfied myself that the connector is the root of all the trouble, and if it be removed from the coil, as I have suggested, we shall get a great deal longer life out of the coils, economy will be effected, and such troubles as fields burning out through the field coil plate and terminals, also motor faults due to burnt leads, will be abolished.

Harry H. Sheppard.

Sheffield, *July 8th*, 1912.

PARLIAMENTARY.

Birmingham Tramways Bill.

Having passed the House of Commons' Committee, the Bill of the Birmingham Corporation was considered by the Duke of Bedford's Committee of the House of Lords on July 2nd, 3rd, 4th and 5th. Various tramways are proposed in the Bill, the most important of which is one up the Hagley Road to the King's Head. When the Bill was before the House of Commons' Committee they cut out that route by which it was proposed to link up Harborne with the centre of the city, on the ground that it should wait until the town planning scheme had been further advanced. Mr. Balfour Browne, K.C., Mr. H. Lloyd, K.C., and Mr. W. J. Geeves represented the Corporation, whilst the London and North-Western Railway Co. and a number of residents were also represented.

Mr. Balfour Browne, K.C., explained that the only route opposed was the Hagley Road. This was a main thoroughfare for people in Birmingham, Oldbury and Halesowen, and was more or less a residential road. Traffic on the road had greatly increased of late years, and there had been a considerable agitation for tramways along it, as the existing facilities for conveyance were insufficient. The tramway system of the city was very extensive, and the only districts with anything like a large population which were without tramways, were Hagley Road and Harborne.

Mr. A. Baker, manager of the tramways department, gave evidence, and said he anticipated that the number of passengers who would be carried on the City tramway system next year, would approach 150 millions. Last year £46,000 was handed over by the tramways department for relief of the rates. The construction of the Hagley Road route proposed by the Bill would give them one continuous line from Bearwood to the centre of the city. He considered Hagley Road was an ideal road for a tramway, and that the tramway would give great satisfaction to everyone in Birmingham, except a few frontagers on the Hagley Road. The capital cost of the proposed tramway, including cars and overhead equipment, would be £43,291. He estimated a gross profit of £7,314, and a net profit of approximately £3,000 from their working.

Replying to Mr. Talbot, K.C. (for the North-Western Railway Co.) Witness said the Tramways Committee had been considering the application of the trackless trolley system to Birmingham, but not in connection with the Hagley Road route. He did not think trackless cars could deal with the mass of people on that road.

In re-examination, Witness said he favoured tramways as against motor-'buses. Owing to the difficulties of turning round in New Street, he thought motor-'buses would be more obstructive to the public convenience than tramcars.

A number of local witnesses were called and gave evidence in support of the Bill.

Mr. A. Dickinson, consulting engineer, of Birmingham, confirmed the estimates of Mr. Baker, and expressed the opinion that a motor-'bus service equal to that of a tramway service could not be given profitably.

Mr. H. H. Joy, counsel for a number of frontagers, called several witnesses, who expressed the opinion that the tramways would seriously prejudice the district.

Mr. Kingsford, the secretary of the Birmingham and Midland Motor-Omnibus Co., gave evidence to the effect that his company would provide a proper number of 'buses for the Hagley Road route.

Mr. G. Conaty, consulting engineer, in answer to Mr. Joy, said he had grave doubts as to the future of tramways, although he would not go so far as to say omnibuses would sweep them off the face of the earth.

Mr. Talbot, K.C., on behalf of the London and North-Western Railway Co., submitted that the present facilities offered by the company were sufficient, but if the Committee were of opinion that further facilities were required, then he urged that a system of traction should be adopted which would throw the smallest burden on the ratepayers.

The Committee decided to allow the proposal, and there being no opposition to other parts of the Bill, it was ordered to be reported for third reading.

Midland Railway (L.T. & S.R. Purchase) Bill.

After a long hearing, the Select Committee of the House of Commons, presided over by Sir Compton Rickett, has passed the preamble of the above Bill by which the London, Tilbury and Southend Railway Co.'s undertaking will become vested in the Midland Co., the shareholders in the latter concern taking stock of the Midland Co. for their present holdings. The Bill has already been passed by the House of Lords' Committee, the opposition of the Great Eastern Co. being then met by the promoters agreeing to give the Great Eastern equal facilities to those they enjoy at present in regard to Fenchurch Street station. The only opposition to the Bill came from the Great Northern Railway Co.

Sir Guy Granet, general manager of the Midland Railway Co., gave evidence in support of the Bill, and repeated his statement before the House of Lords' Committee that the intention was to electrify the line to Southend.

Arising out of the evidence of Mr. R. Philipson, the general manager of the Port of London Authority, in support of the Bill, the Chairman asked for further evidence as to the electrification of the line being compatible with the development of goods traffic.

Sir G. Granet said it was quite possible to have a thoroughly good electric service without running such a number of trains as would make it impossible to deal with goods traffic, and if any difficulty arose he would advise that some means of dealing with the electric passenger service should be found that did not interfere with goods traffic. It would be possible to accommodate an increase of 100 per cent. on the present traffic.

In the course of the proceedings the Chairman pointed out that although the Midland Co. had promised to electrify the line, yet the evidence showed they could not do so without widening the line between Gas Factory Junction and Fenchurch Street Station, and this would mean that the company must come to Parliament again. Furthermore, no figures as to the cost of electrification had been put before the Committee.

Mr. Talbot, K.C., for the promoters, agreed that this was so; but he was prepared to justify the Bill apart from the question of electrification.

The preamble of the Bill was eventually approved of subject to the insertion of the following clause: "The company shall forthwith prepare a scheme for working traffic by electrical power by the direct route between Fenchurch Street Station and Southend, and shall apply to Parliament for such powers as may be necessary in relation thereto, including powers to construct two additional lines of railway between Gas Factory Junction and Stepney, and such application shall be made not later than the Session of 1914, and after obtaining the necessary powers the company shall carry out such scheme within seven years from obtaining such powers or such time as may be extended by Parliament afterwards."

Brighton Tramways Bills.

After a week's adjournment the Bills promoted by the Corporations of Brighton and Hove for the construction of systems of trackless trolley tramways in the two boroughs, again came before Sir W. H. Davies' Committee of the House of Commons of July 3rd. At the previous sitting the proceedings were adjourned for further consideration of the suggestion thrown out by a member of the Committee that the Hove Corporation, which seeks to remove the old tramway owned by the British Electric Traction Co., should make some payment to the company.

Mr. Balfour Browne, K.C. (for the Hove Corporation), now said his clients were prepared to give £1,000 for the old materials in the roadway in Hove. About a fifth of the company's tramway was in Hove. The offer was, of course, contingent on the preamble of the Bill being proved.

Mr. Hutchison, K.C. (on behalf of the British Electric Traction Co.), agreed to the offer, but pointed out that it was not accepted from the money point of view, but from the point of view of principle. They did not want such a clause as the Hove Corporation originally proposed brought up at some future time as a precedent.

The Committee recalled the Mayor of Hove with reference to a number of letters which had been received from residents in opposition to the proposal. In reply to questions, the Mayor said that the Corporation of Hove had passed a resolution opposing the tramway proposals which had never been rescinded. There could be no doubt that the present service for travelling between Brighton and the districts beyond Hove was inadequate, but at the same time those who had studied the welfare of the borough considered that the trackless system would be detrimental to the best interests of Hove. Motor-'busses would serve the purposes of Hove, and, personally, he thought of Brighton also, and he could not see why Brighton could not see eye to eye with them and adopt that system.

The Chairman pointed out that the Committee were placed in an awkward position because the Corporation of Hove were the promoters of the Bill, and yet the Mayor told them that the people of Hove were opposed to it. Witness asked the Committee to understand that Hove promoted the Bill as a precautionary measure. If they had not Brighton might have got their Bill to empower them to run through Hove. He would himself rather have the trackless vehicles installed by Hove than allow another borough to use their roads.

After further discussion, the Committee intimated that having regard to the pledges given by the representatives of both Corporations they had decided to prove the preambles of both Bills.

London Electric Railway Bill.

The Duke of Bedford's Committee of the House of Lords commenced the consideration of the Bill promoted by the London Electric Railways Co. on June 28th, and concluded their hearing on July 3rd by passing the preamble, after cutting out several clauses.

Mr. Balfour Browne, K.C., who appeared for the promoters, explained the provisions in the Bill. At present the Baker Street and Waterloo Railway is being extended from Edgware Road to

Paddington, and it was proposed by the Bill to further extend from Paddington to Queen's Park, where there would be a junction with the line of the London and North-Western Railway now being converted to electric traction. The North-Western Co. would find £1,000,000 for the construction of the new line, and the London Electric Railways Co. had agreed to pay interest on this amount, and would also be bound to run a minimum of four trains per hour from the Elephant and Castle to Watford over the new line. The Bill also authorised the company to take over the authorised railway of the Edgware and Hampstead Co., and to construct a moving staircase in substitution for the passenger lifts at the Oxford Circus Station.

Having heard evidence, the Committee rejected the Oxford Circus scheme. There was no opposition to the other portions of the Bill, and, having heard formal evidence, the Bill was ordered to go for third reading.

Illumination Committee. Mr. Lynch asked the Home Secretary whether he proposed to limit the proposed committee on illumination to the *personnel* of the department, in view of the eventuality of an international congress on illumination, having regard also to the scope of inquiry of the French commission; and whether experts competent to deal with every aspect of the question, and two or three Members of Parliament to consider the problems in their legislative bearings, would be appointed on the committee. Mr. McKenna replied that it was not the intention to limit the committee to officials of the department. The committee would be one of experts, and they would be chosen as far as possible to represent the varied scientific questions involved. In view of the fact that the inquiry would be of a scientific character, he did not think it would be desirable to add non-scientific members to the committee. The consideration of the administrative or legislative action would come later. Mr. Lynch also asked whether the Home Secretary would consider it wise not to restrict the question to the means of establishing a standard of illumination, but would so extend the terms of reference as to permit the investigation of a number of other matters of industrial as well as scientific interest. Mr. McKenna said the exact terms of reference were not yet settled, but it was intended that they should be wide enough to allow the committee to institute such scientific investigations as might be necessary in order to enable them to advise not only as to standards, but also generally upon the lighting of industrial premises.

Lighting of the House of Commons. Mr. Lynch asked the representative of the First Commissioner of Works, whether experiments had been carried through with regard to different filaments for the electric lights of the House; and, if so, whether he could state the conclusions obtained. Mr. Wedgwood Benn, in reply, said that experiments with different filaments were not carried out as the tungsten filament was considered the best.

Loch Ericht Water and Electric Power. This Bill has been passed by the Unopposed Bill Committee of the House of Lords and referred for third reading. By the Bill it is proposed to incorporate a company with a capital of £450,000 to construct and work a water-power for electrical generating stations at Loch Rannoch, in the county of Perth.

Electric Lighting Provisional Order (No. 2) Bill.—This Bill, promoted by the Board of Trade for the confirmation of certain electric lighting orders, has been passed as an unopposed measure by Lord Donoughmore's Committee of the House of Lords. The Bill confirms orders in respect of Abercarn, Aylesbury, Biddulph, Burnley, Darton, Doncaster, Dorchester, Ilkley, Pontefract and Sherborne.

Speedometers.—Replying to Mr. S. Collins, Mr. J. Burns says he is advised that it would be within the powers of the Local Government Board to require every motor-car to carry a speedometer, but he does not find that a sufficiently reliable instrument has yet been devised to justify his making the use of such an instrument compulsory.

Bognor Electricity.—The Bill of the Bognor Gas Co., which seeks power to generate and supply electricity in the area of their gas supply, has been passed by Lord Donoughmore's Committee of the House of Lords as an unopposed measure. When the matter was before the House of Commons' Committee, the opposition was withdrawn on the understanding that the promoters would come to a satisfactory arrangement with the promoter of an electric lighting order, who is already supplying a block of business premises, and the kursaal of which he is the owner.

County of Lanark Tramways Bill.—The Bill promoted by the Lanark County Council for the construction of tramways and for the acquisition of the Lanarkshire Tramways Co.'s undertaking has passed the House of Lords' Unopposed Bill Committee, and been referred for third reading. Terms have been arranged with the Tramway Co., and it is provided that if within two years after the construction of the lines proposed in the Bill, the undertaking of the company is not purchased, then the company will have power to acquire the new lines.

Second Reading.—In the House of Lords on July 3rd, the L.C.C. (Tramways and Improvements) Bill, and on the following day the Preston, Chorley and Horwich Tramways Bill, were read a second time.

LEGAL.

ROBINSON v. NEAL.

In the Divisional Court on Thursday last week, before Mr. Justice Ridley and Mr. Justice Lush, Mr. Hogg applied for an order for a mandamus to the magistrate of Chester to make and sign a special case in the case Robinson and Neal.

MR. HOGG said on May 29th his client, Mr. Neal, was served with a summons for the recovery of the sum of £8 12s. 2d.—the balance said to be due for the supply of 1s. 6d. worth of electricity, and £8 10s. 8d. for electric cable and motor fixed by the Corporation so far back as July, 1911. As to the supply of electricity, defendant's solicitor submitted that this was a continuing debt, and as to the motor and cable, it was contended that under the Summary Jurisdiction Act, there was no jurisdiction to hear the summons. The magistrate over-ruled these objections, and without giving any reasons, entered judgment for the plaintiff.

The Court granted the rule.

THE TELEPHONE ARBITRATION.

(*Continued from page 38.*)

SIR A. CRIPPS said it had been agreed that the evidence should be confined to the first four plant items, and that other items might be left over with regard to that inquiry.

His LORDSHIP said that seemed to involve more than one inquiry.

SIR A. CRIPPS said the big inquiry was undoubtedly the plant cost. If they took the item of plant cost the evidence would be finished before the Long Vacation.

MR. JUSTICE LAWRENCE said the proposal would involve either a postponement until after the Long Vacation or the making of more than one award, and he was not sure they had the power to make more than one award.

SIR A. CRIPPS said he thought probably the Court would have to deal with the matter in more than one inquiry, but he thought the suggestion of an interim award would be the most convenient. If that were done other matters might smooth down.

His LORDSHIP pointed out that that would involve counsel making speeches on the first part of the case, and having the right to make speeches on the further part.

SIR ALFRED said an interim award was wanted for a certain sum agreed upon, because the Government were anxious to pay the company and the latter were anxious to receive it in the interests of the preference shareholders. It was not as a question of speed that they asked for the award, but they thought the matter could be conveniently dealt with in two separate compartments.

His LORDSHIP agreed, but said there was a certain amount of difficulty in making an award before the Long Vacation.

SIR A. CRIPPS said both sides agreed that there was an advantage in having an interim award for a definite figure, say about £3,000,000, because that would enable the claimants to deal with their preference shareholders, and the Government would escape paying a high rate of interest up to the time of the making of the award. By an agreement upon an interim award, it would be unnecessary to press for the ultimate award at an early date.

His LORDSHIP asked if there were any advantage in giving an interim award if the parties had agreed upon the sum to be paid on certain items

SIR A. CRIPPS said that according to the Telephone Transfer Act the money was not to be paid by the Government, except on an award made by the Court.

The SOLICITOR-GENERAL said there was a Treasury difficulty, and one which the Postmaster-General had not the power to get rid of. He agreed, looking at it in a business way, that it would be a pity if it were possible to deal with a substantial part of the case to postpone it unduly, because undoubtedly it was a serious burden thrown upon the State to have to pay interest on what might turn out to be a large sum of money—larger than was reasonable and commercially fair. He asked for an opportunity of consulting the Attorney-General and mentioning the matter again.

His LORDSHIP said the Court was anxious to fall in with the views of counsel.

SIR ALEXANDER KENNEDY, continuing his evidence, said he had compared the cost to electric lighting companies of underground work with the figures given by Mr. Gill for the cost of underground cable work in connection with the National Telephone Co. So far as digging up the road and reinstating work was concerned, they were fairly comparable, but, of course, so far as the cables themselves were concerned, there was no comparison.

Cross-examined by SIR JOHN SIMON, Witness said the problem was what would be the cost of the undertaking if made brand new by the contractor at the time it was taken over.

In all your large experience of tramway undertakings that is always the method applied by valuers?—Yes, what it costs the contractor to do the work completely.

Is 10 per cent. for contractors' profit a usual and reasonable figure?—I am afraid I cannot say, I tried to find out from some contractor friends of mine, but I was unable to do so.

Contractors' profit is usually charged on contractors' costs?—Yes.

In answer to his LORDSHIP, SIR J. SIMON said the odd thing was that Mr. Gill's figures for contractors' profit were calculated on something quite apart from the contractors' costs for material, &c.

MR. ANNS, chartered accountant and secretary to the company, was again called into the box for further cross-examination on the company's figures. The salaries for the engineering department were calculated at £181,142, he said, and for the solicitors' department at £63,000.

Sir J. Simon: According to your basis of calculation, if the engineering department figure is £181,142 and the solicitors' department £63,000, then it follows that there would be three times as much space and office room in the engineering department as there is in the solicitors' department?—Yes, that is the assumption.

Do you really think that is approximately correct?—Well, it is rather difficult to say.

I should think it is.—This is head office engineering. It is not as if you had a large number of workshops. I think it would be fair to take a three to one basis.

Sir A. Cripps said at a later stage of the proceedings that he was glad to inform the Court that the friendly feeling which sometimes exhibited itself in Court had shown itself in a very agreeable manner behind the scenes, and one or two more matters had been most satisfactorily arranged between the parties. It had been agreed that the sum of £592,548 should be allowed for one of the items of plant cost.

Mr. James Swinburne gave evidence in support of the company's claim. In his opinion the table of depreciation prepared by the company was perfectly sound. It was a much better principle to take the purchase price over a number of years instead of endeavouring to arrive at it by taking one particular year.

Mr. W. Wilson Cook, late assistant engineer-in-chief to the National Telephone Co., said he assisted Mr. Gill in preparing the figures for the company, and he supported that witness's evidence. There were 1,507 exchanges in the company's system, and the estimated cost of construction was £2,641,640. The depreciated valuation was £2,297,598. He had divided the exchanges into three classes for the purposes of valuation, viz.: the electric battery exchanges, the local battery exchanges, with more than 300 lines, and the local battery exchanges with 300 lines and under. There were 67 central battery exchanges, and 167 local battery exchanges with more than 300 lines. Each of these exchanges had to be valued separately. With regard to the remaining 1,273 exchanges, it had been arranged that a certain number should be taken as typical of the rest.

Mr. Justice Lawrence asked whether some arrangement could not be arrived at with regard to the 234 exchanges which had been valued separately. If this were not done, the Court would have to go into 234 valuations.

Mr. Buckmaster, K.C., said on the question of the prime cost of constructing the 234 exchanges, the parties were not very wide apart. The real difficulty was with regard to the loading of the original figure by percentages.

Mr. Justice Lawrence suggested that the parties might finally agree as to the original cost of the 234 exchanges and the unit cost of the remaining 1,273.

Sir A. Cripps said the parties would endeavour to do this.

Mr. Butterworth, general manager of the North-Eastern Railway Co., was called by the Telephone Co., and stated that his company had 17,000 miles of telegraph and telephone lines. Their poles cost them the same figure as that claimed by the National Telephone Co. In dealing with the execution of large works costing several millions, witness gave it as his opinion that it was impossible to avoid the expense of raising capital. Therefore, such cost was part of the value where value was based on cost. On the question of depreciation, he said the company's methods of valuation were quite right.

Sir William Plender, of the firm of Deloitte, Plender, Griffiths and Co., the well-known firm of chartered accountants, and President of the I.C.A., gave evidence on behalf of the company.

Examined by Sir A. Cripps, he said he was consulted in the transfer of the water and docks companies and other undertakings. He thought the method of the Telephone Co. in arriving at the amount of depreciation was perfectly correct.

Mr. W. W. Cook was cross-examined by the Solicitor-General in regard to the company's claim for subscribers' apparatus. The tables, he said, showed there were 524,122 installations, and the cost was £3,750,000, after deducting depreciation. The claim of the company amounted to £3,056,474. Dealing with particulars of the claim, witness said that the company paid £2 13s. 3d. for a particular instrument, which was supplied by an Antwerp company amongst others.

The Solicitor-General pointed out that under the contract dated May 11th, 1911, the Government purchased the same kind of instrument of the Antwerp firm at £2 9s. 8d., or a difference of 3s. 7d. That sum had to be multiplied by 139,396, the number of this particular type of instruments for which the company were claiming.

Mr. Gathorne Hardy suggested that the documents relating to the purchase of these instruments should be examined by both sides in order to see where the difference arose.

Mr. Danckwerts said he noticed that the Government contract provided that the instruments should be British made, whereas they came from foreign manufacturers.

Mr. Gathorne Hardy said the Court had enough to do without going into the question of Tariff Reform.

At this juncture of the case, the Attorney-General asked how long the case for the company would last, and what Sir Alfred Cripps proposed to do at the close of the evidence. He was anxious to know before he opened his case what was the claim in money, and what sum was put forward as representing value of the plant. He was very desirous of dealing with the part of the case concerning plant before the Long Vacation.

Sir A. Cripps said he saw no reason why that part of the case should not be finished before the Long Vacation.

The Attorney-General said that if the Court came to a conclusion upon the matter he hoped an interim award would be given. If the parties agreed to a consent order, subject to the assent of the Court for the payment of an amount on account, that would relieve the situation very much. If they did not do that the difficulty was that by an adjournment of over two months the payment of 5 per cent. interest would be thrown upon the exchequer in respect of a large sum of money during the two months in which the Court would be in vacation.

His Lordship intimated that the Court was anxious to fall in with the views of the parties on that particular point. If both sides would agree upon a certain figure and consent to an interim award, the Court would give it before the long adjournment.

Sir Alfred Cripps thought that the Attorney-General was rather optimistic in assuming that the award for the whole plant would be given so early. He did not think it would, but another form of meeting the difficulties he hoped might be arranged. The consent to an award of something like £3,500,000 was not yet completed.

The Attorney-General said he did not think it could be done before the Long Vacation, but he did not think it need stand over until after the long adjournment.

Mr. W. Cook was then further questioned in the witness box with regard to the payment made to company's employés during holiday times, and the averages arrived at in the tables calculating wages, &c. In the case of a foreman in the company's employ about two weeks' annual holiday in the year were paid for.

Sir Guy Granet, general manager of the Midland Railway Co., was called for the National Co. He said his company maintained 17,000 miles of telephone and telegraph lines; 14,000 miles of this belonged to the Post Office. It was largely telephonic, because the company were superseding the telegraph by the telephone, especially between the signal boxes. His company constructed the trunk telephone from London to Settle for the Post Office, 248 lineal miles. The railway company's figure for the cost per pole was little above that estimated for pole cost in the National Telephone Co.'s claim. He agreed with the method adopted by Mr. Gill in calculating depreciation. If they dealt with the problem of arriving at the then value, they had to take into consideration the fact that the plant was satisfactorily constructed and established and in a profit-earning condition. He thought undoubtedly that the method adopted by Mr. Gill was the correct one, subject to it being a fact that the charge for maintenance was a constant charge and not an increasing one. If it were an increasing one, it would not be possible to look at the matter in the same way. It was also subject to the life of the articles in question being correctly estimated.

Cross-examined by Sir J. Simon, witness said he had assumed that the plant was to be built up little by little, and that a very substantial tract of country might be fitted up in a space of two years.

Mr. W. E. Weston, formerly chief of the statistical department of the National Telephone Co., now in the employ of the Post Office, gave evidence upon agreed figures in regard to the plant cost.

This concluded the evidence for the company on the item of £17,000,000 for plant cost, which it was decided the Court should deal with completely before the Long Vacation, and Sir Alfred Cripps addressed the Commissioners generally on the tables, data, &c., bearing upon that item. He pointed out that there was not more than 5 per cent. difference between the parties on the extremely complicated tables of figures which had been produced, and he thought that it was a remarkable testimony to the great care with which they had been prepared.

Sir J. Simon: My learned friend must be saying that upon instructions, because there is no evidence to that effect.

Sir A. Cripps said that he was entitled to make the submission whether he was right or wrong. He was told by some the difference was only 1 per cent.

(*To be continued.*)

Garland v. Newcastle-on-Tyne Corporation.

At the Newcastle-on-Tyne Assizes, on 6th inst., before Mr. Justice Scrutton, Harry Saxton Garland and his wife Elizabeth Garland, of 86, Fern Avenue, Newcastle, sought to recover damages from the Newcastle Corporation for personal injuries to Mrs. Garland, caused by a tramway accident. The defendants denied that Mrs. Garland was injured to the extent alleged, and that was the issue before the jury, the accident itself being admitted. According to counsel's statement, the plaintiffs were in an Osborne Road car which came into violent collision with a Gosforth car at the foot of Northumberland Road.

Dr. W. E. Hume, for the defence, gave it as his opinion that Mrs. Garland's symptoms would disappear very soon after the verdict of the jury was given. They were mostly mental.

Mr. Shortt pointed out that Mrs. Garland had already spent £15 15s. on medical fees, and she was entitled to something for the pain and suffering she had undergone.

The jury found for the plaintiffs for £115, and judgment was entered for that amount with costs.

Armstrong and Armstrong v. Newcastle-on-Tyne Corporation.

At the Newcastle-on-Tyne Assizes on the 6th inst., the hearing concluded before Mr. Justice Bankes and a special jury, of this action, in which Robert Bayles Armstrong and Daisy Bayles Armstrong claimed damages against the defendants for personal and other injuries sustained by them on November 26th last, through the alleged negligence of the defendants in leaving a tramway standard in the middle of Scotswood Road in such a position as to be a danger to the public using the road. The defendants denied negligence, and alleged contributory negligence on the part of the plaintiffs.

Mr. Scott Fox, K.C., in opening for the plaintiffs, said that on November 26th, Mr. and Miss Armstrong and the former's son were motoring along Scotswood Road, and were following the tramlines. Up to a point about 15 minutes' walk from the Central Station, Newcastle, the overhead wires were supported by poles standing at each side of the road; at the point indicated, however, the system changed, and the poles were there placed in the middle of the road. Up to that place, Mr. Armstrong, who had been driving the car, had been accustomed to the poles being at the side of the road, but at that point he drove towards the centre of the road in order to safeguard himself from the traffic which might emerge from the side streets. In doing so he crashed into the first centre pole. The car was seriously damaged. Mr. Armstrong was severely shaken, and Miss Armstrong was thrown through the glass screen. Counsel contended that the pole should have been properly lighted. The Corporation, on the other hand, contended that the system was sanctioned by the Board of Trade 10 years ago, and that the place was efficiently lighted. He (counsel) contended that the sanction of the Board of Trade, granted 10 years ago, could not be taken as a guarantee that the system was safe.

The Plaintiff, a mechanical engineer, living at Heaton, Newcastle, bore out his counsel's statement, and added that it was dark at the time of the accident, and he did not see the centre pole.

Miss Armstrong gave evidence as to the absence of light and as to her injuries, and the landlord of an hotel near the scene of the accident said that he recollected two previous accidents by collisions with the same centre pole.

After medical evidence had been called by plaintiff, Mr. David Balfour, jun., engineer, was called, and he said it was dangerous to have a pole in the centre of four street junctions like the place in question. It was an obstruction, and ought to have been lighted.

Mr. Frederick Edge, civil engineer, and formerly city engineer for Newcastle, expressed the opinion that all centre poles ought to be taken away; but if they were not removed, they should be lighted so that they could be easily seen. He considered the centre pole in question very dangerous. In several towns, centre poles had been removed because of the danger to traffic.

Mr. James Sidney Critchley, vice-president of the Institute of Automobile Engineers, said the tendency was now to remove centre poles wherever possible. He had not seen a single unlighted pole. In London all were lighted. He did not know a town where the first centre pole was not lighted.

Mr. Waugh, addressing the Court for the defence, said that, so far as the placing of the standard in position was concerned, the defendants had the authority of Parliament to do it. Its position alone, therefore, would not give rise to any cause of action. The jury had to find that the defendants had been guilty of some neglect of duty towards the plaintiffs which itself was the cause of the accident. He submitted that there had been no neglect of duty at all. Had the plaintiffs kept a proper look-out, and had the car been going at a reasonable speed, under the circumstances, the car could not possibly have collided with the standard.

Mr. Ernest Hatton, manager of the city tramways, gave evidence as to the Board of Trade sanction of the centre-pole system. That was the first accident that had, to their knowledge, been reported to the Corporation since the pole was erected.

In reply to Mr. Scott Fox, witness said it was a matter of opinion whether side poles were better than centre poles. Standing at that particular centre pole at 10 o'clock at night in December, he could clearly read the print of a newspaper. The centre-pole system was preferred because of the danger under the other system of the overhead wires falling on to the street.

Evidence was then called to show that the lighting was adequate at the place of the accident, and a constable said that at the time of the accident the plaintiff made no complaint of the lighting.

His Lordship, in summing up, said if the jury thought the pole was so insufficiently lighted as to be a cause of danger, they would come to the conclusion that it was negligent on the part of the Corporation not to provide adequate lighting. But, even if they came to the conclusion that the pole was a source of danger, and insufficiently lighted, they had to be satisfied that the plaintiff could not, by reasonable care, have avoided the accident.

The jury found for the plaintiffs, awarding Mr. Armstrong £37 5s. and Miss Armstrong £80. Judgment was entered accordingly, with costs.

Pym *v.* South Shields Corporation.

Judgment in this case (which was mentioned in our last issue) was entered at the Newcastle-on-Tyne Assizes on July 4th, on Mr. Meynell's application, for £145 and costs in both trials, that in which the jury disagreed, and the last hearing.

Electric Fans in Formosa.—According to *Der Mechaniker*, there exists at the present time a lively demand for electric fans in Formosa. The power station in Taihoku, a State concern, has laid in a stock for this season of 252 16-in. fans, and 1,487 12-in. fans. Local representation for the pushing of sales is recommended.

BUSINESS NOTES.

Correction.—In the 1912 edition of the Universal Electrical Directory, the names of the Gilbert Arc Lamp Co., Ltd., Engineering & Arc Lamps, Ltd., and Arc Lamps, Ltd., were by pure inadvertence omitted from the "Arc Lamp Manufacturers'" section among the classified trades. All three companies however, will be found in the Alphabetical Sections.

Leeds.—Messrs. Clayton & Co., Huddersfield, Ltd., of Huddersfield, have just completed a petrol-motor tower wagon to the order of the Leeds Corporation Tramways Department.

Books Received.—"Réception des Signaux Radiotélégraphiques Transmis par la Tour Eiffel." 1912. Paris: Gauthier-Villars.

"Il Nuovo Cimento." June, 1912. Pisa: Tipographico Toscano.

"The School of Mines Quarterly." Vol. XXXIII, No. 4. July, 1912. New York: Columbia University. Price 50 cents.

"The Electric Circuit." By V. Karapetoff. 1912. London: Hill Publishing Co., Ltd. Price 8s. 6d. net.

"Testing of Electrical Machinery, for Non-Electrical Students." By J. H. Morecroft and F. W. Hehne. 1912. London: Constable and Co., Ltd. Price 6s. net.

"Wireless Telegraphy for Amateurs." By R. P. Howgrave-Graham. Price 2s. net. "How to Drive a Motor-Cycle." By "Phœnix." Price 6d. net. London: Percival Marshall & Co.

Dissolutions and Liquidations.—Reno Electric Stairways and Conveyors, Ltd.—A meeting is called for August 7th at 1, Basinghall Street, E.C., to hear an account of the winding up from the liquidator, Mr. M. Lancaster.

French Electric Lighting Boards Ltd.—A meeting is called for August 29th at 13, Basinghall Street, E.C., to hear an account of the winding up from the liquidator, Mr. W. H. Pannell.

Fleet Brass Co., brassfounders and manufacturers of electric fittings, 9 and 11, Fleet Street, Birmingham.—Messrs. A. Raybould and S. Huxley have dissolved partnership. All debts, &c., will be attended to by the Fleet Brass Co., Ltd., whose registered office is as above.

Holidays.—We have received an interesting illustrated handbook relating to Deal and its attractions as a holiday resort. The book is an official publication of the Corporation, and copies can be obtained free by sending a postcard application to Mr. A. C. Brown, Town Clerk, Municipal Offices.

South Africa.—The *British and South African Export Gazette* states that the purchase of electrical hoists for tram haulage at the Shamva Mine is to be undertaken; also that plans and specifications are in course of preparation for an electrical power plant for this property estimated to cost about £100,000.

Catalogues and Lists.—Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—New catalogue (ninth edition) of 170 odd pages, illustrating and stating prices of a great variety of electric light fittings, glassware and other manufactures. Opening with a number of different styles of brackets, ceiling fixtures, hall lanterns and pendant fittings, there are many examples of electroliers in different styles with chain suspension, church fittings, adjustable pendants for dining and dressing rooms, French bronzes, standards, wireless cluster fittings, ships' fittings, illuminated signs, street and shop lighting fittings, and many accessorial parts, followed with electric radiators, heating and cooking apparatus, and glass and silk shades.

Messrs. Stewarts & Lloyds, Ltd., Winchester House, London, E.C.—New catalogue (Section "C") of 12 large pages, giving illustrated descriptions of several designs of branch service connections for use in conjunction with their steam pipes. The designs are suitable for gas, water and air mains.

Messrs. James Keith & Blackman & Co., Ltd., 27, Farringdon Avenue, London, E.C.—Several illustrated pamphlets: No. 15, describing the new open electrically-driven Keith fan; No. 22, dealing with the Keith electric plenum ventilators for window, railway carriage and tramcar service: also a pamphlet on "Industrial Unrest," in which Mr. James Keith puts forward what he regards as the only possible solution. He advocates the formation of a great federation of capital and labour.

The Electrical Engineering and Equipment Co., Ltd., 109-111, New Oxford Street, London, W.C.—Several illustrated price cards relating to electric fans, "Mego-meter" insulation testing sets, &c.

Messrs. Willans & Robinson, Ltd., Victoria Works, Rugby.—Well-bound fully-illustrated catalogue containing descriptive matter concerning the special features of their Willans disk and drum turbines; impulse and reaction blading; rotors; steam glands and packing; bearings and lubrication; governor gear; back pressure and pass-out turbines; exhaust steam turbines; mixed pressure turbines; and mixed pressure governor gear. A large number of half-tone illustrations of complete plants and parts thereof are given, also explanatory line drawings, and at the end occupying many pages is an imposing list of users of Willans turbines, type, speed, and capacity being stated. We have no doubt that power station engineers and designers at home and abroad will welcome this fine publication.

The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, London, N.—36-page pocket booklet entitled "Compressed Air and its Uses."

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—56-page catalogue containing full descriptive and tabular price and other information relating to switchgear for both A.C. and D.C. circuits, which is intended for the use of superintending engineers and those engaged in buying offices. Motor-starters, regulators, and drum type controllers for D.C. circuits are covered in Section I; starters and switchgear for A.C., circuit-breakers, switches, distribution boards, instruments, electric speedometers and resistances are dealt with in Section II.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—New price list W.B. L.1, giving tabulated particulars and illustrations of Wotan battery lamps for motor-cars, motor-'buses, yachts, model lighting, and flashers for miners' lamps, including a number of new types. The firm has arranged a new scheme of discounts, regarding which information can be obtained on application either to Dalston or to any branch.

For the coming lighting season Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have prepared a number of new poster and circular designs. One of these which is before us as we write, is a very effective reminder that "Tantalum is strength," and it cannot fail to carry its intended lesson to the public mind.

Messrs. Ercole Marelli & Co., Milan (26, Garlick Hill, London, E.C.).—16-page price list with illustrations, sizes, code-words, and other particulars of various types of electric fans—desk, bracket, swivel and trunnion, special railway carriage and ship (with aluminium blades), self-rotating ceiling, porthole exhaust with automatic shutters, &c.

Messrs. Adnil Electric Co., Ltd., Adnil Building, Artillery Lane, London, E.C.—16-page list (No. 502E) containing descriptive particulars of their starting controllers, and starting and regulating controllers, for non-reversible motors, also weights and prices of same for direct current and three-phase. The list gives prices of D.C. starters up to 350 H.P., three-phase starters up to 300 H.P., and D.C. and three-phase controllers up to 75 H.P.

Messrs. J. W. Brooke & Co., Ltd., Adrian Works, Lowestoft.—20-page illustrated catalogue of Brooke industrial motors applied to petrol-electric lighting sets, pumps, lifting machinery, organ driving and salvage work.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Supplementary sheet, M. 8, giving particulars of their hand lamps for factories, made to meet the requirements of the Home Office. They are in three types, two being of the usual pattern, with insulating handle, and the third a cast-iron pattern for use in situations where the hand lamps require to withstand very severe handling.

Western Electric Co., Ltd., North Woolwich, London.—Leaflet describing their resin-cored solder, consisting of a drawn seamless tube filled with pure white resin, which cannot set up corrosion. They have used this solder exclusively for many years in telephone exchange work.

The Korfund Co., 47, Victoria Street, London, S.W.—Leaflet giving a number of testimonials received from users of Korfund insulating foundation plates.

Allgemeine Elektricitats-Gesellschaft, Berlin.—Brochure on the economical regulation of the speed of three-phase motors, describing the various systems available; and list of high-speed three-phase motors for driving centrifugal pumps, &c., installed by the company. Also leaflets on the use of portable motors in agriculture, and the A.E.G. thrashing-machine.

Bankruptcy Proceedings.—J. W. Garsden, electrical engineer (J. W. Garsden & Co., Blackburn).—Adjudication order made June 29th, at Blackburn and Darwen Court. First meeting, July 18th, at Manchester; public examination, August 2nd, at Blackburn.

Fred. Shaw, electrical contractor, Hessle Road, Hull.—July 24th is the last day for receipt of proofs for intended dividend. Mr. G. H. Acheson, Official Receiver, York City Bank Chambers, Lowgate, Hull.

E. J. Crosier, engineer and merchant, Newcastle-on-Tyne.—Second dividend of 6d. in the £ payable July 22nd, at 145, Pilgrim Street, Newcastle-on-Tyne, by J. A. Gardner, trustee.

Henry Hallifield Oxley (otherwise known as Oliver Huxley), 22, Uxbridge Road, Hanwell, lately residing at 120, Coldershaw Road, Ealing, described as a consulting engineer. Receiving order made June 21st on creditor's petition at Brentford. This is an amended notice appearing in the *London Gazette* of July 5th.

Private Arrangement.—Herbert Tucker, 232, Kingston Road, Portsmouth, electrical dealer. &c. The creditors interested herein were called together on the 5th inst., the representative of the General Electric Co. being elected to the chair. A statement of affairs was presented by Messrs. E. J. Mills & Co., accountants, of 110, Cheapside, E.C., which showed liabilities of £3,658, of which all but £10 was due to trade creditors. The assets were estimated to realise £1,537, less £51 for preferential claims, leaving net assets of £1,486, or a deficiency of £2,132. It was reported by Mr. Mills that in addition to the liabilities shown on the statement there were bills discounted at the bank to the extent of £755. Those formed a contingent liability on the estate, and the debtor estimated that three-fourths of them were good. It would, therefore, seem that the liabilities would be increased by at least £150. It was further reported that the debtor started trading in small premises in Commercial Street, Portsmouth, in March, 1910, with a capital of about £200. Up to October, 1910, a profit of about £440 had been made. The following January the debtor was joined in partnership, and the partner brought in a sum of £250. The arrangement was that the partner should find £1,000, but that amount was never brought into the business. During the time of the partnership there were some heavy expenses which the business could not stand. Proceedings were commenced for a dissolution of the partnership, and eventually the debtor paid his partner out, and handed over to him a sum of about £300. The dissolution took place in February of the present year. A loss of about £570 was made during the partnership, exclusive of the drawings of £180. The present premises were held on a yearly agreement. The debtor had three life policies, all of which were taken out in favour of his wife. The household furniture was made over to the wife by a deed of gift about four years ago. The turnover of the business had been in the neighbourhood of £12,000 a year. One or two creditors stated that goods had recently been ordered by the debtor, and the latter stated that he was not aware of his position until a few days before the meeting. Until a statement of affairs was prepared he was not aware that his position was so bad. The debtor's solicitor made an offer of a composition of 6s. 8d. in the £, fully guaranteed. An increased offer was pressed for, and it was stated that a larger offer might be made if the meeting was adjourned. Eventually, however, it was decided to ask the debtor to file his petition in bankruptcy. The following are creditors:—

Austin, J., & Sons	£24	Light, C. & R.	£52
Boote, T. & R.	80	Morwoods, Sons & Co.	47
Burtle & Son, Ltd.	25	Meredith & Co.	27
Baldwins, Ltd	58	McKechnie Bros.	18
Breeden, J., & Co.	51	Miles, Druce & Co.	19
Bowness Iron Co.	58	Nordens & Co.	18
Corker, J. & R.	17	Newton Chambers & Co.	19
Codner & Callender	27	Newport Enamel Slate Co.	157
Cameron & Roberton	52	Normansell & Co.	20
Clyde Nail Co.	33	Orme, Evans & Co.	23
Dorrator Iron Co.	22	Park Foundry Co.	74
Diamond Foundry	22	Pritchard, A. A.	46
Every, John	32	Parkes, Josiah	37
Falkirk Iron Co.	29	Purefoy Wood Co.	24
General Electric Co.	160	Pountney & Co.	22
Gibbons, Skinner	106	Quitman, E. & C.	20
Giles & Son	19	Redpath, Brown & Co.	25
General Iron Foundry	24	Rhodes Tile Co.	24
Green & Co.	21	Smith & Wellstood	73
Grenberg, J. O.	23	Scottish Central Iron Co.	23
Gross, Sherwood & Heald	22	Summerford Iron Co.	80
Harrison & Cook	42	Sessions & Sons	56
Hill & Co.	105	Sanders & Co.	46
Hendry Bros.	72	Siemens Bros. Dynamo Co.	86
Howie, J. & R.	18	Tomks, Ltd.	19
Jones, John (Chelsea)	42	Tonks, E., & Co.	24
James & Rosewall	201	Turner, T., & Co.	22
Krupka & Jacoby	20	Wickston Foundry Co.	20
Kingsland Steam Joinery Co.	20	Wade, C.	28
Lysaght, John	81	Welsbach Gas Co.	35
Legg, J., & Co.	23	Whitehouse & Co.	27

And a large number for smaller amounts.

Advance in Prices.—The General Electric Co., Ltd., of Queen Victoria Street, E.C., have issued a list of advances in the prices quoted in their four-volume catalogue. These advances are consequent upon the continued rise in the price of raw material and the higher rates of labour and transit.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., announce that, owing to the continued advance in the cost of copper and of other items of manufacture, they have been obliged to increase the prices of rubber-insulated wires and cables as from 10th inst. Price List No. 40 (October, 1910) will be subject to the following discounts to the trade:—Association grades, 2,500-megohm, 600-megohm, 300-megohm, 600-volt, C.M.A. and Association pure india-rubber flexibles, 20 per cent., 15 per cent. and 10 per cent.; pure india-rubber wires and cables, 15 per cent. and 10 per cent. Price List No. 40A (September 1st, 1911) will also be subject to the above terms.

Trade Announcements.—The Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, London, W.C., have just been appointed sole agents for Great Britain and the Colonies for the firm of Dr. Albert Lessing, of Nurnberg, whose dry cells and carbon brushes are so well known. Dr. Lessing's products also cover carbon contacts for switches, circuit breakers, carbon battery plates, welding carbons and electrodes up to the largest sizes for electrical furnaces, and his factory is one of the oldest in the world.

Messrs. Baxter & Impey, electrical contractors, 54, Dudley Street, Birmingham, have opened a branch office at 10, Orchard Street, College Green, Bristol, and they desire to receive price lists, &c.

Messrs. Veritys, Ltd., announce that owing to increased business they have taken over larger premises at Gascoigne Street, Boar Lane, Leeds, where they have an extensive fittings showroom with a good display of "Aston" cooking appliances. Large stocks of electrical supplies will be carried there.

Messrs. H. W. Butler & Co., of Craven House, Kingsway, London, W.C., have been appointed sole agents for the Crocker-Wheeler Co., of Ampere, New Jersey, U.S.A., whose motors, generators, and other machinery are already known in this country. A stock will be kept here of the sizes chiefly in demand.

Safety Shot-firing Appliances.—A method of making and using detonators in such a way that mis-fires are avoided, or, if they occur, are deprived of danger by the withdrawal of the faulty detonator at a safe distance, has been devised by Messrs. Price and Pryse, under the name of the "P P" system. After the withdrawal of a detonator, a fresh one can be inserted without difficulty or danger.

Reduction of Capital.—Reason Manufacturing Co., Ltd.—A petition for confirming the reduction of capital of this company from £70,000 to £37,553 8s. 6d., is to be heard in London on July 22nd.

LIGHTING and POWER NOTES.

Australia.—The Melbourne City Council contemplates spending £140,389 on extensions to the electrical undertaking during the next three years. A 2,000-kw. turbo-alternator has already been ordered for the winter of 1913, and two [illegible], turbo-generators are required for 1914. An underground concrete water tunnel is to be constructed between the river and power station to supply the condenser water, &c., at a cost of £22,000.

Barnet.—A letter has been received from the North Metropolitan Electrical Power Distribution Co., Ltd., stating that it was the intention of the company in the next ensuing available session to apply for a provisional order under the Electric Lighting Acts, 1882-1909, enabling it to supply energy at Arkley.

Bexhill.—Application has been received by the Council, on behalf of the De La Warr Estate, for the extension of the electric cable to supply a further pumping station to be erected on the Cooden Beach Estate. The Council has agreed to carry out the work on an annual revenue of 10 per cent. of the cost being guaranteed.

Blackburn.—At the T.C., on the 4th inst., Ald. Thompson defended the advance of the electrical engineer's salary on the ground that the town's electrical business was increasing at a rapid rate, and that the present works would have to be removed at a cost of £50,000. One of the factors was the increasing demand for electricity for mills. They already had a contract to supply a mill containing 1,000 looms, each driven by its own motor, and another mill with 300 looms would be applying in a few days.

Bournemouth.—The Lighting Committee has recently recommended the substitution of gas lighting for electric lighting in certain roads, and this was adopted by the T.C.; an amendment referring the matter back, in order that the borough engineer—who had not been consulted—might have an opportunity of looking into the matter, was defeated by 18 votes to 16. Both the electricity company and the borough engineer wrote pointing out the possibility of introducing greatly improved electric lighting.

Bradford.—The Union Workhouse has been provided with a new generating set, and last week this machine was formally started. The new machine is of 100-kw. capacity, and is to be used as a reserve in case of a breakdown, and for providing additional current when there is a demand for it for lighting and power purposes.

The Electricity Committee of the T.C. recommends extensions of mains and the provision of a transformer station at an estimated cost of £1,114, and a change from direct current to alternating current in four districts, with the provision of a transformer chamber, and the relaying of cables at an estimated expenditure of £2,111.

Brighton.—The T.C. has reduced the price of current for power and cooking purposes to consumers just outside the borough, to 1d. per unit.

Bristol.—According to the accounts of the electricity undertaking for the year ended March 25th last, it appears that the gross receipts amounted to £89,269, as against an expenditure of £39,097, which leaves a gross profit of £50,172, which, with bank interest received, brings the total to £50,616. After allowing for interest on loans, &c. (£22,191), repayment of capital borrowed (£25,240), and expenses *re* exchange premises (£185), there remains a balance on the year's working of £2,998, which, with the balance from last account, brings the total to £5,627. From a combination of circumstances which could not be foreseen, the reserve fund accumulated a larger sum than was necessary for its purpose, and Prof. Dicksee was instructed to review his original recommendations, and advise upon the present and future positions of the fund. His advice was that in the altered circumstances, if no further additions were made to the fund, and if the fund is accumulated at 3 per cent. compound interest, by the time that the whole of the assets chargeable against it have been renewed, the fund will show a balance of £6,989, being a surplus sufficient to meet any likely contingencies. In these circumstances, the Committee does not propose to make any further contributions to the fund. The number of consumers at the end of the year amounted to 3,833, being a net increase of 297. The total connections to the mains are equivalent to 583,471 30-watt lamps (as compared 551,991 at the corresponding period of last year. The number of units sold was 10,458,916, being an increase of 1,424,207, or 15·7 per cent. over the preceding year. The sale of units was made up as follows:—Private lighting, 2,793,427; power and heating, 5,462,997; combined rates, 1,318,587; public lighting, 883,905. The total revenue from current sold has increased by £5,072 over that of last year. According to the chief engineer (Mr. H. Faraday Proctor) the total cost per unit sold has again been reduced, the reduction amounting to 5 per cent. as from last year's cost, notwithstanding the extra expense arising owing to the coal strikes, which resulted in a 10 per cent. increase in the coal bill, as compared with what it would otherwise have been. During the year the showrooms were very extensively used, both by persons anxious to obtain information of a preliminary character, and by the general body of consumers of electricity. Publicity was kept well to the fore, and advertising has been carried out on bolder lines than hitherto, which resulted in a stimulating effect on the number of new consumers connected to the system. The total number of consumers increased from 3,586 to 3,883. This increase, viz., 297 (net) is the largest number recorded in one year since 1904. The results from the increased work of the publicity department, indicate that a still further expansion of that department is desirable.

Carlisle.—For the past year the gross profit on the electricity undertaking was £9,971, and the net profit £3,340. There is now a surplus on the net revenue account of £8,337, which includes £4,996 brought forward from the previous year.

Cheltenham.—At a meeting of the T.C. it was reported that in reference to the provisional order granted by the Board of Trade for the extension of electric supply to the adjacent parishes of Prestbury and Leckhampton, the gas company, which is being supported by the Ratepayers' Association, has decided to carry its opposition to the Committee Room of the House of Commons.

Chester.—As previously mentioned in these notes, the Corporation is embarking on an interesting hydro-electric scheme, utilising the water of the River Dee, which was originally used in the old Dee Mills. In connection with the new scheme, Messrs. James Gordon & Co. are supplying three vertical shaft turbines, two capable of passing 30,000 cb. ft. of water per minute, and one for 20,000 cb. ft. per minute. The wheels are specially designed for the tidal conditions of the river, in which the fall of water may vary twice a day from as much as 9 ft. to as little as 2 ft.; on a fall of 8 ft. the turbines together are to develop 950 h.p. Judging by the records of many years, the generation of power will at no time be seriously interfered with, even when there are high spring tides. The turbines are to be coupled by means of helical bevel gearing to dynamos which will be employed in battery charging—the batteries being situated at the existing steam station—and in supplementing the present supply to the Chester mains network. The estimates of output from this plant vary from 1 to 1¼ million units per annum, at a total cost of ·31d. per unit, which is less than the coal cost at the Chester station. The installation will be the only one of its kind in this country, and its completion will be watched with considerable interest. We may add that Messrs. Gordon's contract embraces the buildings and hydraulic plant.

Clacton-on-Sea.—With further reference to our note of last week, the Council has had installed 20 "Metropolitan" flame arcs along the sea front; these are magazine lamps giving 80 hours' burning, and are provided with lowering gear. The installation has been carried out by Messrs. Johnson & Phillips, Ltd., and will provide some 60,000 c.p. at a cost for energy and maintenance of £272 per annum.

Clayton (Yorks.).—At a meeting last week of the District Council, a deputation from the Queensbury District Council attended for the purpose of discussing the question of supply of electricity for the two districts. It was pointed out that the Yorkshire Electrical Supply Co. had given notice of intention to apply for power to sell electricity within the two urban districts. The Queensbury deputation desired to know if the Clayton Council had come to a decision as to the best course to pursue, it being recognised that it was open to the two councils to apply for provisional orders enabling them to purchase in bulk and distribute. Eventually it was decided to invite the Yorkshire Electric Power Co. and Bradford Corporation Electricity Committee to send representatives to a joint meeting of the Clayton and Queensbury Councils.

Cobham.—The local Council is offering no opposition to an application made by the Leatherhead Electricity Co. to supply electricity to certain premises in this parish which are at present outside the area of the company's supply.

Croydon.—The T.C. has reduced the price of energy for heating and power from 2d. per unit to 1½d.

Ellesmere Port.—Some months ago it was announced that the Council had decided to apply for an electricity order. The Mersey Power Co., however, which had entered into an arrangement with the Widnes Corporation, opened negotiations with the Council, and the latter decided to proceed no further with its own application, and dissolved its Electricity Committee. The agreement with the Mersey Power Co. was not completed, and as the Shropshire Union Railways and Canal Co., which has a monopoly of the gas supply, had not replied to the Council's demand for a substantial lowering of the price of gas, the Council, sitting in committee, has again decided to apply for an electric lighting order.

Exeter.—At a recent meeting of the City Council, Mr. Gayton called attention to the fact that the Gas Co. approached builders and offered to bring the gas main to the doors of new houses, and supply the buildings with gas burners and fittings free. He suggested that the Electric Light Committee should offer to wire houses free of cost, and supply fittings gratis, so as to compete with the Gas Co. Mr. Widgery said some Corporations fixed electric fittings and wired houses; Exeter did not. Mr. Gayton said he supposed it was business. What did the Electric Light Committee propose to do in order to meet this form of competition? The Town Clerk said he would bring forward the subject at the next meeting of the Committee.

Farnworth.—The U.D.C. has decided to substitute for the present street arc lamps, 91 metallic-filament lamps of 300 c.p. each.

Dudley.—The statement of accounts of the electricity undertaking for the year ended March 31st last shows that there was an income of £13,722, as against an expenditure of £8,007, leaving a gross profit of £5,714. The sale of current for private lighting at 3¾d., 3¼d., 3d., 2¾d. and 2d. per unit amounted to £4,692, while that for public lighting realised £1,377. The income from the tramway supplies at 1d. per unit amounted to £4,351, while £2,886 was realised by motor supply at 1¼d., 1⅛d., 1d., ·95d. per unit. The cost of generation amounted to £4,495.

Gillingham (Kent).—The T.C. proposes to extend the plant at the generating station, and the electrical engineer has been instructed to inspect the latest types of Diesel engines and prepare a specification.

The T.C. has decided to offer current to the Royal Naval and Marine Orphanage at a flat rate of 3¼d. per unit. The approximate annual consumption will be 800 units.

Guildford.—The T.C. has, after a protracted discussion, adopted a scheme of high-pressure gas lighting in High Street and North Street. Originally the Gas Co. and Guildford Electricity Co. were asked to submit rival schemes at a maximum yearly charge of £150. This was done, but the Council proceeded to put the electrical scheme at £150, against a gas proposal at £162. Naturally exception was taken to this, and the Electricity Co. was given permission to tender to the same figure and offered 26 posts each fitted with two 5 amp. Union semi-enclosed lamps in series, giving at a modest estimate about 16,000 c.p. The Gas Co. offered 26 so-called 1,000-c.p. high-pressure gas lamps (alternate lamps to burn all night). Ultimately the Council, without reference to any further proposal by the Electricity Co. adopted a gas lighting scheme, costing £190 per annum, and giving on paper 31,000 c.p. —the fact that the gas tender was £28 in excess of the electrical tender being conveniently ignored by its supporters, when comparing the tenders.

Hastings.—At last Friday's meeting of the T.C. it was decided to reduce the charge for electric current for heating, power and cooking purposes to 1½d. per unit.

Haywards Heath.—The U.D.C. has appointed a Committee to go into the question of an E.L. scheme for the town.

Hazel Grove-cum-Bramall.—The U.D.C., which has been considering the advisability of applying for a prov. order for E.L., has asked the Stockport T.C. if it is prepared to give a supply of current in bulk if terms can be arranged. The T.C. has referred the matter to the engineer for a report.

Hereford.—The T.C. has applied to the L.G.B., for a loan of £1,000 for services for two years.

Hornsey.—Sanction has been received from the L.G.B. to the borrowing of £8,791 for additional plant, &c., at the electricity works. Wood Green U.D.C. has consented to the proposal of the B.C. to afford a sale of current to buildings in Alexandra Park Road, subject to the reservation of the right to withdraw consent at any time on a supply being available under the Wood Green Electric Lighting Order, 1902, and to the net amount of expenditure by Hornsey Council in laying cable being refunded.

Japan.—The new water-power electricity generating station at Kinugawa of the Kinugawa Hydro-Electric Co., has lately been completed.

London.—Fulham.—According to the report of the borough treasurer, there was a gross income on revenue account on the electricity undertaking for the year ended March 31st last of £34,219, as against a gross expenditure of £32,678. This leaves a surplus for the year of £2,512, as against £3,861 in 1911. The net available surplus, after charging net revenue account with £962 in respect of free wiring, is £1,541, which, added to the balance in hand of £3,235, gives a total available balance of £4,776 to be carried to next year's account. The total number of units sold for private purposes during the year was 2,505,747, at an average rate of 2·42d. per unit, as compared with 2,345,847 units the previous year, at an average rate of 2·45d. per unit. The percentage increase in the units sold during the year over 1910-11 was equal to 6·8, while the actual increase in the income derived from private sales was £983. An increase is shown in the public lighting supply of £62, and the rate of charge for this supply is equal to 1·36d. per unit, the same as for the previous year.

Stepney.—A proposal is being made for the extension of the electricity supply undertaking at a cost of £137,750. The accounts of the electricity supply undertaking for the year ended March 31st show a surplus carried to net revenue account of £38,196, as compared with £24,108 in the previous year.

Middleton (Lancs.).—The Electricity Committee is seeking borrowing powers for £5,200, to cover the cost of cable during the next five years.

The mover of the Electricity Committee's proceedings at the T.C. stated that, after allowing £500 for depreciation, there was a loss on the year's working of £941, and he was afraid that, until they could sell more current and get coal cheaper, they would not be able to make a profit.

Newton Abbot.—The B. of G. has been informed by the electricity company that owing to the increased price of coal, &c., the charges for current for power and heating will be increased by 10 per cent.

Oldham.—The T.C. has received permission from the Springhead U.D.C. and the Crossbank local authority to lay electric light mains in the districts.

Oulton Broad.—The U.D.C. has, by 8 votes to 6, decided "to have nothing more to do with trying to buy up the electricity company."

Royston.—At a Council meeting a discussion was held as to the advisability of the Council taking a bulk supply of electricity. During the discussion the case of Whitwood was cited, where the street lamps are electrically lighted, and cost 21s. 3d. to maintain, as against 30s. to 35s. paid by the Royston Council for gas. It was agreed that an interview with the Power Co. on the subject should be obtained.

St. Annes.—Confirmation has been given to the decision to apply to the B. of T. for a prov. order to authorise the supply of electricity for all public and private purposes within the district of Lytham.

Sevenoaks.—Mr. Cecil E. Currie has informed the R.D.C. that he intends applying for a prov. order for E.L. for the parishes of Westerham, Brasted, Sundridge, Chevening, Dunton Green, Riverhead, Sevenoaks Weald, Seal, Otford, and Kemsing.

Sheffield.—The surplus on the electricity undertaking for the year ended March 25th last, after meeting all charges, amounts to £1,841, which, after adding the accumulated surplus at the end of last year, gives a total available surplus of £6,975. The number of units sold amounted to 16,902,360, as against 14,254,291 in 1911. Working expenses during the year amounted to £37,453, as against £28,724. The rate of working expenses in proportion to total revenue and per unit sold amounted to 38·66 per cent. and ·53 per cent. respectively, as against 33·25 per cent. and ·48 per cent. in 1911. The increase in revenue during the year amounted to £10,482. The whole of the generating plant had been kept in a thoroughly efficient state of repair out of revenue at a cost of £2,134. The total expenditure on capital account to March 25th amounted to £1,078,711.

Shipley.—The U.D.C. has appointed a Committee to consider applications for current for power from large works in the district. If the supply is given an immediate outlay of £3,000 will be necessary, and within a year probably £10,000 will have to be expended. The engineer is to report on the question of the proposed extension of plant.

South Africa.—At a large meeting of ratepayers recently held at Robertson, Cape Province, it was unanimously decided to establish an electric light installation for the town, and the Council was authorised to raise a loan not exceeding £5,000 to carry out the scheme. It is anticipated that the scheme will be a profit-earning venture, and not a burden on the rates.

The Somerset West (Cape Province) Municipality is endeavouring to make arrangements with De Beers Explosives Works to give it a supply of electrical energy for street lighting from the company's works at Somerset Strand.

According to the *British and South African Export Gazette*, Johannesburg is preparing to spend the huge sum recently awarded in what is known as the gas engine action, and among the more authoritative proposals is one for an outlay of £195,956 on extensions and improvements to the local gas, electric and tramways undertakings. Of this sum £67,000 would be spent on the power station and cables, and £60,500 on extending the electrical mains to all parts of the town.

Spennymoor.—The U.D.C. has accepted the tender of the Northern Counties' Electricity Supply Co. for street lighting as follows:—Thirty-four 120-c.p. lamps and 268 50-c.p. lamps at £2 10s. each for the season of 10 months.

Stafford.—The T.C. has agreed to purchase an 850-h.p. Willans-Peebles generating set from the Newcastle-on-Tyne Corporation for £1,200, the price including condensing plant, &c.; a 28 ft. × 7 ft. 6 in. boiler is also being purchased for £410—the additions being due to the growth of the electricity department.

Sunderland.—The annual report of the borough electrical engineer has just been issued. It states that there had been an increase of 21 per cent. in the units sold compared with the previous year, giving a total of 12,373,429. There was a net profit of £5,957 on the year's working, which had been contributed to by a further reduction in the working costs from ·525d. last year to ·475d. this year, representing a difference of £2,500. This reduction had been brought about by a further reduced coal consumption equal to a saving of ⅕th of a lb. per unit sold, and also to the spreading of the costs over a wider basis. The load factor showed an encouraging increase, having risen from 18·6 per cent. in 1909 to 20·25 per cent. in 1910, 22·6 in 1911, and 24·59 per cent. in the year under review. In 1907 the cost of coal was ·43d. per unit sold, in the past year it was ·17d. per unit, and the consumption in weight had fallen from 8·4 lb. in 1907 to 3·49 lb. last year. The capital of the undertaking was £435,499. The revenue was £63,134 and the expenditure £28,586. After paying interest on capital £11,549, repayment of loans £16,620, and other smaller items, the profit above mentioned was left.

Teignmouth.—Messrs. J. & W. Purves, of Exeter, have informed the U.D.C. that they intend applying for a prov. order for electric lighting.

Tonbridge.—The U.D.C. has decided to apply to the L.G.B. for a loan of £2,400 for the provision of a 100-kw. Diesel oil engine set at the electricity works, and for a loan of £1,000 for mains.

Tunbridge Wells.—The T.C. has agreed with the National Electric Construction Co., Ltd., to pay £50 in settlement of the installations carried out in the town by the company. In consequence the T.C. will withdraw its opposition to the company's Bill.

Wadebridge.—The U.D.C. has entered into an agreement with the electric light company for lighting a portion of the district for two years.

Wakefield.—The city electrical engineer's report for the year ending March 31st clearly points to a more satisfactory year's working. After referring to the great reduction in charges for power, he states that the revenue has increased notwithstanding. Two of the largest works in the city have now become users, and there is an increasing demand from the Lancashire and Yorkshire Railway. The cost per unit sold will in future be reduced owing to the new plant installed, which includes a turbine-driven alternator of 800-KW. capacity. The net profit on the year's working is £695, as compared with a loss of £213 in the previous year, and a loss of £805 in 1910.

Wakefield.—It is proposed to augment the electric light plant at Wakefield Asylum at a cost of £582.

Walmer.—Mr. W. T. Priestland, of London, has given notice to the U.D.C. of his intention to apply to the B. of T. for a provisional order for electric lighting in the town.

Walsall.—Mr. T. C. Ekin, on Wednesday last week, held an inquiry at the Town Hall respecting an application by the Council to borrow £10,000 for purposes of its electricity undertaking. It was explained by the town clerk that £6,372 of the £10,000 was required in respect of new works which it was proposed to carry out, and that it was made up as follows:—£3,612 for mains, £2,016 for additional plant at sub-station and an item of £750 for consumers and transformers.—The Inspector: You are only asking for 1½ years. Is that sufficient in view of your fondness for excessive expenditure?—The town clerk said the Corporation was advised by the engineer, and the application was due to the increased demand for electricity, and the opening up of new districts.—Mr. Barnard, electrical engineer to the Corporation, said that part of the £3,612 was to be used for additional plant for traction in respect of extra cars, and probably trolley 'buses.

Walthamstow.—Sanction has been received from the L.G.B. to the borrowing of £22,119 for extensions of the electricity undertaking.

Watford.—At the last meeting of the U.D.C. it was stated that the net profit on the electricity undertaking for the past year amounted to £2,122, as against £790 in the preceding year.

Weaverham.—The Weaverham Electricity Supply Co., Ltd., has given notice to the Northern R.D.C. that it intends applying for a provisional order to enable it to supply electrical energy in the districts of Gorstage, Cuddington, Sandiway and Oakmere. This is an extension of the present lighting scheme of Weaverham, for which Messrs. Callow & Co. have been the contractors.

Wimbledon.—During the year ended March 31st last, the expenditure on the electricity undertaking amounted to £29,710 as against an income of £31,906, leaving a profit of £2,195, as against £2,109 in 1911. The cost of generation amounted to £8,896, or ·810d. per unit sold, as against ·787d. in the preceding year. The amount realised by the sale of current was £26,118. Of this, by far the largest amount (£19,547) was derived from the sale of current at 4½d. per unit, the next largest amount being realised from units sold at 1d., which amounted to £1,620. During the year 3,531,480 units were generated. Of this number 2,637,810 were sold at an average price of 2·869d. per unit, 1,223,711·2 going to private consumers for lighting, at an average price of 4·414d.; 878,489 to private consumers for power and heating at ·986d., and 535,610 for public lighting at 2·424d. The total maximum supply demanded amounted to 1,570 KW.

Wolverhampton.—The gross profit on the electricity undertaking for the year ending March 31st last amounted to £24,042, equal to 9·62 per cent. on the capital expenditure. After allowing for interest (£6,600), sinking fund and repayment of loans (£10,179) and income-tax, &c. (£182), there remained a net profit of £7,079, as against £5,230 in 1911. There was an output of 10,618,143 units, as compared with 10,818,089 in the previous year. The decrease is attributable to the fact that during the previous year a temporary supply amounting to approximately 796,612 units was given to Messrs. Bayliss, Jones & Bayliss during the period that their power station was disabled. The generation expenses amounted to £15,247, as against £18,491 in 1911. The supply of current for public lighting realised £1,962, while the following amounts were obtained for the sale of current at the undermentioned prices per unit: 5d., £4,586; 4½d., £12; 4d., £2,442; 3½d., £1,264; 3d., £1,024; 2½d., £1,527; 2d., £2,309; 1½d., £151; 1d., £13,954; ⅞d., £2,679; ⅘d., £1,902; ¾d., £3,555; ⅗d., £3,761; ½d., £380. According to Mr. Gibson, chairman of the Electricity Committee, the increase in the profits of the undertaking is entirely attributable to the considerable reduction which has been effected in the cost of generation. He emphasises the fact that these economies have been rendered possible by the installation of new generating plant, which has enabled the older plant to be shut down, overhauled and repaired. During the whole of the time in which a difficulty in getting a supply of fuel had been experienced, a continuous supply of electrical energy was maintained, and at the conclusion of the strike a sufficient stock was in hand to maintain a supply for a considerably longer period. The motors connected to the mains at March 31st were 562, representing a total of 6,718 H.P., whilst the total connection for lighting purposes were equivalent to 116,000 8-C.P. lamps.

TRAMWAY and RAILWAY NOTES.

Blackpool.—The borough treasurer recently reported that the Assessment Committee had increased the rateable value of the Corporation's tramway undertaking from £6,000 to £7,449, notwithstanding that the Overseers had recommended the first-named amount. It was resolved to enter an appeal against the increased assessment.

In consequence of the Court of Appeal's decision in the Metropolitan Electric Tramways *v.* Tottenham Council, the Blackpool, St. Anne's, and Lytham Tramway Co. has applied to Blackpool Corporation for repayment of a proportion of the general district rate for last year, and also for a reduction in the amount of general district rate for the current year in respect of the company's undertakings. The matter has been left in the hands of the borough treasurer.

Chile.—The proposal of Agustin Boza Lillo to establish an interurban electric tramway service for passengers and goods to run between Cisterna and the Plaza Vicuna Mackenna, in Santiago, has been approved. Operations are to be begun before April, 1913, and to be finished within three years of the date of commencement. Also his proposal to establish an interurban electric railway service between Vina del Mar and Concon, and to supply electricity for lighting purposes to certain towns on the line of route, has been approved.—*Board of Trade Journal.*

Dewsbury.—The Yorkshire (Woollen District) Electric Tramways Co. has issued notices to the effect that from July 15th the fare for four numbered sections will be 1d., five and six sections 1½d., and seven and eight sections 2d. This is an increase of a farthing on the existing charges for the fifth and seventh sections, and abolishes the farthing fares altogether.

Dundee.—The Corporation tramway revenue for the past year shows a decrease of £416. The year, which closed on May 16th, is interesting from the fact that its record includes the first complete 12 months of the penny-all-the-way system. The total revenue for the past year amounted to £61,104, as compared with £61,520 for the previous year.

Halesowen.—At the meeting of the R.D.C. last week, it was announced that the Light Railway Commissioners had written stating that terms had been arranged between the Halesowen Light Railway Co. and the Birmingham City Corporation for Birmingham to have the line from Balden Road and Victoria to Bearwood, Halesowen to lose the powers through Quinton, and for Birmingham to apply to Parliament for an order.

Holywell.—The Light Railway Commissioners will hold an inquiry here on July 22nd as to the expediency of granting the application made to them by the Mid-Flintshire Light Railway Co., Ltd., for an order.

Hull.—The last year's working of the Corporation tramways shows a total revenue of £152,786—an average of 9·65d. per car-mile. The total working expenses amounted to £97,944, leaving a gross balance of £54,842. Interest, sinking fund, &c., absorbed £30,530, and the deficit on motor-omnibus working also took £4,393, leaving a net profit of £21,111, from which £12,000, as in the previous year, was contributed to the rates, and the balance carried to reserve. The reserve fund stands at £121,028. The passengers carried were 31,399,539 at 1d. fares, and 9,877,665 at ½d. fares, on the tramways, also 445,067 1d. and 176,839 ½d. fare passengers by motor-'bus—the car-miles being 3,761,809 and 109,126 (12,665 "dead" mileage) for tramways and 'buses respectively. The 'buses apparently worked a route less than two miles in length, and resulted in a revenue deficit of £3,742, which, added to loan charges, left a debit of £4,393, or 10·93d. per 'bus-mile, the revenue from fares being at the low rate of 5½d. per car-mile. The Tramways Department operates its own power station, 4,301,386 units being delivered at a works cost of ·55d. per unit.

Japan.—A new electric railway has lately been completed and opened for traffic between Tasaki and Narasaki (Kumanoto).

Kirkcaldy.—For the year ending May 15th the tramways carried 5,198,320 passengers, compared with 4,822,270 for the previous year, an increase of 376,050. Receipts for the year amounted to £15,433, compared with £14,186 for the previous year, an increase of £1,247.

Leicester.—The Tramways Committee is stated to have ordered 10 P.A.Y.E. cars for use on the local routes.

Plymouth.—At a meeting of the T.C. on Monday, Mr. Stephens said they might congratulate themselves on the very great success of the tramway undertaking. The estimated income of the year was £36,256, and the actual receipts £36,144. The expenditure was estimated at £36,302, and amounted to £158 less, notwithstanding the fact that they increased the pay of their men. Their power cost showed a decrease of £1,042. The balance-sheet showed the original cost of the undertaking, £188,000, now stood in the books at £105,715. They had carried 8,225,659 passengers, an increase of 151,849 over the previous year.

Ramsbottom.—Contracts for the construction of a rail-less traction service between Holcombe Brook and Edenfield will shortly be entered into by the U.D.C. The route is 3½ miles, and the proposed expenditure is £10,000, which includes three cars, overhead wiring and fittings, waiting rooms and car-shed. The estimated cost of running, including sinking fund and interest charges, is 8½d. per car-mile. The work is to be proceeded with as soon as the contracts are signed, and the service is expected to commence at Whitsuntide, 1913.

Sheffield.—The total revenue of the tramways department for the year ended March 25th last, amounted to £341,004, the receipts from passengers amounting to £337,801, as against £316,738 in 1911. Working expenses amounted to £196,606, as against £186,024 in the preceding year, or an average cost per car-mile run of 6·111d. The increase over 1911 is chiefly accounted for by the increased mileage run, increased assessment, extra cost of fuel, and increases in employés' wages. The net revenue amounts to £144,397, and after allowing for certain charges, leaves a balance on the working of £61,334, as against £53,209 in 1911. During the year, 7,720,026 car-miles were run, and 90,458,851 passengers carried, as against 7,618,383 and 84,500,331, respectively, in 1911. The total number of units generated is put at 15,603,810, the number used for cars being 13,772,171 at a total cost per unit of ·642d., as against 12,669,319 at a cost of ·634d. in the preceding year. The average total revenue per car-mile amounted to 10·698d., as against the average working expenses per car-mile (including power cost) of 6·606d. The undertaking has been maintained in efficient working order during the year, no less than £44,032 having been spent out of income on general repairs and maintenance. The accumulated balance remaining to the credit of the undertaking amounts to £25,917. The total amount paid out of revenue on various street improvements since the Corporation took over the working of the tramways reaches £54,267.

The tramway track in West Bar and a portion of Gibraltar Street is to be renewed, as is also the track in a portion of South Road, when the opportunity is to be taken to double the line. The total estimated cost of this latter work is £1,302.

South Africa.—The 120-H.P. petrol-electric rail car fitted with the Thomas transmission system that was recently supplied to the South African Railways, has proved able to run 228 ton-miles per gallon of fuel at a speed of 33 miles per hour. The tests were carried out at an elevation of about 5,700 ft. above sea level.—*African Engineering.*

TELEGRAPH and TELEPHONE NOTES.

Algeria.—A comprehensive system of telephones is about to be set up throughout Algeria, the Chambers of Commerce of the leading cities having been authorised to advance the necessary funds to the general Government.—*La Lumière Electrique.*

Austria.—The Government has established a department for wireless telegraphy, and intends itself to undertake the installation of wireless plants on board merchant ships. The system adopted is that of the German Telefunken Co. In addition to six ships already fitted, the equipment of 26 other ships is projected. The manufacture of the plant is to be entrusted to the Austrian branch of the Telefunken-gesellschaft.

Earphones.—Experiments are being made at the New Theatre, London, with the "earphone," an electrical instrument on the principle of the telephone, connected by wires with receivers on the stage; it is claimed that a deaf person (not stone deaf) by placing the receiver to his ear will be able to hear distinctly everything that is said by the actors.

France.—The small wireless stations erected in French-India, namely at Hanoi, Kienan and Cap St. Jacques, having a range of only 350 kilometres, are to be supplemented by three large stations, situated at Saigon, Hanoi and Hué respectively. The range of the Saigon station will be 5,000 kilometres, in order to effect communication with Africa and the Pacific.—*Norddeutsche Allgemeine Zeitung.*

Germany.—The Government has just granted a joint concession to the Deutsche Telefunken-Gesellschaft and the Deutsch-Niederlandische Telegraphen-Gesellschaft to build and work two large wireless stations in German Colonies in the South Seas. The stations, which are to be on the Telefunken system, are to be built at Yap-Rabaul in New Guinea and at Apia on Samoa, and will communicate with Nauru and thence with Yap, where the Deutsch-Niederlandische company's cable comes to land. The iron towers will be 120 m. high, and the plant will be of 120 H.P. A separate company will be formed to work this concession. The distances which will be bridged are—Yap to New Guinea, 2,200 km.; Yap to Nauru, 3,400 km.; New Guinea to Samoa, 4,000 km.; New Guinea to Nauru, 1,700 km.; and Nauru to Samoa, 2,700 km.—*Elek. Nachrichten.*

A wireless receiving station is to be built at Heilbronn, similar to the one at Hohenheim.

International Radio-Telegraphic Conference.—The International Conference closed on Friday last, having, with its three committees, held in all 28 meetings. The International Convention and the regulations for the exchange of messages between ship and shore were thoroughly revised and amended, and in their new form were signed by the delegates of all the countries, about 30 in number, represented at the conference. At the request of the British Government the conference gave special consideration to the question of the use of wireless telegraphy for the prevention of disasters at sea, and passed unanimously a resolution, proposed by the British delegation, in favour of the principle of compulsory equipment of ships with wireless telegraphy.

The new regulations contain several provisions intended to render more effective the service of wireless telegraphy in cases of distress at sea. Ships will in future be required to provide an auxiliary source of power able to work the wireless apparatus for at least six hours. This must be placed in as secure a position as possible, and must be entirely self-contained, so that an accident to the ship which stops the working of the ship's engines need not affect the wireless apparatus. Steps have also been taken to lessen the danger of distress calls going unheard by laying down rules as to attendance on the wireless apparatus in various classes of ships. On ships of the first class, a permanent watch will be required, and in this case two fully-qualified operators at least must be carried. On ships of the second class, where a permanent watch is not considered practicable, the operator must listen during the first 10 minutes of every hour. In the smallest ships (fishing boats, &c.) no regular periods of watch are prescribed. Each Government, in giving a licence to carry wireless apparatus, will determine in which of these three classes a ship is to be placed. Rules have also been made for both ship and shore stations to suspend work and to listen at the end of each quarter of an hour in cases where it is likely that distress calls might otherwise not be heard. To prevent confusion, the ship in distress will, in future, have control over the wireless working of all stations in its vicinity, while the operators on every ship are now specifically placed under the authority of the captain.

Numerous other changes have been made in the regulations, with the object of promoting the smooth and expeditious working of the service. All the countries concerned have now agreed that all ships shall be under the obligation to intercommunicate with one another, irrespective of the system of radio-telegraphy employed. It was decided that it would be premature to attempt to lay down regulations for long-distance service between land stations, and it is expressly agreed that each country remains free to organise services of this nature as it thinks best, the only principles laid down being that interference between different stations must be avoided as far as possible, and that differences in the system of wireless telegraphy employed must not be a basis for refusing intercommunication.

The American delegation conveyed an invitation from their Government to hold the next Conference in Washington, which was unanimously accepted, and 1917 was fixed as the date at which it will be held.

Italy.—The Government has entered into a contract with the firm of Siemens for the erection of two automatic telephone exchanges in Rome, making provision for 2,000 subscribers.—*G. dei Lavori Pubblici.*

Japan.—The Department of Communications has decided to lay a submarine telephone cable between Aomori and Hakodate. The work is expected to cost about £10,000.

Spain.—A wireless station has just been completed on the Island of Santa Isabel which will be able to communicate with that at Duala, the capital of the Spanish possessions in Guinea, and thence to Madrid.—*Industria e Invenciones.*

The Ministry of Marine has obtained a grant of 570,400 pesetas (about £21,000) in connection with renewing and repairing submarine cables.—*Board of Trade Journal.*

Telegraphic Addresses.—Owing to the large number of telegraphic addresses in use in London, delay is incurred in consulting the records, and the Postmaster-General announces that on August 1st a new system will be introduced, according to which an "indicator" word will be included (free) in the telegraphic address, enabling the staff to dispatch a telegram to the appropriate office of delivery without reference to a directory. The adoption of the system, for the present, will be optional.

Wireless Telegraphy.—A correspondent informs us that a French inventor has succeeded in dispensing with all exterior wires and antennæ for receiving wireless signals, by producing a detector far in advance of any in use at present in point of sensitiveness. Our correspondent states that while travelling in France he studied these latest discoveries with Mons. Duroquier, the inventor, and made some interesting experiments, listening to wireless messages from all parts. The most valuable of the discoveries made by Mons. Duroquier is that of a substance which far exceeds in sensitiveness any at present in use for receiving the sound waves; this is incorporated in a new pattern of detector, which cannot get out of order, and is mounted on a base 6 in. × 4 in. in size. With the aid of ordinary telephone receivers of 500 ohms resistance, messages can be received from all over the world. The writer says he listened to messages sent from Ireland, Gibraltar, and the Eiffel Tower, and read the Marconi news-bulletin sent out to all ships at sea which subscribe to the

"Marconi News"; all these messages were received without antennæ or wires to pick up the waves and with no apparatus but the sensitive detector, the coil for "finding" the station and the head receivers, the whole apparatus costing about £2. At night-time, when the conditions of the atmosphere allows of it, signals can even be heard from Canada. These statements are certainly very remarkable; we do not say incredible, for wireless telegraphy itself would have been derided not so very long ago, but confirmation of so startling a report is necessary before it can be accepted.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—July 29th. (*a*) Additional plant at the generating station; (*b*) construction and equipment of tramways and railless system for the U.D.C. See "Official Notices" July 5th.

Ashton-under-Lyne.—July 30th. One 100-K.W. motor-generator, one fuel economiser, two boiler feed pumps, coal elevator and conveyor and ash elevator, for the Corporation. See "Official Notices" July 5th.

Australia.—WESTERN AUSTRALIA.—July 31st. Post-master-General's Dept. Telegraph and telephone material. See "Official Notices" June 21st.

NEW SOUTH WALES.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Post-master-General's department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

TASMANIA.—August 26th. Accumulators for main telegraph circuits and motor-generators for the P.M.G.'s Department. See "Official Notices" to-day.

Barnsley.—July 20th. Electric wiring and fittings at the Workhouse. Mr. C. J. Tyas, clerk to the Guardians, Union Offices, Pitt Street.

Bristol.—July 22nd. Coal-elevating and conveying plant at the Avonbank electricity works, for the Corporation. See "Official Notices" to-day.

Canada.—August 1st. One 500-KW. steam-driven generating set, for the City Commissioners, Moose Jaw, Sask. See "Official Notices" to-day.

Dublin.—July 18th. Transformers, for the Corporation. See "Official Notices" July 5th.

July 19th.—Board of Public Works. Electric lighting of Fitzgibbon Street police barrack and station. Plans and specification to be seen at Office of Public Works, Dublin, where printed forms of tender can be had.

July 24th.—The South Dublin Guardians invite tenders for electric motors for driving the laundry and bakehouse machinery. Specification can be seen at the office of Mr. John P. Condon, clerk of the Union, 1, James's Street Dublin.

Enniscorthy.—July 17th. Continuous-current motor, for the District Asylum. See "Official Notices" July 5th.

Italy.—SPEZZIA, NAPLES and VENICE.—July 22nd. Tenders are invited for the supply of electric lanterns to the Royal Arsenals to the amount of £1,600; deposit £160. Particulars from the Direzione Generali dei R. R. Arsenali, Spezzia.

London.—ISLINGTON.—July 24th. One 3,000-KW. steam turbo-alternator, with exciter, condensing plant, switchgear, piping, &c., for the B.C. See "Official Notices" June 14th.

H.M. OFFICE OF WORKS.—July 18th. Arc lamp carbons for two years. See "Official Notices" July 5th.

Manchester.—July 16th. Permanent way special track work for the Corporation Tramways Committee. Mr. J. M. McElroy, general manager, 55, Piccadilly. (Returnable deposit £2 2s.)

Newcastle-under-Lyme.—July 15th. 1,000 yd. of V.B. mains, for the Corporation. See "Official Notices" July 5th

New Zealand.—August 16th. Electric motor and induced-draught fan for Christchurch City Council. Tenders to City Surveyor. Deposit £5. Copy of specification can be seen at Board of Trade Commercial Intelligence Department, London, E.C.

Nuneaton.—July 16th. One electrically-driven turbine type boiler feed pump, &c., for the Corporation. See "Official Notices" July 5th.

Pembroke.—July 15th. Electric lighting and other works in connection with 43 dwellings for the working classes at Beatty's Field, Ball's Bridge. Mr. S. L. R. Price, electrical engineer. Plans, &c., at Town Hall, Ball's Bridge, Pembroke, Co. Dublin. Tenders to Chairman of Housing Committee.

Rochdale.—July 17th. Steam coal for a year for the Corporation electric power station, Dane Street, and paper-insulated cables for a year. Mr. C. C. Atchison, engineer and manager, Dane Street. (Returnable deposit of £2 2s. in the case of the cable contract.)

Salford.—July 25th. Electric light, telephone and fire alarm installations at the Union Infirmary, Hope, Pendleton, for the B. of G. See "Official Notices" July 5th.

Spain.—The municipal authorities of Calanas (province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of 20 years.

Walsall.—July 30th. High and low-tension switchgear for the Corporation. See "Official Notices" to-day.

Walthamstow.—July 19th. Extra-high-tension and low-tension cables, for the U.D.C. See "Official Notices" July 5th

CLOSED.

Blackburn.—The T.C., on July 4th, decided to accept the tender of Mr. T. Speak, Blackburn, for electric lighting, &c., at the Finnington Infectious Hospital.

Brighton.—Messrs. F. Reid, Ferens Co., steeplejacks, Sunderland, have secured the contract for the repainting of the steel chimneys at the Southwick power station.

Canterbury.—The T.C. has accepted the tender of Mr. G. E. Dashwood, for electrical work for six months; and that of Mr. Philpot, of Canterbury, at £40, for electrical illuminations during Cricket Week.

Dartford.—The U.D.C. has accepted the tender of Messrs. Cox-Walkers, Ltd., for a switchboard and motor-generator, at £816.

Italy.—The Italian Westinghouse Co. has secured contracts for the supply of four transporters and three 10-ton lifts, at the price of £560 each; also those for electric material, to the value of £484.

Japan.—The order received by Messrs. Dick, Kerr & Co., Ltd., for six alternators aggregating 60,000 H.P. for an important Japanese hydro-electric power company, which was mentioned here last week, follows on the firm's recent success in obtaining an order from the Japanese Government for four large gas engine-driven alternators for railway work. A correspondent writes:—"It is particularly gratifying at the present time, when so much is heard of the competition, and even the alleged superiority of foreign electrical manufacturers, that such an important order should be secured by a firm which is not only British in name, but also in origin."

Newcastle-on-Tyne.—The following tenders have been accepted by the Corporation, viz:—

Lorain Steel Co.—Tramway junction, £1,423.
E. Allen & Co. Ltd.—Tramway crossings, passing places and fish-plates.

Sheffield.—The T.C. has accepted the tender of Messrs. Steel, Peech & Tozer, Ltd., for 750 tons of tramway rails; also the tender of the Cavendish Electrical Co., at £58, for supplying and fixing a new reclining electric light bath at the Glossop Road Baths. The tender of Messrs. Gilbert Heathcote & Co. has been further accepted, at £963, for roof principals and structural steelwork for the proposed extensions to the engine-room at the Neepsend power station.

Stockport.—The T.C. has accepted the following tenders:—

Brush Electrical Engineering Co., Ltd.—Three railless trolley cars, £682 each.
Belliss & Morcom, Ltd.—1,500-KW. mixed pressure turbo-alternator and condenser, £5,763, and 500-KW. engine, including brake tests and supervision of erection, £1,743.

Walsall.—The T.C. has accepted the tender of Messrs. Vickers, Ltd., at £692, for a rotary converter and transformer at Darwall Street sub-station, for traction supply; also that of the British Westinghouse Electric & Manufacturing Co., at £275, for the necessary switchgear and connections.

London.—Stepney.—The B.C. Electricity Committee received the following tenders for fuse boxes for the period ending June, 1915 :—

Crompton & Co., Ltd. (recommended)	£285
Henley's Telegraph Works Co.	293
Siemens Bros. & Co., Ltd.	324
British Insulated and Helsby Cables, Ltd.	327
Reyrolle & Co., Ltd.	404
Reason Manufacturing Co., Ltd.	415
Edison & Swan United Electric Light Co., Ltd.	474
Johnson & Phillips, Ltd.	582

The following tenders were submitted for meters during the period ending June 30th, 1914 :—

From 2½ to 10 amperes.

Bastian Meter Co., Ltd. (do not comply with specification; no samples submitted)	£295
W. Geipel & Co. (do not comply with specification; no samples submitted)	307
Siemens Bros. Dynamo Works, Ltd.	*345
Reason Manufacturing Co., Ltd. (recommended)	362
British Westinghouse Electric and Manufacturing Co., Ltd.	405
Isaria, Ltd.	537
British Thomson-Houston Co., Ltd.	545
G. Braulik	575
Ferranti, Ltd.	605
Venner & Co.	605
Landis & Gyr	675
General Electric Co., Ltd.	752

* Do not comply with specification. Drop at full load exceeds specified amount. Dial not to specification. Commutator type.

From 25 to 100 amperes.

Bastian Meter Co., Ltd. (do not comply with specification; 20-amp. capacity only tendered for; no samples submitted)	£152
W. Geipel & Co. (do not comply with specification; no samples submitted)	255
Reason Manufacturing Co., Ltd. (unsuitable)	415
British Thomson-Houston Co., Ltd.	431
Isaria, Ltd. (no samples submitted)	431
British Westinghouse Electric and Manufacturing Co., Ltd. (do not comply with specification; no samples submitted)	449
G. Braulik (no samples submitted)	465
Venner & Co. (recommended)	479
Ferranti, Ltd.	479
Siemens Bros. Dynamo Works, Ltd.	501
General Electric Co., Ltd.	589

For demand indicators required during the same period the tenders were :—

2½ to 100 amperes capacity inclusive.

Venner & Co. ("Lackie" type to be used in connection with Chamberlain & Hookham meters; no samples submitted)	£409
Reason Manufacturing Co. (recommended)	687
General Electric Co., Ltd. ("Merz" type, including Aron meter in one instrument)	3,156
British Insulated and Helsby Cables, Ltd. (unable to comply with specification)	Informal

The following firms quoted for time switches for the same period :—

From 10 to 25 amperes capacity inclusive.

"X.L." Electric Co. (do not comply with specification)	£205
Reason Manufacturing Co., Ltd. (recommended)	275
W. Geipel & Co.	372
Ferranti, Ltd.	425
General Electric Co., Ltd.	430
Venner & Co.	430

Above 25 amperes and up to 100 amperes.

"X.L." Electric Co. (no samples submitted)	£41
W. Geipel & Co.	49
Ferranti, Ltd. (no samples submitted)	62
General Electric Co., Ltd. (no samples submitted)	67
Venner & Co. (recommended)	67
Reason Manufacturing Co.	69

For carbons required during the period ending June 30th, 1913, the offers were :—

Scholey & Co. (no samples received)	£891
Ship Carbons, Ltd. (burning hours 8 per cent. short)	891
Electrical Engineering and Equipment Co., Ltd. (no samples received)	955
Engineering and Arc Lamps, Ltd. (no samples received: open type Conradty or equal flame 23½ and 20 in. Siemens; flame 16 in. Ship)	977
Sloan Electrical Co., Ltd. (recommended)	1,014
W. Geipel & Co.	1,018
" " (alternative)	1,043
C. W. Webster	1,105
J. & H. Grevener (Conradty)	1,117
Johnson & Phillips, Ltd. (Conradty make; prices on "flame" for not less than 50,000 pairs)	1,129
Crompton & Co., Ltd.	1,178
General Electric Co., Ltd.	1,231
Siemens Bros. Dynamo Works, Ltd. (Siemens's make)	1,290

Tenders for coal have also been opened, and a number accepted.

L.C.C.—The Highways Committee has accepted the tenders of Messrs. Pinchin, Johnson & Co., Ltd., and the Maritime and General Improvements Co., Ltd., for insulating varnishes.

The Highways Committee received the following tenders for low-tension cables, &c., for the tramways :—

Johnson & Phillips, Ltd. (recommended)	£6,663
British Insulated and Helsby Cables, Ltd.	6,748
Western Electric Co., Ltd.	6,750
Siemens Bros. & Co., Ltd.	6,750
Callender's Cable and Construction Co., Ltd.	6,820
W. T. Glover & Co., Ltd.	6,869
W. T. Henley's Telegraph Works Co., Ltd.	6,893
Estimate of Chief Officer	6,400

Hackney.—The Electricity Committee recommends that tenders be accepted as follows :—

Leeds Fireclay Co., Ltd.—"V" shaped troughs (certain sizes).
T. Wragg & Co.—"V" shaped troughs (certain sizes).
Key Engineering Co.—Conduits.
J. Joberns & Co.—Blue Staffordshire tiles.

The contract with the Dussek Bitumen Co. for box compound is to be continued for a further period of three years.

Battersea.—The tender of the Foster Engineering Co. has been accepted by the B.C. for the supply, for another year, of the metallic-filament lamps required for public street lighting; also the tender of the Underfeed Stoker Co., Ltd., at £328, to fit a mechanical stoker, complete with motor-driven fan and control gear, to a boiler at the central station.

West Ham.—The Electricity Committee has accepted the tender of Messrs. Whipp & Bourne for switchgear for the works power distribution boards at the generating station; that of Messrs. Babcock & Wilcox, at £826, for the main economiser floor for three boilers, with cast-iron gratings for two only, in connection with the generating station extensions; and the tenders of Messrs. J. P. Hall and Co. and Messrs. G. & J. Weir, at £272 and £306 16s. respectively, for boiler feed pumps.

Worksop.—The U.D.C. has accepted the tender of Messrs. Willans & Robinson, Ltd., for condensing plant, at £829; that of Messrs. W. T. Glover & Co., Ltd., of Manchester, for cables for two years, at £613; and that of Mr. A. Chadwick for building a battery room, at £268.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, July 12th. Visit to the works of the Marconi Wireless Telegraph Co., Chelmsford. Leave Liverpool Street at 10.55 a.m.

NOTES.

Electrical Trades Benevolent Institution.—We have received from the secretary of the Institution, Mr. F. B. O. Hawes, of 18, Park Mansions, Vauxhall Park, S.W., two leaflets, one of which briefly explains the objects of the Institution, and the privileges of contributors and members respectively, while the other sets forth the purposes and advantages of collectorship. Any of our readers who will assist in circulating these leaflets, and in seeing that they reach the right hands, will have the satisfaction of knowing that they are doing good service in the interest of their fellow-men, particularly those who are in distress, without cost to themselves. The leaflets can be obtained by applying to the secretary.

The first of the collecting books to be completely filled has been received by Mr. Hawes: the amounts are all small, none exceeding 6d., but they make a substantial aggregate. They were contributed by the staff of a firm, and the example thus shown may well be followed by other collectors in similar circumstances.

Electricity Supply Rifle League.—The following are the results of the matches shot during June in connection with the above League :—Central (Gaze 96) 557, *v.* Ilford 542; Hackney (Self 96) 537, *v.* Ilford (Hall, McKelvey 88) 503; Hackney (Self 95) 559, *v.* Westminster (Partridge, Winchcombe 97) 572; Shoreditch (Weeks 98) 557, *v.* Stepney (Barber 98) 537; Shoreditch (Weeks 99) 558, *v.* Westminster (Foster 98) 569; Ilford 548, *v.* Stepney (Barber 95) 553.

Position of Clubs to Date.

Club.	Matches. Shot.	Won.	Lost.	Drawn.	Points.	Scores. For.	Against.
Westminster ...	5	5	0	0	10	2,846	2,737
Central ...	5	4	1	0	8	2,783	2,735
Shoreditch ...	5	3	2	0	6	2,782	2,725
Hackney ...	5	1	3	1	3	2,712	2,722
Stepney ...	5	1	3	1	3	2,709	2,771
Ilford ...	5	0	5	0	0	2,641	2,783

Accidents in London.—Mr. Kellaway asked the Home Secretary to state the number of motor-omnibuses and electric tramcars running in the Metropolitan police area for the first six months of this year, and how many deaths were caused by each type of vehicle during the same period.—Mr. McKenna replied that the number of motor-omnibuses was 2,461 and of electric tramcars 2,661. During the six months ending June 31st, 1912, 81 fatal accidents and 1,605 accidents involving personal injury were caused by these vehicles; 69 deaths were caused by omnibuses and 12 by tramcars. Personal injury was done in 793 cases by omnibuses and in 822 cases by tramcars.

Preventing Collisions at Sea.—Sir Hiram S. Maxim has published a pamphlet describing a new system which he has devised for preventing collisions at sea; he bases the invention on an alleged "sixth sense" possessed by bats, which are able to fly about in the dark without coming into contact with obstacles, and gives reasons for believing that the animals apprehend the presence of obstructions by the reflection of vibrations produced by their wings, the heads of many kinds of bats being equipped with organs of fantastic shapes but delicate perception for that purpose. The heads of many of these extraordinary bats are illustrated in the pamphlet. The inventor's proposal is to install on board ship large steam sirens, producing atmospheric vibrations of low frequency, and therefore inaudible. These vibrations will travel many miles, and will be reflected from bodies such as rocks or icebergs; the echo will be received on a large diaphragm, the vibrations of which may either close an electrical circuit and ring a bell, or trace a record on a travelling chart. In the latter case the interval between the dispatch of a train of waves and the arrival of the echo is a measure of the distance of the object. Sir Hiram believes that the system would be useful in preventing collisions with ships and icebergs, and wrecks on shore; but up to the present experiments have not been carried out with it at sea.

Appointments Vacant.—Assistant in the electrical department of the Great Northern Railway Co., Ireland (£120); assistant mains engineer, for the Fulham B.C. (£130); junior assistant in the engineer's department, Provincial Cinematograph Theatres, Ltd. (25s.); switchboard attendant, for the Harrow Electric Light and Power Co., Ltd. (25s.); assistant lecturer and demonstrator in the Electrical Engineering Department, Battersea Polytechnic (£120). See our advertisement pages to-day. The L.C.C. is about to invite applications for the position of a chief engineer to fill the position from which Sir Maurice Fitzmaurice is retiring. The salary will be £2.000 a year.

Tramway Sports.—The eighth annual amateur athletic sports of the Croydon Corporation Tramways Athletic Club were held on Wednesday afternoon on the Brighton Railway Athletic Club's Grounds at West Croydon. Among the events was a mile flat race for a Tantalum Challenge Cup presented by Messrs. Siemens, and an 18 miles Marathon race. The Croydon Corporation Tramways Military Prize Band (bandmaster, Mr. W. Ellis) was in attendance. Mr. T. B. Goodyer, the Corporation tramway manager, is president of the club.

Educational University of Bristol.—The session in the faculty of engineering will commence on Tuesday, September 17th. See our advertisement pages to-day.

Compressed-Air Explosion at Bray.—As we go to press we learn from the *Daily Telegraph* that a disastrous explosion occurred at the Bray electricity works on Wednesday morning, resulting in the death of one man and serious injury to others. A fitter named Coates was engaged in transferring compressed air from one "bottle" to another when an explosion occurred, and Coates was literally blown to pieces, the upper and lower parts of the body being severed. Mr. Sowter, the electrical engineer and manager, had his feet blown away, and Mr. McDonnell, his chief assistant, also suffered serious injuries. At the moment further details are wanting, and we do not know whether the explosion was due to the presence of oil in the air-tanks or to failure of one of the tanks. We are deeply grieved to have to record so sad an event.

Westminster Abbey Memorial to Lord Kelvin.—The President and Secretary of the Institution of Electrical Engineers have issued a circular letter on behalf of a General Committee representing the Engineering Societies of the British Empire and the U.S.A., which has been formed to carry into effect a proposal for the erection in Westminster Abbey of a memorial window to the late Lord Kelvin. As the movement is sure to receive widespread support, it is not necessary for individual subscriptions to exceed £2. Contributions should be sent to Dr. J. H. Tudsbery, hon. treasurer, 12, Dartmouth Street, Westminster, S.W., or to Messrs. Coutts & Co., bankers, 440, Strand.

Annual Outings.—The employés of Messrs. Page and Miles, Ltd., Brighton and Worthing, held their twenty-second outing on Saturday last. The party, numbering 75, accompanied by the directors, Messrs. J. W. Penfold (chairman), E. J. Page and H. J. Miles (managing directors), A. C. Ganson (secretary), and J. T. Baker (works manager), left by early morning train for Richmond, the Castle Hotel being the headquarters. Here they were joined by several London friends. After viewing the sights of Richmond, the party sat down to dinner. The toast of "The King" having been duly honoured, that of "The Firm" was proposed by Mr. F. Patching and responded to by the chairman in a happy little speech; in passing, he mentioned that another record had been established in the number present, and emphasised the good fellowship that existed between the firm and their employés. The toast of "The Works Manager" was proposed by Mr. F. Lowe, and Mr. Baker responded. The party then proceeded to board the launch in waiting for them, and went up to Sunbury Lock. Tea was partaken of on board. The return to Richmond was made in the cool evening. The outing was most successful, and the arrangements were admirably carried out by the works manager, Mr. J. T. Baker.

On Saturday last, the second summer fixture of the Batti-Wallahs' Society took place in the form of a launch excursion up river. The party left Richmond and eventually reached Walton Bridge, tea being taken *en route* at Tagg's Island Hotel. On the return journey, supper was taken, followed by an impromptu concert. The party returned to Richmond shortly before 9 o'clock. Some 42 members and their friends were present, including a very large proportion of ladies. This is the first occasion upon which the summer outing of the Society has taken the form of a launch excursion, and as it proved so successful in every way, it may be made an annual feature in future.

The staff of the Salisbury Electric Light Co., Ltd., recently paid a visit to Ryde (I. of W.) for their annual outing. The party numbered 25, and included Mr. A. B. Randall, engineer and manager, and Mr. C. Godwin, accountant. At the dinner, the directors were heartily thanked for generously providing the outing year after year.

On Saturday last, the whole of the employés of the Lancashire Dynamo and Motor Co. visited South Shore, Blackpool. Prior to the dinner they held impromptu sports on the sands opposite the Victoria Café, after which they adjourned to the Café for dinner. The men were accompanied by the directors and their wives.

Copper.—Messrs. H. Merton's statistical circulars for June 15th and 29th afford an interesting comparison of the movements of the market throughout the month. At mid-month we find supplies to Europe from North America 17,865 tons, which has risen to 32,140 tons, not quite double, by the end of the month. Spain and Portugal to England and France register 1,779 tons and 2,356 tons for the same periods; Chile shipments 2,900 and 4,400 tons, and Australia 2,000 tons and 3,650 tons. Total deliveries, mid-month 25,636 tons and end of month 45,845 tons. Stocks (visible supplies) dropped 1,959 in the first part of the month, and 2,995 tons by the end. Rotterdam stocks had lost 400 tons during the month and Hamburg 1,057 tons. American stocks fell 6,897 tons during May, and are now given as 22,151 tons. The world's supplies are 74,741 tons (May 31st) or less than half what they were at the same date last year.

Inquiry.—The present agents for the Moore Vacuum Tube lighting system in this country are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Last Saturday morning, at the headquarters of the West Ham Corporation Electricity Department, Stratford, a large gathering composed of all grades of the officers and employés of the department assembled to show MR. H. H. COUZENS, their retiring chief, the esteem in which they hold him, and the goodwill they desire that he should carry away with him, to his new post as engineer and manager of the Hampstead Electricity Department. The staff and employés presented him with a handsome gold stop watch, suitably inscribed. Mr. Gilbert, mains engineer, in making this presentation on behalf of the staff, gave utterance to the feelings of goodwill and respect in which Mr. Couzens was held by all those who had served under him at West Ham, and said that it was now three years since Mr. Couzens took up the threads of the great West Ham electricity undertaking, and that, during the period in question, the department had made most substantial progress in all directions. There had been a considerable increase in generating plant and extensions to the mains, necessitated by the large number of new customers the department had gained and the remarkable development of the selling side of the business generally, as expressed in the millions of extra units being disposed of to-day as compared with the output three years ago. Mr. Couzens, in replying, expressed his thanks for their good wishes and for the very handsome gift, which, in the days to come, he should always treasure as a pleasant reminder of his tenure of office in West Ham. Mr. Couzens also thanked every member of the staff for their hearty co-operation with him in making the West Ham undertaking an electrical and financial success, and though great progress had been made since he came there, much still remained to be done, and even now this great undertaking could only be regarded as still in a stage of transition, but he had no doubt that eventually the utmost success would attend the efforts of all those who worked for its development; in fact, he regarded the future of West Ham, from every standpoint, as being an exceedingly bright one, and trusted that all those who were employed in this department would do their best to ensure its success. The proceedings closed by three hearty cheers being called for and given for Mr. Couzens, followed by the singing of "He's a Jolly Good Fellow."

Despite opposition from the Labour Party, Blackburn T.C., on July 4th, agreed to the proposal to increase the salary of the electrical engineer, MR. P. P. WHEELWRIGHT, from £500 to £700 by four yearly increments of £50. The resolution was carried by a large majority. The opposition was led by Mr. Higham (Labour leader), who paid full tribute to the engineer's abilities, but said £500 was as much as Blackburn ought to pay for the post. He disagreed with the policy, and contended that they ought not to exceed the maximum of £500 fixed some years ago. Ald. Hamer (Liberal leader) said having regard to the fact that other towns the size of Blackburn paid £700 a year, and that the cost of living had increased to professional men, just as it had to the working classes, he did not think £700 too large a stipend. Ald. Thompson said the electrical engineer was the responsible head of a great undertaking, representing a capital of £350,000, and the salaries for officials in such positions ruled nearer £1,500 than £500.

Newport (Mon.) T.C. has appointed MR. D. C. HENDERSON, of Grimsby, as engineer-in-charge at the electricity works.

The General Purposes Committee of Poplar B.C. have decided to promote MESSRS. V. H. CRUIKSHANK and E. R. INGRAM, station superintendent and managing superintendent respectively, to a higher grade, whereby they will receive a salary of £200, rising to £250 per year each, as against their present salaries of £150 to £200.

The salary of MR. A. S. BARNARD, electrical engineer, of Walsall, is, subject to the usual sanction, to be increased from £450 to £500 per annum.

The Electric Lighting Committee of West Ham Town Council has decided to increase the salary of Mr. F. Farndon, sales manager, from £300 to £350 per annum, by annual increments of £25.

Mr. A. W. Brealey, of Willesden, has been appointed assistant meter inspector at the Watford U.D.C. Electricity Works.

The *Review of the River Plate* states that Mr. Pakenham W. Beatty has been appointed manager and engineer of the Tucuman station of the River Plate Electricity Co., Ltd.

The Bolton T.C. Electricity Committee has increased the salary of Mr. B. S. Hornby, chief assistant electrical engineer, from £220 to £230, and that of Mr. W. J. Wood, station engineer, from £240 to £250.

General.—Mr. F. Harrison notifies us that his connection with Metalite, Ltd., as engineer and works manager, has ceased.

Mr. Donald McPherson, an electrical engineer, while residing in Crieff, Perthshire, on holiday, made a gallant attempt to rescue a boy who had gone beyond his depth while bathing in the Earn. Twice Mr. McPherson dived into the deep pool in the hope of effecting a rescue, but ultimately he had to give up the task. The boy's body was recovered by the police.

Mr. Jas. Culshaw, of Dewsbury, has been appointed chief inspector under the Electric Traction Co., of Peterborough.

The British Electric Traction Co., Ltd., announces that Mr. C. H. Dade, formerly secretary of the company, and Mr. R. J. Howley, M.I.C.E., formerly chief inspecting officer of the company, have been appointed joint managers. Mr. Thomas Bower has been appointed secretary *pro tem.*

Mr. A. Bromley Holmes, consulting electrical engineer to the Liverpool Corporation, is retiring after a lengthy and distinguished career. Mr. Holmes was born in 1849.

We are pleased to record the appointment of Prof. C. A. M. Smith, M.Sc., as Professor of Mechanical and Civil Engineering in the newly-created University of Hong-Kong. During the last five years Prof. Smith has been working at the East London College, University of London, where his researches have resulted in the publication of many scientific papers in connection with tests on the strength and elasticity of materials. Prof. Smith has frequently contributed original views upon the subject of technical education to our pages, and is a prolific writer on engineering questions. A few days ago the staff of the East London College presented him with a silver tea set, in token of the high esteem in which he is held.

Obituary.—Mr. W. R. Thornton, the oldest-established electrician in Barrow, died on Saturday last at his residence after a somewhat lingering illness. Deceased had a seizure some five years ago, and had been attacked similarly since on different occasions. For the last 12 months he has been practically confined to the house. Mr. Thornton was 72 years of age, and he went to Barrow from Burnley 40 years ago. The business in Ramsden Square, Barrow, is now conducted by his son. Mr. Thornton since 1870 had been in business on his own account. He completed many important electrical installations in the borough.

CITY NOTES.

Durham Collieries Electric Power Co., Ltd.

The directors' report for the year ended September 30th, 1911, states that the trading account showed a profit of £4,215, but after charging head office expenses, cable rentals, fees of trustees for debenture-holders, and rent and royalty to the Sunderland District Electric Tramways, Ltd., this profit was reduced to £850. Against this amount must be debited the charge for prior lien bond and debenture interest for the year under review, with the result that there was a loss of £10,295. There was a considerable improvement in the sales of current for the year, but, owing to the prices obtained and the arrangements made for the generation and distribution, the results were approximately the same as the previous year. The report which was received from an independent electrical engineer was of a disappointing character, and it had been laid before a committee of debenture-holders. This report showed that there was no prospect of the company, under existing contracts and arrangements, making sufficient profit to meet the interest on the debentures. Negotiations had, therefore, been entered into with a view to a sale of the company's undertaking being effected. It was proposed that the company should go into voluntary liquidation, and the formal resolution with regard to this formed part of the notice convening the meeting.

The ordinary general meeting was held on July 4th, at Basildon House, Moorgate Street, E.C., Mr. A. W Tait presiding.

The Chairman, in moving the adoption of the report as above, said that the company had again made a loss, after charging debenture interest, of £10,295. In consequence of the report which the directors obtained from an independent electrical engineer, Mr. Chamen, the prospects were so unsatisfactory that the position was placed before the debenture-stockholders' committee, and an endeavour was made to try and arrive at a settlement by means of getting some amelioration of the conditions under the contracts, but that was found impossible. They afterwards entered into negotiations with the Newcastle-on-Tyne Co. for the sale of the undertaking to that company, and it looked as if those negotiations might be successfully completed. He was afraid that the property would have to be sold at a price which would leave nothing whatever for the shareholders—in fact, there would be a substantial loss to the debenture-holders. The report which they received from Mr. Chamen showed that not only was the position of the company unsatisfactory at the moment, but even if the load grew there was no great prospect of better results. That he thought was due to the mistake which was made originally with regard to the load factor at collieries which had turned out to be considerably less than was anticipated.

Mr. T. O. Callender seconded the motion, and the report was adopted.

An extraordinary meeting was subsequently held, when a resolution was unanimously agreed to for voluntarily winding-up the company and appointing Mr. A. W. Tait as liquidator.

Electric Construction Co., Ltd.

The directors report that the net profit for the year, after payment of £7,192 for debenture interest, and crediting £5,000 as formerly to depreciation account, is £20,364. The sum brought forward from last year is £6,131, and the amount available for distribution is therefore £26,496. The directors recommend that this amount be appropriated as follows:- Dividend of 7 per cent. per annum on the preference shares (whereof a moiety was paid on January 31st), £4,395; dividend of 3¾ per cent. per annum (1s. 6d. per share) on the ordinary shares, £8,407; transfer to general reserve fund (which will then amount to £33,000), £8,000; balance carried forward £5,694. The increased demand for electrical machinery has been maintained during the past year, and the company's works have been fully employed during the entire period. Consequently the profits again show an improvement, and enable the directors to recommend an increased dividend on the ordinary shares. Since the close of the financial year the directors have redeemed £7,700 of the company's 4 per cent. debenture stock at a favourable price. The total amount of the debenture issue is now £175,000, as compared with £250,000 three years ago. The directors report, with much regret, the death of their chairman, Mr. W. S. B. McLaren, M.P., which took place on 29th ult. They have elected Sir Irving Courtenay, Kt., as his successor.

The meeting is called for July 18th at Winchester House, E.C.

Prospectuses.—*Ceara Tramway, Light and Power Co., Ltd.*—The list of applications is to close to-day in an issue of £250,000 5 per cent. first debenture stock, which is being offered at 92½ per cent. by Parr's Bank, Ltd. Purchasers are entitled to a bonus of 10 per cent. in fully-paid ordinary shares. The company has acquired the mule tramways in the city, and has a concession for the electrification and working thereof for 76 years, also for the establishment of an electric light and power installation, at the City of Fortaleza, the capital of the State of Ceará, Brazil. A report on the schemes has been drawn up by Mr. J. K. Bock (McCarter & Kerr Bock, consulting engineers, London), and this is quoted from in the prospectus. The electrical plant and equipment will be supplied by Messrs. Dick, Kerr & Co., Ltd., and the contract is to be completed by March, 1913. Mr. A. A. C. Swinton is one of the directors of the company.

The General Electric Co., Ltd.—The prospectus mentioned by Mr. Hirst in his speech at the annual meeting of this company, reported on another page, is now before the public, and the list is to close to-day (Friday). It offers for subscription £150,000 in 15,000 preference shares (6 per cent. cumulative) of £10 each to provide additional working capital for the carrying on and extending of overseas trade through the medium of the company's various subsidiary and allied companies, and also for the extension of the G.E.C. factories. The progressive operations of the company are well known to our readers, and as we have already said, its doings in the Colonies and abroad ought to bring in a large amount of profitable business for many years to come.

Major & Co., Ltd.—This company is offering 50,000 7 per cent. participating preferred ordinary shares of £1 each for subscription. The list closes on Tuesday next.

City and South London Railway Co.—The accounts for the half-year to June 30th show a balance, after providing for the debenture stock interest, the payment of the dividend on the 5 per cent. preference stocks, 1891, 1896, 1901 and 1903, and the transfer to the renewal fund of £1,500, sufficient to allow the payment of a dividend on the consolidated ordinary stock at the rate of 1¼ per cent. per annum, carrying forward £2,194. The dividend for the corresponding half-year was at the rate of 1¾ per cent. per annum, carrying forward £2,797.

Dublin United Tramways Co. (1896), Ltd.—The directors recommend dividends at the rate of 6 per cent. per annum, less income-tax, on both the preference and ordinary shares for the half-year to June 30th. £10,000 is placed towards the renewal of rails, £1,000 to accident insurance reserve, and £11,234 is carried forward.

National Electric Supply Co., Ltd.—The directors have declared an interim dividend of 3s. per share on the ordinary shares for the half-year ended June 30th.

Madras Electric Supply Corporation, Ltd.

The directors in their report stated that during the year ending December 31st, 1911, the number of units of electrical energy sold was 2,583,326, compared with 1,882,787 units sold in 1910, an increase of 700,539. 319 new consumers came on to the company's mains during the year.

Year.		Consumers.	Equivalent in 8 c.p. lamps.	Units sold.	Gross revenue.
1909		[illegible]	[illegible]	[illegible]	[illegible]
1910	..	719	75,829	1,882,787	£17,454
1911	..	1,038	105,737	2,583,326	£25,898

The agreements with certain large consumers referred to in the circular to the shareholders in December last should come into operation during the current year, and connection to one consumer has already been made which will ensure an additional annual output of over 500,000 units. The board regret that in spite of the new connections and the growth of business, the improvement in net revenue does not come up to their expectations. The directors have, in conjunction with the company's consulting engineers, Messrs. Merz and McLellan, reviewed the whole position, and have come to the conclusion that to enable the company to cater successfully for the demand for power, it is imperative to extend the plant and reduce the generating costs. With this in view, the consulting engineers have prepared plans and specifications. To carry out these proposals and to provide for further extensions to mains, additional capital will be required, which it is proposed to raise out of the proceeds of the sale of a further £117,500 6 per cent. debentures at 91. These debentures, together with those now outstanding, will be secured by a trust deed, and a sinking fund of 2 per cent. will be created for the redemption of the whole. The board have also decided to advise the purchase of all the ordinary capital of the Madras Electric Tramways (1904), Ltd., for the sum of £102,500, to be satisfied by the issue to the owners of these shares of £2,500 6 per cent. debentures and £100,000 6 per cent. preference shares of the Madras Supply Corporation, becoming cumulative after January, 1914, and entitling the holders at any time within ten years to elect that such shares are to cease to be preference shares and are to become ordinary shares, ranking *pari passu* with the existing ordinary shares in the capital. This purchase will secure to the Supply Corporation the entire reversion of the tramway profits. The company already supplies the whole of the power required by the tramways, which is steadily increasing; the system has now 21¼ miles single track, and further considerable extensions are under consideration. The directors, therefore, recommend the acceptance of these proposals which are now submitted for the approval of the shareholders.

Messrs. Merz & McLellan, in their report, state that the development scheme involves not only the extension of the cable system so as to cover a larger area, but also alterations and additions to the existing generating plant so as to lower the cost of production and enable electricity to compete successfully with other forms of motive power. The plans they have prepared contemplate the extension of the power station buildings to accommodate three new boilers with their auxiliary plant and chimney, and three turbo-alternators with condensing plant and other auxiliaries. Their estimate of the cost of these alterations and additions is £65,000, and with this expenditure the company would have a modern and efficient generating plant permitting of economical extension and capable of dealing adequately and in a remunerative fashion with any load which might offer in Madras. This figure does not provide for mains extensions. Messrs. Merz & McLellan say that from the estimates of net revenue of the Tramway Co. which have been submitted to them, and which, from their inspection of the Tramway Co.'s weekly returns appear to be substantially correct, they are of opinion that this undertaking is an improving property, and that the amount available for payment of dividend on the ordinary shares acquired by the Electric Supply Corporation will not only provide for the dividend upon the preference shares issued in exchange for the Tramway Co.'s ordinary shares, but will leave a substantial margin at the disposal of this company. Taking into account both the increased profits on the supply of electricity due to increase of business and reduction of costs, and the dividends on the ordinary tramway shares, they are of opinion that by the end of the first complete year of working with the new plant, the company should be earning sufficient revenue to cover both debenture interest and preference dividend, and to leave over a substantial sum for depreciation and the commencement of a dividend upon the ordinary shares.

The ordinary meeting of the shareholders of the above company was held on Friday last at the offices, Queen Victoria Street, E.C., Mr. A. M. H. Walrond presiding.

The Chairman, in moving the adoption of the report, and the approval of a scheme for purchasing the ordinary shares of the Madras Electric Tramways Co., said the total expenditure on capital account, amounted to £329,090, of which £17,233 was expended last year, the largest item being £10,851 on mains. They had sold £6,020 worth of fans. He was glad to say that the sale of fans was steadily increasing, and he hoped another 12 months would see all, or most of them, sold, and earning revenue for the company. During the last six months of 1911, 476 fans were sold, and 676 had gone off already this year up to May 3rd. The receipts for current showed a very material increase, and now amounted to £23,351, and there was every indication that this increase would be more than maintained, as several good customers would come on the mains during the coming year. They were perfectly satisfied with the progress they were making in this direction. The total costs had increased by nearly £6,000, out of which the repairs and maintenance of the plant and mains represented £2,136. The balance showed a working profit on the account of £2,621, against £28 last year. They would gather from the report that the directors were dissatisfied with this result. The generating plant had proved itself disappointingly expensive in coal consumption, wages, and maintenance, making it clear to the board that the existing plant could not profitably deal with the large field of power which they knew existed in Madras. The directors, therefore, reviewed the whole position with their consulting engineers, the outcome of which was the scheme which they laid before the shareholders. They naturally hesitated a considerable time before suggesting the raising of a further large sum in debentures. They might possibly have been content with a smaller amount to keep themselves going, relying on the increased connections to increase their profits. Messrs. Merz and McLellan, however, pointed out that the road to success lay in reducing their generating costs, and this they could not expect to do to any appreciable extent with the existing plant. Since that plant was designed there had been great strides in electrical matters, and the consulting engineers informed them that if they allowed them to modernise the plant these costs could be reduced very materially. They also pointed out that with their present costs it was impossible to compete successfully with other methods of producing cheap power, for which there was a very great demand in Madras. If they could place themselves in a position to capture the trade it would be worth their while making a great effort to do so. The scheme which Messrs. Merz and McLellan suggested, and which the board had every confidence in recommending the shareholders to agree to, was, in their opinion, the quickest way to earn the dividend which they had so long waited for. That could only be done by largely increasing their output, and the scheme would enable them to do that without increasing their present total costs, and they would also be in a position to deal with many consumers of power who, when the plant was first erected, they hardly contemplated being able to supply. Part of the scheme involved the purchase of the ordinary shares of the Madras Electric Tramways Co. That involved a very large question, and had received most serious consideration by the board. The price which it was suggested they should pay—£102,500—at first sight seemed large, but it was necessary in such a matter to take a comprehensive view of the whole situation, and in their opinion, taking everything into consideration, they had confidence in recommending that part of the scheme to the shareholders. The tramway company had from the first been very closely connected with them. They had the contract to supply them with all the current they required; they had just been putting their house into good order, and he believed they were just at the commencement of a very rapid growth in the business. They had 23¼ miles of single track, and the receipts from passengers showed a large and steady increase, and he considered that there was a big field for tramway development in the city. The company had a comprehensive scheme of extension under consideration and if they agreed to the present scheme they would hold the reversion to all profits they might make in the future after their prior charges had been met. The board believed that in the near future they would receive an addition to their revenue considerably in excess of the interest charge involved in the purchase. The scheme for the sale of the debentures and the purchase of the tramways must be taken together, as the purchasers of the debentures stipulated as part of the bargain that the tramway shares should be part of the assets of the company.

Mr. J. G. B. Stone seconded the resolution.

Mr. Read said he did not quite understand why they should be asked to pay £102,500 for these Madras Tramway Co. shares, for according to the last report of the company they were valued at £57,000, taking them at par, and were producing 2 per cent. dividend.

Considerable discussion ensued on this matter, the proposal of the directors being strongly objected to. Col. Murray said there was a good deal about the scheme that had an unpleasant ring, and he hoped it would not be sanctioned.

Mr. Reeves said that as his name had been mentioned in the discussion as a former director, he wished to say that he strongly objected to this scheme, which he regarded as unsound. To place a large block of 6 per cent. debentures at a price of 91, coupled with the obligation to purchase the ordinary shares of the tramway company, was very much like a gambler or a spendthrift going to a moneylender as the last resource to put him right. He knew the difficulties the board were in because the company wanted money for development, but the price to be paid for it would put the ordinary shareholders into a very sorry position indeed.

Mr. Stone explained that he had been in telephonic communication with those representing the group of trust companies who were prepared to guarantee the debenture issue, and they informed him that they would rather the offer be either refused or accepted then.

The Chairman then put the resolution, which was rejected by three votes, no shareholders voting for.

The Chairman said that under the circumstances he must demand a poll. This was taken, with the result that the proxies for the board numbered 17,000 shares, while shareholders present, representing 745 shares, voted against. Most of the shareholders refused to vote, saying that they declined to take the responsibility. The chairman thereupon declared the resolution carried.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors have declared the interim dividends upon the 4½ per cent. preference shares and the 6 per cent. second preference shares of the company, less income-tax, for the half-year to June 30th, and an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less income-tax, for the same period.

Held Over.—Owing to pressure upon our space our report of the meetings of the Marconi Wireless Telegraph Co., Ltd., and the Nairobi Electric Light and Power Co., Ltd., are held over.

Spanish Telephone Co., Ltd.—The directors have declared a dividend of 5 per cent. for the year to May 31st, £400 being placed to reserve, and £788 carried forward.—*Financier.*

Clontarf and Hill of Howth Tramway Co., Ltd.—The directors have declared an interim dividend at the rate of 3 per cent. per annum.

Cape Town Consolidated Tramways and Land Co., Ltd.

The annual meeting was held on July 3rd at the offices of the company, 1, London Wall Buildings, E.C., Mr. R. Littlejohn presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 24), said that they had had another year with little, or nothing, to show in the accounts in the way of satisfactory results. No dividends had yet been declared by the subsidiary companies, whose undertakings were practically the only asset of this company. The past year's working of the tramway company showed a profit of £1,274, which, though small, was an improvement of £1,650, as compared with the loss of £376 for the preceding year, and there was further satisfaction in the fact that the receipts for the first five months of the current year showed increases as compared with the receipts for the corresponding five months of 1911. With regard to the estate companies, only one sale of land was made during 1911, and the revenue from other sources had not been sufficient to cover the outgoings for upkeep and necessary capital expenditure—hence the "further advances" which the company in London had had to make during the year to the subsidiaries. The future, however, looked much more hopeful. The general business conditions in the Cape Peninsula were steadily improving, and the outlook was brighter than it had been for years. These improving conditions and the brighter outlook would, no doubt, materialise sooner or later, so far as this company was concerned, in a demand for building sites on the estates of their Subsidiary Estate Companies. Camp's Bay district came more into popular favour every year. Having referred to the development work being done at Camp's Bay, the chairman said the principal portion of the tramway revenue was derived as in the past from visitors and pleasure excursions to that place. This class of traffic depended so much on holidays and fine weather that it could not be relied upon to bring in a steady and sufficient revenue. A resident population was what they wanted, and what no doubt they would get in time. Their policy was to economise their resources, and at the same time to keep their properties well before the public. The directors proposed to issue during the current year the £50,000 6 per cent. prior lien debentures recently created, offering them in the first place to the holders of the existing 5 per cent. debentures, and alternatively to shareholders. These prior lien debentures being a first charge on the whole of the company's assets were well secured, and carrying as they would 6 per cent. interest per annum, and being repayable on January 1st, 1916, at £106 per cent., they would no doubt be readily taken up. Meantime, cash advances to the extent of £10,000 had been obtained on the security of prior lien debentures in anticipation of their issue. The proceeds of the issue when made would, so far as they could see, be more than sufficient for the company's requirements till the maturity of the prior lien debentures, before which time it was hoped a demand would have arisen for building sites on their subsidiary companies' estates, at prices sufficiently satisfactory to be taken advantage of.

Mr. Ludwig Breitmeyer seconded the motion, and the report was adopted.

Kalgoorlie Electric Tramways, Ltd.

The annual meeting was held on July 4th at the London Chamber of Commerce, Oxford Court, E.C., Mr. Allen H. G. Stoneham presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 23), said he regretted that the accounts were not of a very encouraging nature. Unfortunately, the returns from the tramways continued to decrease. They were entirely dependent upon Kalgoorlie and Boulder, and those two towns were entirely dependent upon the mining industry. When that industry flourished the towns flourished, and the tramways benefited, but of late years the industry had not been prosperous; there had not been any new discoveries of any great value, with the consequence that fewer men were employed at the mines, and, naturally, their traffic suffered. Another thing which had militated against the traffic was that Boulder had grown much more than was ever anticipated, and men who used to live at Kalgoorlie had gone to live there, and, consequently, they did not need to use the tramways to get to and from their work. When the tramways were started it was always anticipated that Kalgoorlie would be the centre where everybody would live, and that Boulder would simply be the headquarters of the mines. Another disappointment had come to them in regard to the Trans-Continental Railway. They had always anticipated that when that railway was built the headquarters would be at Kalgoorlie, and although at the present moment nothing had been definitely decided, the probability was that the works would be situated 5 or 6 miles out of the town. The railway was to be commenced at once, and would take about two years to construct, and although there could be no doubt that it would bring considerable business to Kalgoorlie, the main factor in their prosperity, or the reverse, was whether new mines were opened up. As to whether there was any prospect of the Australian Government buying the company, there had been one or two overtures and conversations, but nothing definite had been submitted. He found that Governments were very like private individuals—they liked to buy something which they thought was prosperous, at a low price. He did not think there was any doubt but that the Government would eventually want to acquire the tramways, because their policy was to buy all businesses of public utility.

Mr. Oliver Wethered seconded the motion.

Replying to a shareholder, the Chairman said that, of course, the directors were greatly disappointed with the results, but they always recognised that Kalgoorlie was dependent upon the mining industry. They still thought that their best policy was to reduce the debentures as quickly as possible, so that they might be paid off before the end of the concession, and the whole of the profits be available for the shareholders. They were bound every year to redeem a certain amount of the debenture stock, and last year £5,719 was redeemed at a cost of £5,300.

The report was adopted.

General Electric Co., Ltd.

The ordinary general meeting of this company was held on Monday at the Cannon Street Hotel, E.C., Mr. H. Hirst presiding.

In proposing the adoption of the report (see Electrical Review, Vol. 70, page 1053), the Chairman said they had every reason to be satisfied with the year's working. The trading profits had risen from £107,858 to £112,324. The income from investments had increased in proportion to the additional capital sunk in such investments, namely, from £11,279 to £21,224; in other words the net profits, which in 1911 were £119,000, were this year £133,000. They were declaring this year on the ordinary shares a dividend of 7½ per cent. The extra 2½ per cent. absorbed, however, only £10,000, and he thought no apology for this modest step up was needed. They were beginning to realise the benefits of almost luxurious depreciations in past years. Since the inception of the company, they had spent practically £500,000 on property account, which now stood at £288,934. It was recently valued, at the suggestion of, and on behalf of, the debenture-holders, and found to be worth about £100,000 more than that figure. It was their intention, in future, to divide their property account up into three headings, namely:—(*a*) Land and buildings; (*b*) plant and machinery; (*c*) tools, patterns, fixtures, installations, leaseholds, &c. This would help them to carry their depreciation more scientifically, and the shareholders would have a better picture of their assets. Sundry debtors were £411,000; stock-in-trade, £404,000. The equality between those amounts was, to him, after years of experience, always a sign of a certain efficiency. Both stock and debtors bore in a general business like theirs more or less the same ratio to the amount of turnover, and he wished to give them an assurance that those figures this year, compared with the total business done were, in proportion, as satisfactory as they had ever enjoyed. Last year there was a considerable difference in these figures, due simply to the fact that amongst their debtors, which were £60,000 higher, there appeared a number of their foreign subsidiary companies. It is with these outstandings that those companies had been capitalised. The increase in their investment account was largely due to the transfer from the debtors' item; in other words, instead of sending cash to Australia, China, India, the Argentine, &c., they had sent goods and taken shares in payment, shares which gave them absolute control in those subsidiary companies. The investment account represented actual value invested. The ordinary or deferred shares which they might possess in these companies appeared in the investment account at the nominal value of £1. Since last year they had completed both the Indian company and the Argentine company: the former was in full swing. They had added to the Calcutta branch a branch in Madras, and one in Bombay was under consideration. They had the advantage there of the partnership of their former agents, Messrs. Octavius Steel & Co. The Argentine company was completed, and one of their principal managers was over there at present to take over the business for the new company from their former agents, Messrs. Colson, Brookhouse & Pyne, who continued with them in a similar partnership. Australia had, since the last meeting, with its main office in Sydney, opened depôts in Melbourne, Wellington and Brisbane. In China they were now settled in Shanghai and Hong Kong; Tientsien was under consideration; whilst in their South African company it was proposed to add to the depôts in Johannesburg, Cape Town and Durban, a depôt in Kimberley. Matters electrical moved and changed very quickly. The average dealer was afraid of putting down stock, and only this policy of having manufactures ready for use on the shelf in any part of the world where and when they might be wanted secured a continuity of business, and the right kind of business such as enabled one to keep works going at a high efficiency. It was, of course, not to be expected that all these new enterprises were profit-bearing during the first few years, more especially as they pursued with those branches the same policy as at home, namely, writing down such expenses as establishment charges, fixtures, fittings, &c., before using the profits for distribution. As regarded the business itself, their engineering works were very busy, and kept commercially and technically right in the front ranks. The works were filled with orders, amongst which could be specially mentioned a very large number of turbo-generators for the leading Corporations, mines, and industrial establishments at home and abroad. Machines ranging up to 5,000 kw. were turned out. The contracts in hand included the complete electrical equipment of a foreign dockyard, a large number of complete equipments for mines and for the electrification of several distilleries, breweries and cotton mills, all sections in which the firm had specialised. In order to cope with the generally increased heavy engineering work additional machinery had been put down, and the facilities for manufacturing at the works had been extended. The present demand for fans, ventilators, and small motors for domestic use and in industrial establishments, encouraged the company to put down further works specially equipped for the manufacture of these articles; these shops were in full working order and working at top output. The company's business in switchgear and low and high-tension switchboards had greatly expanded and necessitated additional manufacturing facilities. The same could be said of their arc lamp works, which had profited by the generally increased demand for flame lamps and especially magazine lamps. Large extensions in their foundry had been made so as to enable them to cope with the increased requirements of the various works without having to fall back on outside supplies. The carbon works, though not profit-bearing as yet, were beginning to hold their own. It had been their policy there, as in the case of the engineering works, to make themselves as independent of the supply of raw material as possible. They had added soot works during the past year, which were now in working order. It was little realised how important the efficiency of these works would be in the case of national emergency. The Osram business still continued to develop, and he was pleased to say the patent action that was started to establish the Osram rights in this country had been a complete victory for them so far. On the patent which they considered the main patent, both a certificate of validity was granted and infringement proved. In all other electric supplies for which the firm was well known, their output was steadily increasing. Though their conservative policy had enabled them to cope financially with their expansion since 1900 without issuing further capital, they thought it would not be safe to rely on the success of the many new undertakings they had in hand without strengthening their finances. They might be too seriously affected in the case of an industrial crisis or disaster. They had, therefore, decided to issue the remaining £150,000 of preference shares authorised in 1900, and the prospectus would be put before the public within the next few days inviting them to subscribe to these shares. They had been advised by friends of the firm, eminent in finance, that an issue at 5 per cent., so successful in 1900 would not be acceptable in 1912. They had, therefore, decided to offer 6 per cent. for the new issue. As they did not think it desirable, for the sake of so small an amount, to have two kinds of preference shares, and as those shares were largely held by original subscribers and friends of the firm, they had resolved, at a recent extraordinary general meeting, that the existing preference issue should also bear 6 per cent. interest. After alluding to the labour unrest and its indirect effect upon their interests, the chairman referred to the Insurance Act. At the last annual meeting he welcomed its introduction, provided it went through the House in a statesmanlike manner. To his mind it did not do so. Taking only one of many points which affected the company, he said that however little success might so far have attended co-partnership trials between employers and workpeople, in the direction of sick, benevolent funds and insurances generally they had undoubtedly been successful. The Bill struck a fatal blow at many deserving private institutions, a misfortune which could be obviated by the introduction of a surrender value. They would not mind forming themselves into a society under the law; they would not mind largely contributing to this society, so that their own workpeople in their society should have greater benefits than anywhere else. As, however, they only wished to benefit men actually in their employ, and not people who had left them, or people who would join them in order to be members of their society, the day would arrive very soon when they would have to contribute to a society benefiting more people outside the firm than inside it. This, of course, was not desirable, and could not be expected of them. If, on the other hand, the Bill provided a "surrender value" that on a worker leaving the company they could pay to the Post Office or some other society the surrender value of his insurance, and so feel sure that what the company paid to the society was for the benefit of its own employés, then a greater step forward would have been made towards the undoubted utility and benefit that the Bill meant to provide. The Insurance Act would cost them between £5,000 and £6,000 per annum.

Mr. L. G. Byng seconded the motion, which was carried unanimously, after complimentary references had been made to the chairman and directors and staff for their efficient conduct of the business, and to the strong financial position of the concern.

Anglo-American Telegraph Co., Ltd.—The directors report that the lease to the Western Union Telegraph Co. has been completed, and operates as from April 1st, 1911. Pending the completion of the lease, the company under the terms of agreement which was submitted to and approved by the stockholders carried on business for and on account of the Western Union Co. In order to cover this period the revenue account has been brought down to March 31st last. The total receipts for the 12 months ending on March 31st last amount to £303,625. Two quarterly interim dividends of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock were paid on August 1st and November 1st, 1911, absorbing £105,000, and the directors on February 10th last paid the final dividend for the year ending December 31st, 1911, amounting to £1 10s. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock, which absorbed £105,000, leaving a balance of £65,625 to be carried forward. The total distribution for the year ended December 31st, 1911, was £3 15s. per cent. on the ordinary stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock. The final payment for the year 1911 was made without waiting for the stockholders to approve the accounts, which took longer than usual to prepare, as it was desirable that they should be final. The directors felt that in making this payment they would be acting in accordance with the wishes of the stockholders.

Lanarkshire Tramways Co.—An extraordinary general meeting is to be held at 83, Cannon Street, E.C., on July 16th, when the Lanark County Tramways Bill now pending in Parliament, promoted by the Lanarkshire County Council, will be submitted for consideration and approval.

Chilian Electric Tramway and Light Co., Ltd.

Mr. Ludwig Breitmeyer (chairman) presided on July 5th, at the offices, 1, London Wall, E.C., over the fourteenth ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report, said that when he addressed them last year he said they had made a record in the history of the company. This year they had made another record, and the returns which they had had so far during the current year indicated that they would make still another record. Altogether it seemed to him they were now on the path for record breaking, both as regards receipts and profits. Last year the net balance to profit and loss, after deducting the interest on the debentures, was £106,564, and this year it was £135,972, which enabled them to pay not only the usual dividend on the preference shares, but also to pay a further dividend in respect of the arrears on the preference shares of £30,175, which left a balance of arrears on the preference shares to December 31st last of £263,000. The number of passengers carried on the tramways had risen from 83,000,000 to 93,000,000, and the profit had risen from 7,300,000 piestas to 8,200,000 piestas. In the lighting department they had also the same gratifying result, for the receipts had increased from $4,000,000 to $5,000,000. These were gratifying results, especially when they considered that for the first ten years of their existence they had had to struggle against many adversities, and it was only the force of the capital behind the undertaking which had brought it to the successful condition in which it was to-day.

Sir Gerald Fitzgerald seconded the motion, which was adopted without discussion.

It was agreed that the directors' remuneration for the year should be £1,200, the distribution of the same to be left to the discretion of the board.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in

Sun Power Co. (Eastern Hemisphere), Ltd.—Further issue of 3,000 shares of £1 each, fully paid (Nos. 16,508 to 19,507).

And to allow the following securities to be quoted in the Official List

Metropolitan Railway Co.—Further issue of [illegible] consolidated stock, and £25,000 3½ per cent. convertible preference stock.

The Committee has appointed a special settling day as under

Friday, July 12th. Victoria Falls and Transvaal Power Co., Ltd.—Scrip, fully and partly paid, for £1,000,000 [illegible] per cent. second mortgage debentures, series "A."

And ordered the undermentioned securities to be quoted in the Official List:—

Companhia Ferro Carril do Jardim Botanico (Jardim Botanico Tramway Co).—Further issue of £400,000 5 per cent. 40-year first mortgage bonds of £100 each (Nos. A 8,001 to 12,000).

Metropolitan District Railway.—Further issue of [illegible] 4 per cent. prior lien debenture stock.

Victoria Falls and Transvaal Power Co., Ltd.—Scrip, partly paid, for £1,000,000 [illegible] per cent. second mortgage debentures, Series "A."

Westminster Electric Supply Corporation, Ltd.—Further issue of 8,148 4½ per cent. cumulative preference shares of £5 each, fully paid (Nos. 211,953 to 220,100).

Veritys, Ltd.—The directors have (says the *Financier*) declared a dividend at the rate of 5 per cent. per annum (5s. per share) on the ordinary shares for the half-year to January 31st, making 5 per cent. for the year, £195 being carried forward.

Mexico Tramways Co.—The directors have declared a dividend of 1¾ per cent. for the quarter ended June 30th.

STOCKS AND SHARES.

Tuesday Evening.

That business in the Stock Exchange is not as good as it ought to be is a dictum that found apt reflection in the several hundreds of members who attended the meeting held in the House itself last Monday, to protest against the fixed scale of commission, brought into being by the Stock Exchange Committee on June 1st. In slack days it is always easy to draw a crowd of members in protest against anything which is alleged to influence business for the worse. In the present case, however, there is ample scope for reform and modification in the official scale as already passed, but nothing tangible is likely to come of the movement until the end of September at the earliest.

Turning to Electrical markets, there is still a huge business doing in Latin-Canadian issues of all kinds. Mexican things are most in favour at the moment, though Canadians and Brazilians continue to attract a great deal of attention. An issue of £250,000 Ceará Tramway, Light and Power 5 per cent. Debenture stock has been offered this week for subscription. The stock seems somewhat speculative.

Home Railway stocks, after waxing a little, quickly waned when it was announced that the men had decided to prolong the strike in some of the transport trades. Weary bulls who had been hanging on to such speculative stocks as Metropolitans and Districts, flung their holding on to a poor market, and the result is that in the case of the former the drop of 3½ points of last week has been succeeded by a further fall of 2½ now. Districts are only a point lower, and the 6 per cent. debenture stock has gone back a similar amount. Pronounced weakness in Central Londons came as the natural sequel to liquidation by tired holders, and the trio of ordinary stocks shows falls of from one to three points. City and South London stock has gone back 1½, on the declaration of a dividend at the rate of 1¼ per cent., as against 1¼ per cent. a year ago. There has been a further decline in London General Omnibus, the non-assenting stock being marked back to 280 *ex* the £10 dividend just paid; and, in sympathy, London United Tramways Preference shed ¼ to 5⅛. British Electric Traction 7 per cent. Preference gave way to the tune of three points, but the 5 per cent. First Debenture is the turn harder. In the Provincial group, the only change is a slight improvement in Bath Tramways Preference, where the price recovered the dividend deduction of last account.

The Foreign Tramway department is practically given up to the dealings in Latin-Canadians. Rio Trams picked up part of their fall, and Sao Paulo recovered 9 points after its drop of 12 last week. Mexico Tramways are a little easier, but the company's 5 per cent. first bonds rose 1½. Havana Electric Railway bonds are 1 up, in spite of the weakness of Cuban things as a whole, due to the report that bubonic plague has broken out on the island. British Columbia issues are a trifle better. The flatness of Kalgoorlie Electric Tramways has made further progress, the "A" Debenture dropping to 87½, and the 6 per cent. "B" Debenture slumping a further 10 points after its previous fall of 8½ upon the scaling down of the interest on the latter. Lisbon Preference came into demand, and so did the company's 5 per cent. Debenture stock, with consequent rises of $\frac{1}{16}$ and 1½ respectively.

Considerable dissatisfaction exists in certain quarters with regard to the position of the La Plata Tramways Company. The directors issued a statement some time ago, saying that defalcations had occurred amounting to about £900, and it was decided to postpone payment of the Preference dividend until the full amount of the trouble should have been ascertained. Nothing further has transpired, and a few of the people most interested in the company, apart from the directors, are consulting as to the advisability of taking drastic steps to secure the fullest information available. They argue that the La Plata Tramways is quite a good little company, and could be made to pay handsomely: so, unless the board care to meet the demand for news, the dissatisfaction may assume an energetic shape.

In the Foreign Light and Power group, Mexicans are the principal feature, with a rise of 2 in the Common shares and of 1 in the 5 per cent. First Mortgage bonds. The company's Second Mortgage bonds, at 89, are also a shade better, and may be worth notice for the yield which they now give. Coupons are payable on June 1st and December 1st, and the return at the present price is 5½ per cent. on the money. Canadian Generals have risen 4½, without much stock changing hands. Calcuttas are ⅛ higher; Madras ⅛ down. The rest of this market is steady, its principal characteristic being the insistent inquiry for sound 5 per cent. bonds.

Home Electric Supply shares show comparatively few changes. Bromptons are ⅛ better, and London Electric Preference put on ¼, dealers finding themselves caught out of the latter and with buyers still pressing for the shares. Midland Electric 4½ per cent. First Debenture rose 1½ in response to a little inquiry. There is a better tone in the City of London market, the Ordinary shares changing hands freely over 18, although the Preference went back 10s. to 15½. Orders to buy provincial shares still come in pretty freely. There are no Bournemouth and Poole to be had to satisfy the various buyers. Hove shares added 5s. to their 10s. rise of last week, and other similar shares are strong.

In the Telegraph market interest is about evenly divided between Marconis and National Telephones. In both there have been losses this week, due mostly to speculation in each case. The drop in National Telephone Deferred amounts to 4 points, though this, of course, is less than half its rise of the week before. The Third Preference lost ⅛, but the Preferred stock is ½ higher. Investors are buying Anglo-American Telegraph 6 per cent. Preferred, and the improvement of ½ is perhaps an indication of the way in which this stock is likely to advance to a 5 per cent. basis. The Eastern group is almost motionless. Eastern 3½ per cent. Preference gained 2, but beyond this there is no change worth mentioning.

Marconis gave way after the meeting this week, despite the satisfactory nature of the chairman's statement. Some of the holders argued that there was not much left to "go for" at present, and accordingly sold their shares. The decisions of the International Conference on Wireless Telegraphy have done nothing to help the Marconi market. Americans are flatter at 1⅝ and Canadians at 24s. 6d

Electric Constructions are unchanged on an excellent report, and an increase in the dividend from 2½ per cent. to 3¾ per cent. The ordinary shares of £2 fully paid look cheap at 20s., less 1s. 6d. for the dividend now due. British Aluminium Debenture issues have hardened, and, at the request of readers, the prices have been reinstated in our lists overleaf. India-rubber shares are wanted: in fact, several would-be buyers could not get the offer at all, and the price is 15s. higher. Edison & Swan Debenture fell 2. Rubber shares are weak and depressed, commanding little public interest.

The Synthetic Rubber Prospectus.—According to the *Financial Times* only about £70,000 was subscribed out of the offered £450,000 preference capital in the Synthetic Products Co.

Consolidated Electrical Co., Ltd.—A dividend of 3½ per cent. on the ordinary shares for the year to March 31st is announced.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	July 3	3,168	— 85	5	7,497	435	14·4	..
Ayr	„ 6	765	+ 119	7	2,497	94	[illegible]	..
†Bath..	June 26	1,007	— 72	26	21,832	+ 1,356	..	..
Birkenhead.. ..	July 7	2,526	+ 19	13	16,033	— 577	13·68	..
Birmingham Corp.	June 29	21,381	+6,298	13	136,985	+40,244	57·17	..
Blackburn	July 3	2,480	+ 104	$14\frac{3}{7}$	17,232	+ 104	14·62	..
Blackpool Corp. ..	„ 4	4,001	+ 989	..	18,400	+ 2,719	11·87	..
Blackpool-Fleetw'd	„ 6	2,455	— 313	[illegible]	1,387	— 189	8	..
Bournemouth ..	„ 3	3,602	— 183	$13\frac{2}{7}$	24,522	+ 673	21·95	..
Bradford	June 29	11,176	— 800	13	73,410	— 1,507	56	1·2
Brighton	July 7	2,376	+ 177	14	14,300	— 465	9·5	..
Bristol	„ 5	16,108	+2,272	..	179,068	+15,419	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	June 28	638	+ 191	26	7,474	+ 1,887	3·65	..
Barnsley	„ 28	389	+ 3	„	4,322	343	..	..
Barrow	„ 28	825	+ 141	„	9,140	+ 2,259	5·37	..
Devonport ..	„ 28	1,100	+ 113	„	13,792	+ 1,908	8·85	..
Gateshead ..	„ 28	2,377	+ 80	„	26,282	— 74	11·25	..
Gravesend ..	„ 28	387	— 106	„	5,227	+ 46	6·5	..
Greenock.. ..	„ 28	1,788	+ 134	„	20,096	+ 2,357	7·25	..
Hartlepool ..	„ 28	528	— 126	„	6,400	+ 63	6·72	..
Kidderminster ..	„ 28	256	— 13	„	2,781	+ 34	..	..
‡Leamington ..	„ 28	485	+ 81	„	4,310	+ 318	..	..
Merthyr	„ 28	564	+ 126	„	4,928	— 311	2·9	..
Metropolitan ..	„ 28	18,888	— 534	„	226,385	+ 7,462	22	..
Middleton ..	„ 28	734	+ 69	„	8,347	— 49	8·5	..
Mid. Joint Com'tee	„ 28	6,444	+ 131	„	81,416	+ 3,107	..	..
Oldham—Ashton	„ 28	1,250	+ 145	„	15,555	+ 1,154	9·13	..
Peterborough ..	„ 28	311	+ 22	„	3,201	+ 248	5·31	..
Potteries	„ 28	3,985	+ 71	„	47,185	— 2,354	29	..
Rothesay	„ 28	596	+ 37	„	3,153	+ 82	2·75	..
Southport ..	„ 28	649	— 34	„	7,209	— 71	8·17	..
S. Metropolitan..	„ 28	1,831	155	„	21,385	+ 802	..	..
Swansea	„ 28	2,308	124	„	28,454	+ 6	12·5	..
Tynemouth ..	„ 28	774	+ 68	„	5,264	— 178	3·75	..
Weston-s-Mare ..	„ 28	376	— 35	„	2,040	— 275	8	..
‡Worcester ..	„ 28	632	70	„	7,067	— 75	5·75	..
Wrexham ..	„ 28	233	+ 25	„	2,774	+ 270	..	..
Yorks. Wool. Dist.	„ 28	2,273	+ 91	„	27,460	+ 847	17	..
Miscellaneous ..	„ 28	557	+ 91	„	5,746	+ 155	..	..
Burnley	July 6	2,927	+ 287	..	..	.	11·78	..
Burton-on-Trent ..	„ 7	573	— 46	14	3,664	— 246	6·6	..
Bury	„ 7	2,703	+ 83	14	18,767	+ 186	22·5	..
Cardiff	June 29	6,373	+1,159	13	30,696	— 2,352	17·35	..
Chatham and Dist.	July 4	1,811	+ 89	27	22,045	+ 133	14·98	..
Cork	„ 4	1,074	— 49	27	12,730	— 262	9·89	..
†Croydon	June 21	1,822	335	12	22,433	229	11·6	·75
†Darlington.. ..	„ 29	253	+ 42	13	2,884	+ 44	4·87	..
Darwen	July 5	589	+ 68	14	3,952	+ 68	4·36	..
Dover	June 29	504	— 101	13	3,076	— 206	4·75	..
Dublin	July 5	10,718	— 620		.		54·25	..
East Ham .. .	„ 6	2,105	87	14	14,824	291	7·87	..
Exeter .. .	„ 5	709	+ 10	14	4,587	— 306	5·5	..
Glasgow	„ 6	39,167	+ 615	..	100,745	— 1,594	98	·25
Hastings	„ 4	2,111	— 24	..	..	— 1,058	19·3	..
Huddersfield ..	„ 6	4,017	+ 303	14	27,903	+ 890	29·5	1
Hull	„ 6	5,868	+ 396	14	39,937	— 552	13·5	—1
Ilkeston	„ 4	268	— 9	14	1,330	— 548	..	..
†Ipswich	„ 6	983	+ 49	14	6,234	+ 70	10·5	..
Kilmarnock.. ..	„ 6	324	+ 3	7	1,229	— 20	4·25	..
Lancashire United	„ 8	2,908	+ 58	27	35,662	— 264	59	..
Leeds	„ 6	16,203	+ 971	14	109,378	+ 4,181	112·7	..
†Leicester	June 29	2,756	+ 288	..	..	..	20	..
Leith	„ 29	1,451	+ 120	$6\frac{4}{7}$	4,475	+ 106	8·724	..
Liverpool	„ 29	24,549	—1,292	$25\frac{4}{7}$	304,884	+10,388	116	..
‡L.C.C.	„ 26	87,465	—10,387	..	546,442	—19,026	140·5	1·5
London United ..	July 6	13,851	— 990	..	167,203	— 5,202	..	..
Lowestoft	„ 6	382	— 58	40	6,253	— 396	8·5	..
Manchester ..	„ 6	34,673	+1,689	14	235,882	+ 9,791	105	..
Newcastle	„ 6	11,352	+3,270	..	61,975	+ 181	31·3	..
†Newport	June 29	729	+ 28	13	8,881	— 884	7·25	..
Oldham	July 7	4,213	+ 312	15	30,858	+ 656	28	..
Pontypridd	„ 6	712	+ 16	14	4,997	— 989	5·5	..
Portsmouth.. ..	June 29	4,237	— 745	13	27,781	— 2,383	15·75	..
†Preston	„ 26	781	56	13	10,454	+ 151	10	..
Rotherham	July 3	1,492	+ 181	$13\frac{3}{7}$	9,346	+ 329	12	..
Salford	„ 8	10,436	+ 239	14	72,959	+ 2,280	41	..
Sheffield	„ 9	13,699	+ 787		97,778	+ 2,071	40	..
Southampton ..	„ 3	2,704	— 236	13	16,915	+ 363	11	..
Southend-on-Sea ..	„ 3	1,728	+ 126	14	10,190	+ 1,276	7	..
South Shields ..	„ 6	1,468	+ 270	14	8,704	— 131	10·25	..
Tyneside	.	..	..	..	..	..	11	..
Wallasey	June 22	2,271	— 115	$11\frac{4}{7}$	13,254	— 527	8·72	..
Walthamstow ..	July 6	1,602	+ 76	14	11,201	+ 76	[illegible]	..
West Ham.. ..	June 27	5,308	— 462	$12\frac{4}{7}$	34,351	— 671	16·45	1
Wolverhampton ..	July 3	2,032	— 97	14	13,749	+ 38	13·75	..
Cen. London Rly...	„ 6	9,484	—1,602	1	4,440	— 658	6·82	..
City & S. Lon. Rly.	„ 7	6,145	— 772	1	2,953	— 238	7·26	..
Dublin-Lucan Rly.	„ 5	334	+ 33	1	94	— 57	7	..
G.N. and City Rly.	„ 6	3,071	+ 57	1	1,479	+ 61	8·5	..
L'pool Overh'd Rly.	„ 7	3,306	+ 196	1	1,687	+ 60	6·6	..
Llandudno-Col. Bay	„ 4	853	+ 82	31½	6,624	+ 388	6·5	..
Lond. Elec. Ry. Co.	„ 6	27,185	—1,130	1	13,440	+ 150	21·25	..
Mersey Railway ..	„ 6	4,041	+ 136	1	1,927	+ 56	4·5	..
Metropolitan Rly...	June 30	86,189	— 323	1	17,913	+ 23	25·75	..
Met. District Rly...	July 6	26,352	+ 518	1	12,949	+ 587	25	..
Anglo-Argentine ..	„ 1	95,871	+2,706	..	1,331,142	+49,335	..	..
§Auckland	May 31	18,179	+1,090	..	208,987	+16,660	23·31	..
Bombay (B.E.T.) ..	June 7	5,833	+ 234	23	69,550	+ 4,185	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	July 6	7,730	+ 44	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	May	8,270	..	5	15,306	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	May 31	1,738	+ 387	..	16,653	+ 1,931	13·5	·75
§Montevideo ..	June	26,891	+4,639	8	238,422	+34,176	..	..
Perth (W.A.) ..	July 5	3,597	+ 529	..	50,458	+ 7,071	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord.	10	5½	5½	9¾ – 10¾		5 2 4
Do. 4½ % Pref.	10	4½	4½	9 – 10		4 10 0
Do. Second 6 % Pref.	10	6	6	10½ – 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 – 100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8⅜ – 8⅝	+ ⅛	5 12 8
Do. 7 % Cum. Pref.	5	7	7	7⅞ – 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 – 100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½ – 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ – 4⅝	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¼ – 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 – 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅝ – 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 – 100	..	4 10 0
City of London, Ord.	10	7	8	17½ – 19	+ ½	4 4 3
Do. 6 % Cum. Pref.	10	6	6	14½ – 16½	– ½	3 12 9
Do. 5 % Deb.	Stock	5	5	117 – 121	..	4 2 8
Do. 4½ % Second Deb.	100	4½	4½	99 – 102	..	4 8 3
County of London, Ord.	10	5	6	10½ – 11½	.	5 5 6
Do. 6 % Pref.	10	6	6	11½ – 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	106 – 108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 – 103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅞ – 1⅛	.	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 – 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 – 89	..	5 1 2
Folkestone	5	6	6	4¾ – 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾ – 5¼	..	4 15 8
Do. 4½ % First Deb.	100	4½	4½	94 – 97	..	4 12 9
Hove	5	9	9	7 – 8	+ ¼	5 12 6

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 9th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Kensington & Knightsbridge, Ord	5	9	9	7½ – 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 – 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 – 84	..	5 7 2
London Electric, Ord.	3	2	2½	1¼ – 1¾	..	4 5 6
Do. 6 % Pref.	5	6	6	5 – 5½	+ ¼	5 9 1
Do. 4 % First Mort. Deb.	Stock	4	4	90 – 93	..	4 6 0
Metropolitan	5	5	4	3½ – 4	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ – 4¾	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 – 102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	85 – 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	95½ – 97½	+ 1½	4 12 4
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½ – 5	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 – 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 – 11	..	5 9 1
Oxford	5	7½	7½	5⅞ – 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 – 8⅜	..	5 14 3
Do. 7 % Pref.	5	7	7	6⅞ – 7⅜	..	4 15 0
Do. 3½ % Deb.	100	3½	3½	82 – 85	..	4 2 4
Smithfield Markets, Ord.	5	Nil	2	1⅝ – 1⅞	..	..
South London, Ord.	4	5	5	2¾ – 3¼	..	5 18 4
Do. 5 % First Mort. Deb.	100	5	5	98 – 101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/32 – 1 5/32	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 – 100	..	4 10 0
Urban, Ord.	£3	5	..	½ – ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½ – 3	..	3 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ – 88½	..	5 1 8
Westminster, Ord.	5	10	10	8¼ – 8¾	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 – 5½	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ – 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7¼ – 7¾	+ ⅛	5 9 8
Do. 5 % Pref.	5	5	5	5 – 5½	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	95 – 97		5 3 1
Canadian Gen. El. Com.	$100	7	7†	116 – 121	+ 1½	5 15 8
Do. 7 % Pref.	$100	7	7	120 – 124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	8†	2⅜ – 2⅝	..	3 4 0
Do. 5 % Deb.	100	5	..	94 – 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91½ – 93½	..	6 8 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 – 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ – 96½	..	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ – ¼	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 – 106	..	4 14 4
Madras, Ord.	5	..	..	1¾ – 2¼	– ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 – 105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½ – 91½	+ ½	5 9 3
Mexican Lt. & Power, Common	$100	4	4	98 – 101	+ 2	3 19 8
Do. 7 % Cum. Pref.	$100	7	7	109 – 112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	100 – 102	+ 1½	4 18 0

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ – 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	7	8	219 – 224	+ 2	3 11 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 – 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 – 250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 – 114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 – 103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 – 101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	142 – 146	..	8 8 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 – 110	– 1	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 – 106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 – 101	+ ½	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ – 92½	+ ½	5 8 1
Victoria Falls Power, Pref.	1	Nil	11⅞d.	⅞ – 1 1/16 xd	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ – 107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ – 7¾	..	5 8 3
Do. 5 % Deb. Red.	Stock	5	5	96½ – 98½	+ ½	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	147½ – 149½ x	+ 1	5 7 0
Do. Collat. Trust	$1000	4	4	94 – 96	..	4 8 4
Anglo-American Telegraph	Stock	3¾	3	65 – 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	110½ – 111½	+ ½	5 8 7
Do. Def.	Do.	30/-	30/-	25¼ – 25¾	..	5 16 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½ – 104½	..	4 16 2
Chili Telephone	5	7	..	7¾ – 8	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 – 84	..	4 15 3
Cuba Telegraph	10	6	6†	9½ – 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ – 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ – 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 – 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅜ – 7⅝	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 – 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	130 – 133	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	78½ – 80½	+ 2	4 7 0
Do. 4 % Mort. Deb.	Do.	4	4	99 – 101	..	3 19 3
Eastern Extension	10	7	5†	12¾ – 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 – 101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 – 100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	10¾ – 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	12¾ – 13¼	..	4 10 7
Great Northern Telegraph	10	18	18	27½ – 28½	..	6 6 4
Indo-European Telegraph	25	13	5†	56 – 58	..	5 3 5
Mackay Companies Common	$100	5	5	88 – 91	..	5 10 0
Do. 4 % Cum. Pref.	$100	4	4	70 – 73	..	5 9 7
Marconi's Wireless Telegraph	1	[illegible]	20	5 13/16 – 5 15/16	– 1⅜	3 5 4
Do. 7 % Cum. Partic. Pref.	1	16	17	5 – 5¼	– ⅜	3 17 3

Monte Video Telephone, Ord.	1	6	6	1 – 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	¾ – ⅞	..	5 14 3
National Telephone, Pref.	Stock	6	6	101½ – 104½	+ ½	..
Do. Def.	Do.	6	6	147 – 149	– 4	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	6 1/16 – 6 5/16	– ⅛	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99¼ – 100¼	+ ¼	4 9 9
Oriental Telep. and Elec.	1	8	8	1 21/32 – 1 23/32	..	4 13 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16 – 1 3/16	+ 1/16	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	88 – 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 – 100	..	3 18 5
Reuter's	8	5	5†	11½ – 11¾	..	3 8 0
Submarine Cables Trust	Cert.	6	6	127 – 130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 – 101	..	4 9 1
United River Plate Telephone	5	8	8	7⅝ – 7⅞	..	5 1 7
Do. 5 % Cum. Pref.	5	5	5	5¼ – 5½	..	4 11 0
West Coast of America	2½	2½	2½	1 5/16 – 1 9/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 – 99	..	4 0 10
West India and Panama Teleg.	10	1¼	½	2⅝ – 2⅞	..	1 14 9
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ – 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ – 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	100½ – 102½	..	4 17 7
Western Telegraph, Ltd.	10	7	6†	13 – 13½	..	5 3 3
Do. 4 % Deb.	Stock	4	4	96 – 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 – 103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 9th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32 — 11/32	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	- 1/32	6 3 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 41	—3	..
Do. 5 % Perp. Deb. ..	100	5	5	94 — 98	+1	5 2 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	74 — 76	—3	3 19 0
Do. Pref.	100	4	4	81 — 83	—2	4 16 5
Do. Def.	100	2	2	75 — 77	—1	2 12 0
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1½	1⅝	35½— 36½	—1½	4 9 0
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1903	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10¾— 11¼	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅝— 1⅞	..	Nil
Hastings Trams, 6 % Pref. ..	5	Nil	6	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4⅞— 5⅜	- ⅛	..
Do. 4 % Deb.	100	4	4	74 — 77	..	5 4 0

NAME.	Stock or Share.	Dividends for		Closing Quotations July 9th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅝	1⅞	57½— 58½	—2½	3 4 8
Do. Surplus Lands	100	2¾	2⅞	67 — 69	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	86 — 88	—1	3 19 7
Metropolitan District Ord. ..	100	Nil	..	38 — 38½	—1	Nil
Do. 6 % Deb.	100	6	6	141 —143	—1	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 8
Do. 4½ % First Pref.	100	3½	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	6	15/16— 1	..	6 0 0
Do. Def.	1	Nil	..	⅛— 3/16	..	Nil
Do. 5 % Pref.	1	5	5	29/32— 31/32	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16— 7/16	..	..
Do. 5 % Pref.	1	5	5	⅝— ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅛— 4⅜	..	Nil
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	1	1½†	88 — 90	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼— ⅜	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞— 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	78 — 82	..	5 9 9

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5 3/16— 5 7/16	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 15/16— 5 3/16	..	5 6 0
Do. 4 % Deb.	100	4	4	94½— 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	99½—101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11⅛— 11⅝	..	5 3 3
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½— 98½	..	5 1 6
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞— 5½	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	136 —141	+ 1	5 13 6
Do. Pref. Ord.	100	6	6	118 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	108 —111	+ 1	4 10 1
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102½—104½	..	4 6 2
Calcutta Trams, Ord.	5	6	7	6⅛— 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16— 5 1/16	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝— ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5 5/16— 5 9/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 —104	+ 1	4 16 2
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	5	6†	37 — 45	-10	6 13 4
La Plata Elec. Trms, Ord. ..	1	..	..	½— ¾	..	..
Do. Pref.	1	6	6	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	+ 1/16	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	+ 1½	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102 xd	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92 xd	— ½	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	128 —131	+ ½	5 6 10
Do. Gen. Con. 5 % Bonds ..	..	5	5	100 —102	+1½	4 18 0
Do. 6 % Bonds	100	6	6	102 —104	..	5 15 5
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7 — 7⅜	+ ⅛	6 15 7
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16— 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼— 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	153½—156½	+1½	3 4 4
Do. 1st Mort. 5 % Bonds ..	..	5	5	103½—104½ xd	— ¼	4 15 8
Do. 5 % Mort. Bonds ..	100	5	5	99½—100½	+ ½	4 19 6
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	247 —252	+9	3 19 4
Do. 5 % 1st Deb.	$500	5	5	105 —107	..	4 13 6
Singapore Trams, 5 % Deb. ..	100	5	5	82½— 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video ..	5	6	7	5⅝— 5⅞ xd	..	5 19 2
Do. 6 % Pref.	5	6	6	4⅞— 5⅜ xd	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½—106½	..	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝— ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3⅛— 3⅜	..	..
Do. Pref.	1	6	6	1⅜— 1½	..	4 0 0
British Aluminium, Ord. ..	1	..	..	1⅛— 1¼		..
Do. 6 % Cum. Pref.	1	..	..	⅝— ⅞	..	..
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	+1	5 5 3
Do. Deb. Stk.	100	5	5	84 — 86	+2½	5 16 3
B.I. & Helsby Cables	5	10	10	7¾— 8¼	..	6 1 3
Do. Pref.	5	6	6	6¼— 6¾	..	4 9 0
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	3	Nil	..	7/16— 11/16	..	Nil
Do. Deb...	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10½— 11¼	..	6 13 4
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	98 —100	..	4 10 0
Castner-Kellner	1	17½	20	3½— 3¾	..	5 6 8
Do. Deb...	100	4½	4½	104 —108	..	4 10 7
Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	..	27/32— 31/32	..	5 8 1
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	95 — 98 xd	..	4 10 10
Edison & Swan, A, £3 paid ..	5	Nil	..	1⅛— 1⅜	..	Nil
Do. fully paid	5	Nil	..	1⅞— 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	—2	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	Nil	3¾	¾— 1	..	7 10 0
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11¾— 12¼	..	6 0 0
Do. Pref.	5	4½	4½	4 15/16— 5 3/16	..	4 6 9
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	10	..	8¼— 9¼	+ ⅜	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	20	10†	33 — 35	+ ½	6 14 3
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

EXPORTS OF ELECTRICAL GOODS FROM AMERICA.

The following statement showing the exports of electrical and similar goods from the United States during the year ended June 30th, 1911, is taken from the official statistics for that year which have just been published; details for the year 1909-10 are also given and notes of any increases or decreases have been added :—

	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
Electrical appliances including telegraph and telephone instruments.—			
To Argentina	470,000	360,000	— 110,000
,, Brazil	1,604,000	1,962,000	+ 358,000
,, Great Britain ...	621,000	514,000	— 107,000
,, Canada	2,356,000	3,248,000	+ 892,000
,, Mexico	1,195,000	1,119,000	— 76,000
,, Cuba	176,000	657,000	+ 181,000
,, Japan	339,000	908,000	+ 569,000
,, Panama	265,000	163,000	— 102,000
,, Philippine Islands ...	239,000	318,000	+ 79,000
,, South Africa	70,000	68,000	— 2,000
,, Australia	99,000	157,000	+ 58,000
,, New Zealand	45,000	23,000	— 22,000
,, Chile	75,000	180,000	+ 105,000
,, British West Indies ...	55,000	52,000	— 3,000
,, Peru	76,000	80,000	+ 4,000
,, Uruguay	35,000	29,000	— 6,000
,, Venezuela	49,000	83,000	+ 34,000
,, British India	25,000	27,000	+ 2,000
,, Other countries ...	600,000	755,000	+ 155,000
Total ...	8,694,000	10,703,000	+ 2,009,000
Steel rails.—			
To Canada	801,000	1,168,000	+ 367,000
,, Mexico	1,917,000	1,839,000	— 78,000
,, Cuba	1,105,000	904,000	201,000
,, Argentina	2,317,000	1,328,000	989,000
,, Brazil	1,032,000	640,000	— 392,000
,, Japan	364,000	1,467,000	+ 1,103,000
,, Australia	1,418,000	1,715,000	+ 297,000
,, Chile	180,000	419,000	+ 239,000
,, Other countries ...	1,412,000	1,897,000	+ 485,000
Total ...	10,546,000	11,377,000	+ 831,000
Iron and steel wire, other than barbed.			
To Canada	1,297,000	1,483,000	+ 186,000
,, Cuba	178,000	206,000	+ 28,000
,, Mexico	266,000	253,000	13,000
,, Argentina	570,000	864,000	+ 294,000
,, Chile	175,000	343,000	+ 168,000
,, Australia	820,000	1,228,000	+ 408,000
,, New Zealand	197,000	232,000	+ 35,000
,, South Africa	95,000	175,000	+ 80,000
,, Other countries ...	477,000	773,000	+ 296,000
Total ...	4,075,000	5,557,000	+ 1,482,000
Electrical machinery.—			
To France	387,000	253,000	— 134,000
,, Germany	110,000	195,000	+ 85,000
,, Italy	192,000	136,000	— 56,000
,, Great Britain ...	142,000	581,000	+ 139,000
,, Canada	1,151,000	1,665,000	+ 514,000
,, Panama	148,000	112,000	— 36,000
,, Mexico	829,000	1,350,000	+ 521,000
,, Cuba	179,000	185,000	+ 6,000
,, Argentina	196,000	187,000	— 9,000
,, Brazil	371,000	484,000	+ 113,000
,, British India ...	133,000	126,000	— 7,000
,, Japan	715,000	1,307,000	+ 592,000
,, Australia	276,000	383,000	+ 107,000
,, New Zealand	66,000	41,000	— 25,000
,, Philippine Islands ...	121,000	151,000	+ 30,000
,, South Africa	209,000	269,000	+ 60,000
,, Other countries ...	523,000	600,000	+ 77,000
Total ...	6,048,000	8,025,000	+ 1,977,000
Steam and other power engines, and parts thereof stationary.—			
To Canada	840,000	853,000	+ 13,000
,, Argentina	283,000	453,000	+ 170,000
,, Australia	375,000	444,000	+ 69,000
,, France	202,000	175,000	— 27,000
,, Germany	126,000	210,000	+ 84,000
,, Russia	170,000	241,000	+ 71,000
,, Great Britain ...	119,000	155,000	+ 36,000
,, Austria	142,000	179,000	+ 37,000
,, Mexico	83,000	119,000	+ 36,000
,, Other countries ...	759,000	1,214,000	+ 455,000
Total ...	3,099,000	4,043,000	+ 944,000

	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
[illegible]			
To Canada	[illegible]	1,585,000	+ 218,000
,, Mexico	[illegible]	156,000	— 30,000
,, Cuba	487,000	656,000	+ 169,000
,, Argentina ...	122,000	125,000	+ 3,000
,, Brazil	132,000	399,000	+ [illegible]
,, Japan	[illegible]	[illegible]	+ [illegible]
,, Other countries ...	1,049,000	1,093,000	+ 44,000
Total ...	3,689,000	4,424,000	+ 735,000
[illegible]			
To Canada	248,000	346,000	+ 98,000
,, Mexico	412,000	623,000	+ 211,000
,, Brazil	1,043,000	1,199,000	+ 156,000
,, Japan	30,000	395,000	+ 365,000
,, South Africa	89,000	418,000	+ 329,000
,, Argentina	107,000	111,000	+ 4,000
,, Cuba	123,000	154,000	+ 31,000
,, Other countries ...	353,000	708,000	+ 355,000
Total ...	2,405,000	3,954,000	+ 1,549,000
Copper [illegible]			
To Canada	2,835,000	3,569,000	+ 734,000
,, Mexico	388,000	269,000	— 119,000
,, Brazil	158,000	84,000	— 74,000
,, Great Britain ...	384,000	554,000	+ 170,000
,, Cuba	67,000	109,000	+ 42,000
,, Australia and New Zealand	44,000	82,000	+ 38,000
,, Other countries ...	504,000	441,000	— 63,000
Total ...	4,380,000	5,108,000	+ 728,000
Brass, [illegible]			
To Canada	2,024,000	2,632,000	+ 608,000
,, Great Britain ...	1,039,000	1,840,000	+ 801,000
,, Australia	117,000	112,000	— 5,000
,, Germany	197,000	507,000	+ 310,000
,, Mexico	165,000	148,000	— 17,000
,, Cuba	145,000	164,000	+ 19,000
,, Other countries ...	669,000	827,000	+ 158,000
Total ...	4,356,000	6,230,000	+ 1,874,000

Trouble with a Fan.—As a considerable number of blacksmiths' hearths are now fitted up with blast provided by electric blowers, the following incident may be of interest, as it points out a slight defect which may easily cause trouble if not guarded against. In one case where a blast was obtained by an electrically-driven fan, the delivery pipe was surrounded by means of water on account of the heat, and it was found that the temperature of this water rose practically to boiling point when the fan had been in operation for some time. On one occasion it was found that the draught was gradually getting weaker until it almost failed altogether. Suspicion was first of all thrown on the electrical portion of the gear, but this was found to be perfectly in order. The fan was taken adrift and the impellers and all parts of the casing were found to be quite all right. On going still further afield and taking apart the ducts, it was found that the delivery pipe was burned through, which amply accounted for the loss of draught. This burning action was in its turn explained by the fact that owing to the heating of the water, rapid evaporation set in and the level of the water fell below the level of the effective portion of the delivery pipe without its being noticed, with the result that the pipe was exposed to the full temperature of the escaping gases without any cooling action taking place. A new pipe was fitted, and when this was done instead of the water in the surrounding jacket being poured in by hand at intervals as had previously been done, the water pipe was fitted with a ball cock set so that when the water in the jacket got lower than was advisable, the cock was opened and allowed more water to flow into the tank. This simple alteration prevented any further trouble from this cause being experienced, and as the breakdown of such parts might easily cause considerable damage due to the stoppage of an important blacksmith's forge or forges, the point is worthy of attention.

A Newcomen Memorial.—A proposal to establish a memorial to Thomas Newcomen, the inventor of the first successful steam engine, has been put forward by the municipal and other representatives of Dartmouth, his birthplace. It appears that the memory of this celebrated inventor has never been thus honoured, though his work was of such immense importance to this country. Donations may be sent to the hon. treasurer, Mr. A. R. Gregory, Lloyd's Bank, Dartmouth.

SOME RECENT SINGLE-PHASE LOCOMOTIVES OF THE MASCHINENFABRIK OERLIKON.

Dr. Behn-Eschenburg gave an interesting account in the *E.T.Z.* for March 7th of the advances made in single-phase locomotives during the last three or four years. Some three and a half years ago the Oerlikon Co. had only made locomotives having a normal one-hour output of 500 h.p., running at 25 miles per hour, and these were amongst the largest single-phase locomotives made up to that time. They were each fitted with two single-phase series commutator-motors of the Oerlikon type. In 1909 a similar locomotive of 2,000 h.p. was supplied to the Lötschberg line, and this proved so satisfactory that 10 further locomotives of still greater power, but otherwise similar, were ordered for the same line a few months ago. When completed, these will be by far the largest single-phase self-contained locomotives in use. They are for the Bern-Simplon line, and are designed to give out 2,500 h.p. at the rail for one and a half hours uninterruptedly, at a speed of 31 miles per hour, and the maximum speed will be 47 miles per hour. At starting a tractive effort of 40,000 lb. is to be exerted. The pressure on each driving axle is 17 tons, and the total weight on the driving axles is 85 tons. The length of the locomotive overall is 52 ft. As will be seen from fig. 1, there are five coupled driving axles. Three of these are free to move axially sideways, so as to facilitate travelling round curves. The cranks of the two motors are connected together by a triangular frame and by guides to the crank of the central driving wheel. The gross weight of the locomotive is about 108 tons, of which about 50 tons is due to the mechanical structure.

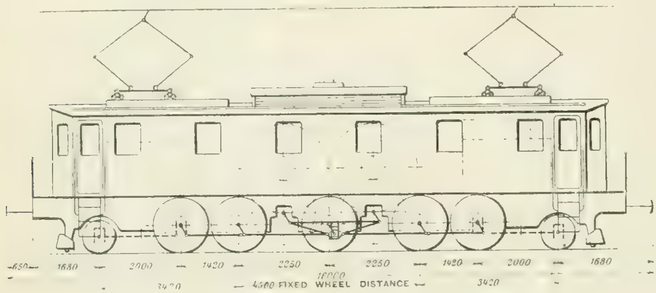


Fig. 1.—Oerlikon s.-p. 2,500-h.p. Locomotive.

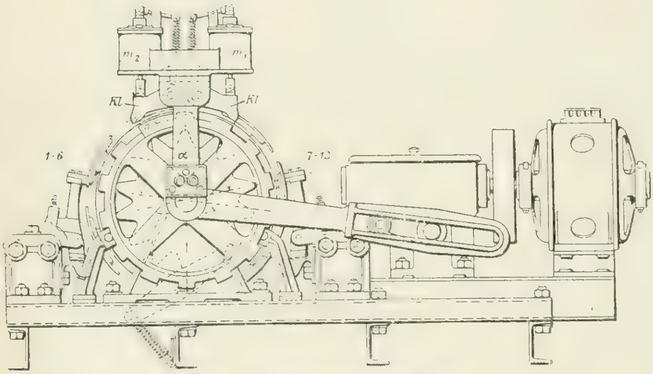


Fig. 2.—Controller, End View

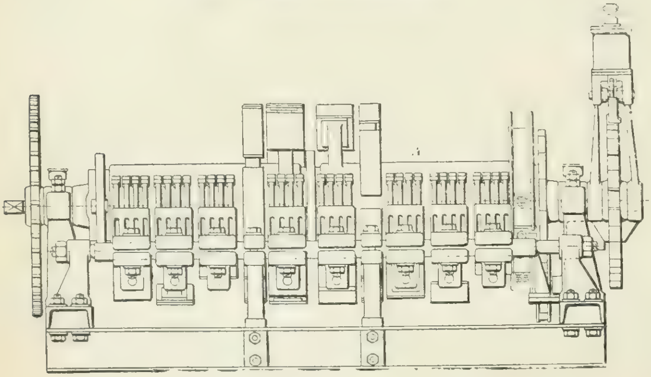


Fig. 3.—Controller for 3,000 Amperes.

As in the previous locomotives, these new motors are worm geared, as this method has proved eminently satisfactory as regards noiselessness and wear. Lubrication of this gear is effected without any trouble, by supplying about 2 pints of stiff grease after every 600 or 700 miles travel. The gear efficiency is extremely high—probably over 98 per cent. The gain in weight of equipment by the use of the gear is obvious; *e.g.*, these particular motors, for a 1½-hour rating of 1,250 h.p., weigh 14 tons each, whilst direct-coupled motors of another make, weighing the same amount, only give 800 h.p. on a 1-hour rating. The use of the gear further enables the dimensions of the motors to be chosen to the best advantage, especially in the case of series motors. The writer considers that series motors have proved themselves superior to those built on the repulsion principle in regard to starting current, commutation and wide speed regulation, especially when provided with commutating poles. The Oerlikon 1,000-h.p. motors on the first Lötschberg locomotive, for instance, have proved as satisfactory as regards commutation as any direct-current motor—the carbon brushes lasting for at least 12,000 car-miles, and the commutator surface being perfectly smooth after long and varied use. The transformers used on the locomotives are air cooled, and the winding is impregnated and embedded in a solid mass of insulating compound as in h.t. cables. They have proved easier to handle, and lighter, than oil-insulated ones.

The controlling apparatus on the locomotives is of especial interest. The motor voltage is only about 400, so that the full-load current is about 3,000 amperes per motor. With, say, 12 voltage steps, each step involves a jump of about 100 k.v.a., and the best way of dealing with this heavy duty is a matter for serious consideration. Some designers employ a series of separate electro-magnetically operated switches; others avoid opening the circuit at all, by the use of induction regulators or by means of brush-shifting control. The separate switch arrangement is, and looks, complicated; the induction regulator is expensive and heavy, and lowers the power factor appreciably, and the brush-shifting method is, of course, only applicable to repulsion motors. After experimenting with the various methods, the Oerlikon Co. finally decided to adopt a self-contained controller, on the same lines as the ordinary tramcar controller, in which a single drum A makes all the necessary connections in rotation (see figs. 2 and 3).

Each transformer carries one of these controllers attached directly to its case, so that the transformer tappings can be connected direct to the controller contact fingers.

Each controller occupies a space 5 ft. 3 in. long, 5 ft. wide, and 2 ft. 9 in. high and weighs a ton. In the controller design chief importance has been given to simplicity and ease of inspection and repair. Special easily replaceable carbon contacts 1—12 are provided to take the sparking, and this is strictly limited by the use of powerful blow-out magnets.

In order to remove all physical strain from the driver these large controllers are not directly hand-operated, but are worked by an ingenious motor-driven gear. This gear keeps up a reciprocating motion continuously, and this causes the controller to move backward or forward step by step according to which of two electromagnetic tappets *Kl* has been released.

The driver, therefore, has simply to move a small switch which sends current from a battery into one or the other electromagnet, m_1 or m_2 and the controller is then rapidly and definitely moved as far forward or backward as is desired.

The two controllers are interlocked, so that normally both move round by identical steps; each can, however, be separately moved in case of accident to the other. Further, the operation can, in case of emergency, be entirely carried out by hand. The motors are so coupled that (1) both can be used in series or in parallel with the two controllers; or (2) both can be operated in series from one controller and transformer; or (3) each half of the apparatus (consisting of a high-tension cut-out, transformer, controller, operating gear and motor) can be quite independently handled.

ELECTRICAL ACCIDENTS IN 1911.

(Concluded from page 11.)

TABLE II.—Electrical Accidents in Factories other than Electrical Stations in 1911.

The small figures relate to fatal accidents, and are included in the principal figures.

Arcing of	switches	37
	fuses	10
Shock or burns from fuses when replacing fuse-wires		28
Portable apparatus, connectors and flexible wires		62^{2}
Unprotected conductors, switches, terminals, fuses, &c.		23
Working on or near live conductors	Skilled persons	41
	Unskilled persons	24
Miscellaneous accidents in electrical manufacturing works—mostly in testing operations		36^{1}
Adjusting brushes and cleaning commutators		2
Miscellaneous		27^{4}
Total		290^{7}

These accidents show a slight increase in number over those of the previous year—290, as against 276—whilst the fatalities were seven, as compared with five in the previous year.

Of those caused by the arcing of switches, a number on motor circuits were as usual primarily due to the previous failure of the no-voltage release on the starting switch, so that the main motor switch was put in on a short circuit, producing a heavy arc at the contacts. In some cases the switches were protected by covers having a slot for the handle to work through. This form of cover is the only one which can be applied to certain types of switch, and while it is satisfactory in preventing the operator from touching live metal, it does not protect the hand from being burned if a heavy arc occurs within the cover, unless there is in addition a shield on the handle. Accidents from the arcing of fuses are due to absence of adequate protection. Some enclosed or cartridge type fuses which will operate satisfactorily on a moderate overload will explode violently on a short-circuit, and need protection as much as bare wire fuses.

Many of the accidents in the renewing of fuses were with the primitive type of bare wire or strip-metal fuses directly connected to the live fuse terminals, and unprotected by a switch. Short-circuits were made with screw-drivers or by the fuse metal getting across both poles. In some cases switches were provided for cutting off the pressure, but were not used. In one case the man took hold of a live fuse terminal, 220 volts alternating, and was unable to leave go until pulled away by someone else.

The 62 accidents in connection with portable apparatus were mostly due to short-circuits, causing burns. In 24 cases the short-circuits were in the flexible wires and were due to the covering of the wires having been damaged, or to the fact that the wires were insufficiently protected in the first instance in view of the rough treatment to which they would be subjected in ordinary use. In 21 cases the short-circuit occurred at the connector plug, and under circumstances where the accidents would have been prevented by the use of plugs constructed with hand shields on the lines which I have described in former reports. Several were caused through connecting hand lamps and even drills, taking a considerable amount of current, by means of "adapters" to ordinary lampholders. There were also several cases of shock received from portable drills which were leaky and had not been earthed. The two fatalities occurred through the use of unearthed and improperly constructed hand lamps.

The accidents to skilled men, *i.e.*, "electricians," when working on live conductors are frequently inexcusable, the men taking unnecessary risks of which they are fully aware. In some cases they have not taken the trouble to switch off the pressure, and in other cases the work might have waited until after factory hours, when the whole installation, or, at any rate, the particular circuit could have been made dead without inconvenience. The similar accidents to unskilled men, *i.e.*, not having technical knowledge, were in several cases due to the stupidity of, or want of proper supervision on the part of, the electrician in charge of the work. In some cases the men attempted to do some work entirely on their own responsibility, and in others they were employed on work for which they were not technically competent.

The accidents occurring at the works of electrical manufacturing firms were nearly all in the testing departments, and, as usual, many occurred to apprentices and the like. The average age of 32 of the 36 persons meeting with accidents was only 21 years. The fatal case occurred in a large testing shop, and was due to a mistake in connecting up two high-pressure machines with the same set of conductors and artificial load, one set of men apparently not being aware of what the others were doing. One machine was started up, and a man working on the other received a fatal shock.

Under the heading "Miscellaneous" there were four fatalities. One occurred at a shed of an electrically-operated railway, the man climbing on to the roof of a carriage, apparently forgetting that the high-tension overhead wires were alive. The second occurred in a shipyard to a man working a large outdoor radial drilling machine which was driven by a three-phase 440-volt motor bolted to it. The machine was fixed to an upright baulk of timber and was not earthed. A leakage occurred at the motor, and the whole machine, together with the metal plate being drilled, which rested on timber, became electrically charged. The man operating the machine was killed, and his helper who went to his assistance received a severe shock. The third fatality occurred to the driver of an overhead electric travelling crane in an engineering shop. He was attempting to get from one crane to another in the adjoining bay by climbing across a girder above which the trolley wires were placed, and with which he appears to have come into contact. He was taking a short cut instead of going down one ladder and up another. The fourth fatality occurred at the trolley wires of a dock crane, which were on the ground and protected except for a longitudinal slot in the cover through which the collectors travelled. The man appears to have dropped something in the slot and to have put his hand in to try and get it out, and touched the conductors.

Prosecutions were taken for breaches of the Regulations in reference to two fatal accidents and two non-fatal accidents. In the fatal cases convictions were obtained and penalties of £50 and £10 with costs in each case were obtained. In the other cases a penalty of £1 and costs was obtained in one instance, and the other case was withdrawn on payment of costs by the firm, the Court deciding that the admitted contravention of the Regulations and resulting accident were due to the wrongful action of the injured person himself.

During the year a considerable amount of work has been done by the District Staff in enforcing the requirements of the Regulations. Although it is evident that generally much greater attention is given to questions of safety, no doubt as a result of the establishment of the Regulations, there are numerous instances where occupiers or their responsible engineers do not take the necessary steps until the various matters are pointed out to them in detail. I again found examples of new work which was not in compliance with the requirements. The electrical contractors are often responsible for this, either in not taking the trouble to consider the Regulations, or, as is evident in some cases, for the sake of cheapness. Even where the occupier specifies that the work is to be carried out in accordance with Home Office Regulations, it is not always done. In one of these cases, where a new factory had been fitted up for light and power, a number of points were not attended to. I met the contractor's engineer on the works, and, as he admitted that he was fully cognisant of the requirements, I inquired why he had not carried them out. The answer was quite candid, and to the effect that he deliberately took the risk, not expecting that I should pay a visit to the works before he had finished with it. A similar case was reported by Mr. Topham, where a new alternating-current installation had been provided with a number of hand lamps of an old and dangerous type. The contractors assured the occupiers that there was nothing amiss, and it was not until the latter were served with a notice that they would be prosecuted on the first occasion that the lamps were found to be in use that the contractors could be induced to change them.

Dangerous fuses continue to be found even in new work. A common fault is that they cannot be handled for the purposes of renewal without danger of shock through touching live metal. Thus I found grip type fuses having a porcelain grip only about 3 in. in length, with exposed live metal end contacts, in use on 500-volt and 440-volt alternating-current systems unprotected by switches, and in earthed metal cabinets, and some over metal floors, and others out-of-doors over wet ground. It is impossible to handle such fuses without risk of dangerous shock. Similar fuses of the cartridge type are also often found under like dangerous conditions. Another common type of fuse carrier for small fuses has the fuse wire lying in a groove on the front of the porcelain bridge, so that apart from the risk of shock, there is danger to the person renewing the fuse wire, when replacing the carrier on the fuseboard, of getting his hand burned should the fuse blow, as it often does, just at that moment by reason of the fault on the circuit which caused it to go in the first instance not having been rectified. In cases where fuses are protected by switches, they are sometimes placed in a dangerous position. Thus, open-ended tubular type fuses, often for large currents, are placed on switchboards immediately above or below the switch without any intervening guard, so that if they should blow at the moment of switching on, the switchman is liable to get his hand severely burned. I found a number of instances of such an arrangement with fuses up to 1,500 amperes capacity. Such fuses for circuits of large current are liable to be dangerous in any event, and ought not to be used unless specially guarded. Reliable circuit-breakers are now obtainable at prices which will allow of their adoption on circuits of comparatively small current, and are often to be preferred to fuses.

In engineering shops I found unprotected main distributing switchboards for alternating-current power circuits not in an area set apart, and with lathes and drilling machines, &c., within a few feet, to the imminent danger of the men working at the machines.

Manufacturers of electric irons do not yet appear to have realised that these articles when used on factory premises come under the Regulations, and that in many places they are liable to be used under conditions which necessitate their being earthed, no provision being made for the attachment of an earth wire. In one laundry I found 10 irons in use on a 200-volt alternating supply. The floor was of brick, non-insulating, and the girls complained that they received shocks from the irons and had to be very careful to handle them with a cloth, so as not to touch the metal parts. The conditions were such as might readily lead to a fatal accident. While electricity supply authorities are using every endeavour to get their consumers to adopt electrical methods of working, it seems a pity that in such a case as this there should not be supervision to ensure that the consumer shall get an article suitable to his needs, and also that it shall be properly and safely installed. The trouble of the flexible wires becoming twisted up into knots and damaged by repeated pulling out, is a common one where electric irons are used. I found in another case that it had been overcome by the use of flexible metallic sheathing. This was rigidly fixed at one end at a point about 5 ft. above the table, and at the other to the iron. While this gave all necessary flexibility for the movement of the iron, it was found that the latter could not be twisted round more than a couple of turns without causing such a strain on the girl's wrist as to cause her to untwist it. If twisted up for more than a couple of turns, it would of itself untwist, turning the iron round when the hand was removed.

In a number of works old-fashioned and dangerous types of hand lamps were still in use, and sometimes incandescent lamps were used merely in lampholders as portable lamps, the lampholders not being earthed. One of the fatal accidents referred to elsewhere was attributable to this arrangement. Safety hand lamps which do not require earthing are now made by a considerable number of manufacturers. Unfortunately, hand lamps and other fittings are sometimes advertised and sold as of "Home Office pattern" without any justification. In one such case a well-known firm put on the market, as of "Home Office pattern," a hand lamp which outwardly looked to be entirely satisfactory, and it was not until I took one to pieces that I found that the metal guard was in actual metallic connection with the lampholder. It was necessary to inform the firm that the occupier of any factory where these hand lamps might be found in use would be liable to prosecution. The firm took steps to recall from their agents all of the defective lamps, but unfortunately it is impossible to trace those actually sold. In this case the fault does not appear to have been in any way intentional, or due to a desire to produce a cheap article, but merely to ignorance on the part of the designer, who seems to have copied certain features of other lamps, but rendered the result abortive by the method adopted for fixing the several parts together.

In many works, particularly engineering works and shipyards, the importance of adequately earthing frames and covers of electrical apparatus is not always appreciated. A fatal accident due to this neglect is referred to elsewhere.

In important electricity supply and traction undertakings there is often neglect of elementary precautions, and the presumably competent persons employed do not always appear to realise the risks they often unnecessarily take. Thus, in a railway sub-station I found an attendant eating his supper while sitting on the bedplate of a motor-generator, with a bare terminal block at 600 volts above earth only two or three inches behind his head.

There are still to be found in use numerous examples of switches of a dangerous type, which I have so often described before, in which the handle cannot be grasped without danger of touching live metal. On a public supply station switchboard I found double-pole switches with live nuts on the handle side of the cross-bar less than 3 in. apart, with the switch handle between, there being 500 volts difference of pressure between the nuts.

In the case of important new stations, the engineers responsible for the design do not always give sufficient attention to the practical side of the subsequent running of the station. Two examples of such want of foresight came to my notice during the year. One was a new station for supplying light and power in a large iron and steel works. High-pressure three-phase current is generated and is required night and day, including Sundays. The switchboard, although divided into sections, was not arranged for screening off live parts from dead parts in case of work having to be done. It was, therefore, impossible to undertake any cleaning, repairs or overhaul of the apparatus in safety without shutting down the station. The other station was also high-pressure three-phase, for the supply of electrical energy over an extensive area through sub-stations. Here, again, the switchboard was badly designed. All the necessary isolating switches were there, but were wrongly connected and arranged. The oil switches for both generators and feeders were connected directly to the bus-bars, the isolating switches being between the oil switches and the generators and feeders. By this means, although it was possible to isolate any generator or feeder, it was impossible to isolate any of the oil switches. Should an oil switch require overhauling, and in every well-managed station such oil switches would be examined and overhauled periodically whether they had given any trouble or not, the work could only be undertaken by shutting down the whole supply. In this case a firm of consulting engineers was responsible for the arrangement.

In premises where dust-clouds are liable to be formed, special precautions should be taken in regard to any electrical installation to prevent the possibility of any sparking or arcing where it could ignite dust.

Although a report on my work must necessarily deal mainly with the unsatisfactory and dangerous features which come under my notice, and with which I have to deal, there is on the other hand an increasing number of examples of excellent work in both electrical stations and factories. The general standard is much better than it was a few years ago. The electrical exhibition held in London in the autumn afforded opportunity for noting progress in different directions. A number of firms showed apparatus which they had specially designed in view of the requirements of the Regulations.

A novel and useful electrical appliance for controlling cranes in the loading and unloading of ships, which seems likely to be extensively adopted, for this and other purposes, not only on account of its efficiency for the work, but also on account of greater safety to the workmen employed, was brought to my notice during the year. It has been already applied to the control of both electric and hydraulic cranes. The driver stands at a convenient point beside the hatchway, whence he can see into the hold. He is provided with a small drum-shaped controller slung from his shoulders, and he can move about freely as he likes. He, therefore, has the load in sight from the bottom of the hold until it is deposited upon the quay, railway wagon, or barge. The controller, which is connected to the crane by a flexible armoured cable is provided with two handles, one for controlling the hoisting and lowering motions, and the other for slewing. There is also an emergency button, by which the current can be cut off and the crane brought instantly to rest. The crane motors are operated through a system of contactors which are controlled from the portable controller by means of a comparatively small current at a low voltage. Thus the crane motors may be worked from a 500-volt supply, whilst 100 volts only may be used in the portable controller, a small motor generator being placed in the crane cabin for providing the low voltage current. The operation of the cranes in this way is very interesting to watch. The most striking features are the perfect control of the load and the fact that the crane cabin having no occupant, the whole operation appears to be automatic.

An apparatus has been devised by Dr. K. A. Fries, of Stockholm, and has been recently introduced into this country, for carrying out the Sylvester method of artificial respiration. The Schäfer method is now generally considered by medical men to be superior, one reason being that the patient being placed face downwards, the difficulty of the tongue blocking the air passages is obviated. A representative committee of American doctors and electrical men, who recently considered the merits of the different methods, have unanimously recommended the Schäfer method.

The use of electrical energy for motive power purposes in factories has been developed almost entirely during the past 10 years, and the horse-power of motors connected to public supply mains is at least 744,000. The actual total for all factories is, no doubt, much larger, as a number of important districts are omitted and factories generating their own electrical energy are not included. Whilst the number of accidents was steadily increasing up to the end of 1907, it has since remained almost stationary. The check in the increase of the number of accidents occurred in the year following the issue of the draft Regulations, in which the attention of occupiers and engineers was further drawn to the consideration of questions of safety by the public inquiry. Had the accidents continued to increase at the same rate and in accordance with the increasing use of electrical energy, they would now have reached more than double the number actually recorded. The results are even more favourable than is indicated, as there are now included for the first time accidents occurring at electrical stations of purely traction undertakings.

TABLE III.—ELECTRICAL FATALITIES REPORTED UNDER THE FACTORY ACTS IN 1911.

No.	Month.	District.	Voltage of system.	Voltage of circuit or probable voltage of shock.	System—A, alternating; 1, single-phase; 2, two-phase; 3, three-phase; D, direct.
1	Feb.	South London	10,000	10,000	A 1.
2	April	Newcastle ...	580	*	D.
3	July	Newcastle ...	440	250-440	A 3.
4	July	Glasgow ...	250	250	D.
5	July	Newcastle ...	20,000	12,000	A 3.
6	July	Manchester ...	10,000	6,000	A 3.
7	July	Birmingham	2,100	2,100	A 2.
8	Aug.	Stockton ...	440	250-440	A 3.
9	Aug.	Newcastle ...	440	250-440	A 3.
10	Oct.	South London	2,200	2,200	A 1.
11	Dec.	South London	220	125-220	A 3.

* Burns, not shock.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"A. P." writes:—"Our electrical system is a private one, not having obtained Parliamentary powers, but permission from the local authorities. We supply energy through overhead wires, and as the G.P.O. wires are also overhead, alterations to their system were necessary to enable us to conform with their regulations. These alterations were carried out at our expense, amounting to nearly £200.

"The whole of our system was passed as satisfactory by the P.O. authorities, but they are continually requiring of us to pay the cost of alterations to their system when making extensions. Thus, when they run a pair of insulated wires to a new customer, which, in the ordinary course, would be bare, we are called upon to bear the extra cost.

"At present I have a pole stayed across the road, in the manner shown in sketch. Extensions to the telephone are being made, which brings their wires down to within 17 ft. from the ground level. I am asked to either move my stay or lower it and give the necessary clearance, but both these are impossible and I want them to put in a taller pole, to which they reply that if they do so, it will be at our expense.

"I ask, are they justified in making these continual charges on us for these alterations, when a satisfactory system, approved by them, was laid out in the first instance? Under the present *régime*, I am absolutely at their mercy. They can, apparently, command me to take up a pole when they like, and move it to a spot to meet their requirements, when a little bit of common-sense on their part could save me a lot of trouble and expense."

*** "A. P." appears to be afraid that he is at the mercy of the Postmaster-General, and having regard to the provisions of the Electric Lighting Act, 1888, which especially apply to undertakings carried on otherwise than in accordance with the terms of a provisional order or special Act, it appears that this is so. Thus, by Sec. 4 (2) of this Act, where in any case any electric line or work is used for the supply of electricity in such a manner as to affect injuriously any telegraphic line of the Postmaster-General, or to affect the telegraphic communication through any such line, the Postmaster-General may, by notice to be served upon the body or person owning or using, or entitled to use, such electric line or work, require that such supply be continued only in accordance with such conditions and regulations for the protection of the telegraphic lines of the Postmaster-General, and the telegraphic communication through the same, as he may by or in pursuance of such notice prescribe, and in default of compliance with such conditions and regulations, the Postmaster-General may require that the supply of electricity through such electric line or work shall be forthwith discontinued. Provided that nothing in this sub-section shall apply to the supply of electricity through any electric line or work laid down or erected under and subject to the provisions of any licence, order or special Act, or which may be used in accordance with any conditions or regulations prescribed by the Board of Trade by, or in pursuance of, any notice given by them under this section.

REVIEWS.

Direct and Alternating Current Manual. By F. Bedell and C. A. Pierce. Second Edition. London: Constable and Co., Ltd. 1912. Price 8s. net.

This book, which was first published by Prof. Bedell in 1909, has now been brought well up to date. Its authors claim that, in a restricted sense, it is now complete. This completeness has been gained by a process of judicious elimination rather than compression, experiments consisting of a large amount of data-taking and tabulation and a small amount of technical content having been dropped in favour of those which have proved most effective in student development.

The "method" of the book is as follows: A typical machine is taken and discussed in some detail. Instructions for testing and obtaining characteristics are given, together with diagrams of connections and curves obtained from such machines. The curves are then discussed in detail and appendices are added to make clear some of the difficult points.

An unfortunate feature is that the footnotes to the pages are often so numerous and lengthy that they encroach on the space and inconvenience the reader. Such footnotes might have been added to the appendices to save confusion.

Typical direct-current machinery is dealt with in the first two chapters, and the rest of the book is devoted to the generation, transformation and conversion of alternating currents.

The chapter on "Single-Phase Currents" is an extremely well-written one. The subject is treated graphically as well as algebraically, and some of the paragraphs, including those on power factors and wattless currents, could hardly have been done better. Unfortunately, the same cannot be said of some of the paragraphs on polyphase currents. Under the latter heading one also expected to find far more information on power distribution than is actually given. The "three-wire system" is spoken of in a vague sort of way, but its importance seems to have been underestimated.

Induction and synchronous motors are dealt with in great detail, graphical methods being frequently employed to great advantage. In these sections, however, the omission of summarised results of experiments is a very marked disadvantage. In the early part of the book one is tempted to believe that the authors have wilfully omitted such obvious comparisons as could be made, say, between the various kinds of D.C. machines, perhaps with the intention of allowing the student to think out such things for himself. But when one finds no summary of the relative advantages and disadvantages of induction and synchronous machines, it becomes evident that the omissions, whether wilful or not, are detracting from the usefulness of the book.

The remark that "the growth of electric traction has been coincident with, if not dependent upon, the general use of the synchronous converter" is followed by a useful chapter on the theory and practice of electrical conversion.

A chapter on Wave Analysis and a collection of problems complete the work. The student of electrical engineering should find enough in this book to enable him to carry out tests on all kinds of electrical machinery in a rational and intelligent manner.—P.H.S.K.

Electrical Engineering Test Sheets. By Prof. P. C. Caldwell. London: Hill Publishing Co., Ltd. Price 9s. 6d. net.

This book, if book it can be called, is a fresh departure in the way of imparting knowledge of electrical testing to students of engineering. It consists of a great number of loose sheets fixed inside a cover, in such a manner that any sheet may be removed or replaced at will.

The author calls his system "The Question and Reference Method." This means a system of laboratory instruction, in which the student is required to answer a number of questions covering the theory and performance of the test to be made, before it is begun, and in which he gets his information from carefully selected references, rather than from a single manual. The author thinks that such a system combines the advantage of the research method with the greater expedition gained by the use of the ordinary laboratory manual. The student has to work up the answers to the preliminary questions before he begins the actual test, and hence he is assured of a good knowledge of the subject before he actually engages in any particular experiment. Again, having some preliminary knowledge of important features of the test, he requires less explicit directions in its performance, independence of action being thus cultivated without too much loss of time.

The chief object of the author, however, in adopting the loose-leaf system is to help to solve the difficult problem of producing a manual adaptable to the varying conditions of different laboratories and courses; for further tests may easily be inserted in leaf form, if such be desired, or some may be omitted that are already there. As many books are referred to in the preliminary instructions, from which students are supposed to make notes, a reference library is indispensable at the Institute where the tests are carried out.

The range of subjects covered is very large, practically embracing the whole gamut of electrical measurements and testing. The experiments are subdivided in order of difficulty, those suitable for elementary, advanced and research students being suitably marked.

It has always been a difficult matter in laboratory work to cater for students belonging to the different colleges and institutions, by reason of the varying types of apparatus to be found in the different laboratories, and the somewhat different courses followed. Most teachers have their own pet methods of giving instruction, and get out their own experimental sheets. They usually resent anything being forced upon them, considering, very truly, that they themselves are the best judges of what is suitable for their own particular needs. Furthermore, it is doubtful if any method, however elastic, can be taken as a standard in laboratory teaching. The very essence of experimental work is a flexible variation conforming to conditions of time and place. So that, taking all in all, laboratory teaching, above all teaching, usually resolves itself into individual instruction.

The work under review is an heroic attempt to standardise laboratory work, to reconcile the various conflicting and antagonistic elements always present in it. The author states that it has been very successful where it has been used, chiefly in the Ohio State University, and we can well believe this. If it would be successful anywhere, that place would be a well-equipped University, where many advanced students were to be found. For there can be little doubt that any student who conscientiously carried out even one-third of the experiments given would have a very good knowledge of electrical testing; for such places, then—for the Universities and higher day institutions—the book will probably answer well. But what about the evening classes in technical institutions, where thousands of students assemble to learn something of electrical testing? Will it do for them? We are afraid not. Evening instruction is a science unto itself. No man who has not engaged in it for years can have any conception of its difficulties and limitations. We may safely say that any text-book which is suitable for day courses, is always unsuitable for evening classes. Indeed, we may go further and lay down as an axiom that what is good for day classes is *ipso facto* bad for evening work.

The work shows in its make-up much painstaking care, and although, as a general method of laboratory teaching, it will not find favour with all, yet we appreciate the fact that there are some who will undoubtedly bless it. The price seems to us excessive. No doubt there is a good 9s. 6d. worth in it, but English text-book readers are accustomed to obtain more *volume* for their money.

Macchine Dinamo-Elettriche e Trasformatori Statici. By Ing. Cesare Della Salda. Milan: Biblioteca di Elettricita. Price 3 lire.

The bewildering number of distinct types of electrical machinery in actual use is only made obvious when a systematic classification is made of them. We have such a classification before us in a treatise by Ing. Cesare Della Salda, with the title of "Dynamo-Electric Machinery and Static Transformers." The sub-title better explains the scope of this work, which is "a synthesis and explanation of the working principles" of the above machinery. The book opens with a comparison of the different conceptions of energy, as kinetic, electrostatic, electrodynamic, magnetic, with a view to keeping in the reader's mind the analogy between the various forms of energy, and the fact that all electrical machinery exists for the transformation of these forms of energy. This point seems to be rather laboured, and indeed, the innovation which the author mentions in his preface, being a physical interpretation of electrostatic potential, seems rather to mislead the student than to help in the classification which forms the value of this book. In order to interpret electrostatic potential in this way, a product is arrived at of $\frac{1}{2} Q V$, where Q is the electrostatic charge, and V its potential, the expression being intended to show the analogy with the expression for the kinetic energy of a moving mass. The most valuable part of the present work lies in the very systematic way in which the types of dynamo-electric machinery have been classified according to the form of energy transformation carried out by each type of machine.

Thus in Part I of the book all the different transformations of energy by electrical machinery are covered. In Part II the various types of dynamo-electric machinery in use are divided into six classes, according to the functions they perform in the transformation of energy.

Class 1A includes 26 different types of machine, forming the most important class commercially. It covers all types of generators of continuous, single-phase and polyphase currents, with independent fields.

Class 2A concerns motors, 32 different types of energy transformations being given.

Class 3A includes various types of transformers of electrodynamic energy into electrodynamic energy, that is, static transformers, motor-generators, converters and rectifiers. Eleven types are described.

Classes 4A and 5A cover single-phase and polyphase generators and motors with combined fields.

Class 6A includes various special transformations, such as transformations of frequency and special grouping of alternating-current motors.

After the setting-out of the above six classes, and the types included, the types are dealt with one by one, and a short description is given of the working theory of each. In Class 1A the theory of several less widely known and special machines is given, and among the better known, those of Heyland, Hutin-Leblanc, Boucherot and Parsons. The theory of the Blathy, Thury and Tirrill systems of mechanical alternator regulators is also described.

In Class 2A some reference is made to the control of induction motors, but there is no mention of the Heyland method of speed control, which has been previously described in these pages, and which has great advantages over the ordinary method of decreasing the number of poles by reversing the current in some of the stator coils. Reversible booster systems are not dealt with in this treatise, presumably because they present no special form of energy transformation.

Of course the value of any such classification as the author has made lies in its applicability to the ordinary uses of the student, and if the various classes do not fall easily into place in the study of the theory of electrical machinery the classification does not fulfil its purpose. There is no doubt that as the various classes have been arranged in this treatise they enable the student to find easily enough the type of machine on which he may want information, but a good index, with something more than the headings of each paragraph, would be an improvement. So also would clearer and larger diagrams be. In spite of any such slight defects the book is a thoroughly useful one, and any practical engineer as well as student would find a place for it among the working part of his technical library.

Elementary Lectures on Electric Discharges, Waves and Impulses, and Other Transients. By C. P. Steinmetz, Ph.D. 1911. London: Hill Publishing Co., Ltd. Price 8s. 6d. net.

In the Cantor Lecture of 1900, Dr. Fleming opened his remarks as follows:—

"The study of electric oscillations and electric waves has of late years borne fruit in practical developments which embrace matters of more than purely scientific interest."

The truth of this statement has been made evident to electrical engineers during the past decade by the vast increase in the use of high-tension power, while its transformation to lower voltages has rendered the study of "transients" a vital necessity.

Dr. Steinmetz has already made an important contribution to the literature of this subject in his "Theory and Calculations of Transient Electric Phenomena and Oscillations." In the book under review he has given a more descriptive account, but withal an account not lacking in precision, of the origin and effects of electric impulses on electric circuits. He describes this book as "a translation from mathematics into English" of his former work. It comprises a series of nine lectures originally delivered to the Graduate Classes of Union University, together with an additional chapter on the calculation of inductances and capacities.

The first lecture deals with the origin and nature of transients. A transient is defined as "the result of a change of the amount of stored energy, and is the phenomenon by which the circuit readjusts itself to the change of stored energy." The author points out the existence of transients with all forms of energy, and gives three interesting reasons why electrical transients have been studied more than others:—

(*a*) Electrical transients generally are simpler in nature, and therefore yield more easily to a theoretical and experimental investigation.

(*b*) The theoretical side of electrical engineering is further advanced than the theoretical side of most other sciences.

(*c*) The destructive effects of transients in electrical systems are far more common and more serious than with other forms of energy.

(*a*) and (*c*) would seem to be sound enough reasons, but (*b*) is, unfortunately, an ideal reason rather than a real one.

The exponential curve, as the expression of the simplest form of transient, is discussed in some detail, and reference is made to the decay of radio-active substances as an illustration of another form of simple transient. The effect of friction on electric impulses is also dealt with.

Lecture II is devoted to the Electric Field, the subject being treated in a very straightforward manner. The analogous relations existing between the magnetic and electric fields and the magnetic, dielectric and electric circuits are set out in useful tables at the end.

Single-energy Transients are dealt with in three lectures: (1) Continuous-current circuits; (2) Alternating-current circuits; (3) Ironclad circuits.

An extremely practical question, viz., the starting transients in A.C. circuits, is discussed at some length; graphical methods for calculating the magnetic fields in polyphase machinery are given, and oscillograms of armature and field currents for momentary short-circuits provide valuable information on this subject.

Lecture VI treats of the case in which the energy is stored in two forms—as dielectric and magnetic energy. The oscillation produced is studied by considering separately the pulsation of energy between the two forms and the gradual dissipation of energy. The subjects of Line Oscillations and Travelling Waves are illustrated by oscillograms taken on actual industrial circuits, while a whole chapter is taken up with consideration of the practical case in which oscillations take place in a compound circuit consisting of transformer, line, load, &c.

In the added chapter on the calculation of inductance and capacity the formula—

$$L = 2 \{\log s/r + \mu/4\} \; 10^{-9} \text{ henrys/cm.}$$

for two wires is derived by considering the internal flux in the conductor of radius r and the external flux, the return conductor being at a distance s. The capacity—

$$C = \frac{K}{2 v^2 \log s/r} \; 10^{9} \text{ farads/cm.}$$

is obtained in the usual way. The value of L for a conductor with earth return is obtained by the method of electrical images.

The book is well indexed, the chapter headings being picked out in larger type, facilitating reference to particular subjects. In so far as it accomplishes the difficult task that its author sets out upon—viz., to translate mathematical physics into English (or, rather, American)—this book must be dubbed a success.—P. H. S. K.

HINTS ON DEVELOPING A MOTOR LOAD.

By WALTER E. ROGERS, A.M.I.E.E.

Happily, the day is now past when many of our station chiefs would not, or could not, admit that a cheap power supply was advantageous to themselves as controllers of an undertaking, generally speaking, representing the local ratepayers' interests directly or indirectly. But in many quarters, especially in connection with the smaller municipalities, the arguments still rage around the question, as our City Fathers put it, of selling a commodity under cost price. The committee-man's point of view usually takes a form based on a number of years' experience as a purveyor of tea and coffee, that if these commodities cost him 10d. per lb., he cannot afford to dispose of them at, say, 8d. per lb. Well and good, so far as his business goes; but this reasoning does not apply to a manufacturing concern where turnover may be said to be the *sine qua non* of a satisfactory balance-sheet. All the arguments brought forward by the station man in favour of a cheap supply of electricity for power can be boiled down to the statement that if, by selling cheaply to day-load consumers, we can increase our units generated by, say, 20 per cent., this so reduces the cost of production that a much larger profit is made on the total output.

In making this statement I am aware that I am by no means exhaustively treating this complex subject; but I maintain that it underlies the bulk of argument on this question. Assuming that by now our Committee has been worked up to the right pitch of intelligence, or enthusiasm, to grasp the fact that it would be to the interests of the department and the ratepayers to proceed on the lines advocated by the man whom the Council has elected, out of 300 applicants, to fill the onerous post of Borough Electrical Engineer at the princely stipend of £200 per year—Where is the money for a motor-hiring scheme to come from? Here is a facer.

The Corporation's Act, or Provisional Order, makes no provision for anything in the nature of hiring-out apparatus, and the Town Clerk advises that it will cost, perhaps, £300 to obtain the necessary powers. In fact, everybody in authority, including the L.G.B., seems to have combined metaphorically to throttle the engineer.

It may be very wrong, but I know of municipalities to-day operating highly successful motor-hiring schemes with never a bit of power or authority for doing so; but since they are such a brilliant success financially, I presume nobody asks questions. The whole thing came about after a quiet conference between the chairman, the engineer and the borough treasurer. Not being present at the conference myself, I know not what went on, but I was given to understand that the air was cleared with overdrafts.

£200 to £300 is enough to start a small motor-hiring scheme, provided one is sure of one's ground, and goes to work feeling one's way cautiously. Do not attempt any hire-purchase work at first, but just rent a few motors out, fixing your rents high. Nothing less than 20 per cent. on capital cost of motor and installation is safe.

I know that all this does not conform to the highly desirable financial methods advocated in your admirable journal, but it is, and has been, done most successfully within my experience, and the only excuse I submit is that "nothing succeeds like success."

The remnant of a conscience prompts me to suggest an alternative to the above scandal. Competition is keen, we are told, amongst electrical manufacturers. In conversation with some of them, I have gathered that a few of them, at any rate, are prepared to stand godparent to a motor-hiring scheme. On these lines it should not be difficult to get to work, to the advantage of all concerned.

Since this article does not purport to treat the subject from the large undertakings' point of view, such desirable aids as an army of canvassers, tons of literature, and a showroom are assumed to be non-existent. I refer only to the undertakings where, eliminating the generating staff, the electricity department is run by the chief, a mains man, a clerk and a boy. Here, if the mains man is keen, he will earn his £2 or £3 per week by combining the duties of canvasser and consumers' adviser, meter tester and draughtsman, and very possibly a host of other duties as well. So far as my experience goes, he will have far more to see to than any one individual can possibly attend to efficiently. Under these circumstances very little genuine canvassing will be done, except possibly in the summer months, when it is quite pleasant to cycle round the town, calling upon all the butchers, bakers and candlestick makers, &c., *apropos* of electrifying their respective chaff-cutters, hoists, &c.

All things considered, our mains man must have considerable latitude as regards hours of attendance at the office or works, and, above all, he must have ample authority to close a deal promptly without too much reference to headquarters. Most vital of all, he must be allowed to use his discretion.

Personally, I have secured more orders, or obtained more consumers, by offering to install free, gratis and for nothing, a motor for a few months on trial, the user paying only for energy consumed, than by any other means. If this be done intelligently by an experienced man with a tongue, who thoroughly knows his town and the people, I venture to predict that very few motors will be returned to stock at the end of the month or two's trial. Some managers have said to me, "Why go in for motor hiring at all, when you can get your fellow-townsmen to buy their own motors outright?" Happily but few are the managers who can talk like this with justice. Usually, if one inquires into this particular manager's works costs, &c., one finds them high, inevitably due to a poor load factor—*i.e.*, lack of day load.

One of the most serious disadvantages under which the Corporation's official labours, as compared with the power company's representative, is in the matter of special rates to special consumers. The narrow-minded bigotry, to say nothing of any legal restrictions, which frequently impedes or hampers the progress of a municipality operating a really going concern, demands that the electricity department shall have a printed and published tariff. In the majority of cases this operates well enough, and obviates complication if the maximum-demand system is not in vogue.

One undertaking with which I was connected was feeling very keenly the influence of a power company's competition. The company could step in and offer a favourable price to a prospective and desirable consumer, because it (the company) knew exactly what the local Borough tariff was.

To meet this kind of one-sided competition, the Borough electrical officials devised a scheme of charges based on the load-factor of the consumer, this being printed, published and circulated after what seemed an interminable amount of squabble and argument in the committee and Council chambers. Armed with the new figures and my chief's authority, I was placed in a position where I could, and did, wage a very successful campaign in competition with the company. Knowing the town as well as my native bush, I approached first of all a corn-mill owner, who was operating his plant with suction-gas equipment. Having had my eye on his plant for some time, I knew every detail of his costs, working hours, H.P., &c.; hence I was able to install a motor free on trial, with the absolute certainty that electricity would show a considerable economy over gas. This proving to be so after three months' trial, I succeeded in electrifying the whole mill, disposing of the gas plant so favourably that the pecuniary outlay, so far as this mill was concerned, did not exceed £10. The owner was, and is to-day, satisfied; we gained a consumer, who, when last I heard of him, was using upwards of 20,000 units per quarter.

I could repeat the above story almost indefinitely, but should be serving no useful purpose in so doing; wherefore, I turn to other matters.

What method shall we adopt to ascertain the load factors of our consumers, be they prospective or actually in being? Here I say most emphatically, when you are, as it were, fighting a company, the less you have to do with recording instruments the better. The hardest weapon, or, rather, the most subtle and far-reaching, which a company employs, is "gab." Therefore, fight it with its own weapon; obtain a good man as your outside commander, and let him be your load-factor recorder.

For many of your smaller consumers, the ordinary demand indicator may be installed. Here the critical reader will say, What a field is here opened up for disputes! So it is, unless you have chosen your man well and are yourself strong enough to carry your point with the committee.

Of course, when you have secured a power consumer, you must have him sign an agreement for a stated period at a stated rental, &c. With regard to these agreements, your Town Clerk will probably advise you that they must be stamped; not being a lawyer, I am not in a position to express an opinion as to the necessity for a stamp, though, strictly speaking, I believe it is not in order without a stamp. Still, a healthy concern with which I was for some time associated, dispensed with the stamp, and carried on what to-day is, I believe, a most successful hiring scheme.

Here, again, the personal element is very closely associated with success or failure. Now and then, an undesirable consumer will be secured, and a bad debt incurred, but this is the ordinary risk met with in any and every business.

Frequently a word or two with your Borough Treasurer will influence your procedure as to the desirability of Mr. X as a consumer. Generally speaking, deposits are advisable, in which case interest at the current bank rate should be allowed, or, as this is a variable quantity, usually your customers will be satisfied with 3 per cent. or 4 per cent., but the rate should not differ for different consumers, or discontent becomes rife.

In your agreement it should be specifically stated that the hirer is to insure his electrical equipment for so much. This does not as a rule involve a serious difficulty, because the amount is usually very small, and the consumer's premises are generally financially protected against a conflagration. If this course is not pursued, your motors should be insured along with the other municipal properties. All Corporation property on consumers' premises should be marked as such.

Another point which invariably seems to crop up with the hiring-out of plant, is as follows:—A consumer is, say, obtaining some equipment or plant on the hire-purchase system, which plant is being driven by a Corporation motor. He fails to pay the rent of his premises. Down comes his landlord and seizes his goods, including the Corporation motor; this does not cause the motor to spark, as it knows all the time that it is protected by the Electricity Supply Act, and cannot be distrained on as can the hire-purchase plant.

Apropos of developing a power load, the following story is relevant. Not long ago one of the large railway companies approached a certain municipality with a view to obtaining a supply of electricity from the Borough; the query was for some 500 KW. or 600 KW. demand, about five miles from the Corporation generating station, where there was already an E.H.T. three-phase plant thirsting for more load. When this query filtered through to the chief engineer, imagine with what alacrity he seized upon his slide rule. However, on figuring it out, he found that, taking into account the capacity of his plant and prospective loads already contracted for, he could not safely tackle the job without some considerable extension, and if the necessary extension was carried out, that incubus, interest and sinking fund, would almost throttle his works, which at that time, with the load he already had, was operating very nearly at its maximum capacity and efficiency as things go in England to-day.

Now, I hold that in an undertaking, however remotely resembling an industrial or manufacturing concern, there is no such thing as "marking time." A concern which is not progressing is not just standing still, but is actually taking a retrograde step, is, in fact, a "sinking ship." Had this particular chief had a little more confidence in his staff, he would have put his heart into the scheme and done all he could to obtain the load. As things were, he was lukewarm. Also, and here was a serious obstacle, the Corporation had been approached by the company *via* the Town Clerk. Now, town clerks are, as a rule, the best of fellows. Some of them are my very best friends. But good lawyers though they are, as engineers and managers of a department with something to sell, they are a failure. Add to this that the particular engineer was at loggerheads with all his brother officials, due to many years of studied dirty work on his part. When the Town Clerk's report came before the committee, it was of a decidedly negative character. Result: the scheme was lost to this electricity department, owing to the personal element; but this is not all. Receiving a rebuff, the railway company placed their project before another municipality situated, if anything, in a worse position to supply, than the Borough I have written about, but with this difference, all was well between officials, and strong men were in command.

The scheme has gone through, and supply is about to be commenced, if, indeed, it is not actually in operation now. Of course, the price is decidedly close cut, but one works has secured a good load for a long period, and one of our premier railways is hardly likely to overwhelm a municipality with a bad debt.

Returning to the question of hiring motors, greater satisfaction is usually obtained if the electricity department supplies the oil for lubricating purposes, even if the supply authority charges for it. Also, when the initial equipment of motor brushes requires renewing, the consumer should pay for these. Inspection and cleaning of motors periodically after installation is very desirable, but very little of this need be done during the first 12 months after inaugurating the motor-hiring scheme.

Particulars of all charges for which the consumer is liable should be clearly stated in the agreement. I am in favour of the department maintaining all motors and wiring free, subject to the usual limitations, such as wilful or malicious damage and neglect. It will be found, as things develop, that the small manufacturers appreciate thoroughly the advantage of having skilled advice and assistance always at call on the telephone.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Canadian Agency of London is said to have been granted a charter for constructing a dam on the Saskatchewan River, about 13 miles north of Saskatoon. Preliminary work has already begun. It is also stated that about £140,000 will be spent by the Agency this year on the dam and in laying some 12 miles of street railway.

According to the newspapers, Sir William Mackenzie, of Mackenzie & Mann (owners of the Canadian Northern Railway, which has developed so rapidly of late), has this week effected a deal, by which his firm now controls practically all the important electrical interests in the province of Ontario, except the Hydro-Electric Power Commission. The Dominion Power and Transmission Co., which controls 14 other companies, has been taken over by Messrs. Mackenzie & Mann, thus adding greatly to their already very large interests in electricity supply and electric railway companies.

The West Kootenay Power and Light Co., of Nelson, B.C., is reported to have decided to install an 8,000-H.P. unit at its No. 1 plant at Bonnington Falls. The company is getting ready to supply power for the Canadian Pacific Railway, a section of which, from Castlegar to Rossland, is to be equipped for electric operation.

The Town Council of Humboldt, Saskatchewan, has just decided to begin work on the construction of an electric light plant. Humboldt lies about 65 miles almost due east of Saskatoon, and is on the Canadian Northern Railway route. Saskatoon is a rapidly growing town about 450 miles west and 150 miles north of Winnipeg.

THE CARE OF CONTROLLERS ON TRAMCARS.

There is no doubt that a great many of the maintenance charges which are found in connection with electric traction systems are due to insufficient attention being paid by the driver to the proper handling of the gear in his charge, and this is nowhere more felt than in connection with the controllers on the tramcar. A careless driver can easily cost a tramway company pounds in the renewal of contact fingers and segments alone, and this is a point which needs to be very carefully watched in order to avoid undue waste. An increased demand for controller fingers and contacts at a depôt on investigation will often be found to be due to the fact that the controllers are being neglected. When the cars are in the depôt, cleaning and adjustment of the fingers and contacts is not being attended to from day to day, with the result that scored contacts and burnt fingers become increasingly numerous and require frequent renewal. The effect of having a bad contact of this description in a controller is cumulative, and wear rapidly augments, so that they should be attended to from the start. Moreover, it has a bad effect on the drivers, because if care is not exercised at the depôt to turn out the apparatus in a good condition for them to handle, they will not be able to handle them properly and there will be trouble in driving, leading to premature wear, which will inevitably be put down to careless driving.

It will be found that controller fingers and contacts rarely require replacing if a few simple precautions are adopted. The barrel contacts should be wiped over every night if possible, and dull contacts should be cleaned with emery cloth. If any burnt fingers are discovered they should be trimmed with a file and readjusted. Finally, the controller cables should be examined, copper dust should be blown out of the controller with a pair of bellows, and all contacts should be wiped over with a rag, on which has been placed a very small quantity of commercial petroleum jelly. If these points are consistently attended to before the car is sent out to service, it will be found that the controller will always be presentable and that the faults will be reduced to a minimum.

On the road a certain amount of inspection should be maintained in order to see that the drivers are handling the controllers carefully and correctly. The driver who tries to adopt a dashing style of driving should be checked before he can do any damage, inasmuch as not only does a slap-dash style of handling the controller induce considerable wear and tear which might otherwise be avoided, but there is generally a lot of wear on the brakes due to the driver having to use these instead of allowing his car to coast, and very frequently owing to the rapid application of the brakes the wheels become locked and skid, causing flats. Moreover, it is obvious that if a car is braked in this way, energy is being wasted which shows itself in the power-house coal bill. It very often happens that controllers fire badly when cars are passing under section insulators and the driver is not quick enough in shutting off his controller. When this has occurred a time or two the fingers become blistered very badly, and when the controller is passed from notch to notch a small amount of arcing is caused which would not occur if the fingers were cleaned and not blistered. Sometimes the same effect is caused by going over the notches too quickly, and a lot of trouble is brought about in this way. A rather curious point has been found on some systems in connection with this matter where meters have been installed on the cars. The driver, knowing that the intermediate notches in the controller are resistance notches, has the idea that if he can get over them quickly he will save current and thus reduce the record against him of energy consumption on the car, and his anxiety to save current has sometimes led to undue wear and tear on the controllers and contacts. Where car meters are installed, the drivers should be especially warned not to handle their controllers too rapidly with the object of saving current.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,692. "Device or protector, for window-sash fastenings, for an electric distribution for protection against burglars and the like." J. Willis. June 24th.

14,693. "Awnings, roofs, canopies and the like for motor and other omnibuses, brakes and vans, electric cars, motor and other launches, vessels and the like military and other huts." W. W. Bengough. June 24th.

14,722. "Electric lighting and reflectors, and screens therefor, especially applicable for footlights or means for lighting stages of theatres, or the like purposes." A. W. Beuttell and J. A. Manners-Smith. June 24th.

14,724. "Time control for electric alarms." S. T. Steel and J. A. Steel. June 24th.

14,735. "Apparatus for the production of high-frequency oscillating currents." V. F. Feeny. (National Wireless Telephone and Telegraph Co., United States.) June 24th. (Complete.)

14,738. "Electric ignition apparatus." S. Rothschild. (Convention date, November 16th, 1911, Germany.) June 24th. (Complete.)

14,739. "Electric switching devices for railways." R. V. Cheatham. (Convention date, June 22nd, 1911, United States.) June 24th. (Complete.)

14,741. "Electrodes for arc lamps." A. Blondel. June 24th.

14,750. "Holders for electric incandescent lamps." R. Wankmuller. June 24th. (Complete.)

14,751. "Electric switches." E. B. Merriam. (Convention date, June 23rd, 1911, United States.) June 24th. (Complete.)

14,752. "Electric switches." E. B. Merriam. (Convention date, June 23rd, 1911.) June 24th. (Complete.)

14,785. "Combined electric switches and plugs." A. H. Railing and C. C. Garrard. June 25th.

14,821. "Thermo-electric generators." E. A. Graham and E. J. Middleton. June 25th.

14,831. "Receivers for printing telegraph systems." G. S. Hiltz. June 25th. (Complete.)

14,837. "Receivers for printing telegraph systems." G. S. Hiltz. June 25th. (Complete.)

14,846. "Means for automatically equalising the load on electric tramways or railways." B. J. G.; son Bergman. June 25th.

14,864. "Vacuum-tube lighting." O. Markiewicz. June 25th. (Complete.)

14,871. "Electric furnace for fixing nitrogen from the air." E. K. Scott. June 25th.

14,872. "Multiple carbon arc lamps." Korting & Mathiesen Akt.-Ges. (Addition to No. 22,631 of 1906. Convention date, June 30th, 1911, Germany.) June 25th. (Complete.)

14,910. "Electric advertisement signs and the like." V. von Vangel. June 26th.

14,929. "Apparatus designed primarily for starting an internal-combustion engine by means of electric energy." E. V. Hartford and L. Mastrangel. (Convention date, July 27th, 1911, United States.) June 26th.

14,931. "Alternating-current commutator motors." Siemens Schuckertwerke G.m.b.H. (Convention date, June 26th, 1911, Germany.) June 26th. (Complete.)

14,939. "Electric slip conduit continuity attachment." A. H. Lamb and C. O'Neill Crowley. June 26th.

14,945. "Call-distributing telephone systems." H. P. Clausen. (Convention date, June 26th, 1911, United States.) June 26th. (Complete.)

14,962. "Machines for manufacturing electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) June 26th.

14,989. "Miners' oil, benzine, electric and acetylene lamps." E. A. Hailwood. June 27th.

15,023. "Electric brakes for tramway and like vehicles." P. S. Turner. June 27th.

15,028. "Means for controlling action of electrical alarm apparatus for cash boxes, jewel boxes and like receptacles." G. Downing and P. S. Moulton. June 27th.

15,038. "Telephonic transmitters." P. Skinner. June 27th.

15,049. "Mine exploders." Sterling Telephone and Electric Co., Ltd., and F. G. Bell. June 27th.

15,053. "Electrical resistance devices." E. Ruhstrat. (Convention date, December 18th, 1911, Germany.) June 27th. (Complete.)

15,057. "Telephone systems." H. P. Clausen. (Convention date, March 11th, 1912, United States.) June 27th. (Complete.)

15,065. "Electric ovens and other electric heating appliances." H. T. Harrison. June 27th.

15,072. "Telephone systems." A. E. Keith. (Convention date, June 28th, 1911, United States.) June 27th. (Complete.)

15,103. "Electrolytic apparatus." A. E. Knowles. (Divided application on 22,759/11. October 16th.) June 27th.

15,119. "Manufacture of tungsten wires or filaments." E. A. Gimingham. June 28th.

15,127. "Electric lamps using incandescence filaments of the second class." A. Clarke. June 28th.

15,134. "Telephone systems." W. H. Derriman. (Automatic Elec. Co., United States.) (Divided application on 15,133/11.) June 28th. (Complete.)

15,171. "Regenerative devices for apparatus for producing Rontgen rays and the like." H. Bauer. June 28th. (Complete.)

15,178. "Automatic electric thermal control." S. L. R. Price. June 28th. (Complete.)

15,216. "System of electrical welding by means of induction current." W. Sokoll. June 29th.

15,229. "Incandescent electric lamps." F. Hoge and H. Hoge. June 29th.

15,256. "Method of, and apparatus for, the electric transmission of signs or speech in mines." J. H. Reineke. June 29th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Centrifugally-operated Contrivance for Automatically Intercepting or Regulating the Flow of an Electric Current from a Dynamo. A. N. Hazelhurst and Longstreths, Ltd. 28,161. December 3rd. June 6th, 1911.)

1911.

Telephone Systems. S. G. S. Dicker. (Automatic Electric Co.) 10,926. May 5th.

Transmission of Electric Power. T. T. Kryshtofovich. 13,492. June 6th.

Remote-controlling Apparatus for Electrically-actuated Travelling Winches and the Like. M. A. Bleichert and M. P. Bleichert. 13,574. June 6th.

Magneto Ignition for Internal-combustion Engines. J. E. F. Cambessedes. 13,633. June 7th. (June 7th, 1910.)

Microphones. A. Rosenberg. 13,884. June 10th.

Detachable Coupling for Electrical Connections. H. D. Thomas. 13,886. June 10th.

Primary Electric Batteries. H. D. P. Huizer. 14,050. June 13th.

Electrically-Driven Clocks or Watch Works of the Primary or Self-Controlling Type. T. Rushton. 14,646. June 21st.

Selective Signalling Systems for Party Lines. Western Electric Co. (E. B. Craft.) 15,321. June 30th. (Convention date not granted.)

Method of and Apparatus for Controlling the Speed of Electro-Motors. Electromotors, Ltd., and E. Greenhalgh. 16,313. July 15th.

Protecting Insulated Conductors against Fire. E. Müller. 16,533. July 18th. (August 3rd, 1910.)

Electro-Mechanical Change Speed and Reversing Device. P. Gasnier. 16,644. July 19th. (July 19th, 1910.)

Automatic Electric Switchgear for Operating Locking Appliances for the Doors of Railway Carriages and other Vehicles. L. H. King. 18,175. August 11th.

Electrical Heating and Air Circulating Appliances. F. Rippingille. 18,324. August 14th.

Means for Supporting and Shading Electric Lamps. M. J. Railing and G. Maurice. 18,583. August 17th.

Electric Arc Lamps. Ges. fur Maschinen und Metall-Industrie. 19,435. August 31st. (September 1st, 1910.)

Circuit Arrangements for Automatic Telephone Systems. Siemens and Halske Akt.-Ges. 19,573. September 2nd. (October 12th, 1910.)

Protective Device for Dynamos, Electro-Motors and similar Electric Machines. F. V. Schiödt. 20,636. September 18th. (September 17th, 1910.)

Dynamo-Electric Generators. G. Inrig and L. Inrig. 20,905. September 21st.

Electric Pocket-Lamps. E. Neudorffer. 21,072. September 23rd. (Addition to No. 14,604 of 1911.)

Electric Vibrators. A. H. Nicholson. 23,191. October 20th.

Storage Battery Electrodes. W. Morrison. 23,261. October 21st.

Means of and Apparatus for Recording Calls made by Telephone. E. H. Bridge. 23,500. October 24th.

Incandescence Electric Lamps. C. Carangelo. 23,725. (Patent of addition not granted.) October 25th. (October 27th, 1910.)

Sparking Plug with Removable Electrode and Central Slidable Electrode. A. L. Cadé. 25,947. November 21st.

Manufacture of Metallic-Filament Incandescent Lamps. Deutsche Gasgluhlicht Akt.-Ges. (Auerges). 28,576. December 19th. (July 19th, 1911.)

Field-Magnets for Multipolar Dynamo-Electric Machines having External Stationary Armatures. E. Volkers. 29,160. December 28th. (December 31st, 1910.)

Suspension Devices for Dynamo-Electric Machines. J. Stone & Co. and A. H. Darker. 9,141. April 12th.

Spark Plugs. A. Schmidt. 13,524. June 6th. (June 9th, 1910.)

Regulators for Dynamo-Electric Machines. British Thomson-Houston Co. and A. A. Pollock. 13,570. June 6th.

Means for Supporting a Telephonic Receiver or similar Instrument in Contact with the Ear. A. Rosenberg. 13,885. June 10th.

Electric Lampholders for Electrically-Illuminated Signs and Devices. H. Bey. 14,303. June 16th.

Terminals for Ignition Plugs. H. G. Longford and W. A. Clark. 16,828. July 22nd.

Electrical Igniters for Gas, Oil and Similar Internal Combustion Engines. A. R. Bellamy. 17,061. July 25th.

Reflector Fittings for Electric Lamps. B. J. Grigsby. 18,160. August 10th.

Electrical Heating Devices. British Thomson-Houston Co. (General Electric Co.) 19,108. August 25th.

Incandescent Electric Lamps. British Thomson-Houston Co. and H. H. Needham. 19,109. August 25th.

Circuit Arrangements for Automatic Telephone Exchanges. Siemens and Halske Akt.-Ges. 19,456. August 31st. (November 8th.)

Automatic Sectioning Means for Limiting Accidental Interruptions of Current Supply in Central Stations. E. Brandenburg., 21,149. September 25th. (October 10th. Patent of Addition not granted.)

Automatic Regulation of Variable Speed Dynamos. E. P. Prior and A. G. Prior. 21,216. September 26th.

Electric Signalling Apparatus. E. Hermsdorf. 22,123. October 7th. (October 19th, 1910.)

Accident Preventing or Life-Saving Apparatus for Electric Tramcars and like Vehicles. T. A. Bennett. 22,274. October 10th.

Electric Batteries or Accumulators. J. H. May and Electrical Power Storage Co. 22,281. October 10th.

Telephone Receivers. E. J. Loosmore. 22,427. October 11th. (February 29th, 1912.)

Driving Mechanism of Portable Electric Generators. J. W. Record. 22,655. October 14th.

Process and Apparatus for the Electrolysis of Aqueous Solutions of Metallic Salts. R. Carl. 24,238. November 1st. (November 3rd, 1910.)

Means for Providing Electric Light for Cycles, Motor Cycles, Motor-Cabs and like Vehicles. F. von Madaler and R. H. Morten. 24,685. November 6th.

Acoustic Pyrometers. C. de A. M. Costa. 25,265. November 13th.

Footsteps for Telegraph Poles and other like Posts or Poles. Bullers, Ltd., and J. W. Jones. 25,518. November 16th.

Tungsten Wire Especially Suitable for use as Incandescence Body or Filament for Incandescent Electric Lamps. O. Krause. 27,360. December 6th. (March 2nd, 1911.)

1912.

Spark Gaps for Use in Electric Circuits adapted for Rapid Electric Oscillations. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 2,768. February 2nd.

Means for Holding Electrical Insulators and Conductors. G. V. Bullers, Ltd., and Twiss. 3,335. February 9th.

Time-Controlled Electrical Switches. G. W. Free. 3,803. February 15th. February 15th, 1911.)

Signalling Systems for Party Line Telephones and the Like. Western Electric Co. (Western Electric Co.) 4,276. February 20th.

Covering for Electric Cables. C. J. Beaver and E. A. Claremont. 5,206. March 1st.

Anti-Vibration Suspension Device Applicable for Electric Lamps. A. W. Sparkes. 491. January 6th.

Automatic Electric Winding-Mechanism for Clocks and the Like. Soc. Anon. des Horloges Electric-Silentia. 1,039. January 13th. (March 10th, 1911.)

Variable-speed Dynamos. H. Leitner. 1,474. January 18th.

Means for Controlling Electric Switches from a Distance. Siemens Schuckertwerke Ges. 1,541. January 19th. (January 20th, 1911.)

Electrically-driven Hydraulic Lifts. E. M. T. Boddam. 1,829. January 23rd.

Driving of Lighting Dynamos for Motor-cars. F. Sieber. 2,739. February 2nd.

Electrically-driven Fans. A. Schaeffer. 3,556. February 12th. (February 11th, 1911. Addition to No. 13,623 of 1911.)

Electromagnetically-operated Circuit Breakers. W. Schroeder. 4,792. February 26th.

Apparatus for Electric Welding of Tubes. Ges. fur Elektrotechnische Industrie. 5,962. March 9th. (March 9th, 1911.)

Electromagnetic Vibrators. A. H. Nicholson. 9,502. April 23rd.

Electric Arc Lamp Winding. A. P. Strohmenger. 1,274. January 16th. (August 28th, 1911.)

Insulating Walls and Ceilings. W. Mittelmann. 1,332. January 17th.

Arc Lamps. Korting & Mathiesen Akt.-Ges. 3,269. February 9th. (December 2nd, 1911.)

Magneto-Electric Machines for Lighting of Cycles, Motor Vehicles, and the Like. J. Geisslinger and E. Schlurick. 3,946. February 16th. (May 29th, 1911.)

Electrodes or Anodes employed in the Prevention of Corrosion in Steam Boilers and other Liquid-containing Structures. P. E. G. Cumberland. 4,251. February 20th. (Divided application on 19,637 of 1911, Sept. 4th.)

A New Accumulator.—Referring to a recent notice in our columns of Prof. Hannover's invention of a metal alloy, "Porenmetal," and its use in the construction of accumulators, whereby a fivefold increase of electricity is effected, the *Elektrotechniker*, of Vienna, deplores the fact that we gave no particulars of this invention; while, on the other hand, the *E.T.Z.* declares the claims made regarding these accumulators to be unfounded. The following details of this invention are summarised from a notice in our German contemporary, *Elektrotechnische Nachrichten*:—The outcome of a number of experiments carried on since 1907 with various alloys, Porenmetall is a porous lead alloy, whose surface is pierced with millions of microscopic holes. This peculiarity fits it especially to store electricity, and experiments in the State Railway workshops have shown that accumulator plates made of this alloy possess a four to five-fold greater receptivity than the ordinary plates. Patent rights have been applied for in Denmark and other countries; but the inventor admits that the new metal has not yet been exhaustively tested, and particularly with regard to the durability of the plates. It is also to be tested with an alkaline electrolyte instead of acid, with a view to its use in Edison's accumulator; should it retain its receptivity, it will mean a great improvement for the latter. Prof. Hannover adds that porous zinc for use in primary batteries is likewise capable of being produced by a similar method.

New storage batteries are notoriously apt to prove disappointing, and we have little faith in the merits of the alleged invention.

THE

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ELECTRICAL MANUFACTURING COMPANIES.

THE reports of four leading British electrical manufacturing firms bear testimony to the improved conditions that have of late prevailed in connection with the industry. In two cases the betterment finds expression in a manner immediately satisfactory to the ordinary shareholder, the G.E.C. ordinary dividend having advanced from 5 per cent., at which figure it had stood steadily for many years, to $7\frac{1}{2}$ per cent., while that of the Electric Construction Co. has risen from $2\frac{1}{2}$ per cent. last year to $3\frac{3}{4}$ per cent. this. The other two companies we have in mind are not yet able to yield return in an equally acceptable form, but they are able to report a lower rate of loss for the 12 months, which, at all events is something to be thankful for; we refer to Crompton & Co., Ltd., and the Brush Electrical Engineering Co. Of course it will require a prolonged period of increased output at good prices to enable ordinary capital in electrical industrial concerns to return anything like a commensurate profit to investors, but we shall all welcome these better results, especially bearing in mind that they have been obtained in a year of exceptional, almost universal, labour troubles, and we may reasonably hope that, if there be a cessation of strife, for which all industries are now crying out, the present returns may mark the beginning of better times all round.

A year or two ago it seemed to be the fashion to write and speak as though there was no hope for the British electrical industry; those who, like ourselves, endeavoured to keep reasons for optimism well to the fore have some occasison to feel satisfied at the present upward movement, small as it is. Despondency is good for neither man nor industry, and the hopeful spirit which is now more prevalent will itself bear good fruit. Even the Brush Co., which, surely, nobody will accuse of over-joy at any time, finds that its manufacturing output for 1911, both from the electrical engineering and from the rolling-stock departments, shows a marked improvement over the results for the previous three years, in spite of industrial disorganisation through strikes. The loss, which in 1909 was £21,230, and in 1910 was £10,780, has been reduced to £5,688 for 1911, and the directors "confidently hope that in future at least an equilibrium as between expenditure and income will be established." Lack of working capital has been one of the company's troubles for some time, and naturally while things were in so bad a state this was a difficulty not easily to be overcome. Now, however, it is considered that the time has arrived for dealing with the accumulated debit of profit and loss, and the shrinkage in assets value, and a scheme for reduction of capital is to be considered. A special effort is needed "to strengthen the company's finances in order that full advantage may be taken of the improved conditions." Steam turbine contracts and orders for motor-'bus bodies are two branches in which there is greater activity, but in all Brush departments the orders in hand and in prospect are satisfactory, and "prices—although still too low—begin to show an upward tendency." Remembering the great tribulations through which the Brush Company has passed again and again ever since the old days when the late Duke of Marlborough was its chairman, it is high time for it to have a successful issue from its reconstruction experiences, though, seeing the quoted values of its different classes of securities, we suppose the operation will not be altogether painless. Maybe, however, with the new Electrical and Industrial Investment Bank of the B.E.T. group at its back, the operation may be somewhat facilitated, though it is stated that the nominal stake of the B.E.T. in the Brush Co. was £247,310 at March last.

Cromptons—another of the good old names of the electrical industry—have also in their career passed through periods of trial requiring capital reduction. A year or two ago, however, just as things appeared to be righting themselves, an unfavourable wind brought bad weather, and, no doubt, a good deal of care has had to be exercised to steer a safe way through the rocks. How far success has attended such efforts may be gathered from the statement that the loss for the year has been only £1,507, as compared with £14,195 in the previous year, and £20,493 in the year before that. The hope that these figures engender that the current year may witness a return to profit-earning, is further encouraged by the statement that the economies effected in various directions, and a careful selection of the class of business undertaken, have distinctly improved the company's position, with the result that although a loss was incurred in the first half of the financial year (1911), "the gross profit earned in the second-half was more than sufficient to pay all outgoings for that period including debenture interest and other charges against revenue, and this improvement is being maintained." Furthermore, some of the company's electric supply investments have begun to yield dividends, while the value of orders in hand at the end of the year showed a satisfactory increase. But unfortunately there is an accumulated debit balance of £58,730.

The improvement that has taken place in the transactions of the two dividend-paying companies mentioned at the beginning of these comments has already been indicated in our "City Notes" pages, but it may be as well to set forth here, as bearing upon the subject, the experience of the E.C.C.:—"The increased demand for electrical machinery has been maintained during the past year, and the company's works have been fully employed during the entire period. Consequently, the profits again show an improvement and enable the directors to recommend an increased dividend on the ordinary shares." Remarks of this kind are very acceptable reading, especially when they issue from some of the oldest electrical manufacturing works in the United Kingdom.

If we bear in mind that reports by other industrial undertakings issued earlier in the year showed that their works were so full of orders that extensions were imperatively and urgently needed; that the electrical export figures continue to show very satisfactory advances, in spite of labour troubles and a large importation of Continental electrical machinery (taking last year's return as a basis); that the electrical export trade spirit is still healthy and active; also, that electrical supply works everywhere are expanding, and will do so wherever proper measures are taken to secure the varied domestic load; and finally, that the general trade of the country continues to be very good amidst all the drawbacks of modern times—we cannot help feeling that unless some severe world-shock occur, like the American financial panic of a few years ago, to shake the universal confidence, there should be a continuance of profitable activity affording an opportunity for our old-established and greatly-tried concerns to retrieve their fortunes and for firms generally, ancient and modern, to secure an ampler share of profit, setting even ordinary shareholdings in a position of less reproach. This is an objective well worth aiming at and a result worth living to see.

Australian Trade.

Some time ago we drew attention to the establishment of an Association with the title "Australian Association of British Manufacturers and their Representatives," which had been started under the auspices of Mr. Hamilton Wickes (then H.M. Trade Commissioner in Australia) for the purpose of seeking to extend British trade in the Commonwealth. Since that date we have occasionally heard of this Association's activities, and it would appear that it has already been found possible to do some useful work.

Our reference to this Association again, springs from the fact that we have received from the Secretary a very careful analysis of the trade of Australia in 1910 prepared by H.M. Trade Commissioner. The first part of this analysis gives a new idea of the British position in Australian trade. Mr. Wickes shows that to take the gross figures of total imports into Australia, and the gross figures of imports of British origin, does not give an accurate view of the real situation. A considerable amount of the total imports consists of what he calls "non-competitive" goods, *i.e.*, goods in which the United Kingdom cannot compete, such as rice, coffee, tea, timber, &c. If the amount of these "non-competitive" imports is deducted from the gross imports, the proportion of British trade to the total is found to be much larger than would otherwise appear. For instance, the gross imports in 1910 were valued at £60,014,351, and the imports from the United Kingdom at £30,420,540. But if the non-competitive imports are deducted, the total imports are found to be £47,145,514, and the imports from the United Kingdom, £29,905,531 or 63·42 per cent. of the total.

This proportion is very satisfactory, but a glance at the second part of the statement now under review shows that conditions are not altogether as they should be, and that with proper organisation the British proportion could be much increased. From time to time we have urged manufacturers to approach export trade in a scientific way, and instead of relying on snatch orders, to choose their market and work it thoroughly. We could have no better illustration of our point than the figures now submitted to us. Their idea is to show the position *in each State* of British trade in the leading lines, and the differences in the proportion in different States for the same lines of goods which the figures indicate, prove that British firms are not working the whole of Australia with equal force. So far as we can gather, this is primarily due to ineffective representation in some States, as compared with others, and we would impress upon firms the necessity for reviewing their Australian position, in order to find out why their goods are not just as successful in one State as in another. To illustrate our contention, we may take one example from Mr. Wickes's analysis, which, as regards "chemical fertilisers," shows that although the British proportion of the total imports of this line into Western Australia is 82·7 per cent., it is only 14·1 per cent., 25·8 per cent. and 19 per cent. in New South Wales, Victoria and Queensland respectively.

The whole analysis is interesting, but from the point of view of the electrical trade we should have liked to see a little more detail, and, perhaps, we may express the hope that another year the Association may see fit to extend the examination without making it too exhaustive. The analysis of the trade in which our readers are chiefly interested goes no further than the general headings "machinery" and "manufactured metals," but it may be interesting to reproduce the figures under these headings:—

Machinery.	Percentage of British trade to total.	Manufactured metals.	Percentage of British trade to total.
New South Wales ...	49·2	New South Wales ...	70·3
Victoria	45·7	Victoria	64·2
Queensland	57·2	Queensland	65·1
South Australia ...	47·5	South Australia ...	70·3
West Australia ...	47·4	West Australia ...	62·2
Tasmania	40·7	Tasmania	74·7

The Association has done a service to British trade by publishing these statistics, and we congratulate it on its enterprise, in the hope that as time goes on it may receive such support as will enable it to do even more valuable work in the interests of British trade than it has been able yet to accomplish. The offices of the Association are at 424, Little Collins Street, Melbourne, and we would again urge British manufacturers who are interested in Australian trade to get into touch with its secretary for the purpose of co-operating in what must prove to be a very valuable service.

A Call for Common Sense.

The town of Somerset East in Cape Colony, South Africa, contemplates establishing an electricity supply undertaking. Its scope may be gauged by the fact that the white population numbers 1,875 and the coloured about 3,000.

We have not seen the actual specification, but a copy of the general conditions has been sent us, and in view of the size of the town they are in several respects worthy of comment. They fill ten sheets of typed foolscap, and are largely concerned in keeping power in the hands of the purchaser of the plant while throwing all responsibility upon the contractor. Such attempts were common in this country ten years ago, but, fortunately, now are somewhat rare. One may be mistaken, but the perusal of such stringent clauses tends to give the impression of weakness and indecision—if not want of knowledge—on the part of the technical adviser of the purchaser.

Thus Clause 1 stipulates that omissions from either or both specification and drawings shall not absolve the contractor from liability to supply without extra charge anything necessary for the completion of the work.

Clause 5 gives the purchaser's inspector power at any time to suspend the progress of the work without any allowance being made to the contractor. Clause 7 empowers the inspector to alter, amend, pull down or remove any work if, in his opinion, it is unsound and imperfect, and the contractor shall protect all the work against immediate or future injury, whether by the act of God or otherwise, without extra payment. In Clause 9 it is stated that if, during the period of maintenance, immediate attention is demanded and the contractor is not at hand, the purchaser may employ others to do the work and charge the full cost to the contractors.

If the inspector allows imperfections in the work to pass unobserved, Clause 10 calls upon the contractor to make good at his own expense all such defects, and completely absolves the inspector from the results of his own remissness.

Clause 11 asks for the constant attendance of the contractor himself, or the appointment of a duly authorised responsible representative, who must obey the instructions of the Council's inspector. This inspector is to have full power to discharge any of the contractor's foremen or workmen who may demur at obeying his orders, or may be, in his opinion, unskilled or incompetent. Such powers would be refused to any purchaser in this country; he might have the power to ask for the removal of any incompetent person from that particular job, but here at any rate the employer, who pays, is allowed the right to dismiss or retain his own men.

In asking permission to sublet any parts of the work, the price at which the sub-contract is let must be stated. The contractor is to keep the works free from water, and take all risks of landslips and floods, high gales or other contingencies. If, in the opinion of the inspector, the completion of any part of the work is urgent, he may call on the contractor to work continuously day and night without extra payment. The value of the contract may be varied by the inspector to any extent he may think fit, and should the price of the work be increased, full details of the names, occupations and times of all workers employed upon the extra work are to be sent in not later than the next day, or they will not be considered. Any practical man will see that such a course is not possible, and if insisted upon, would mean that no claim for extras could be substantiated.

Clause 25 makes the contractor responsible for the accuracy of any figures or quantities furnished by the purchasers. Several clauses deal with the manner in which, for various causes, the purchasers may take the work out of the contractor's hands, and make use of any of the contractor's tools or appliances for the purpose of completing the work.

As one might almost have expected, the Council's representative or inspector is to be the *sole judge* and arbiter in the event of any dispute between contractor and purchaser as to the contract, his decision being binding on both parties. This is one of the most flagrant cases we have recently come across of one of the disputants being judge of his own case. It is not fair that such should be the case, and whether in England or South Africa we shall always condemn it.

Stringent clauses oblige the contractor to pay to all workers recognised rates of wages. If this is not done, the purchasers may call upon the contractors to pay them—not the workers—a fine of £100 for every breach of this regulation, without its being necessary for the purchasers to prove that they have suffered any actual damage.

This outline shows how in remote districts antique customs still survive, and how watchful contractors still have to be in insisting, when dealing with such would-be purchasers, that, in carrying out contracts, each side has rights, and that justice and common-sense demand that these rights should be mutually recognised. Experience shows that stipulations such as those in this case only increase the cost of carrying out work, without in any way improving its quality.

Development in Germany in 1911.

Dr. Budde, who presided over the twentieth annual conference of the Verband Deutscher Elektrotechniker, which was held at Leipzig last month, submitted a report in relation to the development of electrical engineering in Germany in 1911, from which it appeared that employment in all departments was good, although no epoch-making innovations were recorded. As far as light electrical engineering was concerned, the working of wireless telegrams on all German merchant ships by the German Operating Company for Wireless Telegraphy had passed into the hands of a German company, in which native engineering had a predominating influence. A further noteworthy development in automatic telephony took place as a result of the striking success of the exchanges at Munich. The Imperial Post Office authorities were introducing the semi-automatic system at Dresden and Posen, whilst the first exchange on that method in Europe was erected at Amsterdam. Interesting successes of German industry were implied by the obtaining of orders for the telephone exchange at Bucharest, and the fire and police-alarm installation at Winnipeg. Probably the most important technical progress in heavy electrical engineering in 1911 was the achievement of the regulation without loss of three-phase motors. Winding engines up to 600 kw. were already making headway, and small polyphase current motors were being adopted in all possible branches of industry, especially in the textile trades. The use of high pressures was increasing, and voltages up to 110,000 volts were employed. A growing business was to be found in turbo-generators, which were already constructed up to an output of 21,000 kw. The report proceeded to state that a prominent success of German industry lay in South Africa, where the power transmission plant of the Victoria Falls and Transvaal Power Co. had been set in operation. The large winding plants, where the motors were connected either directly with the drums or through toothed gearing, had well stood the test. In Germany the sale of winding engines, especially for potash mines, had assumed a large scale. Referring to overland central stations, it was mentioned that a quiet period had arrived; the cases of prosperity were not yet sufficiently numerous to allow of general conclusions being drawn; the existing cases were partly unsatisfactory. The situation was affected by the fact that stations were built years ago which would not be erected to-day; the financing of agricultural enterprises was not lightly undertaken by serious firms, and that could be regarded as an advantage. On the whole the experience with electric ploughs was satisfactory, and several German ploughs were at work in other countries. It was desirable that smaller ploughs of from 30 to 40 h.p. should be built for agriculturists in a medium way of business. The principal event in connection with lighting was the introduction of drawn-wire filaments, which also facilitated the use of electric lighting in trains. As far as electric traction is concerned, the report stated that the conversion of the Berlin City Railway had entered upon the stage of practical preparation and ten experimental locomotives had been ordered and were to be first tested on the Dessau-Bitterfeld railway. Electrical working on this line had been completed and the proposed extensions to Magdeburg, Leipzig and Halle, &c., were in progress. In conclusion, it was mentioned that the Electrotechnical Association had decided to prepare an historical work in relation to electricity.

FURTHER NOTES ON THE DESIGN AND EFFICIENCY OF AMERICAN STREET LIGHTING STANDARDS.

By L. CROUCH.

By kind permission of the Editors, the author is allowed to add a few more to the street lighting standards illustrated in his earlier article (Electrical Review, March 22nd, 1912, pages 479-481), and to discuss, in particular, the question of the efficiency attained and the capital and operating costs of the new equipments.

Design.—In preparing the earlier article referred to, the writer endeavoured to make a representative selection from the numerous designs at his disposal. Fig. 10 (page 480) hardly does justice to the design shown—the cross arm is really more slender, and of very elegant appearance. The post shown in fig. 7 (page 480) is admittedly bizarre, but in the surroundings for which it was designed its appearance is thoroughly good, though a less degree of ornamentation would have been desirable. A yet more unpromising design, which has, nevertheless, given satisfaction in lighting facades, entrances and so on, is shown in fig. 1 herewith. Fig. 2 shows the style of lamp pillar used on the kerb line round the People's Savings Bank (Cedar Rapids, Iowa); a square brick column carries an ornamental metal capital and a single large opalescent globe. This design is certainly not artistic to English eyes, but has been very considerably praised in the land of its inception.

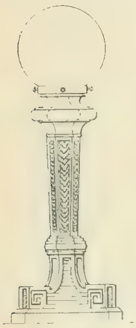
Fig. 1.

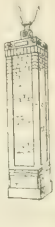
Fig. 2.

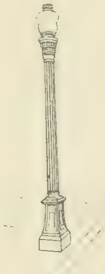
Fig. 3.

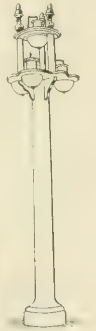
Fig. 4.

The success of the magnetite arc for street lighting has been phenomenal. A not inconsiderable advantage of this lamp is the great reduction possible in the size of the control-mechanism container. This is strikingly illustrated in fig. 3, which shows a magnetite-arc lamp-post and globe, as recently adopted in New Haven (Conn.). A photograph reproduced in the February issue of the *Illuminating Engineer* (New York) shows the exceptionally uniform and brilliant lighting effected by this installation.

Improved designs of street lamp-posts (along the lines illustrated in this and the earlier article) are appearing in every part of the States, and are meeting with such general approval and extensive adoption that the importance of the movement cannot safely be neglected or belittled. To show that these tendencies of design are not confined to the electric lighting field, or even to the U.S.A., reference may be made to figs 4, 5 and 6.

Fig. 4 shows a unique design of post (carrying four five-mantle inverted gas arcs), designed by the Sheboygan Gas Co. (Wis.), and considered by the *Illuminating Engineer* to represent a "positive advance in ornamental street lighting." It need hardly be pointed out how very great is the obstruction offered by the platform, carrying the lower lamps, to light directly emitted from the upper globe—yet the subdivision of the total candle-power, and the *white finish*[*] *of the post and all fittings*, make the whole an efficient lighting unit. Obviously, the latter expedient for raising efficiency could be applied to all the multi-light posts illustrated in the present and previous notes. The efficacy of such a means of reducing obstruction losses is well instanced by the Jandus flame arc lamp, the large circulating tubes of which throw a negligible shadow, and result in very little loss of efficiency, owing to their white surface and the diffused "source" formed by the opalescent globe; (these conditions are very similar to those existing in many of the designs here discussed).

Figs. 5 and 6 represent designs for street lamp-posts by Mr. A. Stevens (designer of the Wellington Memorial, St. Pauls). The designs are applicable to either gas or electric lighting, and certainly come within the same category as many of the American designs illustrated. Apparently we have already started in pursuit of our American friends; we may attain results which are more beautiful than theirs (to our eyes), but the principle is the same in each case—departure from the dreadful plainness of the average lamp-post with its plain lantern, or, in the case of arc lamps, with its "one-foot globe surmounted by a miniature bucket" (to quote an American contemporary).

Efficiency.—Owing to the foreign field of application of the new lamp-posts, and the comparatively short time which has elapsed since their installation, the writer has found some difficulty in collecting authoritative cost data. However, the following examples will show that the efficiency of the new installations is by no means so low as might at first sight appear to be the case.

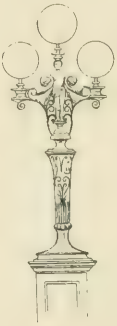
Fig. 5.

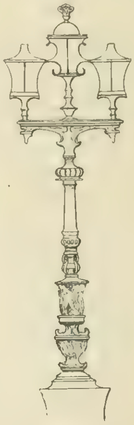
Fig. 6.

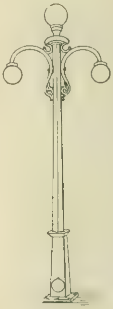
Fig. 7.

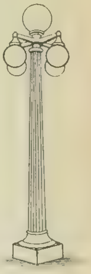
Fig. 8.

Savannah.—Three and five-light standards (in the styles shown in figs. 7 and 8) are placed only 30 ft. apart in the main shopping streets, and a 100-watt tungsten lamp is placed in each globe. Exceedingly brilliant display lighting is obtained, but a greater pitch, post to post, is, of course, economically essential in smaller streets, and is then quite satisfactory from the illuminating standpoint.

Five-year contracts, with the tradespeople, are made for energy supply and lamp renewals on a foot-frontage basis. According to figures published by the Savannah Electric Lighting Co., the costs for 11 posts (nine three-light, two five-light) on each side of the street in a 300-ft. building block are :—

Materials and labour for supply system	11s. 8d. per foot frontage
Decorative lamps, globes, &c. ...	9s. 2d. „ „

Total ... £310 10s. per block.

Lighting and maintenance, 5d. per foot frontage per month.

Comparing the costs per 60-c.p. unit for 2,000 burning hours per annum, and assuming electricity at 3d. per unit; gas at 2s. per 1,000 cb. ft.; one new tungsten lamp, two new carbon lamps; 1·5d. per night per gas burner for maintenance, renewals and lighting; 1·25 w. and 3·5 w. per c.p. respectively for tungsten and carbon lamps, and 3·5 cb. ft. per hour for the gas burner :—The total annual costs are £2 0s. 6d. tungsten, £5 7s. 6d. carbon, £2 19s. 8d. gas, and in order that the gas lighting may be as cheap as the tungsten system, the cost of maintenance, renewals and lighting must be about 0·87d. per lamp per evening in the former. (New York experience shows the cost of lighting by tungsten lamps and Auer mantles to be roughly equal at £1 15s.-£6 per 60-75 C.P.)

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[*] "The post is made of cement, fine cinders, sawdust and expanded metal, finished with a weatherproof coating, which gives it the appearance of polished white marble. Lucite globes and white enamelled fittings are used, and are in keeping with the general appearance of the post." The cost of this (experimental) post, without lamps, was $85, and a number of similar posts were to be installed a few months ago.

In addition to the above decorative scheme, Savannah has 4-amp. series D.C. arcs in another important street, and with the posts 90 ft. apart (in a 40-ft. street), *i.e.*, six lamps per 180-ft. block, "the illumination is not to be compared" with that given by the above incandescent system. The cost of the arc lamps and poles installed complete was, per pole, $155 in overhead supply districts, and $275 in underground supply districts, *i.e.*, from $930-$1,650 per 180-ft. block, as against $1,500 per 300-ft. block in the other installation. The power consumption of the arc installation per mile of street is probably about one-fourth that of the incandescent scheme.

Atlanta.—The installation laid down in this town was based on the above equipment in Savannah. Five-light 14-ft. "Corinthian" standards (see fig. 1, page 479) were placed 70 ft. apart, and 122 posts were used in all. 100-watt tungsten lamps were mounted in 12-in. and 15-in. opal globes, so that the power allowance here = 75·5 KW. per mile, as against 130 KW. per mile in Savannah. The cost of the installation amounted to 6s. 3d. per foot of frontage, paid half by the property-owners and half by the tenants, while the operating and maintenance costs (paid by the city authorities on contract) work out at £9 7s. 6d. per post per year = 2·75d. per foot frontage per month.

The great expenditure of energy per mile of street in both of the above installations is very noticeable but, as discussed below, the end seems to justify the means. An allowance of 5-10 KW. per mile will, if expended in tungsten lamps provided with fluted, or other specially designed, reflectors, yield an illumination sufficient for the needs of small streets, but in important thoroughfares 20-60 KW. or more per mile should not be grudged if it provides better results than the lower, usual allowances.*

E. Darrow (*loc. cit.*) estimates the maintenance costs in the "curb line" system of illumination (as used in Des Moines, Seattle and Indianapolis) to be, per 1,000 burning hours per post (in shillings) :—

—	Lamp renewals and attendance or carbons and trimming.	Reprs. and glassware.	Total.*	Approx. watts per sq. ft. of road per ft.-candle illumination.	Radius of action (feet).
5 100-w. tungstens	24·0	8·0	60s.	0·3—0·5	100†
D.C. enclosed arcs	4·8	2·0	34s. 10d.	0·25—0·45	125
Metallic flame arcs	30·0	8·0	66s.	0·06—0·13	300
Flaming arcs ...	38·0	8·0	74s.	—	-

* Including 8s. depreciation allowance and 20s. for 500 units in each case.
† Using standards such as shown in figs. 1-6, p. 479 and figs. 7, 8, herewith.

(These figures appear to overcharge for tungsten renewals and to underestimate, relatively, at least, the cost of repairs and globes for enclosed arcs.)

In support of the general contentions of this article, the following excerpt (Darrow) is significant :—

"From the above considerations it would appear that, due to the combined influence of public sentiment, first costs, and maintenance charges, series burning constant metallic flame lighting units are driving all other types of illuminants from the residence and suburban districts of our municipalities. However, there is a strong trend in business sections of our progressive cities to artistic lighting effects, as is evidenced by the many attractive forms of arches and curb line lighting which have been developed in the past eighteen months."

GENERAL CONSIDERATIONS AND CONCLUSION.— Granted that some of the post designs illustrated in this and the earlier article, on the same subject, involve a somewhat higher total annual lighting cost, is it not reasonable to pay the additional cost (which has been shown not to be excessive) on grounds of justification by results? In workshop and general interior lighting, the fallacy of selecting a system by cost considerations alone is already realised. In such a case the cost of lighting is so small a fraction of the total costs of administration, and the effect of the quality and distribution of light on output and æsthetic and physical comfort is so great, that the direct lighting-costs become of secondary importance in deciding the choice. Admittedly, that system which will give certain results with minimum outlay will always hold the field, but, in the writer's opinion, the question as to the suitability for street lighting of the lamp-posts here illustrated is answered in the affirmative, by the following considerations :—

1. On the testimony of very many "keen" American communities, supported by numerous photographs reproduced in various American journals, multi-globe standards, of the types here considered, present an attractive appearance by day and by night, and provide brilliant and satisfactory lighting at a reasonable cost.

2. These installations may be wasteful of energy (as judged on a purely technical basis), but to produce an equally desirable effect, gas lighting must sacrifice a corresponding percentage of efficiency, hence the relative merits of the two illuminants are unaffected by the new means for their application.

Some of the posts illustrated are suitable for use in residential streets, others are best adapted to "display" in shopping areas, seaside promenades, and so on. In any case, uniformity of illumination is the first essential. In "display" lighting—providing dazzle is avoided—the actual source of light should be visible, there undoubtedly being a fascination in promenading streets plentifully strewn with "soft" sources of light, placed at a reasonably low height.

Whatever may be said for the latest arc and gas lighting systems (which involve very high candle-power units and the use of costly poles), the older of these systems provide very irregular street illumination. Multi-light standards avoid this defect without involving any of those inherently attached to high C.P. units. With several of the types of pole here illustrated, higher efficiency could be obtained by increasing the height of the main column—a matter which is easily arranged, and which is specially desirable where inverted globes are used (as in fig. 2, p. 479). Such increase in height must not be carried to excess, or the whole object and suitability of the designs is sacrificed, and if the kerb-line is planted with trees, the foliage of the latter causes great obstruction losses.

The comparatively low height at which the lamps are arranged in the designs employed in the States does not cause dazzle to pedestrian or vehicular traffic, since the intrinsic brilliancy of the diffusing globes is quite low.* On the other hand, this arrangement of lamps greatly favours the perception of traffic, obstacles, and so on by "silhouetting," the importance of which in street illumination appears to have been overlooked in this country.

A great advantage of the multi-light standard is the possibility of switching out one or more lamps per post at 11 or 12 p.m., thus reducing the illumination to the bare needs of late night traffic, while retaining a uniform distribution, which will, in itself, reduce the total lighting output required. It is an easy matter to increase the total C.P. per standard at crossings, &c., by the use of more globes or higher C.P. units per globe, and it is interesting to note that at least one American city (using the type of post shown in fig. 1, page 479) provides an additional service wire on each standard (from the positive and negative mains alternately), and a plug socket, so that festoons and arches of lamps can be run along and across the streets with minimum cost and trouble on days of festival.

In conclusion, it may be emphasised that though most of the new designs dealt with above have primarily been designed for use in White Ways—with a view to providing that abundant (even spectacular) lighting which is so beneficial to shopping districts and pleasure resorts that far greater extravagance than is actually involved in its realisation might well be pardoned—many of the styles are quite applicable, and have already been applied, to ordinary town-street and residential lighting.

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* In this connection, refer to E. Darrow, *Michigan Technic* (reprint in July, 1911, issue of *Municipal Engineering*).

* Many low posts used in this country for gas and electric lighting do not employ diffusing globes, though these are certainly desirable; further, many arc lamp installations remarkable for their high electro-luminous efficiency are realised to be "garish" and distressing to the eye, when once the novelty of their brilliance and (possibly) peculiar colour has subsided.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

An Objectionable Clause.

It is quite true that my first letter was written in the vain hope of inducing intending contractors to except the objectionable clause from their tenders. I am sorry, but I am not to blame for the fact that Mr. Webb gathered the impression that I thereby sought to secure for the successful contractor the reversion of the powers of sole arbitrator. I am confident that the majority of your readers did not take the letter in that sense. That Mr. Webb may be satisfied that it was not a necessary corollary to the deletion of the clause, I quote an extract from a letter covering the tender which my firm submitted:—". . . While we are quite willing to pay the rate of wages and observe the hours of labour and regulations recognised by the Trade Union concerned, we are not willing to accept . . . the Trade Union as the sole arbitrator on any point not covered by existing printed regulations. We would have no objection to its being a joint arbitrator, we to appoint the other should occasion arise . . ."

Mr. Webb writes, with misplaced sarcasm, "What a blessing it would be if no wages were paid at all; then, evidently, this country . . . would capture all the work of the world!" But, surely, it is obvious. If England were Arcady, and bread and boots were to be obtained by pleasant words, we would sweep the world's markets. We owe our premier position to-day to the Napoleonic wars and their aftermath; we obtained so long a start of our rivals in the development of our resources and means of communication, that, even after 100 years, they have not been able to catch us up, despite our ever-growing handicap of a heavy wages bill. But economic conditions tend to equalise in all countries having large natural resources. So, unless the present course of events is interrupted by political actions and reactions, it is not improbable that Mr. Webb may live to see China the chief electrical workshop of the world. The Chinese workman, we are credibly informed, can subsist on a daily handful of rice. Forgive this extract from the elements of political economy, but Mr. Webb, in common with most Trade Union officials and Labour members, appears to be so far advanced in the science as to have forgotten the elements altogether.

Mr. Webb seems to find it difficult to reconcile my statement that whenever, through the efforts of Trade Unions, wages have risen, unemployment has been more rife, with my further statement that Trade Unions have done much in the past to better the lot of the workers. Both statements are correct, and he will see that for himself if he will underline the word "workers." My point was simply that an advance in wages, while it benefits those who can keep in constant employment, inevitably swells the ranks of the unemployed. It is unnecessary for me to analyse the reasons therefor—they should be clear even to the most advanced of political scientists. The fact itself is incontrovertible; and if an incontrovertible fact needs corroboration, I refer Mr. Webb to Government returns.

To descend from the general to the particular, Mr. Webb challenges my assertion that most of the best men in the trade ignore the Electrical Trade Union. Such a statement is necessarily made on personal experience, and not on figures. The onus of disproving it lies, I think, with Mr. Webb. I have recorded an impression, and knowing that it is shared by every responsible contractor I have ever come in contact with, I have not hesitated to record so general an impression as a fact. It is to Mr. Webb's interest, of course, to prove that this general impression is a wrong one. I do not know how he will set about it. It is no use his pointing out that, let us say, 60 per cent. of the wiremen in the kingdom belong to his Union. That does not prove that, to take an extreme case, the remaining 40 per cent., who do not belong to his Union, do not comprise all the best men. We are dealing with quality, not quantity. In 13 years' experience of contracting—mainly country-house work—I have known many good foremen, charge-hands, and wiremen. Of them all I cannot remember that one belonged to the Union, to my knowledge. Some, as Mr. Webb suggests, may have done so clandestinely—though why they should be ashamed of it, he knows best—but most of them, I know for a fact, did not belong to it. On the other hand, some of the bad workmen I have met did belong to it—the sort of men who knew they could not possibly command 9½d. an hour unless they did belong to it. Such are the grounds of my assertion; and if some of those of your readers who are experienced contractors will take the trouble to write to you, I have no doubt there will be found plenty of support for it. And Mr. Webb, I am sure, will do his best for the other side.

The correspondence has broadened to a wider issue than its heading betokens, and, as Mr. Webb tells us that the contract in question has been placed (it is curious, by the way, that he should have information that has not yet been vouchsafed to my firm, one of the tenderers), and that the objectionable clause remains, it is of little use discussing it further. One can only sympathise with the fortunate contractor, should it come to pass that Mr. Webb, as he threatens with a characteristic albeit Hibernian touch, is appointed "one of the sole arbitrators."

Fairplay.

Mr. Collins raises a few points to which I should like to reply. My organisation may be weak, or it may not. I have heard some people say that we were too strong, and even Mr. Collins, in his first letter on this subject, said that this particular clause in this particular instance was framed for our benefit. And really an outsider would not consider it to the credit of an employer to discharge men for belonging to a Trade Union (my branch alone can point out dozens). One hears such a lot of the "Old Brigade." Perhaps Mr. Collins was at one time a member of the E.T.U. At any rate, it is nearly time that "Old Brigade" yarn died a natural death. We have no room for it. If it pleases Mr. Collins, he has my assurance that I should make it a penal offence for any man (I suppose non-Unionists do it even as Union men) to rob his master of time, by hanging his job out, or what not. But it should also be prison for the employer who puts in 300-megohm grade wire when he ought to put in 1,200 grade, or C.J. tube, when it ought to be brazed. Also the same penalty for the employer who sent a boy out to do a man's job, such as repairs, &c., and charged his customer the rate of a man. Of course the employer's excuse would be "business" or "commercial instinct." In conclusion, I may say that our new rules and rates of pay will be presented just as soon as the E.T.U. are ready; much as I should like to oblige Mr. Collins, I am only one, and my society will not be hurried or flurried by Mr. Collins or the Transport Workers' strike, feeling sure that when the time is opportune our demands will be made and met satisfactorily by those masters (and I certainly trust Mr. Collins is one of these) who admit that the district rate for wiremen in London, viz., 9½d. per hour, is much too low for the class of work done. My best thanks are due to the editor of this journal for his fair treatment. His columns are always open to men of my class, and if I may be allowed to say so, that is something very seldom given (in some papers).

W. J. Webb.

London, S.W.
July 15th, 1912.

[This correspondence is now closed.—Eds. E.R.]

Trouble with the Trolley Head.

With reference to the article on page 43 of your issue of July 12th, the conditions essential to safety and economy in the use of current collectors on railways and tramways with overhead conductors are:—That the make and break of contact with the conductor be effected by the driver from his compartment with ease and certainty of action on any portion of the track, on the straight, on curves, on points and crossings, whether the vehicle to which the collector is attached is at rest or in motion in either direction, without danger or inconvenience to the driver or the public.

The bow collector complies with these conditions entirely; its use has by its small contact pressure (about one-fourth that of the trolley), and its elimination of the hammer at the ears, the very great advantage of lengthening the life of the conductor wire, and sticking to its post, for it cannot derail.

Geo. P. Spooner, M.I.Mech.E.

July 15th, 1912.

Railway Cab-Signalling.

Mr. Dupré is very much mistaken when, in your edition of the 12th inst., he expresses the opinion that I should find in practice that the rubbing contactor is better than the rotating one. The fact is, I started upon a two years' full-sized test with the same views that Mr. Dupré expresses on this point; and it was the practical experience thus gained that caused me to abandon the incorrect idea which he advances.

Several times during this test I ran the locomotive over the ramps while the brushes gripped the wheels so firmly that the latter could not rotate. With this rubbing contact I got several safe errors of indication. But during the whole two years and more, no matter how dirty, rusty, or icy the ramps, a rotating contactor never once gave an error of any sort. Now that a practical test has taught me the fact, I have since been able to see the reason; and I think that, on a little reflection, Mr. Dupré will see it as clearly as I.

It is very much to be regretted that Mr. Dupré tacitly contradicts in his concluding statement the important truth contained in the second sentence of his letter. The Brown-Mackenzie system is certainly not "absolutely reliable," for it violates Mr. Dupré's statement that "every failure must give the danger indication."

William H. Dammond.

West Bridgford, Notts,
July 13th, 1912.

Agencies Abroad.

In the course of an article headed "Trade with Canada," in your issue of May 4th, you make use of the following remarkable expression, "Agencies are notoriously unsatisfactory." Living, as I do, in a town where everybody is, or wishes to be, an agent for somebody, and where everything is distributed, from needles to anchors, from patent medicines to men-of-war, I crave space for the views evoked by your opinion set forth in the above sentence with uncompromising clearness.

Obviously you intend to convey to your readers (as you are writing at home) that agencies are notoriously unsatisfactory to manufacturers and producers, *i.e.*, that agents are, on the whole, a mighty poor lot, and the sort of fellows to have as little to do with as possible; believe me, Sir, there is a vast deal to be said on the other side, as to the why and wherefore of the unsatisfactory working of agencies, when they *are* unsatisfactory, as I propose to show you.

There are various agencies, bank, shipping and insurance, which, from their very nature, are satisfactory, all expenses being borne by the concern represented, and a decent livelihood assured to the agent. For the purposes of my argument, however, these may be dismissed with the remark, that they are satisfactory because they are properly organised, adequately remunerated and efficiently backed.

Again, there is the "brass plate agency"; by this I mean the "agent" who puts on his doorpost the name of Messrs. So & So, Ltd., for a small retaining fee, and sits supinely behind it waiting for orders which seldom come. This sort of agency is the direct outcome of two unsatisfactory conditions: on the one hand, the desire of Messrs. So & So., Ltd., to be represented at a nominal cost, and to be able to refer proudly, but inexpensively, to their "agencies in all parts of the world" in their circulars and addresses to shareholders; and on the other, the readiness of the class of agent these small retaining fees are likely to secure, to accept any and every agency offered, till the multiplication of numbers alone provides him with a living. "No previous experience necessary" is a standing condition of this class of agency, with the inevitable lack of results, and occasional squabbles leading to a reshuffling of the brass plates; little loss on the one side, little work on the other, and no credit to either; just, in fact, what you describe "Notoriously unsatisfactory."

I come now to the type of agent who in the real and active sense of the word "represents" his principals; the principals in this instance being makers of electrical machinery and kindred products, the agencies, say, numbering three or four, all being sympathetic and homogeneous, and each reacting upon the other; I say electrical machinery, for this, Sir, is your business and mine. To a marked personality, this man must add practical experience, a thorough knowledge of the Chinese and their customs, and be able to devote the whole of his time and energies to his work, viz., electrical development, a field which, assiduously cultivated, offers great opportunities. His part of the contract is well defined, and it is certainly up to his principals to see that he receives wholehearted support, power to act on his own initiative, and adequate remuneration. But does he get it? From my own experience, and that of others similarly situated, I say he does not. His the pioneer work, his the labour and heat of the day, his also the charges for travelling and entertainment inseparable from the transaction of Chinese business; money which he must spend to have any hopes of success. And for his remuneration the commission, often reduced to meet competition, accruing on accomplished sales, plus a small, a very small, annual contribution towards expenses; he is fortunate, indeed, if at the end of the year his income meets those expenses. All the time, too, he is steadily establishing the reputation of the firms he represents, building up a goodwill which, in the not unlikely event of disassociation, belongs to them, and not to him. The crux of the question, the real reason for the existing notorious dissatisfaction, is the inadequate remuneration offered by the home firms for this special and valuable work; believe me, if this were accorded, there would be no need for the formation of large special concerns to push the sales of British machinery, here or elsewhere, such as you advocate. Parsimony and production do not go together, and until British manufacturers have learned the lesson, "There is that scattereth and yet increaseth; there is that withholdeth more than is meet, but tendeth to poverty," so long will their business be restricted, and so long will dissatisfaction endure.

Video Meliora Proboque.

June 28th, 1912.

[Our correspondent is entitled to defend his profession, and we welcome the expression of his views. There are certain features of his letter, however, to which we must direct attention. In the first place, our article explicitly related to "Trade with Canada"; the conditions in Canada are unique, in that the border of the Dominion marches for thousands of miles with that of a great manufacturing country, one of our keenest industrial rivals, admirably equipped with knowledge of local conditions and exceptional business aptitude to compete with us, and our remarks were not intended to apply equally to China, as our correspondent appears to suppose. Secondly, we spoke of *agencies*, whereas he deals more particularly with *agents*. We have no quarrel with the latter; we referred to the system, not to the men, and we had not the slightest intention of conveying to our readers, as he infers, the impression that "agents are, on the whole, a mighty poor lot." We do not blame the agent for the faults of the system, nor did we say anything in the article reflecting upon his qualities. The financial agencies which he cites are satisfactory, for the reasons given by our correspondent, which are precisely the features in which the general agency is lacking. In fact, in the main we are in hearty agreement with him, and, moreover, he agrees with us when he attacks the *system*, to which he ascribes, in terms almost identical with our own, "the existing notorious dissatisfaction."—Eds. E.R.]

Searchlights for Liners.—The Hamburg-Amerika Line has installed on the *Kaiserin Auguste Victoria* an electric searchlight of 80,000 C.P., equal in size and range to the searchlights mounted on German men-of-war. It will be used as a means of guarding against collision with icebergs and other vessels.

PARLIAMENTARY.

Falkirk Electric Lighting.

On July 10th, Viscount Falkland's Committee of the House of Lords considered the Electric Lighting Confirmation (No. 4) Bill, which seeks to confirm a Board of Trade order for electric lighting in respect of certain burghs and parishes in the Counties of Linlithgow, Stirling and Dumbarton, to Mr. Geo. Balfour. Mr. Fitzgerald, K.C., and Mr. Macassey appeared for the promoter, and Mr. Balfour Browne, K.C., and Mr. Beveridge for the Falkirk Town Council.

The facts, as explained by Mr. Macassey, were that Mr. Balfour, who had carried out various electric lighting and tramway schemes and was a director of the Falkirk and District Tramways Co. and the Scottish Central Electric Power Co., sought to obtain an order for the supply of electricity over a considerable area adjoining the Burgh of Falkirk; but such order, if confirmed, would have to be transferred to a company within 12 months. The Town Council of Falkirk, whose area was not included in the order, opposed the application. Last year that Council promoted an order for the extension of their boundaries, and after a local inquiry by a Commission presided over by Lord Clinton, the order was rejected. The Town Council had now promoted another order for an extension of their boundaries, and also asked that they should be enabled to supply electricity and gas within the area they had scheduled. It had been decided by the Chairman of the House of Lords and the chairman of Ways and Means, that the Town Council could only proceed by way of private Bill to get power to supply gas and electricity, but the order for the extension of the burgh would proceed and would be heard towards the end of the month. When Mr. Balfour's application came before the Board of Trade, the Town Council asked that the area which they sought to annex should be struck out of the order, but this the Board refused to do. They did, however, insert a clause to the effect that if the Falkirk Town Council got their extension order then Mr. Balfour should not be entitled to exercise the powers contained in the Board of Trade order in that area which might be added to the Burgh of Falkirk. He submitted that this adequately protected the position of Falkirk.

After hearing evidence, the Committee passed the preamble of the Bill.

Cheltenham Electric Lighting.

Sir Francis Lowe's Select Committee of the House of Commons on July 11th and 12th, considered Electric Lighting Provisional Order (No. 3) Confirmation Bill, the only opposed order being the Cheltenham Order, the object of which is to enable the Corporation to extend their area of supply so as to include Prestbury and Leckhampton.—Mr. Jeeves appeared for the Corporation, and Mr. Raikes represented the Cheltenham Gas Co., who were the petitioners.

Mr. Raikes said the Gas Co. opposed as ratepayers, and not on the ground of competition, and they asked for the insertion of a clause in the Order regarding the charges which were to be made for public lighting. He pointed out that the Corporation embarked on their electric lighting undertaking in 1896, and had made a loss of something like £18,000 by 1904. In that year the Local Government Board held an inquiry and sanctioned a loan for the payment of the debt, and he submitted that since then excessive sums had been charged for public lighting. He asked the Committee to insert a clause dealing with the prices which should be charged for public lighting, so as to prevent the Corporation making an undue profit out of the ratepayers in this way.

Mr. G. L. Jones, A.I.E.E., gave evidence, and submitted a table dealing with 10 towns, which he said were fairly comparable with Cheltenham, and in connection with which the average charge for public lighting was slightly over 2d., whereas in Cheltenham the price was nearly 3d.

After hearing evidence from a representative of the Board of Trade, the Committee refused to insert the clause asked for, and passed the preamble of the Bill.

Mr. Jeeves applied for costs for the Corporation against the Gas Co., and these were allowed.

Sheffield Corporation Bill.

After a long hearing, Sir R. W. Holme's Select Committee of the House of Commons, has passed the preamble of this Bill. The main objects of the Bill were sanitary, but powers were also sought to construct tramways and to run trolley vehicles, this portion was not opposed. One of the tramways sought to be constructed, will go beyond the boundaries of the City into the Urban District of Handsworth, but the Committee found that, having regard to the circumstances, such construction ought to be allowed, and that it was not necessary to insert the clause referred to in Standing Order, No. 170a, for the protection of the local authority in whose district such tramway is proposed, as Sec. 43 of the Tramways Act, 1870, is incorporated in the Bill. The promoters withdrew the clause empowering them to enter into agreements for running powers over other tramways. The Committee fixed the following periods for the repayments of loans sanctioned by them:—£137,000 for the construction of tramways, 30 years; £24,000 for the equipment of tramways, 15 years; £38,000 for the general purposes of the tramway undertaking, 20 years; £20,000 for the electrical equipment for trolley vehicles, 20 years; £7,500 for provision of of trolley vehicles, 10 years.

London Tramcars.—Mr. Kellaway asked the Home Secretary whether, in the comparison which he recently made between the 533,000,000 passengers carried by the L.C.C. trams and the 520,000,000 passengers carried by the London General Omnibus Co., he was aware that the L.C.C. trams were limited to the County of London, which was a much smaller area than the Metropolitan police area; and whether, in order to allow of a more just comparison, he would ascertain the numbers carried by the tramway companies operating in the larger area, viz., the London United Tramways, the North Metropolitan Tramways, and others, and would show the number of fatal accidents for vehicles and per million passengers carried respectively.—Mr. McKenna, in reply, said that so far as could be ascertained in the absence of official figures, the total number of passengers carried upon tramcars in the metropolitan area was approximately 746,000,000, and the total number carried by motor-omnibuses was approximately 595,000,000. On this basis the number of fatal accidents for 1911 would be approximately, for tramcars, one for every 27½ million passengers carried; and for omnibuses, one for every 6¾ million passengers carried. 92·5 per cent. of the tramcar accidents occurred in the County of London.

Third Readings.—In the House of Lords on July 11th, the Metropolitan District Railway Bill and the London United Tramways Bill passed third reading.

The following passed third reading in the Lords on July 10th:—the Lanark County Tramways Bill, the Ericht Water and Electric Power Bill, and the Bognor Gas Light and Coke Company (Electricity) Bill.

On July 16th, the London Electric Railway Bill passed third reading in the Lords, and the Ericht Water and Electric Power Bill was read a second time in the Commons.

LEGAL.

Bankruptcy Prosecution: A Debtor Convicted.

Before the Common Sergeant (Sir F. Bosanquet, K.C.) at the Central Criminal Court last week, Ludwig Lehmann, lately carrying on business as a shipper of hardware and electrical and cycle goods, at Basinghall Street, E.C., surrended to his bail, and pleaded not guilty to an indictment charging him with failing to disclose to Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C., the trustee in his bankruptcy, how certain goods had been disposed of.

Mr. Travers Humphreys and Mr. Waldo Briggs prosecuted, while the defendant was represented by Mr. R. D. Muir and Mr. Curtis Bennett.

It was stated that the indictment was framed under three subsections of the Debtors' Act, and the charges related to one fraud which it was alleged was committed during the defendant's bankruptcy. A person who was made bankrupt was obliged to disclose to his trustee all his property, and the way in which he had disposed of property which had been obtained on credit. It was alleged that in regard to some of his property, the defendant intentionally misled the trustee in his bankruptcy with regard to the disposal of those assets for cash. The defendant was made bankrupt on January 21st of last year, and according to the statement of affairs which he prepared, the liabilities amounted to £12,000, of which some £5,000 was due to unsecured trade creditors in respect of goods supplied within four months. The assets were estimated to realise £8,000, but they were made up of such things as an interest in a Russian coal mine. That asset alone he valued at £4,000, and there were shares of a considerable nominal value. The whole of the defendant's assets, however, had only produced £47. At the date of the bankruptcy there was stock-in-trade of £117, and cash in hand of £1 13s. 11d. In other words, the debtor, having had £5,000 worth of goods on credit, had neither stock or cash to show for them. During the bankruptcy proceedings the defendant was ordered to file cash and goods accounts, covering the period from July, 1910, to January, 1911. In the goods account he stated that he had sold goods to the value of £400 to Mr. Leo. Kaiser. He declared that he had been dealing with Kaiser for a long time, and gave his address as Westbourne Park Terrace. Mr. Leo. Kaiser was privately examined in the bankruptcy, and stated that he was a traveller on commission, and had never bought anything from the defendant. The latter was then further examined, and said he had made a mistake. The goods had been sold to Mr. Max Kaiser, a brother of Mr. Leo Kaiser. A private sitting was then held for the examination of Max Kaiser, and that gentleman also declared that he had never bought any goods from the defendant.

Mr. Hawkins stated that the defendant did not keep a full set of books. He kept a cash-book, which covered the last 15 months of his trading, but it contained no record of any dealings with Mr. Kaiser.

Evidence having been given for the prosecution, the defendant went into the witness-box, and denied that he had withheld any information. The figures which he had produced had been supplied to him by his manager.

The jury found the defendant "Guilty," and the Common Sergeant sentenced him to five months' imprisonment in the second division.

The Telephone Arbitration.

(Continued from page 54.)

The Solicitor-General, in opening the case for the Postmaster-General on this claim for plant, said he desired, first of all, to mention to the Court that when the inventory was being taken from time to time, the Post Office representatives were disposed to take the view that certain things ought not to be included in the list on the ground that they were not things the Postmaster-General ought to take over, whilst on the other hand, the N.T.C. took the opposite view. Of course, that was inevitable, but what was done was very sensible. It was decided to include in the inventory everything which the company suggested should be put in. The inventory, therefore, gave correct figures in this sense. It was agreed that its contents were the quantity of plant which the company were tendering to the Postmaster-General, but it was subject to modification if the Post Office were right in seeking to reject some portions of the plant tendered.

Sir John handed up to the Commissioners the inventory in question, which was a very bulky document. It was impossible, he said, to ask any tribunal to deal in detail with the particulars of such a gloomy document. What the Post Office had done, therefore, was to obtain a summary of the quantities in their different classes, to which exception was taken, and so put before the commission two sets of figures. One set was based on the assumption that the Post Office had got to take everything in the inventory, and the second set on the assumption that they had to take the list in the inventory, less those portions of plant, to which objection was taken. He suggested, however, that if the parties could agree in the meantime upon a right sum to subtract it would very greatly help the Court.

In reply to a question by Sir Alfred Cripps, the SOLICITOR-GENERAL said it would be quite easy to supply the N.T.C. with a list of plant to which the P.M.G. took exception.

SIR J. SIMON, continuing, then again reminded the Court in some detail of the "tramway terms" which he said, substantially the Court would have to apply, in arriving at a decision. The "tramway terms," counsel said, which were in substance, the terms of the purchase, were defined by the Court of Appeal and the House of Lords as meaning that the sum to be paid was what it would cost the purchasers if they had to make the undertaking. The object of the House of Commons in using those words was to get a well-known system applied to the transfer. The tribunal would have to consider what were the tramway terms and how they were arrived at. He pointed out that Sir Alex. Kennedy in his evidence said that if tramway terms were applied in the ordinary way the contractor's price would be ascertained. That would cover the contractor's profit. Secondly, he said they would regard the contractor as making his prices on the date of the transfer. Further, they had to provide the over-all charge from the company's side which, he said, was in practice expressed as a percentage, and which was as small as 4 per cent. or 5 per cent., tending to be smaller in proportion as the contract was larger. That was the view which he, the Solicitor-General, was given to understand ought to be adopted.

MR. GATHORNE HARDY said he could not see how the contractor's price on December 31st, 1911, could be right. They must have his price at such a date as he would be able to construct and deliver a telephone system in working order.

The SOLICITOR-GENERAL said he saw the force of the suggestion, and the Court would find that that consideration had not been neglected, because he would be in a position to show that if one did to that extent vary the accepted traditional method, the effect upon the price they would have to pay would not be to their disadvantage.

MR. GATHORNE HARDY: That is a matter of evidence.

His LORDSHIP thought they were being asked to consider what was impracticable. No contractor had ever undertaken the provision of a telephone system for 10 or 11 millions. He thought all the Court had to do was to find "the then value."

The SOLICITOR-GENERAL said that he did not appreciate how it mattered whether they assumed a single contractor or two or three contractors. It was often expedient to give work to several contractors. Proceeding, he submitted that the method of the company might fairly be attacked as a method which could not be accepted as leading to a reasonable, accurate, and trustworthy result. He hoped to offer an alternative method which was more consonant with experience and more useful as a guide to the Court. Their complaint about the method of the National Telephone Co. was that it made a maximum use of assumptions instead of a minimum use and laid itself open at every stage to the possibility of error, which in the cumulative result might well amount to millions of pounds, and which made it extremely difficult to find out the stage at which error occurred. Counsel then went into detail on the criticisms which he offered to the claimants' method of calculations, tracing the courses of alleged error in proceeding by the percentage method. He complained that the company had distributed certain figures between capital and revenue which were largely the result of estimates, although they had by their district books kept a record of what they regarded as properly due to capital and properly due to revenue.

SIR JAMES WOODHOUSE said he understood the contention to be that the system on which the claim was founded was so full of fallacies as to be unreliable.

The SOLICITOR-GENERAL: Exactly.

Criticising the company's figures, the SOLICITOR-GENERAL said their revised figures were based on percentages, which, according to their own showing, could not stand. Was it suggested, he asked, that the general manager's salary in a great business like that was properly to be regarded as spent on the construction of new works and on the management of his business in proportion to the money spent on construction of new works? He hoped to show a method which would not involve such a wilderness of figures as those in the company's method. In the course of a critical analysis of the company's figures, Counsel asked, "Can people rely on figures based on percentages when assumptions have to be made before you arrive at your percentages?" A matter of £1,000,000 hung on the percentage. At every stage in the calculation one could point to error of logic, error in proportion, and error in percentage. The most reckless assumptions had been made in order to divide between construction and revenue. He further pointed out that part of the figures put forward by the company were based on piecemeal construction, which meant added expense. Was it right, he inquired, that in endeavouring to arrive at "tramway terms" the then value of a physical installation like the telephone system, they should be guided by the figure of cost? The question to be decided was not what it had cost the company, but what it would cost if it had to be re-erected by a particular date. Once it was conceded that piecemeal construction meant added expense, it followed that the figures admittedly based on piecemeal construction, as were the percentages, were figures that were too big.

The SOLICITOR-GENERAL said it was the experience of all telephone undertakings that in many cases they were begun on a small scale and multiplied and made bigger as time went on. That was common with most distributing undertakings. That, however, was not the case in the present instance. The Telephone Company were here tendering to the Post Office a highly developed undertaking, and what the Postmaster-General ought to be asked to pay for that was not what it had cost to construct, in view of its piecemeal history, but what it would cost to construct if it were constructed in its present state.

MR. JUSTICE LAWRENCE said the question which weighed most strongly on his mind was not what the undertaking had cost, but what it would cost to carry out by some contractor, supposing he was going to build it as it stood to-day. The difficulty there was how they were going to treat the matter. Was it possible to look upon it as something which could be done at a particular date. It seemed to him that when they tried to get close to that point, a vast field of difficulties cropped up.

SIR J. SIMON said there were two difficulties. First, as a matter of business and good sense, it must be recognised that a telephone installation was always a matter of gradual growth, and secondly, there was the difficulty of applying the idea of reconstruction on a certain date, in view of the fact that they were dealing with an undertaking which could not be constructed in a night or so. His contention on the piecemeal point was that, in order to arrive at the "then value," they must ask themselves the question, "What would this thing cost if it were going to be reconstructed now?"

MR. GATHORNE HARDY: We are not inquiring into the cost, but into the value.

SIR J. SIMON said that was quite right, but the question they must consider was what would the undertaking cost if it were constructed in its present state, and it could not be made any more valuable because of its history. Therefore, what the Court and valuers had to do, putting aside any question of depreciation, was to say what it was that was being sold. They were selling poles, &c., of such and such a weight, and wires of a certain number, &c., and if it were right to say that the cost of it all, as it stood, was less than its cost, if regard be had to its history, then the smaller figure and not the larger one should be adopted as a guide to the then value of the undertaking. The history of the undertaking could not affect its price. It was impossible, of course, to treat a telephone undertaking like that of the company as a thing of mushroom growth which could spring up in a night, between the rising of the sun on December 31st last, and January 1st of this year. He agreed that the price of the plant, as it stood, was not likely to be the same in any one year, because there was a tendency for metal and rubber to vary. Having obtained the price of the undertaking on a particular date, however, one had to consider whether there was anything further to add to the contractor's profits. There would be something to add, because it would be necessary to supervise what the contractor was doing. The proper way to approach that, and the way it was approached in ordinary practice, was to charge an over-all percentage upon the contractor's own price, such percentage representing the employer's supervision. That was a business-like way of approaching the matter, and would not involve any hypothetical provisions about the work being carried out in a moment of time.

The whole undertaking of the National Telephone Co., continued SIR J. SIMON, contained about 500,000 stations. In America the construction of the same number of telephone stations was going on every year. Indeed, he had just been informed that it was something like 800,000, so that they were not making a very extraordinary hypothesis when it was suggested that if the United Kingdom were deprived of its telephone system it could get a new one in something like two years. They recognised that there must be a certain time occupied in construction, and the contractor would have regard to that. As a guide to what would be a fair price, therefore, the practical basis would be to ascertain the contractor's price and the sort of considerations by which the contractor would be influenced. By approaching the question on those lines, the Court would avoid the wilderness of percentages on percentages. Continuing, counsel said the company's prices for materials had been based on an average of 11 years, but there were some items of materials, the prices of which had come down during the last 10 or 11 years. He would be able to prove that with regard to instruments. They would not allow that figure to be inflated by the history of high prices in the past. There were special reasons for the company having to pay high prices. It would be found that they bound themselves by a contract, which had a tendency to keep prices high. The Postmaster-General, however, would not be prejudiced by that. Sir J. Simon further submitted that the cost of raising capital was not any part of the cost of raising plant, though it was an element to be taken into consideration in the working of the business. The Court were trying to get at the value of the plant, the cost if it were consecutively constructed, as distinguished from the cost of their instituting or carrying on the business of the company.

SIR JAMES WOODHOUSE said that how the plant could be enhanced or diminished in value by the cost of raising money was a point he would want, on either side, to be convinced upon.

(To be continued.)

The Birmingham and Midland Tramways, Ltd.

By a petition heard by Mr. Justice Parker, in the Chancery Division, on Tuesday last, the Court was asked to sanction alterations in the memorandum and articles of association of this company so as to give it increased powers.

Mr. Frederick Thompson, in support of the petition, said that since the company was incorporated in 1883 electricity as a motive power had become much more widely used. Since the abandonment of its horse cars the company had used only electricity as a motive power. Recently, however, resolutions had been passed for the adoption of 'buses propelled by electricity, steam or otherwise, as feeders to the tramways. They had large works for the construction and maintenance of their rolling stock, but it was felt doubtful whether under their present powers they could manufacture vehicles propelled by self-contained power. Also since the company's incorporation light railways had been coming to the fore, and the company desired powers to promote Bills in Parliament for light railway construction, as they could be constructed more cheaply than tramways, and when they were taken over by the local authorities, the company was in a better position under the Light Railways Act than under the Tramway Act. The company were associated with a number of subsidiary companies, and it was desired, further, that they should have the power of guaranteeing the loans raised by the associated companies.

There was no opposition, and his Lordship sanctioned the proposed alteration, limiting, however, the company's power to construct motor-vehicles to such as were used in connection with, or were auxiliary to, their own undertaking or the undertakings of any of the auxiliary companies.

Electric Railway and Omnibus Fusion.

On Monday, July 15th, the Master of the Rolls and Lords Justices Farwell and Kennedy heard the appeal of Mr. Costello and 15 other shareholders in the London General Omnibus Co. from the refusal of Mr. Justice Swinfen Eady to restrain the carrying-out of the scheme of amalgamation between the Omnibus Co. and the Underground and Electric Railways.

The appellants' objection to the scheme was that the price they were to receive for their shares was inequitable, having regard to the price the shares stood at on the market. For the company it was argued that the Court would not go against the wishes of 95 per cent. of the shareholders, who were in favour of the scheme.

The Master of the Rolls said there was no evidence before the Court that the price to be paid for the Omnibus Co.'s assets, which was £4,500,000, was not a fair price, and the wishes of the majority must therefore be given effect to.

Lords Justices Farwell and Kennedy concurred, and the appeal was dismissed with costs.

Tramway Accident Claims.

An application for a new trial has been made by the Edinburgh and District Tramways Co., Ltd., in the action at the instance of a domestic servant for damages in respect of injuries sustained through being run over in Lothian Road when she was on her way to church. When the case was recently before Lord Hunter and a jury, a verdict was returned for pursuer, the damages being assessed at £350. The case has now been sent to the Roll for discussion.

In the Court of Session, intimation was made of an extra-judicial settlement in an action by a clerk for £300 damages against the Edinburgh Tramways Co. The pursuer averred that when he was trying to board a car at a stopping place, the car was violently jerked forward and he was dragged along the street, the wheels passing over his left hand. The defenders' servant, he stated, acted negligently in first slowing down the car and then starting it with a violent jerk. Fault was denied, defenders contending that pursuer endeavoured to board the car when it was in motion, and that he acted in negligent disregard of his own safety. In a minute lodged by pursuer, his allegations regarding the construction of defenders' car were withdrawn. Defenders have made pursuer a payment of 60 guineas in full discharge.

The Taxation of Telegraph Cables.

Before the Judicial Committee of the Privy Council last week their Lordships dismissed the appeal of the Attorney-General of Newfoundland from a decision of the Supreme Court of Newfoundland of May, 1911, the question being whether the Commercial Cable Co. was liable to taxation as a company carrying on telegraph business in or from Newfoundland. Their Lordships were of opinion that the cables were not liable to taxation. It was not competent for the Government to lay a tax on cables outside its territorial jurisdiction. The hearing is reported in the *Times* of July 11th.

Battery Cars in Germany.—The battery cars used on the Prussian-Hessian Railways have hitherto only been able to travel a distance of 62 miles before the accumulators have required to be recharged. As this has caused inconvenience, owing to its being impossible to complete the intended journeys unless the cars have actually reached the charging stations, it has been decided to make provision for additional cells, which will enable the cars to travel a total of 80 miles. The first cars of increased capacity have been placed on the Berlin-Jutebog section, and further cars are to be similarly equipped.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Milled" Type Simplex Nipple.

For some eight years the practice of providing electrical continuity in conduit installations has been gradually growing, and the early drawback of increased cost has led to many attempts to devise means for rendering ordinary unscrewed tube electrically continuous. One of the most successful methods for achieving this result was the Simplex Grip nipple, which has been used on hundreds of installations. This nipple was cut out of the solid hexagon steel bar, and, with a view to reducing the cost, the Simplex Co. has now introduced a modification in which the hexagon head is replaced by a milled head, this enabling prices to be reduced by approximately one half. Full particulars of the "Milled" type nipples are contained in List T 2 (448) (issued by Simplex Conduits, Ltd., 116, Charing Cross Road, W.C.) which, among others, illustrates the inspection tee shown in fig. 1, in which it will be noticed the nipples are of the new type, having milled instead of hexagon heads.

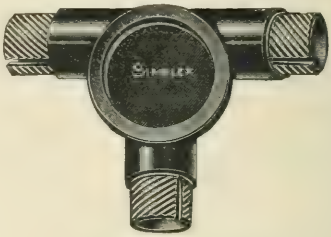


Fig. 1.—Tee with Milled-Type Simplex Nipples.

Mining Switchgear.

We illustrate in fig. 2 a modification of Messrs. A. Reyrolle and Co.'s well-known design of "Drawout" pillar for mining work. In this case the pillar is fitted with a potential transformer, housed in a casing above the bus-bar chamber, and connected to the bus-bars through potential fuses; otherwise the design follows the lines which Messrs. Reyrolle have been working on for the last two or three years. We understand that they are supplying many of the largest colliery companies in the country with one or more panels, and that at the present time they have close upon 100 panels in progress in the shops.

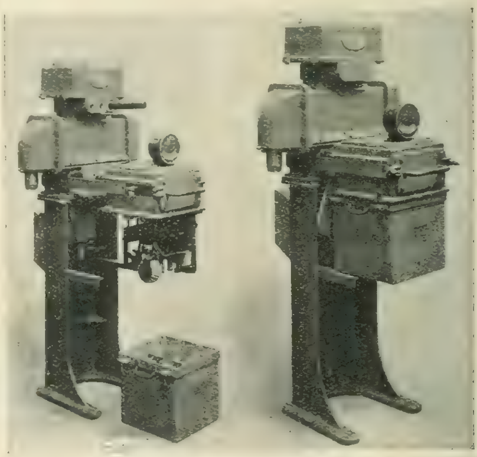


Fig. 2.—Reyrolle "Drawout" Pillar with Transformer.

Electric Rove Stop.

Great interest has been aroused in the Dundee jute trade by the invention of an electric rove stop by Mr. Peter Sharp, yarn merchant, late of Dundee, and now of New York. The device, which is expected to effect a great improvement in the spinning of jute, has been fitted to a small spinning frame in the new Technical College.

"Fabroil" Pinions.

"Fabroil" pinions, which are patented in the United Kingdom, are manufactured by the British Thomson-Houston Co., Ltd., Rugby, and consist of a special woven fabric, which is compressed under several tons pressure between steel flanges, and held together either by threaded sleeves in the case of the small pinions, or threaded studs in the case of the larger ones. It is claimed that their strength is greater than that of any other non-metallic pinion, and thanks to the slight flexibility of the teeth, which allows of good bearing surface across the full width of the face, these pinions will run at high speeds without vibration, and absorb shocks sufficient to strip the teeth of a cast-iron pinion, or to cause a brass pinion rapidly to lose its shape, and consequently give trouble.

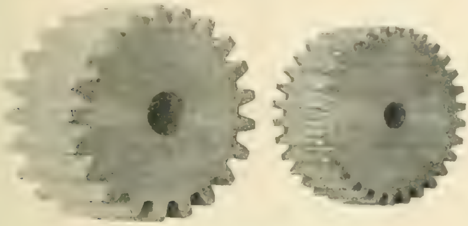


Fig. 3. "Fabroil" Pinions.

The teeth are cut to the 14½ degree involute system, according to Brown & Sharpe's standard. After the blanks have been assembled and machined, they are impregnated with oil, and after the teeth are cut they are again impregnated with oil, thus rendering them self-lubricating, impervious to moisture, and proof against atmospheric conditions. They are also immune from injury by vermin and insects. Because of their noiseless operation, long life and high tooth strength, they are applicable to numberless types of machine shop tools and auxiliary machinery.

Machines equipped with "Fabroil" pinions are operating under every condition of service, from driving a small, light tool to operating heavy punch presses and shearing machines, at the works of the manufacturers. Under all tests so far applied, these pinions are said to have shown up remarkably well. They are supplied from 2 in. to 12 in. outside diameter, and from 1 in. up to 12 in. face.

Adams Igranic Ironclad Pillar Panel.

The accompanying illustration shows one of a range of ironclad pillar panels of the "Conspede" type, fitted with a voltmeter and an ammeter, made by the Adams Manufacturing Co., Ltd., Bedford. This panel has the great advantage of having only one handle, so that there is no possibility of the various operations being performed in improper sequence, as might occur if there were two or more handles, and the attendant were to operate them in incorrect order. The circuit-breaker and starter are so interlocked that the first movement of the handle in the direction for starting causes the circuit-breaker to close, but should an overload (beyond that for which it has been adjusted) occur, either through too rapid starting or from any other cause, it will reopen, and no effort on the part of the operator will avail to keep it closed until the load is lightened. Furthermore, having opened, the circuit-breaker will not close again until all the starting resistance has been reinserted.

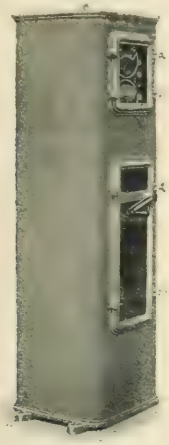


Fig. 4.—Adams "Conspede" Switch Pillar.

The controller may also be used for "inching" to an unlimited extent without sustaining any injury, because of the patented method adopted for the interlock, whereby the slightest backward movement of the handle, either from the first or last or any intermediate contact, causes the circuit-breaker immediately to open, and so confines the duty of opening circuit always to the circuit-breaker, thus preventing the starter contacts being burned and damaged. This is a most valuable feature (especially for use with machine tools or printing machines).

Star-Delta Starter.

A new star-delta starter panel has recently been put on the market by Mr. George Ellison, of Victoria Works, Warstone Lane, Birmingham. It consists of a cast-iron base-plate, upon which is mounted a totally-enclosed drum-type star-delta starter, mechanically interlocked with a totally-enclosed cast-iron box, containing three replaceable fuses. These fuses are in circuit when the running position is attained. The handle of the starter cannot be left in the starting position, and the fuses cannot be tampered with unless the starter is in the off position. If desired, an interlocking mechanism can be fitted to prevent the operator throwing the starter into the delta position before the start. An ammeter and bracket can also be fitted. The panel is designed for wall mounting, and is capable of withstanding any amount of rough usage.

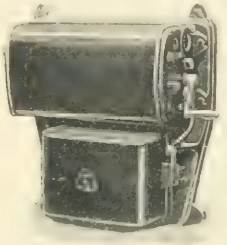


Fig. 5.—Ellison Starting Panel.

Dust-proof Fitting.

One of the most serious difficulties met with in connection with indirect lighting is the accumulation of dust, spiders' webs, &c., in the upturned reflectors, necessitating frequent cleaning, under penalty, if this is neglected, of a great loss of illuminating efficiency. The trouble with insects is particularly in evidence in tropical countries. Moreover, the accumulation of foreign matter is not only hidden from direct observation, but it is difficult to remove without damage, on account of the presence of the lamp or lamps in

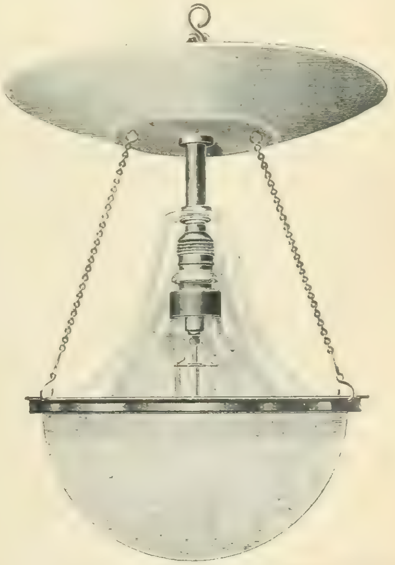


Fig. 6.—Dust-proof Fitting for Indirect Lighting.

the reflector. To remedy this disadvantage. Messrs. Seear, Page and Co., of 16 and 17. Devonshire Square, London, E C., have introduced the device illustrated in fig. 6, p. 91. It will be seen that the lamp is enclosed in a clear glass bell-shaped shade, which covers the whole of the reflector, and effectually excludes insects and dust. The idea is certainly a good one, as the dust deposited on the dome will be readily seen and easily removed; the shape of the dome, as well as of the reflectors, ought, of course, to be designed with due regard to its effect upon the path of the light.

BUSINESS NOTES.

Meetings of Creditors.—Garrett, Hunt & Co., Ltd., Tram Terminus, Catford, electrical engineers.—The creditors interested herein were called together last week at the offices of Mr. R. E. Smith, 8, Queen Street, Cheapside, E.C. It was reported that the shareholders of the company had already met and passed a resolution to the effect that it had been proved to their satisfaction that the company could not continue its business by reason of its liabilities, and that it was advisable to wind up the concern voluntarily. A further resolution was passed appointing Mr. Smith as liquidator. The latter presented a statement of affairs showing the position as at June 24th last. This disclosed gross liabilities of £624, of which £514 was expected to rank. The assets were estimated to realise £301, less £89 for preference claims, leaving net assets of £213, or a deficiency of £301. It was stated that the business was originally carried on by Messrs. Garrett, Hunt & Co., and was then transferred to a private limited liability concern with a nominal capital of £2,000. Practically all the shares of the company were issued as fully-paid. In March of last year a Mr. Daniels bought the shares of the company for a sum of £1,500, and since that time he had put in other moneys and was now scheduled as a creditor for £139. In addition, he was entitled to certain arrears of salary, and £50 of that claim had been included as preferential. The stock of the company had been removed from the premises, but sufficient had been left to satisfy the claim of the landlord, who was a creditor for £20, and that amount was not included in the statement of affairs. During the past year there had been a loss on the trading of £500. The principal business of the company had been contracting for picture theatres, but owing to the falling off in the turnover, and the heavy expenses, it was unable to continue. After some discussion a resolution was passed confirming the voluntary liquidation of the company with Mr. Smith as liquidater, and the representatives of the Armorduct Co. and Mr. A. C. Hands were nominated to act as an informal committee. The following are creditors:—

Armorduct Co.	£91	Daniels	£137
Attree & Co.	14	Hands, A. C.	85
British Thomson-Houston Co.	13	Welsbach Co.	15
Crypto Electrical Co.	14		

H. G. Norton & Co., Ltd., Cheltenham and Gloucester, automobile, cycle, and electrical engineers.—A meeting of the creditors of the above was held recently, when a statement of affairs was presented, showing the position as at June 25th last, which had been prepared by Messrs. Lewis Izard & Son, I.A., Cheltenham. The statement disclosed unsecured liabilities of £13,517. There were fully-secured creditors for £9,620, who held securities of the estimated value of £16,600, or a surplus of £6,980. There were contingent liabilities of £1,084 in respect of bills discounted, but no portion of that amount was expected to rank on the estate. The assets were estimated to realise £18,769, from which had to be deducted £187 for preference claims, and £9.337 owing on debenture bonds. The estimated amount available to meet the claims of the unsecured creditors was £9,245, showing a deficiency of assets to meet liabilities, subject to the costs of liquidation, of £4,272. The company was said to have had numerous difficulties to contend with. It had been hoped that some proposal would have been made for the continuance of the business without liquidation proceedings taking place. When the figures were got out the bank appointed Mr. Izard as Receiver, and that gentleman was in possession of the assets. Voluntary liquidation was then recommended, and Mr. Izard and Mr. G. G. Poppleton were appointed joint liquidators. It was pointed out that in order to conform with the requirements of the Companies' (Consolidation) Act, a further meeting of the creditors would have to be called.

Book Notices.—*Alternating Electric Current and Induction Motors.* By T. Harding Churton, M.I.E.E.—This is the second edition of a booklet published by the author's firm at Leeds, at 2s.; in many ways it is an excellent production, containing in briefest form just such information as would be required by an engineer who was fairly familiar with direct-current work, but knew very little about alternating current. Starting with explanations of the terms used, and the construction of induction motors, the author deals with the control, rating, selection and management of A.C. motors, as well as with their installation, in a comprehensive manner, and with many sage hints derived from practical experience. The contents are highly useful and instructive; and it is only with the view of making them still more useful in future editions that we proceed to point out some faults that we have noted. On page 8 "the root-mean-square values of the *maximum* values" are mentioned; perhaps the author meant to write "instantaneous" instead of "maximum," but even with this amendment the expression is obscure. On the same page we are told that "when alternating current is supplied to motors, the current does not keep in step with the alternating volts, but 'lags' behind"; we suggest that the word "not" should be deleted, for the lag is in phase only—synchronism is maintained. We also read on page 8 "the actual power, or energy, of the circuit"; but power and energy are very different things. On page 10 we read "the electrical energy (watts)" and "the mechanical energy (B.H.P.)"—but why? Energy is never measured either in watts or B.H.P. These slips may be said to be of minor importance, though we do not agree, but a serious error certainly occurs in a diagram (fig. 24) on page 53. When the switch is in the starting position, the main winding of the stator is on open circuit, and as the starting winding also is connected with only one of the supply mains, the starting torque and current are both likely to be zero.

The Wireless Operator is the title of an interesting little book issued by the British School of Telegraphy, Ltd., of 179, Clapham Road, S.W., for the benefit of youths who intend to enter wireless telegraphy as a profession. The romance and pleasures of an operator's life on board ship are painted in the rosiest colours, and certainly the post is one which offers many attractions to the young adventurer—especially now that first-class passenger ships are to carry two operators. The illustrations are very effective, and the booklet leaves a good impression on the mind of the reader.

"Science Abstracts." Sections A and B. Vol. 15, Part 6. June 25th, 1912. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net. each.

"*Journal* of the Institution of Electrical Engineers." Vol. 48, No. 213. London: E. and F. N. Spon, Ltd. Price 5s.—The issue for May, 1912, contains the following papers:—Electrical Driving of Rolling Mills, by C. A. Ablett; The Heat Paths in Electrical Machinery, by H. D. Symons and M. Walker; Dynamos for Motor Road Vehicle Lighting, by J. D. Morgan; Recent Steam Turbine Practice, by K. Baumann; Flashing-over in Commutator Machines, by W. W. Firth; 1,200-volt Traction in U.S.A., by T. Stevens.

"A Primer on Alternating Currents." By W. G. Rhodes. 1912. London: Longmans, Green & Co. Price 2s. 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 5. May, 1912. Chicago: The Society. Price 50 cents.

"First Annual Report of the Bureau of Mines, June, 1911." Washington: Government Printing Office.

Transactions of the North-East Coast of Engineers and Shipbuilders." Vol. XXVIII, part 7. July, 1912. Newcastle-on-Tyne: The Institution.

"Portable Wireless Telegraph Stations." London: Marconi's Wireless Telegraph Co., Ltd.

"Atti della Associazione Elettrotecnica Italiana." June, 1912. Milan: The Association.

"Information for Visiting Members, Entertainment Program and Program of Excursions." (Announcement No. 4 of the Eighth International Congresss of Applied Chemistry.) New York: The Secretary of the Congress.

"Eighth Report of the University of Leeds, 1910-11." Leeds: The University.

"La Soudure Autogène du Cuivre, des Laitons et des Bronzes." By M. R. Amedeo. Paris: Union de la Soudure Autogène. Price 1 fr.

Holidays.—Messrs. T. W. Broadbent, Ltd., Victoria Electrical Works, Huddersfield, are closing for the annual works holiday from Friday night, July 26th, to Tuesday morning, August 6th. An office staff will deal with special correspondence.

The Wardle Engineering Co., Ltd., of Manchester, announce that their works and offices will be closed from August 2nd to 12th, for the annual holidays.

The works of the Adams Manufacturing Co., Ltd., of Bedford, will be closed from 12 o'clock noon Saturday, August 3rd, until 9 a.m. on Monday, August 12th, for the annual holidays. A small office staff will be in attendance to deal with urgent correspondence.

Liquidations.—Cowans, Ltd.—A meeting is to be held at 33, Princes Street, Manchester, on September 9th, to hear an account of the winding up from the liquidator, Mr. J. Cooper.

Perfectophone, Ltd.—This company is winding up voluntarily with Mr. W. Adgie, Park Row, Leeds, as liquidator. A meeting of creditors is called for July 24th.

Switchgear Co., Ltd.—A meeting is to be held at 109, Colmore Row, Birmingham, to hear an account of the winding up from the liquidator, Mr. H. Keeling.

The Davis Electrical Co., Ltd., 17, Moor Street, Cambridge Circus, London, W.C.—The public examination of Harry Emanuel Davis, promoter, vendor and managing director of the above-named company, has been fixed for July 23rd, at 2.15 o'clock, before Mr. Registrar Hood, at Bankruptcy Building, Carey Street, W.C.

Oerlikon Single-Phase Locomotives.—Messrs. Andre Citroen & Co. write to point out that all the new Oerlikon locomotives for the Loetschberg railway are equipped with their Citroën gears, and not with worm gear, as stated in our last issue. We regret the error, which must have occurred in the course of translation.

New Zealand.—According to a recent report the value of the electrical machinery imported into New Zealand last year attained a value of £256,474, as contrasted with only £207,565 in 1910

Bankruptcy Proceedings.—Mr. Alfred Slatter, consulting electrical engineer, Caxton House Westminster, S.W., a director of the Wycombe Borough Electric Light and Power Co., Ltd., and the Chesham Electric Light and Power Co., Ltd. At Bankruptcy Buildings, Carey Street, W.C., on July 11th, the statutory first meeting of creditors was held under this failure. Mr. Egerton S. Grey, Official Receiver, presided. For the past 10 years the debtor had carried on business as a consulting electrical engineer, first at Bridge Street, Blackfriars, S.E., and afterwards at Caxton House. In 1910 he went to Mexico and secured a concession from the Federal Government for a railway between Zacateras and Manewra (160 miles long) and he then formed a syndicate in this country, called the Mexican Zacateras Development Co , Ltd., for the purpose of working the concession. The syndicate had applied to the Government for an extension of time for beginning work, but had not yet received advice as to whether such application had been granted. It had expended some £5,000 on the scheme. The debtor held in the syndicate 9,000 ordinary shares of £1 each, fully paid, and it owed him £1,000. In 1910 he secured an option for the utilisation of certain rights in a certain town in Mexico for the development of electrical power, and entered into an agreement with a Parisian firm of financiers to find £400,000, which was the amount of capital necessary to carry out the scheme. Under the agreement he was to receive £5,000 by March 31st, 1912, and £100,000 in shares in a company which the Parisian firm undertook to form, but they failed to carry out the agreement, with the result that the option had lapsed. But for the purpose of keeping the project alive the debtor had obtained loans. Judgment was obtained against him in respect of one of them, and the Receiver's order followed. He estimated his liabilities at £800, whilst the only available asset was a sum of 15s. The debtor, however, thought that there might be some surplus value in his shares in the Zacateras Co., although they were all charged. He entirely attributed his present position to the failure of the foreign financiers. On behalf of the debtor, Mr. T. Goldman asked for an adjournment of the meeting to enable his client to bring in a proposal, but the chairman refused to accede to this application, and, acting upon his proxies, passed a resolution from them. Mr. F. G. Salaman, chartered accountant, was thereupon appointed trustee.

H. H. Oxley (Oliver Huxley), consulting engineer (see last issue).—First meeting July 22nd at 14, Bedford Row, W.C., at 3 p.m. ; public examination, July 23rd, at Brentford Court House, at 11 a.m.

W. F. Flint, electrical engineer, Hull.—July 27th is the last day for receipt of proofs for dividend. Trustee : W. G. Hall, Union and Smith's Bank Chambers, Silver Street, Hull.

T. E. Morgan, electrical engineer, Sheffield.—July 29th is the last day for receipt of proofs for dividend. Trustee : J. C. Clegg, Figtree Lane, Sheffield.

When the first meeting of creditors was held on Monday of M. Chosidow & Co., Russian merchants, 4, Lloyd's Avenue, E.C., an application was made by debtor for an adjournment as he had been, and was still, engaged negotiating for an electric light concession in Europe, which, if obtained, would enable all creditors to be satisfied. The meeting was adjourned until August 2nd.

Meeting of Lamp Salesmen.—At Rugby on July 8th and 9th the British Thomson-Houston Co. held the annual meeting of their lamp salesmen, who came from all parts of the country to take part in the Convention. The meeting brought together some 40 active aggressive representatives. The object of these annual meetings, we understand, is three-fold, and may be briefly stated as :—(1) Encouragement, (2) instruction, and (3) conviviality. The papers and discussions at the meeting afforded evidence of the valuable work which the lamp and wiring supplies department of the company is doing in extending electric lighting service throughout the country. We learn that the event was a thoroughly enjoyable one to all taking part therein.

Continental Notes.—Italy.—The report of the French Chamber of Commerce at Milan states that the manufacture of electric glow lamps in Italy is only of recent date ; nevertheless several fairly large manufactories are already in existence. Notwithstanding this, the importation of these articles continues to advance each year, and the growing number of installations shows that their employment is far from having attained its maximum. Consequently, despite the increasing output of the native works, there is still a good opening for the products of foreign manufactories. The placing of a good article of foreign manufacture should not prove difficult. The help of explanatory advertisements should not, of course, be neglected, the more so as much enterprise is already locally shown in this direction by the use of multi-coloured placards and electrically-illuminated announcements. Much good business has, says the report, also been already secured by the direct approach to concessionaires and individual consumers by means of coloured cards and prospectuses. Imported glow lamps are subjected to a duty of 5 lire per cent. Another line capable of sale is carbons for arc lamps, the imports of which are on the up grade, this form of public lighting having a tendency to displace gas in all the large towns. The articles are subjected to a duty on importation of 10 lire 100 per kg. gross weight. The imports of carbons for dynamo-electric machines is likewise considerable, but their supply is generally reserved to the firms having direct relations with the builders of the machines.—*La Lumière Electrique.*

A new company to import and manufacture electrical appliances at Perugia, Italy, has been founded under the title of "Societa Perugina di Elettricita," with a capital of 150,000 lire. "Sacheri & Francesi" is a new firm to import and deal in electrical goods at Turin. Capital, 10,000 lire.

Germany.—The South German Telephone Apparatus, Cable and Wire Works Co. is the name of a new concern which has just been formed in Nuremburg, with a capital of £50,000, to acquire and carry on the Nuremburg branch works of Messrs. Felten and Guilleaume, Carlswerk.

Norway.—Until further notice, carbon brushes for electric machines are to be admitted into Norway free of Customs duty.—*Board of Trade Journal.*

Spain.—The Province of Catalonia, in Spain, according to the *Moniteur Officiel du Commerce*, as a consequence of the present prosperous commercial situation, offers an excellent opening for various kinds of electrical wares. In particular, there is an active demand for dynamos, motors, both benzene and electric, and accessory electrical material. Long credit is, however, expected from large suppliers. payment being required to be spread over five years.

Catalogues and Lists.—Messrs. Macdonald, Syer and Co., Ltd., 295, Gray's Inn Road, London, W.C.—Price leaflet relating to "E.S.M." D.C. ventilating fans.

Messrs. Pirelli, Ltd., 144, Queen Victoria Street, London, E.C.—Forty-page catalogue in a cover of very pleasing and artistic design, giving a great deal of tabular matter relating to their wires and cables. The contents include ordinary standard types as well as most other types of wires and cables likely to be required. Space has not been occupied with general particulars, effort being made to limit information to data necessary for estimating purposes. Paper, rubber and bitumen insulated cables, for light and power, extra-high-tension cables, colliery, aerial and telephone cables, flexible cords, motor-car cables, bell wires, shot-firing cables, instrument wires, rubber gloves, and accessories for installation work—these may be mentioned to roughly indicate the contents. Members of the trade can have copies for keeping in their catalogue files on application.

Messrs. W. Mickelwright & Co., Sicilian House, Southampton Row, London, W.C.—Pamphlet describing the "Wright" number indicator for indicating the next item or turn at music halls and cinematograph theatres, arrivals and departures at railway terminii, results of sports, tramway routes, &c. A number of special shaped metal boxes or compartments, each of which contains an electric lamp, are so arranged behind a coloured glass panel that when the lamps required are switched on, perfectly shaped numerals are formed. The lamps are controlled by a switch of new design.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—Price list of miniature carbon-filament lamps, covering all the shapes and sizes of lamps likely to be required for ornamental lighting purposes, including small pear shape and round bulb lamps, tubular, flame, and tinted flame candle lamps, mushroom, onion lamps and miniature lamps for outline lighting.

From the Flanders Manufacturing Co., of Pontiac, Mich., we have received a large and effective print in artistic colouring on a black background showing one of their Flanders Colonial electric automobiles (1913 model).

Messrs. Otto Reunert & Co., Munich.—Leaflets relating to their various systems of automatic electric regulation as applied to heating apparatus, thermostats, reducing valves, pumps and fans, boiler-feeding, water-level indication, &c.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflets relating to their aluminium ship and cabin fittings and gas lamps, and various applications of sheet aluminium, including spun lamp reflectors, pressed meter cases, tanks (with welded seams), car bodies, &c. One leaflet shows the laying of 60,000-volt aluminium feeders for a railway.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—Eight-page illustrated price lists of electric fans and small-power motors, also motor hair brushes, hair dryers, vibrators and vacuum cleaners. Copies may be obtained on application.

Holiday Resorts.—Three useful publications relating to Llandrindod Wells, Ventnor and Bembridge respectively have been issued for the benefit of undecided holiday-makers. All are fully illustrated, and are issued by the Health Resorts Association. Copies can be obtained by sending a postcard to the town clerk at either of these places.

Trade Announcement.—Messrs. Baxter & Caunter, Ltd., are removing from their present address in Charing Cross Road, to 219, Tottenham Court Road, W. The warehouse and trade counter will be at the back of these premises, at 8, Alfred Place. W.C. The firm's telephone numbers will be the same. The removal is consequent upon the need for larger premises due to increasing business.

The Far East.—It is reported from Saoul that the Japanese firm of Okura & Co. has obtained a concession for the establishment of a central station in the province of north Ping Yang, which is specially intended to furnish power to the mines in that district. The work of equipping the station, particularly the supply of turbines and overhead conductors, has been entrusted to the A.E.G., of Berlin. It is as yet uncertain whether the Japanese firm will form a separate company or carry out the enterprise on its own account. Comparatively cheap coal can easily be obtained from the Penschiho coal mines, which are also in the possession of the Japanese firm and which adjoin the Mukden-Antung railway.

Electric Furnaces.—The Société Electro-Metallurgique (Paul Girod), of Ugine, has concluded a community of interests with the Gesellschaft für Elektrostahl Anlagen, of Berlin, which is associated with the Siemens group, whereby the Berlin company has acquired the exclusive right of utilising the arc resistance furnace on the Girod system, the company already using the Deubs arc-radiation system. The agreement is said to be of great importance, as the Berlin company already owns the leading patents for induction furnaces, and its scope extends, apart from Great Britain, the British Colonies and the United States, over all other countries.

LIGHTING and POWER NOTES.

Acton.—When the Metropolitan Electric Supply Co., Ltd., in June, 1911, obtained their Parliamentary powers for the transfer of the Council's undertaking to them, one of the conditions of the transfer was that the company would accept liability for the payment of interest and sinking-fund charges on the loans then taken up by the Council in connection with the undertaking. After the actual transfer had taken place, however, there were still several outstanding matters needing attention, such as stores, &c., and in March last the company intimated to the Council that they claimed, as coming within the terms of the transfer. a sum of some £5,700 representing the unexpended balance of money previously borrowed by the Council for capital expenditure on electricity. With this contention the Council disagreed, but the company subsequently deducted from their repayments of principal and interest on the Council's loans, a sum equivalent to the amount of principal and interest accrued to the lenders of the £5,700, one instalment of principal and interest on which they had previously paid, in anticipation of the unexpended loan being handed over to them later. The Council promptly returned the company's cheque, and protested against such a course of action and interpretation of the contract by the company, and although conferences and efforts at a compromise have been numerous, and the claims of both sides have been modified substantially, a deadlock has occurred. The Council at its last meeting decided to make a final offer to the company, failing the acceptance of which proceedings are to be commenced, the dispute, unfortunately, not being covered by the arbitration clause in the agreement for the transfer. Another bone of contention is the ground rent in respect of the site of the Council's generating station ; the Council asks a firm price of £75 per annum, whilst the company refuse to go beyond £50.

Algeria.—A scheme is at present under consideration for the establishment of a central electric lighting station and an electric tramway in the town of Birkadem.

Australia.—Mr. J. E. Donoghue, general manager of the Balmain (N.S.W.) Electric Lighting Corporation, has been appointed consulting electrical engineer to the Manilla Municipal Council, and is to prepare plans and specifications for the proposed electric lighting scheme.—*Australian Mining Standard.*

According to the same paper, the Footscray (V.) City Council is about to borrow £10,000, of which £4,000 will be devoted to extension of the electric lighting system.

The same exchange states that the Order-in-Council having been granted, empowering the Brunswick (V.) City Council to install electric light and power, permission is being sought to borrow £16,000 for that purpose. The consulting electrical engineers (Messrs. J. A. McCarty & Co.) have nearly completed the specifications.

Barrow.—The annual report of the borough treasurer states that the income of the electricity department last year from lighting and power supply was £11,262 ; traction, £2,810 ; public lighting, £1,858 ; sundries, £2,701—total, £18,631, compared with £15,369 in the previous year. The expenditure was for generation and maintenance, £7,268 ; services, £2,224 ; loan charges and interest, £7,466—total, £16,958, compared with £14,663. The high expenditure and income in connection with services were due to work done by the department on the overhead equipment of the Biggar Bank and Ferry Road tramways. The gross profit was £9,139, and the net profit, £1,673, compared with £706 in the previous year. The net profit was allocated to the renewals fund, which at present amounts to £2,187. Owing to the refusal of the L.G.B. to sanction further borrowing powers for the purchase of new meters, a sum of £441 had had to be charged against the renewals fund for that purpose. The capital account was £118,203, and the outstanding debt was £82,734.

Bath.—Some considerable time was spent at the last meeting of the T.C. in discussing the report and accounts of the Electricity Committee. The receipts for private lighting, it was pointed out, had amounted to £11,273, and for power and heating, which was a comparatively new branch, to £4,001. They had sold under contracts to the amount of £200, and the revenue from public lighting was £4,704, the total gross revenue for the year being £21,427. The expenditure had amounted to £11,329. They had incurred bad debts to the amount of £32 out of a revenue of over £21,000, and the balance of profit was £9,885. The main items of the expenditure were the coal bill, £3,369, as against £3,056 last year; salaries and wages £3,455, and rates and taxes £894. Interest on loans had absorbed £5,289, and repayment of capital £5,793, and the balance carried forward was £1,522. They had received interest on their investments of £1,600. They had in the sinking fund towards the repayment of loans £44,963 ; they had actually paid to the sinking fund £62,122, but out of that they had repaid mortgage loans of £5,750, and also borrowed for half another loan £11,409. The original loan for the purchase of the undertaking, £44,000, would be paid off on April 18th, 1918. It was stated that in spite of the reduction of energy consumption due to the invention of the Osram lamp, they had supplied 1,725,165 B. of. T. units, against 1,557,132 for the year before.

The E.L. Committee proposes to apply to the L.G.B. for power to raise £5,000 for extension of mains and house services, in addition to £3,000 applied for in connection with the western extension.

Messrs. Waygood & Co. have just installed two electric lifts in Bath institutions, one at the Royal United Hospital and the other at the Church Street Nursing Home.

Bettws-y-Coed. — The U.D.C. is applying to the L.G.B. for sanction to a loan to carry through the electric light undertaking.

Burnley.—The annual report of Mr. J. E. Starkie shows that the units sold for lighting, power, heating, &c., were 924,727 (previous year, 834,221) ; for domestic purposes, 357,337 (273,266) ; for traction, 2,717,670 (2,440,498) ; the total being 3,999,734 against 3,547,985. Financially, the year had been very successful, and enabled the department to contribute £4,500 to the relief of rates, and there was a further contribution of £2,281 to the depreciation fund. Compared with last year the capacity of the plant has received an important addition by the installation of a 1,500-KW. turbo-generating set, making the total capacity of the station 4,140 KW. Mr. Starkie recommends the early sale of the last rope-driven set rather than wait until it has to be removed to make room for additional plant. Three boilers are recommended for immediate removal, to be replaced by two large boilers. Mr. Starkie again brings forward the question of supplying electricity for long-hour power users at cheaper rates. The recent price reduction has made no appreciable difference, and is certainly not sufficiently tempting to attract power users of between 40 and 50 hours per week. He suggests that all consumers using full power installed, for over 25 hours per week, should have further reductions. Other industrial towns are building up large day loads at charges varying from ½d. to 1d. per unit, and providing the generating plant used is modern and efficient, a handsome profit should be made.

Canada.—By the terms of the agreement for the transfer of the Dominion Power and Transmission Co.'s stock to Messrs. Mackenzie & Mann, the latter undertake to pay over $6,000,000 now, and the balance during the next five years. The price paid for the stock, it is learned, was at the rate of $135 a share for first preferred, $115 for second preferred, and $110 for common stock. The company has a capital of $25,000,000, and of this the following amounts have been issued :—First preferred, $3,673,000 ; second preferred, $5,100,000 ; and common, $2,608,000 ; $6,488,000 5 per cent. bonds are also outstanding. The acquisition of the Dominion Co., which controls a number of power and traction concerns, will provide the Canadian Northern with an excellent system of feeders.—*Financier.*

Continental Notes.—France.—La Société d'Energie Electrique de Mons-en-Pevele is the name of a new company which has lately been formed at Roubaix, with a capital of £34,000.

The Conseil Général of the Department of the Vendée has accepted the modification made by the Conseil d'Etat in their scheme for the construction of the second network of departmental tramways, relating to the increase of the sums allocated for this object, and a loan of 18,400,000 fr. (instead of 16,000,000 fr.) is now to be raised to realise the scheme.—*La Lumière Electrique.*

Spain.—The Barcelona Light and Power Co., which has acquired the major part of the shares of the Compania Barcelonesa de Electricidad, has contracted with the A.E.G. Thomson-Houston Iberica for the supply of two new turbo-generator units of 6,250 KW. each, at a pressure of 6,000 volts and 1,500 R.P.M., thus raising the capacity of the Barcelona central station to 34,500 K.V.A., and making it the largest steam central station in Spain, and one of the largest in Europe. This central station is destined shortly to serve as the reserve station of the large hydro-electric plant of 130,000 H.P., which the aforesaid company has acquired in the Pyrenees.—*Industria e Invenciones.*

Norway.—According to German newspapers a joint stock company is in course of formation, with the object of utilising a waterfall at Meloy in the Nordland Amt, Norway, for the generation of power for an electric smelting works which is to be established there. The scheme will call for an outlay of 12,000,000 marks, one-third of which will be raised in Norway, the remaining two-thirds being supplied by foreign capitalists—presumably German.—*Elektrotechnische Nachrichten.*

Germany.—A huge water conservation scheme with a view to the generation of electricity on a large scale is projected in Prussian Silesia. The waters of the River Oder, and various other streams which rise in Austrian Silesia, are to be impounded in reservoirs whose contents will aggregate 275 million cubic metres. Four dams are to be constructed in the River Oppa district, five in that of the Ostrawitza, nine in that of the Biele, two in that of the Weide, and one in each of those of the Oder and Mohra; in the district of the Vistula three weirs and five dams are required. The costs for the works on the Oder are estimated at 100,000,000 marks. It is expected that part of this outlay will be recovered by the establishment of overland electricity works. Five power stations in the Oder district are to be erected, and one in the Vistula region. The report on this subject issued by the Prussian agricultural engineer Kohut concludes with the remark that, as Prussia will derive the chief advantages from the dams to be erected on Austrian territory, it is only right that she shall bear the greater portion of the cost. *Elek. und Maschinenbau.*

As the result of a suggestion from the Government, the Circuits of Göttingen, Münden, Warburg, Fritzlar, Melsungen, Hofgeismar, and Homburg have joined forces for the establishment of a water-power electric generating station on the reservoir built in the valleys of the Eder and the Diemel. Prof. Kraetzer, of Bingen, has been appointed consulting engineer to the scheme. *Zeit. für das ges. Turbinenwesen.*

The establishment of an overland electricity works to serve the whole of the administrative district of Stade, exclusive of Verden, but inclusive of Harburg, in the neighbouring district of Lüneburg, has been decided upon. The Siemens-Schuckert Werke have submitted an offer to supply energy for lighting at 5d. and for power at 2d. per unit.

An overland station has also been decided upon to serve the entire circuit of Heinsberg in the Rhineland, an agreement as to electricity supply having been come to with the Kohlscheidt Electric Co. The distribution network is, however, expected to cost 1,200,000 marks, for which a loan is to be raised. *Zeit. für Elek. und Maschinenbau.*

The Elektricitäts Genossenschaft Weiershaben und Doabenderhöhe is the style of a company just formed to supply those and neighbouring localities in the Gammersbach circuit with light and power.

A limited liability company has been founded at Astrup and Sondernx in Schleswig-Holstein to supply electrical energy to the places named. Its title is die Elecktrische Gesellschaft m.b.H. Astrup og Sondernx.—*Zeit. für Elek. und M.*

AUSTRIA.—The Austrian-American Magnesite Co. at Radenthein, Carinthia, propose to erect a hydro-electric station at Tweng, on the Tieferbach, for the generation of electricity for their works. Another industrial undertaking, the cellulose manufactory at St. Michael, near Leoben, intend to erect a hydro-electric station to generate current to work their factory, on the River Mur, by the construction of a weir and the utilisation of a fall of 4·35 metres. The Imperial State ironfoundry are likewise erecting at Kudzsir, at a cost of 1,000,000 kronen, an electric supply station, with armoured concrete dam, flume and turbine house for the supply of 1,500 H.P. to the projected extension of the rolling mills.—*Zeit. für das gesamte Turbinenwesen.*

SWITZERLAND.—The Société Franco-Suisse pour l'Industrie Electrique has, according to the *Franckfort Zeitung*, obtained a concession to utilise the motive power of the Rhone, and generating stations are to be built at Génissiat and Malpertuis. To realise the scheme the company's capital is to be raised from 25 million francs to 50 million francs.

BAVARIA.—The Siemens-Schuckert Co., of Berlin, have secured a contract for the supply of electrical energy for lighting purposes in the town of Olfenbach.

SERVIA.—At Vlasotinci, near Leskovac, Servia, a new company has been formed with a capital of 200,000 fr., to erect a hydro-electric power station.

DENMARK.—A central generating station is about to be established on the Island of Falster, in the Baltic Sea, to give lighting and power supply to six small towns on the Island. Diesel plant is to be at first put down, of 1,200 H.P.

Cuba.—A station is to be set up at Palmiras, in the Province of Santa Clara, for lighting the town by electricity.

Darwen.—The electricity department accounts show a gross profit of £4,173 and a net profit of £572. Out of the department's balance £1,000 is being transferred to aid the general district rate. The revenue account of the tramways shows a net profit on both sections of £271. This is the first time since the electrification of the tramways that a net profit has been shown when both sections were taken together.

Dunfermline.—The T.C. has received a letter from the Fife Electric Power Co., giving notice that within one month they propose to commence the work of laying electric cables and mains, commencing at the burgh boundary in the main road from Wellwood to Dunfermline, thence through the old town and south by way of Inverkeithing Road to a point a little short of the eastern boundary of the Rosyth Dockyard. The company also intend to lay a second cable along the western boundary of the city.

Gloucester.—The report of the borough electrical engineer for the year ending March 31st last states that the gross profit on the year's working amounted to £6,219, as against £6,734 in the previous year. The revenue amounted to £13,402; working expenses, £7,183; interest and repayments, £5,815; leaving a surplus of £404. Out of the surplus a sum of £156 has been transferred to capital account, and the balance is carried forward with the surplus of previous years, bringing the total sum thus provided up to £1,190. The average selling price per unit during the year was as follows:—Private consumers, 2·24d.; public lighting, 1·77d.; tramways, 1·00d.; refuse destructor, 1·00d.; total supply, 1·76d. Owing to the early incidence of Easter, the consumers' meters were read one week earlier, and hence the sales of electricity, and the revenue, so far as consumers are concerned, are both based on a year of 51 weeks. Thus, the sale of about 15,000 units, and a sum of about £150, is carried forward to the current accounts. Among the special items of expenditure are £100 for extra coal; £110 for the prevention of possible transmission of vibration to neighbouring property; £130 for water supplies; £100 as bank interest on overdraft; £70 in connection with the purchase of consumers' meters; and the adoption of a higher rate of depreciation on hired arc lamps and spare parts of the generating plant has increased the amount written off these items by about £50. In view of this, the engineer claims that the financial outcome of the year's work is fully up to that of last year. He also mentions that it has been necessary to rely almost entirely upon the plant installed prior to 1904 for the generation of the whole year's output, as the new plant was not delivered until January, and has not yet been brought into use. Owing to the use of meters on the cars, there has been a marked decline in the amount of energy sold to the light railways department, the decrease being no less than 123,000 units, but additional business has been secured in other directions to the extent of 91,000 units. The amount of energy supplied for general lighting and power purposes has shown a well-maintained rate of progress, particularly in the class of supply devoted to the operation of industrial machinery. The number of consumers connected now amounts to 800 (equivalent to 80,000 30-watt lamps).

Haslingden.—The new Workhouse Infirmary erected by Haslingden Union was opened on Saturday by Mr. John Burns, President of the Local Government Board. Included in the contracts for the work is that of Messrs. Simpson Bros., electricians, of Hapton, for the electric lighting installation.

Heywood.—The Electricity and Tramways Committee has arranged with Mr. A. A. Day, the manager of the Bolton Corporation electricity and tramways departments, to give a report on the condition of the electricity undertaking, and possible improvements.

Hinckley.—The Leicestershire and Warwickshire Electric Power Co. has applied to the R.D.C. for consent to erect overhead transmission lines in the district.

Japan.—According to a report lately issued by the Japanese Department of Communications, there are now 10,419 electric motors, aggregating 47,188 H.P., in use in Japan, these figures representing an increase of 17,548 H.P. on the 12 months.

Kidsgrove.—The U.D.C. has consented to the Birchinwood Colliery Co. laying two electric lighting cables from their works to the residence of Dr. Steele, in The Avenue.

Launceston.—At a meeting of the T.C. on Monday the question of lighting the town was introduced by Mr. Hicks, who outlined the negotiations with the Gas and Electric Lighting Companies. On behalf of the Lighting Committee, he moved that the Council accept the Launceston Gas Co.'s tender for the supply of gas at 3s. 3d. per thousand cubic feet, and the Launceston and District Electric Supply Co.'s tender for public lighting on the terms of their letter of June 4th; and that the Launceston and District Electric Supply Co., Ltd., be requested to light all the 70 lamps on their mains. The report was adopted.

London.—HAMMERSMITH.—The Electricity Committee recommends the extension of the mains in Brewster Gardens, &c., at a cost of £255, which will enable supply to be given to 92 houses, and also enable nine public gas lamps to be converted to electric. The Committee also recommends, in consideration of Messrs. Gwynnes, Ltd., agreeing to an extension of the present agreement for the supply of electricity for a further 12 months at existing rates (3d. for lighting and 1d. for power), additional electrical apparatus required by the company be provided by the Council on hire. The apparatus includes 15 D.C. motors of from 1½ to 16 H.P., one each 50 H.P., 30 H.P. and 20 H.P., two 2-H.P. variable-speed motors, and one motor-generator, the cost being £1,150.

BERMONDSEY.—According to the accounts of the electricity undertaking for the year ended March 31st last, there was a total expenditure of £13,062, as against an income of £24,907, leaving a balance of £11,845 to net revenue account. The total number of units generated amounted to 4,594,293, as against 4,776,061 in 1911. Of the former number 4,029,160 were sold to private consumers by meter (3,485,418), and for public lamps (543,742). The quantity used on works amounted to 338,230, while the quantity unaccounted for totalled 226,903. The total maximum supply demanded amounted to 1,711 KW. The revenue derived from the sale of energy by meter amounted to £19,473. The total expenditure on capital account to March 31st last amounts to £181,172, as against receipts amounting to £180,596. The estimated surplus on the current year's working is put at £1,546, as against £627 this year.

The L.C.C. has granted the Borough Council permission to borrow £18,000 for electric lighting purposes.

HACKNEY.—Mains are to be extended in two roads, at an estimated cost of £260.

MARYLEBONE.—According to the accounts of the electricity undertaking for the year ended March 31st last, there was a gross profit of £122,813, and after allowing for interest and special charges (£74,255), and repayment of loans (£39,912), there remains a net surplus of £8,646. The total number of units sold during the year amounted to 13,488,698, an increase of 1,151,742 units over 1911. The increase in the quantity sold to private consumers amounted to 931,789 units, or 51,160 units over the quantity estimated for at the beginning of the financial year. The increase in units sold (excluding public lighting) is at the rate of 8·6 per cent. over the previous year; the rate allowed for in the estimate was 7 per cent. The income from the sale of energy to consumers totals £163,044, as against £156,900 in the preceding year, being an increase of £6,144, which is larger than on any previous occasion. The average price per unit sold to private consumers works out at 3·296d., which compares with 3·44d. of last year. Including the net cost of the sales and publicity section of the department, the total expenditure on revenue account stands at £56,772, as against £46,371 last year, and £57,773, the amount estimated for the year. Generation expenses show an increase of £904 over the estimates for the year, and £3,177 over 1911, this being chiefly accounted for by the increased output. The labour unrest in the railway and coal trades during the year under review had an adverse result of upwards of £1,000, but for which the generation expenses would have been below the estimate, although the sales were greater than anticipated. The capital expended during the year amounted to £8,663, which is the smallest total ever recorded. The total capital expenditure at March, 1912, amounts to £2,069,823. Loan indebtedness has been reduced during the year by £39,013, while the total capital raised by loan to date amounts to £2,064,506. The total charged against revenue account to date (*i.e.*, amounts actually paid or set aside) is £185,537, or 9 per cent. of the sum raised, leaving a balance on loans account of £1,878,969. The extensions to the battery plant effected during the year will be sufficient for anticipated requirements during next winter, allowing for a normal increase of business, but in the near future, when the price of lead is more favourable, the question of a further addition to the storage batteries in order to cope with the increasing demand for electricity in the borough will have to be taken into consideration. Of the total number of units sold (13,488,698), 1,617,538 were used in public street lighting, and 11,871,160 were sold to private consumers by meter. 1,053,574 units were used on works and offices, and 1,367,344 on batteries, while the quantity used in transmission and distribution amounted to 1,330,258. The maximum load on feeders during the year amounted to 8,748 KW. The total cost per unit sold amounted to 1·010d., as against ·901d. last year. The lighting in several thoroughfares had been improved during the year without additional charge, and a considerable increase in candle-power on that which obtained when the thoroughfares were lighted by gas, as well as on that agreed to be given when the contract was transferred to the electricity department, was now given. The gross income from the sale of fittings, hire and maintenance agreements, amounted to £23,188, while the total expenditure and prime cost of repayable works totalled £24,398. The latter sum includes the whole cost of publicity and development work, as well as the cost of attending to complaints, and in many other directions, of maintaining the present business and extending its operations. So far as the sales and publicity work is concerned, the Electricity Supply Committee states that the new scheme of working, by which a large proportion of the orders obtained is sub-let to a number of electrical contractors, involves a lower margin of profit, and that it does not anticipate being in a position in 12 months' time to record so satisfactory a financial result.

Merthyr Tydfil.—The Merthyr Electric Traction and Lighting Co. are making an extension from the generating station to Treharris, a distance of about eight miles. The company run cars to Dowlais and Cefn from Merthyr, and they also light the main streets of Merthyr and Dowlais by arrangement with the Corporation. They are now carrying wires along the mountain top and down the valley to the extreme end of the borough, and there will be a branch line to Merthyr Vale, which is midway between Merthyr and Treharris. The pressure employed will be 11,000 volts to commence with, but the line and apparatus has been so designed as to enable the pressure to be changed to 22,000 volts if a heavy load develops. Alterations are being made at the power station to accommodate new rotary converters and transformers for transmission purposes, the electricity supply in the Merthyr and Dowlais districts being on the D.C. system. The electrical energy will be delivered to transforming stations at Merthyr Vale and Treharris, where the pressure will be reduced by means of transformers for lighting and power purposes. An extensive system of underground low-pressure cables will be laid in the streets of Merthyr Vale, Aberfan and Treharris. The company hope to be able to supply electricity for lighting and power purposes in the lower parts of the borough early in September. The extension is being carried out under the direction of Mr. Lewis N. Dixon, the company's managing engineer.

North Berwick.—It was intimated at a meeting of the Town Council that notice had been given by the Electric Light and Power Co. of their intention, in terms of agreement, to apply for a provisional order for North Berwick.

North Shields.—The profit on the past year's working of the electricity undertaking, after paying interest and sinking fund, amounts to £1,300.

Petersfield.—A prov. order for E.L. is being applied for by Mr. Theophilus Wood on behalf of himself and a company, to be known as the Petersfield and District Electric Light and Power Co., Ltd.

Rawtenstall.—Messrs. David Whitehead & Sons, Ltd., weaving shed proprietors, have retained Mr. E. M. Lacey, consulting engineer, in connection with the new sheds they are building. The looms will be driven each by a separate motor.

Reading.—The Reading Electric Supply Co. has adopted the scheme of generating works extensions which has been devised by Messrs. May & Hawes, the consulting engineers, in conjunction with Mr. E. R. Hill, the manager, and orders are now being placed for the plant. The scheme embodies the erection of two 1,500-KW. three-phase alternators with reversible rotary converters, E.H.P. switchgear, and enlargement of the economiser. These extensions have been necessitated by the rapidly-increasing demands which are being made upon the company. We recently noted the fact that the company had taken the bold step of fixing the rate for cooking and heating supplies at a ½d. per unit. Further evidence of the enterprising policy of the directors is furnished by the purchase of extensive premises in the town for central offices and showrooms. We are informed that, when completed and equipped, the sales department of the Reading Co. will be one of the finest in the kingdom.

Romford.—The County of London Electric Supply Co., Ltd., have informed the R.D.C. that they intend applying to the B. of T. for a prov. order for electric lighting within the area of the Council.

Stalybridge.—At a special meeting of the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board last week, the business was to consider the point raised at the recent L.G.B. inquiry, when the Inspector intimated that there was an outstanding loan of £9,747, and that this amount would, in all probability, be deducted from whatever sum was sanctioned to be borrowed. It was resolved that the application to the L.G.B. for further borrowing powers be amended so as to include the first 3,000-KW. set, instead of providing the same out of revenue. The total amount which the further application will involve will be about £9,000, bringing up the amount desired to be borrowed to about £41,000.

Stockport.—Electric power is being used in the filtration works connected with the Stockport Corporation new waterworks at Kinder, opened last week. The plant for cleaning the filters is driven by power generated in a Gunther turbine by the compensation water supplied to the river, the turbine also serving to drive a dynamo.

Swanage.—The U.D.C. has supported the application of Dr. J. A. Purves for extending the life of the Electric Lighting Order for three months, the object being to do away with the necessity for applying for a new order.

Swindon.—A L.G.B. inquiry has been held into an application by the T.C. to borrow £12,550 for electricity purposes. The town clerk stated that the loan asked for was required to provide a Diesel oil engine set for the electricity works (£6,500), and also to make provision for new mains and services (£6,050). It was ultimately decided to accept £4,000 for mains and £1,000 for services—making the total loan £11,500.

Swinton and Pendlebury.—The Lancashire Electric Power Co. is about to open up Bridge Street, Bolton Road and Carrington Street for the purpose of laying a cable.

Taunton.—At a recent meeting of the T.C., the Electricity Committee reported that the offer which the Council authorised them to make to the National Electric Construction Co., Ltd., in full settlement of the liabilities of the Corporation under the full wiring agreements, viz., £500, had been refused by the company. Further negotiations had been necessary, and the company finally agreed to accept the sum of £1,000 in full settlement of all claims under the agreements, and to insert a clause in the Bill to authorise this arrangement, and to vest installations put in under the agreements in the Council. The amount of the liabilities of the Council under the free-wiring agreements was £1,557, and the amount of the arrears of interest to date was £397, making a total due to the company of £1,984. If this settlement were confirmed the Council would pay just over one half of the amount due to the company under the proposed terms of settlement. The Council confirmed the terms of settlement with the company as mentioned, and granted the sum of £1,000 for the purpose.

Turton.—The following scale of charges for energy has been adopted by the U.D.C.:—

Power.—First 1,000 units per quarter, 1½d. per unit; beyond, 1d., except for two hours per day, when the charge is to be 2d., the hours to be between 7 p.m. and 9 p.m. in the summer, and 5 p.m. and 7 p.m. in the winter. Heating and Cooking.—Where electric light is used in the house, 1d. per unit, and 1½d. during the two hours specified above. The minimum charge for any consumer is fixed at £1 per annum.

Ticehurst (Sussex).—The Crowborough District Gas Co. have informed the R.D.C. that they intend applying to the B. of T. for a prov. order for E.L. within a portion of the Council's area.

Tilbury.—A prov. order for electric lighting is to be applied for by the City of London Electric Lighting Co., and the U.D.C. has invited the company to send a representative to discuss the matter.

Venezuela.—It is planned to erect an electric light and power station at La Victoria, in Venezuela, to serve the districts of Maracay, Tejerias, Turmero, Cagua, San Mateo and El Consejo.

Walthamstow.—The working expenses of the electricity undertaking for the year ended March 31st last amounted to £18,377, and the income was £34,833, leaving to be carried to net revenue account £16,455. The sale of current by meter for power and lighting realised £18,880, while that for public lighting amounted to £5,298. £7,405 was realised by the sale of current for traction purposes at 1½d. per unit. The number of units generated totalled 5,843,488, the amount sold being 4,701,664. Of this latter number 538,226 were for street lighting; 1,196,478 for traction (including 11,542 for lighting the route); and 2,966,960 to private consumers by meter (1,061,013 for lighting and 1,905,947 for power). There was a total of 843,379 units unaccounted for. The total maximum supply demanded amounted to 1,825 KW. for lighting and 400 KW. for traction.

Wareham.—At a meeting of the T.C. on July 5th, a letter was discussed from Mr. Sydney Morse, with formal notice of an intended application by Messrs. J. A. & W. T. Purves, for a provisional order.

Warrington.—The T.C. has rescinded the scale of charges for the use of electric power adopted on March 5th, 1907, and substituted the following:—Rate to consumers having motors running continuously, not less than 650 hours per quarter, 1,000 to 2,000 units per quarter, 1d.; 2,001 to 4,000 units, ·98d.; 4,001 to 6,000 units, ·96d.; 6,001 to 10,000 units, ·94d.; 10,001 to 14,000, ·92d.; 14,001 to 18,000 units, ·90d.; 18,001 units and above, ·88d. Consumers who run motors continuously day and night are allowed 1d. per unit off the above scale. The charge for heating and cooking purposes was fixed at 1d. per unit.

Watford.—The R.D.C. has been informed that prov. orders for E.L. for the parish of Chorley Wood are to be applied for by Mr. Fisher, of Chorley Wood, and the Colne Valley Electricity Co., and the question of consent is to be considered at a future meeting of the Council. The Northchurch E.L. and Power Co. has also applied for consent to supply current within the parishes of Rickmansworth and Watford Rural, but in view of the fact that electricity might be supplied from Watford, consent has been withheld for the present.

Weymouth.—A L.G.B. inquiry has been held into the Council's application for sanction to borrow £7,500 for the electricity undertaking. The Council has decided to erect a 220-KW. Diesel engine set, costing £5,000. The other £2,500 is required for mains and services.

Whitworth.—The U.D.C. has decided to invite the Rochdale Electricity Committee to arrange for a canvass of the district in order to ascertain the approximate demand for electricity.

Witham (Essex).—Under agreement with the U.D.C. steps are to be taken by Messrs. Crompton & Co., Ltd., to provide an electricity undertaking for the town. A local syndicate will be formed.

Woodford (Essex).—Mr. W. Pressland has informed the U.D.C. that he intends applying to the B. of T. on behalf of a company for a prov. order.

Worksop.—The U.D.C. has received the sanction of the L.G.B. for a loan of £2,595 for additional plant for the electricity works.

TRAMWAY and RAILWAY NOTES.

Birkenhead.—The T.C., on July 10th, considered the recommendation of the Tramways Committee, that the tender of Messrs. Siemens Bros. Dynamo Works, to supply and deliver six tramcars (with bodies built by Messrs. Hurst, Nelson & Co., Ltd., of Motherwell) be accepted for the sum of £4,374. The cars are double bogie, with a seating capacity of 60 passengers, and are intended for use on the New Ferry route, between the Woodside terminus and Port Sunlight. The original tender of Siemens Bros. in March last for six cars was accepted by the Council, but owing to allegations that the Committee had withheld from the Council certain matters which ought to have been disclosed, but had not, the whole question was referred back for special consideration by the Committee. Councillor E. T. Coston, in now moving the recommendation, explained that it was identical with the one rejected by the Council two months ago. A week afterwards the Committee met on the matter, and the majority came to the conclusion that they could do nothing but stand by the firm whose tender was accepted in March last. The Committee had under consideration small single-track cars and trailers, but after negotiation with the B. of T. the idea was dropped. After the alternative tender had been considered and rejected, the Committee returned to the original tender for the 60-passenger cars, the equipment of which would be up-to-date, and he did not think the Council would throw over Messrs. Siemens Bros. for the paltry difference of £2 16s. per car between theirs and another tender. An amendment to take the minute back for further consideration was supported by Councillor Furnival, who advocated the acceptance of a local firm's tender, in the interest of local employment. The amendment was rejected by 27 votes against 3, and the recommendation was agreed to. The question of establishing tramway communication between Birkenhead and Wallasey was raised on a motion by Councillor Webb, but it was shown that the question was already under the consideration of a special committee appointed some months ago.

Blackpool.—Arising out of a [illegible] to give moral support to Blackpool tramway men in their trouble with the Corporation, it was suggested at Accrington Trades Council, on July 10th, that delegates should be sent to Blackpool, at the Council's expense, to hold street-corner meetings and persuade the people of Blackpool to help themselves by returning Labour candidates at the November elections. Lancashire holiday makers, it was urged, could not be expected to boycott the tramcars at Blackpool by walking the length of the promenade. The Council passed a resolution recommending Accrington visitors not to use Blackpool tramcars, and protesting against Blackpool Town Council's treatment of the tramway men.

Chester-le-Street (Co. Durham).—The local Ratepayers' Association has passed a resolution urging the Councils concerned in the tramway question, to run the trams themselves instead of inviting a company to do so.

Continental Notes.—Holland.—The Amsterdam T.C. has been authorised to construct three more electric tramways to complete the system in that town. The constructional cost will be over £33,600. Fifty new electric cars will be bought, 37 of which will be used on the new sections.

According to a report (says the *Financial News*), the A.E.G. has succeeded in obtaining the concession for the construction of an electric railway from Vaals, *via* Guelpen, to Mastricht. The cost of construction is estimated at 1,200,000 gulden, towards which the Government is said to have conceded a State subsidy amounting to 325,000 gulden.

Italy.—The Italian State Railway authorities have decided to electrify the railway between Rome and Ancona, a distance of about 190 miles. The waterfalls at Fabriano and Terni are to be utilised in the generation of the necessary electrical energy.

A new electric tramway has lately been completed and opened for traffic between Como and Erba.

The *Gazzetta Ufficiale* (Rome) publishes a decree authorising La Società "Les Tramways de Palerme" to construct and work five sections of electric tramway in Palermo.—*Board of Trade Journal*.

Turkey.—According to Turkish newspapers a small electric station is to be shortly established at Kabatache to supply driving current for the Galata to Ortakeng tramway pending the construction of the central station at Silinghtar. This tramway will start working on August 23rd, and will probably be extended to the Place Emine-Enu (Stamboul).

The Conseil Général of the Pyrenées Oriental has decided to grant authorisation to any person or company prepared to undertake at its own charges the preliminary studies for the second network of local railways, comprising four lines, and optionally any others which may be required, the plans and estimates to be submitted on or before the last day of February, 1013.

Austria.—The surveys for an electric railway from Pola to Fasana, projected by the Istria Electricity and Railway Co., have been sanctioned by the Austrian Ministry of Railways.

Spain.—Somewhat leisurely the Spanish Government has at last accorded its sanction for the extraction of water from the Rivers Carol and Segre for the generation of current for the working of the projected railway from Lerida to the French frontier at Puycerda.—*La Lumière Électrique*.

Hertfordshire.—The Light Railways Committee are recommending the County Council to affix its seal to an agreement with the Metropolitan Electric Tramways, Ltd., as to the lease to the company of the light railways from the Middlesex County boundary at Bushey, through Bushey and Watford, as proposed to be authorised by the order now before the Light Railways Commissioners.

Heywood.—In his annual report the tramways manager (Mr. J. Stott) states that the total revenue from the tramways for the year was £11,549, and the total expenditure £7,408, leaving a gross profit of £4,141.

London.—Lord Aberconway will lay the foundation stone of the new Baker Street Station for the Metropolitan Railway on July 24th. The work of completely reconstructing the station shows substantial progress, and it is hoped that, by the end of the year, the new station will be complete.

In place of the single line of metals, over which, at the present time, the whole of the through traffic from the St. John's Wood line to the Inner Circle has to be worked, the widening scheme will provide for a central double track, which will lead through to the Circle lines, and there will be two bays or dead-ends. This will facilitate the dealing with a very much larger number of through trains from Harrow and beyond to the City. The platform area will be considerably increased by two island platforms 375 ft. long and 35 ft. wide. The additional lines have necessitated the replacement of the old tunnel between Baker Street and St. John's

Wood Stations by a covered way of heavy girders, the biggest weighing about 54 tons, and reinforced concrete. In opening out the 560 ft. of this tunnel, a number of important sewers and water, gas and electric mains had to be diverted, and since the work of demolition had to be carried out in working hours, a special shield formed a temporary lining to the tunnel, and capable of being moved from section to section as the work progressed, had to be built. The permanent way will be relaid with 95-lb. rails. The signalling system will be all-electric, and a 37-lever all-electric frame box will be substituted for the existing signal cabins. In the signal boxes will be illuminated diagrams, which will show the operator at a glance the position of any train in his neighbourhood.

The London Electric Railway Co. has further accelerated its train service on the Hampstead tube railway by running 44 trains per hour. Thus, 604 trains enter and leave Charing Cross Station daily. Counting each twice for signalling purposes, 1,208 trains are "worked" in and out of the station. The previous record for frequency of service on this or any other railway was 40 trains per hour, or a train every 90 seconds. The present service, however, provides one train every 82 seconds. The advantage to the passengers at Golder's Green, Highgate, and other stations is that there are four more trains per hour, and each train passes at least one station without stopping. In addition to increasing the frequency of the trains, the new service reduces the running time as follows:—Golder's Green to Charing Cross, 18½ minutes; Highgate to Charing Cross, 15½ minutes, as against 19½ minutes and 16½ minutes respectively on the former service.—*Standard.*

Owing to a failure of current at the Lot's Road generating station of the Underground Railways of London, Ltd., on Monday last at 8 p.m., all the trains suddenly came to a standstill, and lights failed on trains running east and west on the District Railway, the Charing Cross and Hampstead Tube, and the Piccadilly and Brompton Tube. Thousands of travellers were held up in trains in the tunnels. Lights at the stations also failed. After half an hour's delay the fault was remedied, light was restored, and the trains began to move, and by 9.15 everything was in perfect working order.—*Daily Telegraph.*

HAMMERSMITH.—In reply to a question in the House of Commons by Sir William Bull, Mr. Buxton stated that complaints had been received as to the condition of the tramway track in Hammersmith and of that part of the road which was repairable by the tramway company, and an inspection thereof had been asked for. The position was, however, peculiar; the company's undertaking in Hammersmith was being acquired by the London County Council, and when the purchase was completed the track would be relaid. The purchase price had to be fixed by arbitration, and the arbitrator's award had already been issued. As regarded the actual state of the track and roadway, a referee was appointed by the Board of Trade in November last on the application of the Hammersmith Borough Council, to determine certain points as to the manner in which the track and roadway had been maintained, and his determination, which was issued in May, was in favour of the tramway company. There was no foundation whatever for the suggestion that there had been any remissness on the part of the Board of Trade. It must be evident that no inspection which they could order could affect the position, as there was no question that the present condition of the road and tracks was unsatisfactory.

The directors of the East London Railway Co. say in their report that the electrification of the line was commenced in the spring, and the progress made is quite satisfactory.

Monmouthshire.—The proposal to install a system of railless traction in the Western Valleys of Monmouthshire is taking concrete shape. It is suggested that the service should extend from Abercarn to Brynmawr, a distance of about 15 miles. A 15 minutes' service during three hours of the day and a 20 minutes' service during the remainder of the running period is proposed.

New Zealand.—CHRISTCHURCH (N.Z.).—The Electric Tramways during the year ending March 31st, 1912, earned a profit of £2,531. The gross revenue for the 12 months totalled £124,017 and operating expenses £74,041, leaving the sum of £49,975 as net earnings. Of this sum, interest and sinking fund absorbed £25,475, whilst for depreciation, fire, reserves, and renewals £22,200 has been set aside. The number of passengers carried during the year was 15,183,108, and the car-mileage run was 2,131,111 miles. The operating cost per car-mile was 8·28d., as against 9·05d. in 1911.

DUNEDIN.—The revenue of the tramways for the year ended March 31st amounted to £71,762, being an increase of £798 over the previous year. The total expenditure amounted to £68,642, representing an increase of £4,280, of which working expenses account for £3,541. The net result is a profit of £3,119, as against £6,601 for 1911. During the year expenditure on capital account for extensions and new property was £11,122, and this, together with the contribution of £2,000 to the municipal funds, has necessitated a corresponding increase in the bank overdraft, which on March 31st stood at £13,483.

WELLINGTON.—The total revenue from the tramways for the year ended March 31st was £138,709, as compared with £133,708 for the previous 12 months. The working expenses were £99,909, leaving a balance of £38,800 to be carried to net revenue account. The allotment of the £38,800 was as follows:—To interest, £18,935; sinking fund, £4,794;, depreciation, £13,829; leaving £1,242 to be carried to the appropriation account, as compared with £5,646 last year.

Southampton.—Additions are to be made to the tramcar depôt at Portswood at an estimated cost of £800. The work of laying a double tramway line between Four Posts and Bourne Road is to be carried out by Mr. J. Douglas on the terms of his existing contract for the reconstruction works now in hand between Grove Road and Shirley.

Stourport.—The B. of T. has informed the U.D.C. that it intends renewing for seven years the power of the Electric Tramway Co. to run tramcars between Kidderminster and Stourport.

Tasmania. — The Devonport Municipal Council has instructed the town electrical engineer (Mr. G. H. Lofts) to report on an electric tramway scheme of 13 miles.—*Mining and Eng. Review.*

Torquay.—At the last meeting the Council was informed that the contract for supplying electricity to the tramways company expired at the end of this month. After correspondence with the company, it had been decided to arrange a conference in London with a view to settling future terms. It was agreed that for the first 550,000 units the company should pay 1½d. per unit, and for any additional energy in the same year 1⅛d. The minimum payment of the company was fixed at £4,000. The agreement was to be in existence for eight years from August 1st. The committee had also agreed to act as "stand-by" to Paignton.

Weston-super-Mare. — The Weston-super-Mare and District Electric Supply Co., Ltd., have intimated their intention to apply to the B. of T. for a further extension of time for a period of two years for the completion of the tramways authorised in 1900.

Willesden.—Owing to complaints having been received as to the variable nature of the direct-current supply from Taylor's Lane, the Electricity Committee has decided to carry out the following works to overcome the difficulty:—Erection and connection of a new feeder pillar (estimated cost), £75; extensions to several mains, £633; erection and connection of two 60-ampere C.M.B. or similar balancers. The electrical engineer reports that the Duplex and General Bearing Co. contemplate erecting large works near Oxgate Lane, and will require to be supplied with about 80 B.H.P. as a day load, which would be doubled during lighting time, with a night load of about 40 B.H.P. The company will transform the current at their works and the amount supplied will probably be 250,000 units per annum. This will involve an extension to the high-tension feeder to the transformer chamber, at a cost of £630. In the event of the proposed works being erected, the work of extending the mains is to be carried out.

TELEGRAPH and TELEPHONE NOTES.

Telephone Communication with Ireland.—In view of the inefficient working of the telephone communication between the South of England and Ireland, which has to go through the cable between Stranraer and Donaghadee, the Post Office is taking steps to lay a telephone cable from North Wales to Dublin.

Solar Radiation and Wireless Telegraphy.—In an article contributed to the *Electrical Review and Western Electrician* of July 6th, Dr. Nikola Tesla denies that the adverse effect of sunlight upon wireless transmission is due to the ionisation of the atmosphere by the sun's rays. He holds that the transmission takes place by conduction through the substance of the earth, and not by Hertzian radiation, and ascribes the weakening effect of sunshine upon the signals to the evaporation of water on that side of the earth which is turned towards the sun, the vapour carrying off more or less of the electrical charges imparted to the ground.

North Borneo.—The British North Borneo Co. is considering the installation of wireless telegraph stations in connection with the coal mines at Silimpopon, and at other points in its territory, communicating also with the Imperial system that is to be constructed.

The Telephone Purchase.—On Wednesday Exchequer Bonds for £4,000,000 were issued, at 93½ per cent., bearing interest 3 per cent. and running for 18 years; the money is required in connection with the interim award in the arbitration between the Post Office and the National Telephone Co., Ltd. The details of the award, which was made on Tuesday, at the request of both parties, were not disclosed.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—July 29th. (*a*) Additional plant at the generating station; (*b*) construction and equipment of tramways and railless system for the U.D.C. See "Official Notices" July 5th.

Ashton-under-Lyne.—July 30th. One 400-KW. motor-generator, one fuel economiser, two boiler feed pumps, coal elevator and conveyor and ash elevator, for the Corporation. See "Official Notices" July 5th.

Atherton.—July 31st. One 250-KW. single-phase transformer, for the U.D.C. See "Official Notices" to-day.

Australia.—WESTERN AUSTRALIA.—July 31st. Postmaster-General's Dept. Telegraph and telephone material. See "Official Notices" June 21st

NEW SOUTH WALES.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day

August 6th.—9,200 yd. of ·2 sq. in. concentric cable, and 2,200 yd. of ·1 sq. in. concentric cable for the Melbourne City Council. See "Official Notices" to-day.

TASMANIA.—August 26th. Accumulators for main telegraph circuits and motor-generators for the P.M.G.'s Department. See "Official Notices" to-day.

Barnsley.—July 20th. Electric wiring and fittings at the Workhouse. Mr. C. J. Tyas, clerk to the Guardians, Union Offices, Pitt Street.

Belgium.—July 27th. The Belgian Post and Telegraph authorities at La Bourse, Brussels, are inviting tenders for the supply of a quantity of material required in connection with the erection of new telegraph and telephone lines.

Bradford.—July 30th. Electric lighting and sundry other work for the new premises of the Bradford District Bank in Commercial Street and Cheapside, Halifax. Messrs. Richard Horsfall and Son, architects, 22A, Commercial Street, Halifax.

Bridlington.—July 24th. Wiring on the "Stannos" system of the new extension buildings of the Grammar School. Borough Electrical Engineer.

Bristol.—July 22nd. Coal-elevating and conveying plant at the Avonbank electricity works, for the Corporation. See "Official Notices" July 12th.

Canada.—August 1st. One 500-KW. steam-driven generating set, for the City Commissioners, Moose Jaw, Sask. See "Official Notices" July 12th.

Dublin.—July 24th. The South Dublin Guardians invite tenders for electric motors for driving the laundry and bakehouse machinery. Specification can be seen at the office of Mr. John P. Condon, clerk of the Union, 1, James's Street Dublin.

France.—The Paris, Lyons and Mediterranean Railway Co. are, says *La Lumière Electrique*, about to place, shortly, an order for 1,598 goods wagons.

Germany.—The municipal authorities of Bremen are about to invite tenders for the supply of a new 3,200-KW. steam turbine and alternator for the extension of the central electric lighting station.

July 22nd.—The Tramways Department of the Dresden Municipality is inviting tenders for 25 electric tramcars and 25 trailing cars.

Hull.—July 31st. Steam and water pipes, pumps, &c., for the Corporation Electricity Department. See "Official Notices" to-day.

Hungary.—ELEK (ARAD).—July 31st. The authorities of Elek, county of Arad, Hungary, are prepared to receive tenders for a concession for the establishment and working of a generating station in the town. Particulars of the Magistrat, Elek.

VERSES.—August 4th. Tenders are invited for a concession for the erection and working of an electric installation in the town. Particulars, Magistrat, Verses.

London.—ISLINGTON.—July 24th. One 3,000-KW. steam turbo-alternator, with exciter, condensing plant, switchgear, piping, &c., for the B.C. See "Official Notices" June 14th.

L.C.C.—July 30th. Electrical installation at the County Secondary School, Streatham. See "Official Notices" to-day.

New Zealand.—August 16th. Electric motor and induced-draught fan for Christchurch City Council. Tenders to City Surveyor. Deposit £5. Copy of specification can be seen at Board of Trade Commercial Intelligence Department, London, E.C.

Portsmouth.—July 24th. Coal (other than Welsh), for the Corporation electricity supply department. Engineer, Electric Lighting Works, Gunwharf Road, Portsmouth.

Salford.—July 25th. Electric light, telephone and fire alarm installations at the Union Infirmary, Hope, Pendleton, for the B. of G. See "Official Notices" July 5th.

Spain.—July 28th. Tenders are being invited by the municipal authorities of Toledo for the concession for the electric lighting of the town during a period of ten years.

The municipal authorities of Tudela de Duero (province of Valladolid) have lately invited tenders for the concession for the electric lighting of the town during a period of ten years.

Sunderland.—August 1st. Two steam-driven boiler feed pumps, one air compressor, one motor-driven centrifugal pump, pipework and valves, for the Corporation. See "Official Notices" to-day.

Swansea.—July 30th. Alterations and additions to suction and discharge pipes, work for suction chambers, strainers' &c., for the Corporation Electricity Department. See "Official Notices" to-day.

Walsall.—July 30th. High and low-tension switchgear for the Corporation. See "Official Notices" July 12th.

Walthamstow.—July 19th. Extra-high-tension and low-tension cables, for the U.D.C. See "Official Notices" July 5th.

West Ham.—August 1st. Electric light installation (800 points) at the Forest Gate Sick Home, for the B.G. See "Official Notices" to-day.

CLOSED.

Australia.—The following acceptances of tenders are notified by the [illegible]

PERTH.—Postmaster-General's department :—

[illegible] W. D. Moore & Co., Fremantle (W.A.).
2 [illegible] 1,000 [illegible] per mile, £1 [illegible] 104 [illegible] per mile, [illegible] Cables, Ltd.

SYDNEY.—Postmaster-General's department

7,500 insulators, porcelain, pattern "A," at 5·48d. each; 9,000 insulators, porcelain, pattern "B," at 2·23d. each.—British and Foreign Indent Co.,
2 miles wire, tinned copper, No. 18 L.S.W.G., vulcanised india-rubber, insulated, taped and [illegible], at £[illegible] per [illegible] Lawrence and Hanson Electrical Co., Ltd.
Machinery, &c., required in connection with the electrical installation on H.M.A. [illegible] Training Ship [illegible], £1[illegible]; [illegible] £74; [illegible], £47, £540. Gibson, Battle and Co.
Installation of synchronised clocks at Royal Military College, Duntroon, £274.—Ingram Bros., Melbourne.

Belgium.—Seven concerns, six German and one Belgium, submitted tenders to the Belgian Post and Telegraph authorities in Brussels last week for the supply and laying of telephone cables in the town of Huy. The lowest offer was that of the Société A.E.G. Union Electrique.

Bradford.—Alterations at Municipal Technical College :—

3½-H.P. motor.—Brown, Boveri & Co., Ltd., £64.
Replating old battery.—Chloride Electric Storage Co., Ltd., £19 10s.
Electrical wiring of college main building.—Collinson Bros., £476 10s.

The Tramways Committee has accepted the offer of the Ramsome ver Mehr Machinery Co., to supply an electrically-driven No. 0 concrete mixer for the Permanent Way Department, at £225.

Bury St. Edmunds.—The T.C. has accepted the tender of Messrs. Ridley's Coal and Iron Co., of Bury, for Bolsover Mansfield hand-piched steam coal, at £1 0s. 5d. per ton.

Croydon.—The County Council has accepted the tender of Mr. C. Sedgwick, at £149, for the erection of an electricity substation at Mint Walk.

Fleetwood.—Mr. R. Barron, of Fleetwood, has secured the contract for the electrical work at the new storage house of the Fylde Ice and Cold Storage Co.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

WAR OFFICE.

Electric cable.—Hooper's Telegraph & India-Rubber Works, Ltd.

INDIA OFFICE, STORE DEPT.

Accumulators.—Pritchetts & Gold.
Cable.—Siemens Bros. & Co.
Cells.—Siemens Bros. & Co.
Pumps.—British Westinghouse Electric & Manufacturing Co.
Switchboards.—British Thomson-Houston Co.

CROWN AGENTS FOR THE COLONIES.

Electric cranes.—Babcock & Wilcox, Ltd.

OFFICE OF WORKS.

Fuse and switchboards.—Baxter & Caunter; Electric and Ordnance Accessories Co.

GENERAL POST OFFICE.

Telephonic apparatus.—British L.M. Ericsson Manufacturing Co.; London Electric Wire Co. and Smiths, Ltd.; Peel-Conner Telephone Works, Ltd.; Sterling Telephone & Electric Co.; Western Electric Co.
Telephonic cable.—Callender's Cable & Construction Co.; W. T. Henley's Telegraph Works Co.; Johnson & Phillips, Ltd.; Siemens Bros. & Co.; Western Electric Co.
Enamelled steel conduit.—Armorduct Manufacturing Co.
Telephone exchange equipment, Margate.—Peel-Conner Telephone Works.
Telephonic wire.—T. Bolton & Sons, Ltd.; British Insulated & Helsby Cables, Ltd.; C. Macintosh & Co.; Shropshire Iron Co.

COMMISSIONERS OF PUBLIC WORKS, IRELAND.

Electrical works and supplies, Dublin district.—W. Coates & Sons, Ltd.

Holland.—The A.E.G., of Berlin, is reported to have received a concession for the construction of an electric tramway from Vaals Guelpen to Maastricht. The estimated expenditure amounts to £100,000, inclusive of the contribution of £27,000 granted by the Dutch Parliament.

Huddersfield.—For electrical work at the new Yeomanry Drill Hall being erected at Huddersfield, the tender of Messrs. E. Bould & Sons has been accepted.

Liverpool.—The Mersey Docks and Harbour Board of Liverpool have ordered from Sir W. G. Armstrong, Whitworth and Co. four electric cranes with large radius jibs, fitted with the Musker-Davison patent luffing gear.

London.—L.C.C.—The Fire Brigade Committee recommends that one of the horsed turntable long ladders in use in the fire brigade be converted into an electrically-driven appliance, and that the offer of "Cedes" Electric Traction, Ltd., to do the work for £810 be accepted. The other tenderer, Messrs. Henry Simonis and Co., quoted £780. Each firm promises to deliver in four months, and proposes to sublet the battery contract to the Tudor Accumulator Co. Messrs. Simonis would have obtained the chassis from Nuremberg, while the Cedes company will construct them at their works at Stamford Hill. It is proposed by the Committee that the six ladders in use shall be so converted by fitting electric motor chassis as and when opportunity occurs. It is stated that "these appliances are very heavy, and it is only with considerable difficulty that they can be taken to a fire at a good speed by a single pair of horses."

The following tenders were received by the Fire Brigade Committee for the electric lighting of the Dulwich and Greenwich fire stations, the two stations next in order for installation. Tenders were invited from five firms in each case :—

(1) Dulwich fire station—

C. H. Cathcart & Co.	(recommended) £150
Tilley Bros.	169
Tredegar & Co.	182
G. Harland Bowden & Co.	230
John Barker & Co., Ltd.	253

Chief engineer's estimate, £172.

(2) Greenwich fire station—

G. Weston & Sons, Ltd.	(recommended) £145
E. Newbald & Co.	169
W. J. Fryer & Co.	176
Stegmann & Co.	188
Malcolm & Allan, Ltd.	201

Chief engineer's estimate £151.

The Highways Committee recommends the acceptance of the tender of Messrs. Kerridge & Shaw, at £32,722, for the reconstruction of the horse-car shed at Cressy Road Hampstead.

HOLBORN.—The B.C. has accepted the tender of Messrs. Barlow Bros. & Co., at £61, for electric light installation work in the Shaftesbury Avenue public convenience.

The Metropolitan Water Board has accepted the tenders of Messrs Falk, Stadelmann & Co. and the General Electric Co., Ltd., at £44 and £87, for electric light fittings, including inspection tees and elbows, drawn wire lamps, &c., and the supply of one slate switchboard, two generator panels, and one power panel, respectively.

BERMONDSEY.—The B.C. has accepted the quotation of Messrs. Crompton & Co., Ltd., at £45, for two field coils for pump motor.

HAMMERSMITH.—The Electricity Committee recommends that the tender of the Universal Steam Trap Syndicate, Ltd., for 19 traps, for £65, be accepted.

The following tenders for high and low-tension electric supply cable were received :—

			Prices for ensuing 12 months.		
Name.	Class of cable.	Price quoted for quantity now required.	Basis price of copper per ton.	Tendered price, with copper at £75 per ton.	Tendered price, with copper at £85 per ton.
Elec. Engineering and Equipment Co.	Swiss	£600	£84	£573	£602
General Electric Co.	Italian	608	60	657	692
Standard Cable Manufacturing Co.	German	619	81	595	635
Union Cable Co.	German	653	81	636	664
Aubert, Grenier & Co.	Swiss	669	84	609	676
Western Electric Co.	British	681	81	662	691
British Insulated and Helsby Cables, Ltd.	"	690	80	614	767
Johnson & Phillips	"	697	81	677	707
Jas. Littauer	Austrian	697	85	—	697
Siemens Bros.	British	701	81	683	714
W. T. Glover & Co.	"	701	81	682	712
W. T. Henley's Telegraph Works Co.	"	704	82	684	713
R. R. Todd	French	712	81	694	724
Callender's Cable Co.	British	718	81	701	730
Connolly Bros.	"	719	81	702	729

Tender withdrawn.

The Committee recommends that the tender of the Electrical Engineering & Equipment Co., Ltd., at £600 10s., for the cable now required, and also for the supply of cable as specified for the ensuing 12 months, be accepted.

STOKE NEWINGTON.—The B.C. has accepted the tender of Messrs. Bruce Peebles & Co., Ltd., at £1,720, for the supply of a 400-KW. motor converter. Other tenders received were from the British Thomson-Houston Co., Ltd., at £1,981, for a 4 500-KW rotary converter, with transformer and booster; and the British Westinghouse Co., Ltd., at £1,668, for a 400-KW rotary converter, with transformer

River Plate.—Messrs. Siemens, Schuckert & Co. have secured the contract for the supply of electrical material to the National Asylums at "Open Door" and Oliva, at about £5,000.—*Review of the River Plate.*

Swinton and Pendlebury.—The tender of the British Westinghouse Co., at £86, for a steam generator set in connection with electric lighting at the destructor, has been accepted by the D.C.

Sunderland.—The T.C. on Tuesday accepted the following tenders :—

Aiton & Co.—Cast-iron pipes.
Alley & MacLellan.—Cast-iron sluice valves.
General Electric Co. and Sleigh & Wood.—Metal-filament lamps.
Sleigh & Wood.—Carbons.
H. E. Pitt.—Foundations and building work at Hylton Road electricity works.
Herbert Morris, Ltd.—Travelling crane.
Davenport Engineering Co.—Cooling tower.
Ferranti, Ltd.—E.H.T. switchgear.
Stewarts & Lloyd.—Steel tubes.

West Ham.—The T.C. has accepted the tender of Messrs. Newbald & Co., at £205, for the installation of electric light at Colegrave Road School.

Winchester.—The T.C. has accepted the following tenders for coal for a year for the electricity works :—Mr. R. G. Gifford, Norton Hill slack; Messrs. Bradbury, Son & Co., Ltd., Camerton slack.

Worksop.—The U.D.C. has accepted the tender of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., for a switchboard, at £67.

FORTHCOMING EVENTS.

Association of Consulting Engineers.—Monday, July 22nd. General meeting. At 4.45 p.m. At the I.E.E. Embankment, W.C.

NOTES.

Contractors' Hydro-Electric Power Scheme.—At the new waterworks contract at Loch Arklet there is an interesting installation of hydro-electric power. The contractors, Messrs. Charles Brand & Son, of Glasgow, are constructing a dam across Loch Arklet, and boring a tunnel through rock to convey water to Loch Katrine. Loch Arklet is about 1½ miles from Loch Lomond, and hilly ground separates these two lochs. The contractors have an aerial ropeway conveying all the material from a jetty at Loch Lomond to the contract works. The little Arklet stream is tapped, and the water led in steel riveted flanged pipes, 21 in. in diameter, along the side of the stream to a point 310 ft. above the level of Loch Lomond. Here the water is transferred to the heavy pressure pipes, 16 in. in diameter, which go down the side of the hill to the power house built close to the Lomond shore. This pipe enters the power house in two branches, to each of which is attached a Pelton wheel of 135 B.H.P.; and these, again, drive two compound-wound electric generators of 80 KW. each. The effective hydraulic head is 300 ft., and either, or both, Pelton wheels can be operated according to the power required. When working at full load about 650 cb. ft. of water per minute is used. A very efficient governor is fitted to the turbines for speed controlling. When the full load is on, all the water from the nozzle is allowed to pass, and to diminish the load a deflector is automatically brought into operation. The system of transmission is by direct-current generated at a pressure of 550 volts. Overhead copper wires distribute the current. The aerial ropeway is on the Bleichert principle. There are 22 steel lattice-work standards over the 1½ miles of line, the highest of which is 35 ft. The longest span between standards is 950 ft. An electric motor of 55 B.H.P. operates the ropeway, which is capable of carrying 50 tons per hour in single loads of 2 tons each. Electric power is used to drive the stone crushers, the concrete mixers and all the derrick cranes. The air compressors at the dam and tunnel are driven by motors of 40 B.H.P. All the lighting is by electricity, and all the pumps and labour-saving appliances are electrically worked. Though the cost of this hydro-electric scheme has been considerable, the benefit gained by the contractors has been very great, and the economy in working has much reduced the wages bill.

The Explosion at Bray.—We regret to say that the facts reported in our last issue have been confirmed; Mr. Coates was killed instantly, and though Mr. Sowter only lost one foot at the time, the other was so badly injured that amputation was necessary. As Mr. Sowter and Mr. MacDonnell were unable to attend the inquest on account of their injuries, details regarding the explosion are not yet available.

The Electric Farm.—The diversified advantages of electricity are well exemplified in an "electric farm" situate on the outskirts of Boston, U.S.A., and operated by the Boston Ediston Co. With the installation, the other day, of a 2-ton electric truck, its equipment was completed. Electricity does everything on this up-to-the-minute establishment. It cuts the fodder, milks the cows, washes the dishes, pumps the water, churns the butter, and finally takes the product of the farm to the city in an electric truck. It is thoroughly electrified, and is attracting considerable attention, for thousands of Boston people visit the farm every week

Tramwaymen's Athletics.—The athletic festival annually promoted by the Liverpool Tramways Employés' Social and Athletic Society was held at the Green Lane Athletic Grounds on Thursday and Friday last week, when an attractive programme was presented. The Lady Petrie Cycle Challenge Trophy Competition (3 miles scratch) was won by T. Halliwell (Smithdown Road depôt), so that Smithdown Road, who were the holders, retain the trophy.

Litigation in Belgium.—The Belgian Court of Appeal has (according to the *Moniteur des Intérêts Matériels*) just given its decision in a patent action between the Allgemeine Electricitats Gesellschaft, of Berlin, and the Société des Constructions Electriques, of Charleroi. The former sought to prevent the Charleroi concern from using the Knight and Potter improvements (patented in Belgium in July, 1892) of the Anderson controller (patented in England in December, 1889, but not patented in Belgium). The A.E.G. are the holders of the Knight-Potter patent rights, but the Court of Appeal held that their claim was not well founded, and ordered them to pay damages to the Charleroi company in respect of the controllers they had seized.

Fire at Buenos Ayres.—Part of the works of the "Deutschen Elektrizitaets-Gesellschaft," at Buenos Ayres, have been destroyed by fire. The damage is estimated at upwards of £75,000.

Annual Outings.—The annual outing of the Hull Corporation electricity department was held on Saturday last, a party of about 70 visiting Kirksmeaton. The chairman and deputy-chairman of the Electricity Committee, Mr. Bell (city electrical engineer) and Mrs. Bell, Mr. Magoris (chief assistant engineer) and Mrs. Magoris, were among those present. The afternoon was devoted to sports, the boiler house "A" team winning the inter-departmental tug-of-war contest. After dinner there was an air-rifle shooting competition. The prizes were presented by Alderman Hanger, chairman of the Electricity Committee.

The employés of Messrs. A. P. Lundberg & Sons held their annual outing on Saturday last. The party, accompanied by Mr. G. Pegg (works manager), left London by early morning train for Hastings. The enjoyment of the party was greatly assisted by the arrangements carried out by the stewards, Messrs. E. Burrell, H. W. Boulted, and J. M. Hale.

Messrs. Siemens Bros. Dynamo Works, lamp works' staff and employés also went to Hastings for their annual outing on Saturday last.

On Saturday a party, numbering some 600 staff, employés, and friends, associated with the Robertson and Osram Lamp Works' Social Club, held their annual outing. The party, which included Messrs. Wilson, Shepherd, and Dr. Grisel, Messrs. Jessop, Simmonds, Gosling, Pring, Collings, Hale, and Adams, journeyed from Addison Road to Hastings. Luncheon was served at the Metropole Hotel (Gilderslava), and afterwards there was a pleasant motor drive to Bodiam, where, after the old castle had been visited, tea was partaken of at the Castle Hotel, Bodiam. The party motored back in the cool of the evening, and began the return trip to London from Hastings at 8.30. The weather, like the excursion and the arrangements generally, left nothing to be desired.

The annual outing of the members of the staff of the Guildford Electricity Supply Co., Ltd., was held on Monday, July 1st, when a first-rate trip was made to Brighton. At luncheon, which was partaken of at the Old Ship Hotel, the staff were joined by several guests. Altogether a most enjoyable day was spent.

On Saturday last the employés of Messrs. Macdonald, Syer & Co., Ltd., London, held their customary annual outing, visiting Margate. During the afternoon a successful sports meeting was held; dinner was served at the West End Restaurant.

First Meeting of the Point Fives.—The first meeting of the Point Fives took place in the Artists' Room at Paganis on Saturday last. All the members turned up with the exception of Mr. Rowley Hill, who was unable to attend owing to ill-health, those present being Messrs. A. S. Blackman, W. H. Cooke, C. S. Davidson, Thomas Roles, A. H. Seabrook (secretary), H. F. Street, and Mr. J. H. Bowden, chairman. With Mr. J. Horace Bowden as chairman there could be little doubt as to the success of the evening. The principle was adopted of appointing as chairman of the meeting the engineer of the undertaking first adopting the domestic rate of ·5d. Mr. Bowden adopted it as far back as early in 1909, thus he was the first in the country. Mr. Street, of Southampton, being the next in order of date to adopt the rate, was appointed chairman of the next meeting to take place early in December, with Mr. Cooke, of Luton, as vice. Considerable discussion arose as to the name to be adopted, the decision being eventually to leave it as at present—"The Point Fives." What was significant during the discussion was a debate as to the actual figure to be used, as the general opinion was that ·5 would not long remain the lowest price charged for domestic uses of electricity other than lighting. ·5d. was, however, agreed as a good starting price, but not to be considered final in view of the knowledge which was being gained as to the value of this class of load and its effects upon costs of production (including capital charges). It was strongly and unanimously held that no difference whatever was to be made as to the eligibility between company and municipal undertakings, the criterion being the price per unit charged for domestic cooking or cooking and heating. Mr. Seabrook was appointed hon. sec. It was further decided that the Society should remain of an informal character, and its meetings should be in the form of occasional dinners, and subsequent informal discussions. At the conclusion of the business (necessitated by the meeting being the first) a general discussion ensued as to tariffs, design of cooking apparatus, maintenance and hire schemes, and what was, of course, the most valuable, was the experience to date of each member, and his observations as to the effect of the cooking load upon the load curve and the cost of production. As to tariff, it was not generally agreed that a universal flat rate would be the eventual outcome of the present attention being paid to tariffs, but it was unanimously held that it was desirable and quite possible for a differential rate to be evolved with a universal secondary charge per unit of ·5d. or lower, and a primary charge varying in accordance with the locality, the costs of production of each particular undertaking and the nature of the service required by the consumer. It was considered that the great difficulty to be overcome was the method of arriving at the primary charge, and its application in a convenient form to the consumer, and so framed as to bring in from each different class of consumer an approximately uniform rate of profit.

Institution and Lecture Notes.—Junior Institution of Engineers.—About 100 members of the Junior Institution paid a visit last week to the works of Marconi's Wireless Telegraph Co., at Chelmsford. Captain H. Riall Sankey, assisted by the officials of the company, conducted the party over the works; they were particularly struck by the perfect organisation and administration of the factory, and the ideal conditions under which the men of the company do their work. The visitors were entertained to luncheon by the company.

Royal Society.—On Tuesday the Society celebrated the completion of an existence of no less than 250 years. A reception took place on Monday evening in the rooms of the Society at Burlington House and on Tuesday evening a banquet was held at which many distinguished guests were present.

Institution of Mechanical Engineers.—The Belfast meeting will be held on July 30th and 31st, in the hall of the Municipal Technical Institute, Belfast. The following papers will be read:—"New Graving Dock, Belfast: Mechanical Plant and General Appliances," by Mr. W. R. Kelly; "Rolling Stock in use on the principal Irish Narrow-Gauge Railways," by Mr. R. M. Livesey; "The Evolution of the Flax Spinning Spindle," by Mr. J. Horner; "Wire Ropes for Lifting Appliances, and the Conditions that affect their Durability," by Mr. D. Adamson; "Reciprocating Straight-Blade Sawing Machines," by Mr. C. Wicksteed; "Commercial Utilisation of Peat for Power Purposes," by Mr. H. V. Pegg.

Physical Society of London.—At the meeting held June 28th, a paper on "Hysteresis Loss as affected by Previous Magnetic History," by Prof. Ernest Wilson and Messrs. B. C. Clayton and A. E. Power, was read by Prof. Wilson. As regards the importance of the subject to engineers, it may be mentioned that the watts dissipated by magnetic hysteresis may be increased by as much as 45 per cent., and the magnetising force by 85 per cent., on the values of these quantities that suffice when previous history effects have been wiped out. It would seem, therefore, that after severe short-circuits it might pay to demagnetise the cores of transformers, static balancers, &c.

A paper on "Dielectric Hysteresis at Low Frequencies" was read by Prof. W. M. Thornton. The paper is an attempt to determine from dielectric hysteresis loops the nature of the change of polarisation which gives rise to the absorption of energy.

A paper on "The Efficiency of Generation of High-frequency Oscillations by means of an Induction Coil and Ordinary Spark-gap," by Prof. G. W. O. Howe and Mr. J. D. Peattie, was read by the former. The apparatus used was similar to that employed in small radio-telegraph stations. The input, output and efficiency were determined for various degrees of coupling, various aerial decrements, different lengths of spark-gap and with various primary voltages, the object being to determine the effect of these various factors on the working of a small radio-telegraph station. Oscillographic records of the primary and secondary currents of the induction coil explained the variation of input with spark length. This was shown to be due to the particular phase at the moment of "make" of the remanent current in the primary induced in it by the oscillations in the secondary produced by the last spark; this depended on the time which had elapsed since the last spark.

A paper, entitled "The Self-demagnetisation of Steel," by Messrs. S. W. J. Smith and J. Guild, was read by the secretary. The constituents, iron and iron carbide, are easily traceable in annealed steel, owing to the differences between their magnetic properties. It is shown that the residual magnetism of short annealed steel rods is determined by the retentivity of the carbide, and that the residual polarity of the iron is negative. The iron may thus be said to contribute less than nothing to the residual magnetism of the rods.

The Faraday Society.—The annual general meeting was held on July 2nd, when the report of the Council and the statement of accounts and balance-sheet for the year ending December 31st, 1911, were adopted. The following officers and Council were elected to serve for the ensuing year:—President: Dr. R. T. Glazebrook, C.B., F.R.S.; Vice-Presidents: G. T. Beilby, F.R.S., Prof. K. Birkeland, Sir Robert Hadfield, F.R.S., F. W. Harbord, Prof. Bertram Hopkinson, F.R.S., Alexander Siemens, Prof. James Walker, F.R.S.; Treasurer: F. Mollwo Perkin, Ph.D.; Council: R. Belfield, Dr. H. Borns, W. R. Bousfield, K.C., Dr. J. A. Harker, F.R.S., Prof. A. K. Huntington, Dr. R. S. Hutton, Dr. T. M. Lowry, Dr. R. Seligman, Dr. G. Senter, Maurice Solomon. Mr. Leon Gaster and Mr. J. W. Hinchley were re-elected honorary auditors. The report states that the Council endeavoured to arrange a visit to Norway this summer to inspect some of the installations described by Mr. Scott-Hansen, but the response on the part of members has been so meagre that the visit may have to be postponed. Unfortunately it has not been found possible to obtain permission to visit some of the most interesting of the electrochemical works.

The Insurance Act.—One of the clerks in the employ of the electricity department of the Ealing Corporation has just escaped being compulsorily insured under the Insurance Act. His present salary is £160 per annum, and as some doubt seemed to exist as to whether he was compelled to come under the provisions of the Act, he applied for a small increase of salary to enable both himself and the Town Council to escape payment of the contributions. At last week's meeting of the Council the Electricity Committee brought forward a recommendation that the case be met by an increased salary of 10s. per annum. Councillor Marshall, supporting the action of the Committee, said the Insurance Act was such a glorious muddle, that he did not think there was anything dishonourable in assisting one of their officials out of an entanglement. The recommendation was carried by a substantial majority.

Territorials at Falmouth.—The Lancashire Fortress (Electrical) Royal Engineers (Territorials), under the command of Col. Harry Langdon, C.B.V.D., paraded on Saturday evening at the headquarters in Liverpool. After receiving their equipment they marched to Lime Street station, where they entrained for Falmouth. During the training the corps will be instructed in searchlight work, fortress engineering, signalling, &c.

Metric System.—The Government of Venezuela has adopted the metric system for official purposes, and has made its use obligatory in the Law Courts and other public departments.

Name Wanted.—A correspondent asks for the name and address of the manufacturer of the "Iota" lamp.

Fuel for the Navy.—The *Times* understands that a Royal Commission will shortly be appointed to investigate the subject of fuel for the Navy and other matters connected with warship propulsion. "The problems connected with coal, gas and oil as fuel, with various kinds of prime movers, and with motor-driven vessels, are many, and demand thorough inquiry"; therefore, the terms of reference may be very wide.

Fatalities.—Mr. Joseph Herbert Wragg, electrician, of Bromley Street, Sheffield, was crushed to death on Saturday at Messrs. Hadfield's Steel Foundry, Tinsley, Sheffield. A somewhat similar fatality occurred lately with a travelling electric crane at the Wolverhampton Corrugated Iron Co.'s great Mersey Ironworks, Ellesmere Port.

A report appeared in Wednesday's papers to the effect that three men were killed by electric shock whilst bathing near an electric power station at Kriegletten, near Geneva. Details are wanting, and it is difficult to see how the accident could happen, unless perhaps an overhead conductor fell upon the bathers.

Educational. As a result of a new grant made by the London County Council, the Senate of the University of London has appointed Dr. J. A. Fleming, F.R.S., Professor of Electrical Engineering, to teach at University College.

University of Manchester.—The session in advanced electrical engineering commences on October 1st. Further particulars are given in our advertisement pages to-day.

Appointments Vacant.—Lecturer in electrical engineering, for the Rutherford Technical College, Newcastle-on-Tyne (£130); assistant lecturer and demonstrator in electrical engineering, for the Battersea Polytechnic (£120); electric wiring instructor, two evenings per week, for the South-Western Polytechnic, for Chelsea (10s. 6d. per attendance). See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—St. Anne's U.D.C. has decided to increase the salary of Mr. J. H. Clothier, electrical engineer, by £12 for one year.

According to the *Australian Mining Standard*, the Electric Supply Committee of the Melbourne City Council recently recommended that the salary of the city electrical engineer, Mr. H. R. Harper, be increased from £900 to £1,000 a year.

The Walthamstow Council has fixed the following maxima for the clerical staff in the electricity department: chief clerk, £175; invoice clerk, £130; consumers' clerk, £130; correspondence clerk, £100; stores clerk, £110; and junior clerk, £40 per annum.

Mr. P. Wardle, mains assistant at Rawtenstall electricity department, has been appointed mains assistant at Carlisle, and Mr. F. Newey, shift engineer at Rawtenstall, has been appointed to the vacant position of mains assistant. Mr. Coates, of Nelson, has secured the position of shift engineer vacated by Mr. Newey.

Mr. W. J. S. Jones, the managing engineer of the Wellingborough Electric Supply Co., Ltd., was presented by Mr. W. Carter, the oldest hand, on behalf of the staff, with a silver mounted walking stick, on his leaving to take up an important engineering appointment at Brisbane, Australia. A smoking concert took place later at the Swan and Nest Hotel, a very enjoyable evening being spent.

Mr. H. H. E. Wood, mains superintendent, has tendered his resignation to the Fulham Borough Council to take up a similar position under the Hampstead Corporation. To fill the vacancy caused, Mr. J. F. White, assistant mains superintendent, is to be promoted; the salary is £180 per annum.

On Friday evening, July 12th, a number of the staff of the West Ham Corporation Electric Supply met at the Connaught Rooms, Kingsway, at a farewell dinner to Mr. H. Herbert Couzens, on his leaving West Ham to take up his appointment at Hampstead. Mr. Couzens, in responding to a toast, thanked those present, and the staff generally, for the cordial support which they had always given him. If the department had been attended by any measure of success, he said, it was due to the splendid co-operation he had received from members of the staff, and he hoped that the same co-operation would be as readily given to his successor—Mr. J. W. Beauchamp. A concert was given by some of the members of the company. Mr. Sydney Hart received several encores, as also did Mr. H. B. Johnson. Mr. E. Tombs and Mr. C. Rockley also sang, the latter gentleman rendering "Sergeant Buzfuz." A very happy and enjoyable evening was brought to a close with "Auld Lang Syne."

General.—His Majesty the King has conferred a knighthood upon Mr. Francis Fox, M.I.C.E., a member of the firm of Sir Douglas Fox & Partners, consulting engineers. The *Financial News*, in referring to the matter, says that "he was appointed by the Federal Government of Switzerland, on the nomination of the British Government, as a member of the committee of three experts on tunnelling for the construction of the Simplon Tunnel. He is chairman of the British Radium Corporation, a member of the Engineering Standards Committee, and joint engineer of the Great Central Railway extension to London, the Charing Cross, Euston and Hampstead electrical tube railway, the Great Northern and City Railway, the Cape to Cairo Railway, and the Electrical Equipment for the Supply of Power to the Mines of Johannesburg and the Witwatersrand.

Mr. M. Harold Curry is resigning his position as assistant engineer and manager of the Coventry Electric Tramways, and will sail at the end of August for Calcutta to take up the position of assistant electrical engineer of the East Indian Railway Co. His agents will be Messrs. King, Hamilton & Co., Calcutta, to whom all correspondence should be addressed.

Mr. B. Heap, works superintendent of the Chloride Electrical Storage Co., Ltd., was married on July 6th, at Bloxwich Parish Church, to Miss Olive Fielding, youngest daughter of the late Mr. J. A. Fielding, of Manchester. Mr. Heap has been with the Chloride Co. for 14 years, and has gained the esteem of all the members of the company, who marked the occasion of his marriage by the following presentations: Mr. Heap's colleagues, pictures and vases; office staff, umbrella; works staff and employés, Japanese screen.

The following appeared in the *London Gazette* for July 12th:—"Royal Engineers.—London District Telegraph Companies, Royal Engineers (Army Troops): Lieutenant-Colonel and Honorary Colonel (Honorary Major in the Army) Andrew Bain, M.Inst.C.E., M.Inst.E.E., on completion of his period of service in command, is retired, and is granted permission to retain his rank and to wear the prescribed uniform. Dated July 13th, 1912."

The Liverpool Tramway and Electric Power and Lighting Committee, in accepting Mr. A. Bromley Holmes's notice to terminate his position of consulting electrical engineer to the Corporation at the end of September next, placed on record "the valuable service he has rendered to the Corporation and to the community during the 16 years he has served in the management of the electric supply department." Mr. Holmes has been associated with the supply of electricity in Liverpool for the past 30 years, as he helped to found the Liverpool Electric Supply Co. in 1883. He occupies the position of Associate Professor in the Faculty of Engineering, Liverpool University, and was also one of the founders and engineers of the Birmingham Electric Supply Co.

On the occasion of his marriage, Mr. H. C. Spooner, of the testing department of the British Thomson-Houston Co., Ltd., of Rugby, has been presented by his colleagues with a watch and chain and Gladstone bag.

Mr. H. Bacchus, electrical contractor, High Street, Bedford, has been placed on the Commission of the Peace for the borough.

The *Times*, of July 12th, stated that Mr. D. A. Thomas, managing director of the Cambrian Coal Trust, and Mr. Leonard Llewelyn, the general manager, had gone to Germany, and were making a tour of the steelworks, coking and by-product plants, and electrical machinery there.

Mr. Charles S. Demaine, late of the Melbourne City Council Electric Supply Department, has commenced practice as a consulting electrical engineer at 400, Collins Street, Melbourne.—*Australian Mining and Engineering Review.*

Mr. Arthur Musker, consulting engineer, has removed to 11, Victoria Street, London, S.W.

According to the *Daily Telegraph*, Dr. H. Lewis Jones, who has been electro-medical specialist at St. Bartholomew's Hospital for 20 years, is resigning that office. When Dr. Jones commenced his work there, the use of electricity in therapeutics was of but small proportions. To-day the electrical department is one of great importance and dimensions, and in its practice and equipment is a model upon which other like institutions make their plans.

Tramway Officials.—Mr. L. E. Harvey, manager of the South Shields Corporation Tramways, has been appointed to a similar position under the Ilford Urban District Council at a salary of £400 per annum, rising to £500.

The *Australian Mining Standard* states that Mr. W. E. Tozer, who for the last three years has been employed at the Great Fitzroy mines, Mount Chalmers (Q.), as foreman fitter, has been appointed tramway engineer to the Rockhampton City Council. Mr. A. Mills has been appointed traffic manager of the Council's tramways.

Obituary.—Mr. A. W. G. Wilmshurst, who for the last five years has been the out-door representative of Messrs. Home and Rowland, electrical engineers, of Charlton, Kent, died on Sunday last, of consumption, which had developed very rapidly. Mr. Wilmshurst had previously been engaged in the test room of Messrs. Johnson & Phillips, of Charlton.

Lieut.-Col. Arthur Hill Holme, J.P., whose death recently occurred at his residence at Liverpool, was for many years chairman of the Liverpool Electric Supply Co. He was head of the firm of Hill Holme & Co., civil engineers and railway contractors.

NEW COMPANIES REGISTERED.

Menai Bridge Electricity Supply Co., Ltd. (122,966.) This company was registered on June 28th, with a capital of £2,500 in £1 shares, to take over from W. E. Parry and E. S. Lance the business of producers and suppliers of electric light and power carried on by them at Menai Bridge, as the "Menai Bridge Electricity Co." The subscribers (with 100 shares each) are:—W. E. Parry, 31, High Street, Menai Bridge, cabinet maker; E. S. Lance, 16, Lloyd Street, Llandudno, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. E. Parry and E. S. Lance; qualification, £100. Solicitor, R. A. Johnson, Llandudno. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Pictorial Telegraph Syndicate, Ltd. (123,040.)—This company was registered on July 5th, with a capital of £8,200 in 8,000 preferred shares of £1 each and 4,000 founders' shares of 1s. each, to acquire any patents, rights, brevets d'invention, licences, protections, concessions, options and interests in an invention relating to "photo-telegraphy," and to the electrical transmission and reception of signals, drawings, photographs and the like, in particular to acquire the rights and interests in certain patents granted to Thomas Thorne Baker and the Pictorial Newspaper Co. (1910), Ltd., relating thereto. The subscribers (with one preference share each) are:—Marquis di Campo, Villa Margherita, Southfields; W. M. O. Wilson, 7, Althorp Road, Wandsworth Common, S.W., barrister; O. Fulton, F.R.P.S., 3, Clifford Street, W., scientific expert. Private company. The number of directors is not to be less than two or more than five; the first are Marquis di Campo, W. M. O. Wilson and O. Fulton; the last two named are permanent. Registered office, Bond Street House, 13, Clifford Street, W.

CITY NOTES.

United River Plate Telephone Co., Ltd.

The directors' report for the year ended March 31st last states that the gross receipts in sterling in the River Plate were £468,992. Deducting expenses in Argentina and London, debenture interest, dividend on preference shares, and interim dividend on ordinary shares, and adding interest on investments, transfer fees, &c., and £5,393 brought forward, there remains an available balance of £102,813. The provision for renewal of plant chargeable against revenue for the year has, as previously, been estimated and included in the item "maintenance." A further appropriation for the renewal fund is proposed, the directors, as mentioned last year, being of opinion that owing to the increase in the plant the fund requires strengthening. After making the proposed appropriations shown below, the directors recommend that a final dividend of 5 per cent. be paid on the ordinary share capital, making with the interim dividend paid on December 30th last, a return of 8 per cent. for the year, free from income-tax, and that the balance of £5,493 be carried forward. The company continues to make satisfactory progress, and in consequence fresh capital is required. It is proposed to make an issue forthwith of 40,000 ordinary shares to the ordinary shareholders at par. For this purpose an increase in the nominal capital of the company will be necessary and a resolution to this effect will be submitted at the meeting on July 23rd. In view of the inconvenience to many shareholders of having accounts submitted during July, the directors are arranging for the company's financial year to end on December 31st in future. The next accounts presented—probably in April, 1913, will therefore only embrace a period of nine months. The balance is appropriated as follows: To reserve for renewal of plant, £40,000; to staff provident fund, £2,000; to final dividend (5 per cent.) on the ordinary shares, £55,350; carried forward £5,493.

Chili Telephone Co., Ltd.

The annual meeting of this company was held on July 11th at the offices, 42, Old Broad Street, E.C., Mr. George Keith, presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 28), said it was a most satisfactory record. The aggregate increase in the number of subscribers was larger than it had been in any previous year. The improvement shown was due to the general expansion of business at the various centres. The currency revenue in Chile had increased by 13 per cent., but with the higher expenditure and the lower exchange ruling during the year, the net sterling income did not come out so well. The working expenses amounted to 49½ per cent. of the revenue, or an increase of 4¼ per cent. due mainly to the rise which had taken place in wages and prices generally. The financial situation in Chile continued very depressed during the year, and the average rate of exchange came out at 10·49d., as compared with 10·90d. for the previous year. The revenue from Chile when converted into sterling showed an increase of £2,853. Interest brought in £284 more, and taking transfer fees into account the gross income amounted to £53,012. On the debit side, the London expenses remained unchanged, with the exception of the income-tax, which had increased by £307. The result of the year's business was a credit balance of £48,960, which, after providing £23,942 for the reserve, and £9,322 for the interim dividend of 3s. per share paid last January, enabled the board to recommend a final dividend of 5s. per share, absorbing £15,537, making a total distribution of 8 per cent. for the year, leaving £3,382 to be carried forward. As regarded the year's surplus revenue, £13,950 expended on increasing and extending the property, had been carried to capital expenditure account, and £12,200 expended upon replacements and improvements had been charged to the reserve account, which now stood at £64,000. Sundry debit balances showed an increase of £4,026, due principally to the increased expenditure on unfinished works at the end of the financial year. For the same reason the stock account showed an increase of £9,582, causing a decrease in investments and cash due to meeting the additional outlay in materials required for construction work in connection with the development of the business. As regarded the company's property, a new exchange building had been erected during the year at Chorrillos, in the Valparaiso district, and another had been purchased for an office in Concepcion, where a new switchboard was now being installed. The internal and external plant at the various centres had been increased and improved to meet the growing requirements of the business. The truck lines had been extended to several small towns where exchanges had been equipped and opened for service. The placing of the aerial lines underground in the City of Santiago had also made satisfactory progress. Measures were being taken for the conversion of the currency with the value of the Chilian dollar fixed at 1s., and should that become law, it would be the means of maintaining an international exchange which was so necessary for successful business in Chile.

The Hon. Herbert T. Allsopp seconded the motion, and the report was adopted.

Chatham and District Light Railways Co.

The directors' report for the half-year ended June 30th, 1912, states that the revenue was £21,913, and the expenses were £12,411, leaving £9,502; less rent of Rochester Corporation lines, £1,872; interest on debentures, £1,234; interest account, £221; leaving £6,175, plus balance brought forward, £496, making a balance of £6,671, which is to be disposed of as follows:—£2,940 to dividend (5 per cent. per annum for the half-year) on the preference shares; £1,590 to dividend (3 per cent. per annum for the half-year) on the ordinary shares, carrying £2,141 to revenue new account. The traffic receipts show an increase of £469 and the expenses a decrease of £103, as compared with the receipts and expenses for the corresponding half-year of 1911. The directors will, as usual, provide for depreciation when the final accounts are made up at the end of the year. The dividends are to be paid on 31st inst.

Consolidated Diesel Engine Manufacturers, Ltd.

Mr. C. C. Ellis presided at the statutory meeting of this company held on July 10th at Cannon Street Hotel, E.C. He said that the whole of the 427,076 shares offered to the public for cash had been taken up. The arrangements for building the new works at Ipswich had been proceeded with, and the order placed for their construction, including the foundry, machine shops, erecting and testing shops. The builders estimated that the first portion of the works would be erected in about seven months, so that it would not be long before they were making Diesel engines in this country. They were at present buying 20 acres of freehold land, and had obtained an option of a further 15 acres. The works would at first occupy an area 850 ft. long × 350 ft. wide, and when they got into full swing would employ between 500 and 600 men. It was intended to build stationary engines, marine engines, and other types of which they might hear more later. The engines would be both of the four and two-stroke types, and would range from 40 h.p. upwards. The arrangement referred to in the prospectus for the extension of Carels Freres' works at Ghent had been proceeded with, and additional workshops were in course of erection. The company had taken larger offices in Aldwych, and they would get into them in August. The speaker referred to the progress of the company's licensees (Messrs. Richardsons, Westgarth & Co., Ltd.) in the building of the Carels-Diesel marine engine.

Mr. Carels, the chairman of the Carels Co., and a director of this company, addressed the meeting briefly, and a few questions by shareholders were answered by the chairman.

Lanarkshire Tramways Co.

An extraordinary general meeting was held on Tuesday at the offices, 83, Cannon Street, E.C., Mr. A. R. Monks presiding.

The Chairman proposed the following resolution: "Resolved that the Lanark County Tramways Bill now pending in Parliament promoted by the Lanarkshire County Council as introduced or proposed to be introduced into the House of Commons and intituled an Act to authorise the County Council of the County of Lanark to construct tramways in that county; to authorise the County Council and the Town Councils of the Burghs of Hamilton, Motherwell, and Wishaw to acquire the undertaking of the Lanarkshire Tramways Co.; and for other purposes now submitted to this meeting be, and the same is hereby, approved." He said the shareholders would have seen from the circular which had been sent out what were the objects of the Bill. The Lanarkshire County Council was taking power to construct the lines which were not completed by the company, and they would be worked by the company, and they would pay interest at the rate at which the

County Council borrowed for the purpose. The County Council and local authorities would be empowered by the Bill to purchase their undertaking at any time before August 11th, 1928, by agreement, and if they did not so purchase before the expiration of two years from the opening of the new lines for public traffic, the company was to purchase these new lines from the County Council at cost price.

Mr. Levis seconded the motion, which was carried unanimously.

Brush Electrical Engineering Co., Ltd.

The report of this company for 1911, to be presented to the meeting on the 22nd inst., states, as printed in the *Financial Times* (we have not been favoured with a copy by the company), that the company's manufacturing output for 1911, both from the electrical engineering and from the rolling-stock departments, showed a marked improvement over the results for the previous three years. Still better results would have been reached but for the disorganisation caused to the industries of the country by the railway and other strikes, one effect of which was to make it increasingly difficult to obtain deliveries of raw materials, thus causing serious delays in the execution of contracts. Although the net result of the year's working is a loss of £5,688, after paying interest on all the debenture stocks, this loss is less than in preceding years and compares with a loss of £10,780 for 1910, and with a loss of £21,230 for 1909. The directors confidently hope that in future at least an equilibrium as between expenditure and income will be established. As stated by the chairman at the last annual general meeting, the directors have had in mind the necessity for a reconstitution of the company's capital account, and they consider that the time has come to deal with the accumulated balance to debit of profit and loss account, and with the shrinkage which has taken place in the value of the company's assets. The directors have prepared a scheme for reduction of capital and for raising fresh capital required to pay off existing loans and to enable the company to carry on its business with greater advantage. They consider it advisable, however, that they should have the benefit of conferences with representative shareholders and debenture-holders with regard to these matters, and they propose that a small representative committee be appointed for this purpose. Any shareholder willing to serve on this committee is invited to communicate with the secretary, so as to assist the directors in the selection of a representative committee. The company has been hampered in its operations by the lack of adequate working capital, and has been obliged for this reason to let pass favourable opportunities for expansion of the business. The contracts undertaken by the company are mainly of a class which involve a large lock-up of money while in progress, and shortage of liquid capital has made it necessary to arrange for temporary loans. To secure part of these loans, bonds for £50,000 of a new issue of second prior lien debenture stock have been deposited. Any scheme that may be decided upon for the introduction of fresh capital will include provision for redemption of this stock. In the opinion of the directors, a special effort is necessary to strengthen the company's finances in order that full advantage may be taken of the improved conditions. In the electrical engineering industry the most noteworthy feature has been the extraordinary advance in popularity of the steam turbine. The company's experience and excellent reputation as builders of plant of this class have procured for it a good share of the contracts. On the car-building side important contracts for main-line rolling stock are in course of execution. Orders for tramcars have been infrequent and comparatively small in value, but this scarcity is now compensated for by the active demand for motor-omnibus bodies, of which the company has a large number under construction. Generally, it may be said that in all departments the orders in hand and in prospect are satisfactory, and that prices—although still too low—begin to show an upward tendency.

Edmundson's Electricity Corporation, Ltd.

The directors' annual report for the year ended March 31st, 1912, states that the business of the company continues to show steady progress. During the past year, the trading profit has increased by £309, dividends and interest have increased by £2,555, whilst the loss on working the local authorities' undertakings is reduced by £1,080. Owing to the expiry of the Urban Co. guarantee, administration expenses, hitherto charged direct to the Urban Co., are now borne by this company, but the consequent increase in this company's administration expenses is more than set-off by the Urban Co. management fee. The net profit, after deducting interest on debenture stocks and other items, including a provision, which appears for the first time, of £4,720 for the redemption of debenture stock, amounts to £16,114. The directors recommend that this sum be carried to reserve. The loss of £94,728 on the company's holding of 47,364 ordinary shares in the Urban Co., consequent on the reduction of that company's ordinary capital by £2 per share, has been charged against reserve. The balance of the reserves, including the net profit for the past year and a sum of £3,640, added in respect of the past year before arriving at the gross trading profit, will, in due course, be absorbed under the scheme of capital reduction unanimously adopted by the shareholders. As soon as the scheme has received the approval of the Court, it is the intention of the directors to pay an interim dividend at the rate of 6 per cent. per annum for the first half of the current year on the new 6 per cent. cumulative preference shares arising under such scheme. During the year, the purchase of the Winchester undertaking by the Winchester Corporation was completed and the sum of £31,422, including a profit of £5,607 realised on the company's holding, has been utilised towards the redemption of the prior lien debenture stock. On July 12th, 1912, the company redeemed the outstanding prior lien debenture stock, thereby avoiding payment of the additional ½ per cent. rate of interest, which would otherwise become payable, on the 4½ per cent. first mortgage debenture stock.

The report is accompanied by a schedule giving particulars of investments in, and advances to, subsidiary and other companies at March 31st, 1912. A summary of this information is as follows: Shares, £688,159; debentures, £228,071; advances, £480,341 = £1,396,571.

From the schedule showing capital expenditure and gross profits of subsidiary and other companies we extract the following:—

Name.	Gross profit (before providing for capital charges and depreciation). 1911.	1910.	Lamps connected (equivalent 33-watt). 1911.	1910.
	£	£		
Alderley	2,274	2,213	22,866	21,377
Bromley	13,081	12,643	101,276	95,307
Folkestone	16,539	15,465	124,149	118,149
Guernsey	3,483	5,526	106,078	95,833
Isle of Wight ..	13,986	12,367	115,987	107,028
Ilfracombe .. .	1,293	1,029	18,627	16,697
Lymington .. .	1,789	1,588	17,043	17,370
Melton Mowbray ..	2,282	2,215	21,063	19,889
Newmarket ..	2,421	2,401	27,039	25,988
North of Scotland	5,782	5,097	71,872	66,597
Ramsgate ..	2,676	1,902	34,548	31,661
Scarboro' Trams .	864	59		—
Salisbury	6,015	5,974	89,569	87,813
Urban Co.	47,649	45,300	589,737	525,160
Winchester ..	(Purchased by local authority)			
Wycombe .	5,432	4,931	57,961	53,379
Cromer	889	909	14,271	13,430
Dorking	2,117	1,767	19,743	18,363
Frome .. .	1,208	967	34,253	33,153
Hamilton ..	3,261	2,695	52,623	48,670
Surbiton . .	*4,363	*3,615	*39,585	*35,974
Total	£137,354	£128,633	1,508,170	1,381,648

*Figures for year ended March 31st.

The annual meeting will be held on July 25th at Salisbury House, E.C.

Mr. P. C. Tuckett, chairman, presided on Thursday, July 11th, at Salisbury House, E.C., over an extraordinary meeting of the company for the purpose of confirming the resolution passed on June 25th for the reduction of the capital from £800,000 to £640,000.

The Chairman formally moved the resolution, which, he explained, had been slightly altered in accordance with the feeling expressed at the last meeting to the extent that the commission which the company might pay to any person for taking up shares had been reduced from 25 per cent. to 10 per cent. Having gone so fully into the matter at the last meeting, he did not intend to repeat what he said, but was prepared to answer any questions.

Mr. Swinton seconded the motion, and it was carried without discussion.

The Chairman remarked that he was very glad that the resolution had been carried at both meetings without any dissentient shareholders. The company started fair from that day, with, he hoped, improved prospects. They had had a disappointing experience in the last four years, and had had no dividends, but if they lived in hope he thought they would get them.

Montreal Light, Heat and Power Co.—The report, as abstracted in the *Financier*, states that the gross and net revenue and surplus earnings for the year to April 30th show substantial increases, notwithstanding the liberal reduction made in gas and electric rates during the year. The gross earnings amounted to $4,969,300, and the expenses to $2,125,200, leaving a net revenue balance of $2,844,000. Interest on bonds, together with insurance charges, has absorbed $495,700, dividends amounting to 8 per cent. have been paid, $490,000 has been written off in respect of depreciation and renewals, and after setting aside $10,000 to officers' pension fund, there remains a surplus of $498,300, which, added to the balance brought forward, gives a total of $2,894,100 to be transferred to the 1912-13 balance-sheet. In order to meet the continued demand for gas and electric service consequent upon the rapid development of the city and suburbs, there was necessitated during the year an expenditure on capital account of $1,002,000. The company is rapidly approaching the limit of its capacity, and an auxiliary gas generating station is being designed for early construction. As regards the electric supply, the company has, with other interests, purchased a control in the Cedar Rapids Manufacturing and Power Co., with the intention of forthwith constructing a hydro-electric plant, utilising the water-power of the Cedar Rapids for an estimated development of 150,000 h.p.

The directors have announced a dividend of 2¼ per cent. (at the rate of 9 per cent. per annum) for the quarter ending July 31st.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have declared interim dividends of 2½ per cent. on the preference shares, and 2 per cent. on the ordinary shares, less income-tax.

Indian Electric Supply and Traction Co., Ltd.—A petition for confirming the reduction of capital from £800,000 to £517,688 is to be heard on July 23rd in London.

Anglo-American Telegraph Co., Ltd.

The annual meeting was held on Friday at Winchester House, E.C. Mr. F. A. Bevan presiding.

The Chairman, in moving the adoption of the report and confirmation of the payment of the final dividend in February said that the directors did not hold the usual meeting in February, because, owing to the peculiar situation in which they were placed, the accounts, which were very complicated as between themselves and the Western Union Co., took much longer to finish than they at first anticipated. The present meeting was almost a formal one, for, as they were aware, the company no longer had the management and control of the lines, neither were they concerned as to the traffic. All that happened was that they received a quarterly sum from the Western Union for the lease of their cables, and they dealt with that sum by dividing it among their shareholders. The question had again been raised why, seeing they received that quarterly dividend, they did not give the deferred their proportion, the same as the preferred. He was sorry to say they were informed by their solicitors that they could not legally do that, but that they must continue the old arrangement of retaining any dividend that might accrue to the deferred shareholders until the last quarter of the year, until the preference had received their 6 per cent. He and the other directors very much regretted that state of things, but he did not see how it could be got over. He was sorry that the deferred shareholders should think they were in a worse position than formerly. As a matter of fact, they were in a much better position, for instead of having to wait until the end of the year to know what dividend they were going to receive, they had the absolute certainty as long as the present lease lasted, that they would receive their 1½ per cent. at the close of the year. Some suggestions had again been made that they should unify the stock, but he did not think it would be wise to enter upon that matter at the present juncture. They had been sounding some of the larger shareholders, and at present the directors did not feel much encouragement to proceed with the matter. All the directors were of opinion that it would be desirable in the interests of all the shareholders, preferred as well as deferred, to unify the stock to pay 5 per cent., the preference receiving their due proportion, so that they should receive exactly what they got at present. They thought such a stock would be more marketable, but at present some of the shareholders saw difficulties about the matter. Therefore the board did not see their way to proceed any further with the question at this moment, though he hoped the unification would come about in course of time.

Sir Herbert S. Leon seconded the motion.

Mr. H. A. Begg endorsed the remarks of the chairman as to the desirability of unifying the stock, and said that now the company was leased to a powerful American concern, it seemed an extraordinary thing that upon some legal quibble the directors were still obliged to keep to their former practice of paying the deferred stockholders once a year only.

The resolution was carried.

Sir Herbert S. Leon proposed the re-election of Mr. F. A Bevan as a director.

Mr. R. H. Benson, in seconding the motion—which was carried —remarked that the question of unifying the stock was a matter for the shareholders. They could call for a special meeting, and a three-fourths majority of both classes of shareholders would carry the scheme.

Sir J. Swinburne suggested that the directors should themselves call a special meeting for this purpose.

The Chairman said the directors would take the question into consideration, and he could not help thinking that if the shareholders would look at the matter a little more carefully they would come to the same conclusion as the board, viz., that it would be in the interests of all to adopt a unified stock. If the guarantee of the Western Union was really good—and seeing the enormous amount there was to back it, there was no doubt that it was—the preferred stockholders could not be in any worse position by consenting to such an arrangement, and he thought the deferred would also be in a safer position by having a better and more marketable stock. They must, however, give the directors a little more time to consider the point, because evidently some of the shareholders did not take their view of the matter.

Crompton & Co., Ltd.

The directors report that for the year ended March 31st, 1912, the result of trading, after the usual provision for depreciation, shows a loss of £1,507, as compared with a loss of £14,195 for the year ending March 31st, 1911. After providing for debenture interest and other charges shown in the net revenue account, the balance to the debit of this account is increased to £58,730. Economies in various directions and a careful selection of the class of business undertaken have distinctly improved the position of the company, with the result that, although a loss was incurred in the first half of the financial year, the gross profit earned in the second half was more than sufficient to pay all outgoings for that period including debenture interest and other charges against revenue, and this improvement is being maintained. The directors are glad to report that a dividend of 2 per cent. for the year ending December 31st last has been paid on the shares of the Electric Supply Corporation in which the company has considerable interest. The value of orders in hand at the company's works at the close of the financial year shows a satisfactory increase. Mr. A. J. Hodgson and Mr. E. Reeves have been appointed joint managers of the company.

The meeting will be held on July 22nd, at Salisbury House, E.C.

Nairobi Electric Power and Lighting Co., Ltd.

Mr. A. W. Mayo-Robson presided at the offices, 8 and 9, Martin's Lane, E.C., on July 4th, over the meeting of this company.

In moving the adoption of the report (see Electrical Review, page 1054), he said that on the assets side of the balance-sheet the capital expenditure on works amounted to £29,367, an increase of £3,456. This was an item which would naturally increase as the company extended its business at Nairobi, and in consequence of the growing demand for current a much larger increase of capital expenditure would have to be faced in the immediate future. The concession purchase account, standing at £600, represented part of the purchase price paid to the vendor. Since the date of the accounts the vendor had completed his contract, and the remaining part of the purchase price, 3,900 fully-paid ordinary shares, had been allotted to him, thus discharging the contingent liability appearing on the other side of the account. Stocks on hand and in transit, at £3,321, showed a considerable increase over the figures of the previous year. The share capital stood at the same figure as before, and debentures at £15,000, against £12,800 for 1910. The further capital expenditure necessitated this being called up early in 1911, bringing the issue up to the authorised total of £15,000. The item of bills payable represented entirely bills drawn by them upon their Nairobi office against shipments of goods. In the revenue account the receipts from sale of current, which was the principal source of revenue, increased from £2,718 in 1910 to £4,356 in 1911, an increase of 60 per cent. The expenditure for the year, £3,769, showed an increase of only £19 over the expenditure for 1910, but as debenture interest was £173 more than in 1910, the other expenses worked out at less, which, with the increased business done, was satisfactory. The recent advices from Nairobi indicated a much greater increase of business for the present year, and the directors, therefore, anticipated that the results for 1912 would not only wipe out the adverse balance in the revenue account, but would leave a considerable sum in hand towards the establishment of a sinking fund and the commencement of dividends. At the last annual meeting it was stated that a sinking fund was to be established, and the matter was to be dealt with further at this meeting, but the board had decided that the adverse balance in revenue account must first be wiped out before this was commenced. The prosperity of Nairobi, and the rapidly increasing demand for current, now necessitated the putting down of further plant, and the directors were considering the installation of auxiliary power stations, as customers were already in sight for very much more than the whole of their present capacity. Mr. Charles Udall, the manager and chief engineer, had now returned to England for a holiday and to confer with the directors and consulting engineers as to the installation of the further plant required, and the thanks of the company were due to him and to those who had worked with him, as well as to the managing director, Mr. R. C. Bayldon, for all their efforts in bringing the company to its present measure of success, which was only small compared with that which they were assured lay before them in the future.

The report was adopted.

Mr. Chas. Udall, the chief engineer, said that the progress of the company was just about the same as last year. They had just about as much load in front of them at the present time as they had four years ago, when the company started to look for it. The country, however, was developing very rapidly, and hotels were now being erected out there on European lines. He thought the company could considerably increase its earnings by supplying cooking apparatus. Most of the people out there still burnt wood, and he was sure the idea would go down well with them, and mean an increased revenue to the company. He did not think there was at present any large incentive to lay down further machinery, and at the present time he thought they were well equipped for all emergencies. He considered the outlook for the company was extremely rosy. In the first three months of this year they had done more business than in the six first months of last year. A suggestion had been put forward of passing a vote of thanks to the staff out in Nairobi, but he would like to say that they would be very glad to get a small monetary bonus.

The Chairman said they were all very pleased to hear the few remarks of Mr. Udall, who had been out in Nairobi for the last four years. If he, as chief engineer, thought fit to increase the plant, he could assure him it would be carefully considered by the board.

Mr. Moorhouse said he would like to express his thanks to Mr. Udall and his staff for the excellence of the engineering work out in Nairobi, which, he thought, had been carried out very expeditiously and thoroughly.

Stock Exchange Notices.—The Committee has appointed special settling days as under :—

Friday, July 19th.—Alabama Traction, Light and Power Co., Ltd.—Scrip fully and partly paid for $6,000,000 5 per cent. first mortgage 50-year gold bonds (also to be officially quoted).

Thursday, July 25th.—Sun Power Co. (Eastern Hemisphere), Ltd.—Further issue of 3,000 ordinary shares of £1 each fully paid, Nos. 165,508 to 168,507.

Caergwrle Electricity Supply Co.—The annual meeting of this company was held on Thursday last week, when a satisfactory report was presented. The progress of the undertaking since its inception three years ago has been continuous.

St. James' and Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 7 per cent. per annum, and on the ordinary shares at the rate of 10 per cent. per annum, for the half-year ending June 30th. The transfer books are closed from July 18th to 31st inclusive.

Marconi's Wireless Telegraph Co., Ltd.

COMMENDATORE G. MARCONI (chairman) presided on Tuesday last week at the Hotel Metropole over the fifteenth ordinary general meeting of the above company, when there was a large attendance of shareholders.

THE CHAIRMAN, in moving the adoption of the report (see ELEC. REV., p. 976), said that their business had made great strides during 1911, as compared with 1910, but the increase of business for 1912 promised far and away to exceed the ratio of increase of 1911 over 1910. They had followed their usual custom of dealing only in their accounts with completed contracts, carrying to the current year all the work which was in hand, but not finally disposed of, at December 31st, 1911. That a substantial improvement and development of their business set in last year the accounts themselves indicated, but it was during the first six months of 1912 that the most important developments had taken place. In the first instance he referred shortly to the general development of their many affiliated companies. It was, of course, quite natural that with the universal recognition of the great value and utility of wireless telegraphy, the success of their associated companies should follow closely on the heels of the parent company. There was, for instance, the Marconi International Marine Communication Co., Ltd., in which their company held over 200,000 fully-paid shares out of a total issued capital of about 204,000, and of which the receipts from ships' telegrams, news service, traffics, ships' subsidies, &c., increased from some £40,000 in 1910 to £64,000 in 1911—an increase approximately of 60 per cent. The profits for the year showed an equally satisfactory improvement. The business, however, of 1912 promised even a greater proportionate advance. He regarded the shares held in the Marconi International Marine Communication Co., Ltd., as one of their most valuable assets to-day, and one which would surely materially improve year by year. The Russian company was doing a very substantial and satisfactory business. It had already obtained orders from the Russian Government for considerably over one million roubles, and was negotiating for further business of a very extensive and important nature. Their holding in that company was substantial, and was also in their opinion a very valuable asset. They contemplated that St. Petersburg, where they had extensive freehold works, would become a very important centre for the development of wireless telegraphy over the vast territory to the East, where very little in the shape of telegraphic communication yet existed. The Canadian company was also making satisfactory progress. During his recent visit to New York, accompanied by their managing director, Mr. Godfrey C. Isaacs, they met the chairman of the Canadian company, Mr. Andrew A. Allan, and with him approved the appointment of Mr. A. Lauer, late of the Canadian Transport Co., to act as manager of their company, especially devoting himself to the extension of the company's business throughout Canada, where there could be no doubt wireless telegraphy must play a great part in the future development of that vast country. Their latest information was to the effect that a further agreement of importance had been come to with the Canadian Government and waited the return of the Ministers who were now visiting this country, for it to be signed. Their trans-Atlantic service had shown considerable improvement during the past year, and the traffics showed a marked increase. There had been delay in the progress of the Argentine Co. They had, however, a very able representative visiting Buenos Ayres at the present moment with the object of straightening out many matters which they felt required to be dealt with, and they had received highly satisfactory cables from him, and could now look forward to substantial progress and development in that part of the world. They hoped to be able to give some further interesting information in this connection at not too distant a date. There could be no doubt that of all their associated companies, by far the greatest and most important development had been that of the American company. The capital had been increased to 10 million dollars, over seven million dollars of which was now a liquid cash asset. The balance was represented by valuable assets in the shape of some 80 important telegraph stations situated upon the Atlantic and Pacific Coasts and the Great Lakes: they conducted a big telegraph business both with each other and with ships at sea. There were also 500 ship stations on the principal vessels flying the American flag. This marine telegraph business was conducted upon similar lines to that of their International Marine Communication Co. The business, however, had been extensively developed consistent with the progressive nature of the country. Thus the existing business alone of the American company was a very substantial and remunerative one, and they looked for a great extension of this branch of the company's business. But however important and profitable this section of the business might be, it was, they thought, dwarfed by the impending developments of the telegraph business which had been taken in hand, and to which the seven million dollars of new capital would be devoted. He would not venture here to quote the anticipated revenue from these services. Shareholders were aware that their American company had been in existence for some years, but made slow progress, the principal reasons for this being:—(1) The fact that the telegraph service was not a State monopoly in America, and there was no legislation respecting wireless telegraphy; (2) The United States of America were not adherents to the Radio-Telegraphic Convention of Berlin of 1906, consequently everybody was free to do what he would, with the result that a state of chaos existed; (3) The existence of the United Wireless Telegraph Co., of America, with whose business methods it was impossible to compete; (4) The complexity of the patent situation. When, however, in their opinion the moment was mature, the managing director and himself proceeded to New York, which resulted in agreements of which they had already been apprised. The whole of the business of the United Wireless Telegraph Co. passed into their hands; judgment was entered in their favour in respect of patents, and a perpetual injunction was granted. There, however, remained temporarily one further complication regarding the patent situation, for which they had had to wait but a very short time for the solution. There was a further company in America holding patents which claimed a prior grant of their important patents. He need not enter into the details of how this came about; it would suffice to say that the Boston Courts of Appeal had now given their judgment in which they held that the patent in question had borrowed from Lodge and Marconi; and so the whole atmosphere had been cleared. At the time of their visit the American company was doing a comparatively small business, and had paid no dividends; its prospects were gloomy indeed, and its $25 shares were practically unsaleable. The directors, although highly appreciating their scheme, were not unnaturally unwilling to accept the responsibility of it without them furnishing the capital. Confident that they were able to carry through their negotiations successfully, they took it upon themselves to undertake to provide this capital, and immediately set to work in New York to make such arrangements as would insure them against the heavy responsibility which they had assumed. These negotiations, which embraced the introduction of the new shares to the markets of both New York and London, they were successful in carrying through to the extent which they felt incumbent upon them in relief of their responsibility. The subsequent successful termination of all their other negotiations, together with the very assiduous attentions of a very attentive American Press, brought about the unexpected result that every shareholder availed himself of his legal rights and applied for all the shares to which he was entitled. Considerable excitement resulted in New York and a great deal of speculation followed, in which it was not necessary perhaps to say that their company took no part, could not foresee, and for which it was in no way responsible. They were now holding a considerably increased number of shares in the American company; it was their intention to retain their interest, for they felt confident that it would see a great appreciation in the future. They looked to the Marconi Wireless Telegraph Co., of America, becoming one of the big and important industrial institutions of the United States. Recently they had received a telegram from their lawyers in America and also from their American vice-president informing them that all the contracts had been completed, and he was glad to inform them that they represented a handsome profit to their company, which would go far to ensure an excellent balance-sheet for 1912. In regard to the Spanish and General Trust Co. which was formed this year, with the exception of some 2,000 shares which this company subscribed for in cash, there had been no issue except in respect of those £1 shares of the Spanish Trust Co., which were issued to shareholders of the Spanish Wireless Co., in payment of the 500 peseta shares which they converted. In dealing with all these matters he had in part disposed of some of the developments of 1912, but he had yet to speak of perhaps the most important, viz., the contract entered into with His Majesty Government in respect of the Imperial wireless scheme. They had already been informed generally of the nature of this contract. The agreement comprised the construction of a number of high-power stations communicating over a range each of about 2,000 miles, in places which had been already defined, and at all such other places as might subsequently be required and agreed upon. They would be erected in accordance with specifications prepared by them and approved by the Postmaster-General of the United Kingdom on behalf of the Government of the United Kingdom and of the Governments of all the Dominions and Colonies concerned. It was also provided that all and any other long-distance stations which the Government of the United Kingdom and the Governments of the Dominions and Colonies might require within five years of the date of the agreement should be constructed by the company upon the same terms as those now agreed upon, with any further conditions which might be found necessary or desirable. The conditions provided that the company should furnish complete wireless apparatus for duplex and fast-speed automatic working, masts, earth connections, and duplicate power plant at each of the stations for the sum of £60,000 per station. The company undertook, if so desired, to construct the buildings, make the foundations for masts and machinery, and carry out other necessary works at cost price for the account of the Government. A speed of 20 words a minute duplex with ordinary working, or 50 simplex with automatic working, was guaranteed. The company undertook to work the stations for a period of six months at cost price for the account of the Postmaster-General, after which period the stations would be handed over to and worked commercially by the Governments concerned. The agreement extended over a period of 28 years from the date of the commencement of the service of the first three stations. It was determinable at the end of 18 years, in which case, however, the Government would cease to have the right of use of any of the company's patents. During the duration of this agreement, the company was to receive 10 per cent. of the gross receipts derived from the service. It was open to the Postmaster-General to cease the payment of royalty in the event of his finding it more advantageous to use a system entirely independent of all the Marconi inventions and be able entirely to dispense with the whole of their apparatus. They regarded this as a perfectly reasonable and harmless condition, and did not attach the smallest importance to it. Wireless telegraphy of to-day comprised a very large number of inventions and improvements, which together represented an efficient commercial system. Although there might be new inventions other than those of this company in the matter of wireless telegraphy, and of which their company might not become the possessors, they were not in the least likely to represent a system, but only a small part of which was comprised in a wireless telegraph installation such as was required at the present day. As late as this year they had applied for several new and valuable patents, making a further marked step towards perfecting wireless telegraphy, which embraced more perfect syntonisation, the directing of the electric waves from station to station, improvements in receiving apparatus, minimising atmospheric influences, and instruments for perfecting the efficiency of wireless communication between ships. They had also acquired a very large number of patents including all those which were owned by the Lodge-Muirhead Syndicate, and some 130 from America, representing various improvements in some of the details contained in wireless telegraphic installations. These many patents, added to the very large number which they already possessed, and to which they continued to add, would give some indication of the reasons why they saw not the smallest grounds for objecting to the clause which the Postmaster-General thought should be inserted in the agreement with the Government for the Imperial stations. They looked forward to a very important revenue being derived from the 10 per cent. of the proceeds of such a telegraph service as would be represented by a Government Service conducted between this country and Egypt, between this country, Egypt and Central Africa, between this country, Egypt, Central Africa and South Africa, from this country to India, to Singapore, Hong Kong, and subsequently no doubt to Australia and other parts of the British Empire, and also from the services between Dominions beyond the seas with Dominions beyond the seas. The revenue accruing to this company would be without cost to the company, and an additional profit to the company's existing business without affecting its capacity for output or occupying the time of its staff. The plans had now been prepared and much preparatory work done, so that the construction of the first stations, which they would be prepared to erect simultaneously, should be complete, and the stations in operation when he addressed them next year. He had very considerable satisfaction in informing them that the International Radio-telegraphic Conference of London had just come to a close after some five weeks of arduous work, in which they had taken part, and to which they had devoted their whole attention. Nothing could be more satisfactory than the results which had been obtained. The vexed question of intercommunication between ships independent of their system had been most satisfactorily disposed of, and they had announced their intention of putting the new conditions into immediate effect without waiting until July 1st next, at which date the new Convention would come into force. The difficult position which previously existed owing to the existence of the United Wireless Telegraph Co. and the non-adherence to the Convention of the United States Government, had now been entirely disposed of, and their company, with its affiliated companies, directly or indirectly controlled, with some 20 or 30 exceptions, the ship stations of the world. The question of re-transmission of telegrams had been settled, and satisfactory rates therefor had been agreed upon. Provision had also been made for reply-paid telegrams, repeated telegrams, telegrams with multiple addresses, or circular telegrams, and telegrams which might be forwarded by express or post. The accounting had been very considerably simplified, which would be productive of much economy in working. The question, however, of the greatest importance had been that of the unanimous resolution by the delegates of 42 nations to recommend to their Governments immediate legislation for compulsory wireless telegraphy on board all sea-going vessels, both passenger and cargo. The importance of this to their company, and to its affiliated companies, could not be overstated, for not only would it result in a very considerable impetus in telegraph stations on board ships, but it would also bring about a very large increase in the construction of coast stations and in the telegraphic receipts of both. Their new works at Chelmsford were now completed, and were capable of a very largely-increased production. The work they had in hand would keep them very fully occupied for a long time to come. After referring to the dividends announced in the report, he said that the interim dividend for 1912 was at the rate of double that which they paid this time last year, and he thought they were fully justified in hoping to maintain this ratio of increase in view of the fact that the amount of their orders in hand alone represented well over four times the figure at which they stood at this time last year. Both on his own behalf and on that of his co-directors, he would like to put on record their appreciation of the manner in which Mr. Godfrey Isaacs had placed his whole energies and time at the disposal of the company.

Mr. G. Isaacs, in seconding the resolution, thanked the chairman for his appreciative remarks, and said he had just received two messages from abroad, which the chairman had not yet heard of. One was from Portugal stating that the Portuguese Parliament had approved of a provisional contract which the company had entered into, and had ratified it with considerable extensions which they would require to deal with in the future with the company. The second was from their representative in Bolivia stating that the Bolivian Government had accepted the company's terms for the erection of some seven stations on conditions which were very satisfactory to the company. These two additional contracts would add very materially to the figures which the chairman had dealt with. He would only add that the successful results were largely due to the loyal and untiring support of their managers, secretary and staff.

Mr. MacLaren asked what would be the maximum speed of wireless telegraphy under favourable conditions.

The Chairman said in ordinary telegraphy the speed depended very much on the distance over which they were telegraphing, and with cables the speed went down very rapidly with distance. In wireless telegraphy distance did not come in as a factor for reducing speed, and if 100 words a minute could be done over a short distance it could also be done over a long one.

A lady shareholder asked when they might expect a dividend from the American company.

Mr. Isaacs said he was perfectly confident that in 12 months they would be able to pay a reasonable dividend.

The report was then adopted, as were also resolutions for the payment of dividends and the re-election of the retiring directors and auditors.

Mr. Isaacs proposed a resolution to the effect that the board should be enabled to take such sum as they thought desirable and distribute it by way of bonus to the staff, and also that they should be empowered to establish a pension fund for the benefit of the staff. He pointed out that many of their staff were constantly engaged in travelling for the company, and were often exposed to stays in unhealthy places, and it would be an encouragement to them to know that those dependent on them would be provided for, at all events to some extent if they themselves did not return.

The Chairman seconded the motion, which was carried with acclamation.

City and South London Railway Co.

The directors' report for the half-year ended June 30th, 1912, shows that the receipts from all sources amounted to £87,926, and the cost of working was £42,585, leaving a profit of £45,341. Inclusive of the balance brought forward, the net revenue account shows an aggregate total of £48,156. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £32,694. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks 1891, 1896, 1901 and 19[illegible] and that [illegible] at the rate of 1[illegible] per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving a balance of £2,194 to be carried forward, as against 1[illegible] per cent. per annum and £2,[illegible] carried forward at the corresponding period last year.

Half year.	Number of passengers [illegible]	Receipts (including [illegible])	Dividend per cent. per annum on ordinary stock.
Ended December, 1910	12,8[illegible]	8[illegible]	1
,, June, 1911	[illegible]	8[illegible]	1[illegible]
,, December, 1911	[illegible]	8[illegible]	1
,, June, 1912	[illegible]	81,[illegible]	1[illegible]
Total since the [illegible]	[illegible]	2,[illegible]	

The reduction in the dividend is to be attributed to the coal strike and consequent loss of traffic and increase in the price of fuel and to the keen competition of the omnibuses and tramways. It should be borne in mind that the receipts of the last three weeks of the half-year compare with those of last year in which the Coronation festivities and functions took place, when the traffic was exceptionally heavy and when other unusual receipts further augmented the revenue. The acceleration in the speed of the trains is being experimentally developed with the object of counteracting the surface competition referred to in the previous paragraph. The subway connecting the stations of the Metropolitan Railway and the Great Northern and City Railway with this company's own at Moorgate Street is rapidly approaching completion, and the directors are of opinion that it will be the means of increasing the traffic between the Metropolitan Railway and this company's system.

The meeting is to be held on July 23rd.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange has quite assumed its holiday appearance, and most of the markets give the usual summer account of themselves in having little business to report. The deplorable strike at the docks hangs over the Home markets as a cause of depression and flatness, accentuating the slump in Consols, the price of which makes a further descent almost every day.

In the Home Railway market the outstanding feature is again a big drop in Metropolitans. The price has fallen within the last three weeks from 65 to 54¼, and the whole of the decline is difficult to explain simply on the assumption that the "bull" account is unwieldy. There seems to be some mysterious cause of the flatness which has not yet transpired. Of course, looking at it from the investment point of view, the yield, even at current price, is nothing exciting, and full trustee securities can be bought to pay more interest on the money than "Mets." do, but hope, of course, hangs upon the anticipation of the Great Western or the Great Central, or one of the bigger lines, taking over the Metropolitan Company, and guaranteeing a much better dividend on the stock than it returns now. Districts have gone back a little, and City and South London shed 2½ upon further consideration of the dividend and the report. Central Londons, after their big fall, have steadied at the lower levels. The Liverpool Street extension will be opened on the 28th inst. There has been some demand for London, Tilbury and Southend stock, on the impression that if the Midland takes over the company it will at once set to work to electrify the system. East Londons slipped back to 7¾, in consequence of the dock trouble, but, on the other hand, Great Northern and City Preferred Ordinary pulled up ⅛, the buying being based on a vague expectation that the forthcoming report may have something to say on the point of the company being taken over by a more powerful tube.

London United Tramways issues are unchanged, but there is considerable inquiry for the shares of the Metropolitan Electric Tramways, upon which the price of the Ordinary improved 5s. 7½d. to $1\frac{5}{32}$, while business was done in the Deferred up to 5s. 3d., and the Preference gained $\frac{1}{16}$. There is some anticipation of a rearrangement of the company's capital account, wherein the Deferred might be paid out at a price to be settled. British Electric Tractions are also harder as regards the prior charge stocks. Underground Electrics were inclined to ease off, and the shilling "A" Ordinary shares, after changing hands as low as 12s. this week (which compares with the comparatively-recent highest of nearly 17s.), hardened to 13s. 3d.

The English electricity supply group is extremely steady, the chief firmness being noticeable in the quotations of the London companies. County of London Ordinary improved to 11⅜. Citys have risen to 19¼, a gain of £1. London Electric Ordinary are ⅛ up, and their are various other improvements which do not appear in the official prices. It was stated in the market the other day that there is a scheme on foot for binding together all the London companies, the arrangement to include also a number of the Borough Councils and other local authorities. The source of this rumour it is not difficult to guess, and the report is as interesting as at present we believe it to be premature. There is, of course, nothing particularly new in it. Efforts for several years past have been directed towards unifying in some way or another the various interests of companies and local bodies, the advantages of which are obvious enough. It is just as obvious that to bring about any such rapprochement between the many parties concerned would be a business requiring the utmost delicacy of handling, and one which bristles with innumerable difficulties. In time we have little doubt that some such scheme may be carried through, but at present it is, as we have remarked, decidedly premature.

Telegraphs and telephones are, on the whole, very steady, the features being marked improvements in the Anglo-American Telegraph trio. The Ordinary Stock at 66½ is ½ higher; the 6 per cent. Preferred at 112¼ has risen 1¼, and the Deferred at 25⅞ is ⅜ up. Here, again, unification is the word which spells improvement. A movement is being organised to convert these three classes into one, which seems to be the most sensible way of dealing with the matter. As all classes have a guarantee, there is little object in retaining the three different kinds of stock. In one stock there would be a better market than there is now in the three, and it should become a popular investment security, which the Deferred stock of the Anglo-American Company is hardly likely ever to do, for nothing will divest it of the old-time gambling flavour during the present generation. The Eastern group is quiet. and West India and Panama Ordinary have again given way, though to the extent of only $\frac{1}{16}$. Marconis, now quoted *ex* 4s. dividend, had a smart fall at the end of last week, the price being forced down at one time to 4¾, from which they jumped to 5⅝ again. Americans fell to 1½. and recovered to 1¾ bid. Canadians touched 1⅛, and then hardened to 24s. 6d., while even Spanish are better. National Telephone Deferred fell to 146, the progress of the arbitration revealing nothing of startling interest during the last few business days. The Third Preference at $6\frac{3}{16}$ are unchanged.

The directors of the La Plata Tramways issued a circular last Friday to their proprietors, saying that the defalcations, already mentioned. turned out to be £10,000, and that a judicial inquiry had been ordered. No doubt the board will see that the inquiry is made on searching lines, and that it covers a period of several years past. In the first place, the loss was expected by the board to be about £900, and now that the actual figure is 11 times as much, the directors are certain, one would suppose, to take the shareholders into the fullest confidence that is possible.

Amongst Latin-Canadians, one feature is a rise of 18 points, following upon last week's advance of 9, in Sao Paulo Trams. There has been a tip going round to buy these shares and Rio Trams, a further statement being issued in connection with the amalgamation of these two with the Sao Paulo Electric Company, the new concern to be called the Brazilian Traction, Light and Power Company, Ltd. Rio Trams have been moving like the mercury. Since this time last week the price dropped to 149, soared to 160, and, on balance, is 3¼ higher at 156½ *ex* dividend. On top of this deal have come rumours of a contemplated alliance between the Montreal Light, Heat and Power and the Shawinigan Water, with the result that the Common shares of the former rose 18½, while "Shaws." on the week are 14¼ to the good. Mexican issues are lower. except Monterey Fives, which are a point better. Bombay Electric Preference have gone ahead substantially, and Calcutta Preference hardened slightly, Calcutta Supply shares being ⅛ higher. Para Electric Ordinary are strong, with 5s. rise to their credit.

The General Electric Company has been making a new issue of Preference capital, and this had no effect upon the price of the existing shares. The company's 4 per cent. Debenture stock is marked up 7 points to 94½ middle. Electric Constructions are ⅛ higher, possibly as a result of the attention drawn to their cheapness in our last week's notes. The Brush Electrical Company, in its report, proposes to draft another reconstruction scheme with the object of wiping out the £235,700 deficit shown in the balance-sheet, and of raising more money for working capital. No changes have occurred in the quotations for the company's issues. Cromptons also report a loss on the year, although this is no more than £1,500 against £14,000 12 months ago. British Aluminium Debentures are still in considerable demand, and the stock, with a rise of 2½, is 5 points to the good on the fortnight.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 17th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¼d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£24 15	..
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£25 10	..
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3⅜d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7¼d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3⅜d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb	8d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9d.	¼d. dec.
c ,, Tube (brazed)	,,	11¼d.	¼d. dec.
c ,, ,, (solid drawn)	,,	9¼d.	¼d. dec.
c ,, Wire, basis	,,	9d.	¼d. dec.
c Copper Tubes (brazed)	,,	1/0¾d.	¼d. dec.
c ,, ,, (solid drawn)	,,	11¾d.	¼d. dec.
g ,, Bars (best selected)	per ton	£92	£2 dec.
g ,, Sheet	,,	£92	£2 dec.
g ,, Rod	,,	£92	£2 dec.
d ,, (Electrolytic) Bars	,,	£91 10s.	.
d ,, ,, Sheets	,,	£99 10	..
d ,, ,, Rods	,,	£88	..
d ,, ,, H.C. Wire	per lb.	10¼d.	
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/7	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	4/10¾	1¾d. inc.
j Iron Pig (Cleveland warrants)	per ton	57/-	2 11 inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 15s. to £19	.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 10	10s. inc.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£200 to £201	£8 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Brazilian Amalgamation.—The shareholders of the Sao Paulo Tramway, Light and Power Co., Ltd., Rio de Janeiro Tramway, &c., Co., and Sao Paulo Electric Co., Ltd., have all been notified by circular of the details of the scheme for the exchange of their shares for shares in the Brazilian Traction, Light and Power Co., Ltd., a company formed in Canada with a capital of $120,000,000 in 1,200,000 shares of $100 each.

Anglo-American Telegraph Co., Ltd.—The directors have resolved to declare an interim dividend for the quarter ending June 30th, 1912, of 15s. per cent. on the ordinary stock. and £1 10s. per cent. on the preferred stock, less income-tax, payable on August 1st. The dividend of 1½ per cent. to the "A" stockholders is not payable before the end of the year.

Belgium.—La Société Belge d'Electricité, Eclairage, et Force Motrice, is the name of a new company which has just been formed in Brussels, with a capital of £4,000.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 16th.	Rise + or Fall	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord.	10	5½	5½	9¾—10¼	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10½— 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8⅜— 8⅞	..	5 12 8
Do. 7 % Cum. Pref.	5	7	7	7⅞— 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½— 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4⅝	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾— 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅜— 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	7	8	18½— 20	+1	4 0 0
Do. 6 % Cum. Pref.	10	6	6	14½— 16½	..	3 12 9
Do. 5 % Deb.	Stock	5	5	118 —122	+1	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	5	6	11¼— 11⅝	+ ½	5 3 3
Do. 6 % Pref.	10	6	6	11½— 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	7/16— 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87 xd	..	5 3 6
Folkestone	5	6	6	4¾— 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	94 — 97	..	4 12 9
Hove	5	9	9	7½— 8	..	5 12 6

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 16th.	Rise + or Fall	Present Yield p.c. £ s. d.
	*					
Kensington & Knightsbridge, Ord	5	9	9	7½— 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 8
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82 xd	..	5 9 9
London Electric, Ord.	3	2	2½	1¾— 1⅞	+ ⅛	4 0 8
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3½— 4	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	85½ - 87½	+ ½	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	+2	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½— 5	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5¾— 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8¾	..	5 14 3
Do. 7 % Pref.	5	7	7	6¾— 7¾	..	4 15 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
Smithfield Markets, Ord.	5	Nil	2	1⅝— 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½	+ ⅛	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛— 1 5/32	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	5	..	¼— ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½— 3	..	8 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord.	5	10	10	8¼— 8¾	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5½	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 16th.	Rise + or Fall	Present Yield p.c. £ s. d.
Adelaide, 6 % Pref.	5	6	6	5⅜— 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7½— 7¾	+ ⅛	5 8 0
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	95½— 97½	+ ½	5 2 7
Canadian Gen. El. Com.	$100	7	7†	114 —119	− 2	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	13/16— 15/16	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	− ½	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½— 96½	..	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— ¼	..	Nil
Do. 6 % Pref.	1	6	6	19/32— 23/32	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1⅞— 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89½— 91½	..	5 3 3
Mexican Lt. & Power, Common	$100	4	4	94 — 97 xd	−3	4 2 6
Do. 7 % Cum. Pref.	$100	7	7	107 —110	−2	6 7 3
Do 5 % 1st Mort. Gold Bds.	..	5	5	100 —102	..	4 18 0

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 16th.	Rise + or Fall	Present Yield p.c. £ s. d.
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90 xd	−1	5 11 1
Montreal, Lt., H. and Power	$100	7	8	235 —245	+18½	3 5 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	155 —160	+14½	3 2 6
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½— 92½	..	5 8 1
Victoria Falls Power, Pref.	1	Nil	11⅞d.	⅞— 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½—107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 16th.	Rise + or Fall	Present Yield p.c. £ s. d.
Amazon Telegraph	10	Nil	4†	7¼— 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½— 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	147½—149½	..	5 7 0
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3¾	3	65½— 67½	+ ½	4 9 0
Do. 6 % Pref.	Do.	6	6	111¾—112¾	+1¼	5 6 6
Do. Def.	Do.	30/-	30/-	25⅜— 25⅞	+ ⅜	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½—104½	..	4 16 2
Chili Telephone	5	7	..	7½— 7¾ xd	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	..	4 15 3
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅜— 7⅝	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128 —131 xd	− ¾	5 6 10
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79 xd	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	98½—100½	− ½	3 19 7
Eastern Extension	10	7	5†	12⅝— 13⅛ xd	..	5 6 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	10¾— 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	12⅝— 13⅛	− ⅛	4 11 5
Great Northern Telegraph	10	18	18	27½— 28½	..	6 6 4
Indo-European Telegraph	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	+1½	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5 9/16— 5 11/16 xd	− 1/16	3 10 6
Do. 7 % Cum. Partic. Pref.	1	16	17	4 13/16— 5 1/16 xd	..	3 7 0

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations July 16th.	Rise + or Fall	Present Yield p.c. £ s. d.
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 3
National Telephone, Pref.	Stock	6	6	101½—104½	..	..
Do. Def.	Do.	6	6	145 —147	−2	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	6 3/16— 6 5/16	..	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99½—100½	+ ¼	4 9 7
Oriental Telep. and Elec.	1	8	8	1 21/32— 1 23/32	..	4 13 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16— 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	11¼— 11¾	..	3 8 0
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7½— 7¾	− ⅛	5 3 3
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 11 0
West Coast of America	2½	2½	2½	1 5/16— 1 9/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	½	2 3/16— 2 7/16	− 1/16	1 15 7
Do. 6 % Cum. 1st Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾— 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17 7
Western Telegraph, Ltd.	10	7	6†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

*** Unless otherwise stated, all shares are fully paid.** † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 16th.	Rise + or Fall —	Present Yield p.c.
		1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32 — 11/32	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 3 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum.Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 43	+1	..
Do. 5 % Perp. Deb. ..	100	5	5	95 — 99	+1	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	74 — 76	..	3 19 0
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def...	100	2	2	75 — 77	..	2 12 0
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1½	1⅝	33 — 34	—2½	4 15 6
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1903	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10¾ — 11¾	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1¼ — 2	+⅛	Nil
Hastings Trams, 6 % Pref. ..	5	Nil	6	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4⅞ — 5⅜	..	..
Do. 4 % Deb.	100	4	4	74 — 77	..	5 4 0

NAME.	Stock or Share.	Dividends for		Closing Quotations July 16th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅜	1⅞	54 — 54½	—3½	3 8 10
Do. Surplus Lands	100	2¾	2⅞	67 — 69	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89xd	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	86 — 88	..	3 18 8
Metropolitan District Ord. ..	100	Nil	..	37¾ — 38¼	— ¼	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3¼	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	6	1 3/32 — 1 7/32	+ 9/32	4 18 4
Do. Def...	1	Nil	..	3/16 — ¼	+ 1/16	Nil
Do. 5 % Pref.	1	5	5	⅞ — 31/32	+ 1/16	5 4 2
Do. 4½ % Deb...	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — ¾	..	6 13 4
Do. 4½ % Deb...	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	..	Nil
Do. "A"	1/-	..	..	⅝ — 11/16	— 1/32	..
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	1	1½†	88 — 90	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	78 — 82	..	5 9 9

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5 3/16 — 5 7/16	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 15/16 — 5 3/16	..	5 6 0
Do. 4 % Deb.	100	4	4	94½ — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	99½ —101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12¼	+ ¼	4 18 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	96½ — 98½	..	5 1 6
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	136 —141	..	5 13 6
Do. Pref. Ord.	100	6	6	118 —123	..	4 17 7
Do. 5 % Pref.	100	5	5	106 —109 xd	..	4 11 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105 xd	+2¼	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102½ —104½	..	4 6 2
Calcutta Trams, Ord.	5	6	7	6⅛ — 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	+ 1/16	4 17 7
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5 9/16 — 5 13/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103 xd	+ 1	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	+ 1	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½ xd	..	6 18 0

La Plata Elec. Trms, Ord. ..	1	..	..	½ — ¾	..	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb...	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	125 —127 xd	—1½	5 10 3
Do. Gen. Con. 5 % Bonds ..	..	5	5	100 —102	..	4 18 0
Do. 6 % Bonds	100	6	6	102½ —104½	+ ½	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7½ — 7⅝	+ ¼	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16 — 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	155 —158 xd	+3¼	3 3 3
Do. 1st Mort. 5 % Bonds ..	..	5	5	103¼ —104¼	— ¼	4 16 0
Do. 5 % Mort. Bonds ..	100	5	5	99¾ —100¾	+ ¼	4 19 3
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	265 —270	+18	3 14 1
Do. 5 % 1st Deb.	$500	5	5	106 —108	+1	4 12 7
Singapore Trams, 5 % Deb. ..	100	5	5	82½ — 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video ..	5	6	7	5⅜ — 5⅞	..	5 19 2
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½ —106½	..	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝ — ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3 1/16 — 3 5/16	— 1/16	..
Do. Pref.	1	6	6	1⅜ — 1⅝	..	4 0 0
British Aluminium, Ord. ..	1	..	..	9/16 — 13/16	..	..
Do. 6 % Cum. Pref.	1	..	..	⅝ — ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	+1	5 4 2
Do. Deb. Stk.	100	5	5	85 — 90	+2½	5 11 1
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	6¼ — 6¾	..	4 9 0
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	3	Nil	..	7/16 — 11/16	..	Nil
Do. Deb...	100	4	4	57 — 60	—1	6 13 4
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10½ — 11¼	..	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	98½ —100½	+ ½	4 9 6
Castner-Kellner	1	17½	20	3⅝ — 3¾	..	5 6 8
Do. Deb...	100	4½	4½	104 —108	..	4 10 7

Crompton & Co.	8	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	..	27/32 — 31/32	..	5 8
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16 — 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅝ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	⅞ — 1⅛	+ ⅛	6 13 4
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	92 — 97	+7	4 2 6
Henley's, Ord.	5	15	10†	11¾ — 12½	..	6 0 0
Do. Pref.	5	4½	4½	4 15/16 — 5 3/16	..	4 6 9
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	10	..	8¼ — 9¼	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction.. ..	12	20	10†	32½ — 34½ xd	..	6 16 6
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

A PECULIAR FRACTURE IN A SUBMARINE CABLE.

The submarine telegraph cable between Gutzlaff and Amoy, belonging to the Great Northern Telegraph Co. was, in May, 1909, partly removed from its old track to a new position nearer the coast in order to reduce its length.

Unfortunately, the new track turned out to be very bad, inasmuch as no fewer than 10 fractures occurred in the course of about six months, all between 46 and 49 miles from Gutzlaff, at a depth of about 13 fathoms. The armouring of the cable consisted of 10 No. 1 mild-steel wires with an outside serving of tarred jute. The cable, when picked up, was covered with a thick layer of mud and, while the serving was quite undamaged, the copper strand and more or less of the sheathing wires were broken without showing any notable elongation, the surfaces of the fractures being quite plane, exactly like those found in brittle substances.

During one of the repairs, a bend was found in the cable, and when the serving was removed, nine out of the ten sheathing wires were found broken. In another case a small piece of wire a few inches long dropped out from the sheathing when the serving was taken off.

A length of the cable near one of the fractures was cut out for test by the National Physical Laboratory at Teddington. Two wires from the cable were compared with two new ones of the same quality, all being turned down before the tests were taken.

The results are given in the following table :—

Tensile Tests.

—	From broken cable.		New wire.	
	A.	B.	A.	B.
Diameter in inches...	0·210	0·236	0·210	0·236
Elastic limit, tons per sq. in.... ...	11·68	11·95	11·10	11·03
Modulus of elasticity, lb. per sq. in. ...	30·3 × 10⁶	30·5 × 10⁶	30·3 × 10⁶	30·1 × 10⁶
Yield stress, tons per sq. in.	Broke at a crack outside gauge marks, the crack extending halfway through the specimen.	23·98	23·32	24·78
Maximum stress, tons per sq. in.... ...		30·53	30·46	30·66
Ratio $\frac{\text{Yield}}{\text{Maximum}}$ ...		0·79	0·77	0·81
Extension on 3 in. ...		*16·0 %	18·0 %	19·7 %

* Broke ⅜ in. from gauge mark.

By single-blow impact tests on notched specimens in the Izod machine, one sample from the broken cable absorbed 11·75 ft.-lb. at fracture. A second sample from the broken cable, however, only absorbed 7·65 ft.-lb., and showed a crystalline fracture.

The last-mentioned sample piece, as well as sample A, were nearest the fracture, and the National Physical Laboratory therefore concludes that the brittleness is only found there, and that the wire was of exactly the same quality as the new wire it was compared with.

The general micro-structure of both the old and the new wires was found to be very similar and quite normal for iron or very mild steel wires of this description. Quite close to the actual fracture, however, the wires showed a number of microscopic cracks whose presence readily accounts for the results of the two mechanical tests just described. The appearance of one of these cracks is illustrated in fig. 1, magnified 100 diameters.

The National Physical Laboratory points out that the cracks are of a very distinctive and typical kind, such as are always found in specimens of iron or mild steel which have been exposed to repeated alternations of stress up to, or nearly up to, the breaking point. These cracks are typical of the gradual failure of such material under fatigue or alternating stress.

The different tests appear to indicate that the wires in the cable were of the usual quality, and that the defects observed are in all probability the result of some mechanical action to which the material was subjected after the cable was laid. The fracture appears to have been caused by the material having been fatigued by many thousand bends or twistings, and, as all the wires were broken close to the same point, and the copper strand showed no signs of stretching, these bends or twistings must have been of a very local character.

The Great Northern Telegraph Co. have themselves tested several of the wires from the cable, and have obtained similar results to those of the National Physical Laboratory. The breaking strain was between 28 and 32 tons per sq. in., with an elongation between 15 and 20 per cent., and 11 to 17 twists in 6 in. Two of the wires broke like glass when hammered out with a wooden mallet on a wooden block, while the remaining pieces of the same wires were subjected to tensile tests without showing anything abnormal. On bending a piece of wire (one end of which was fastened in a vice), backwards and forwards at a very small angle, or, so to speak, shaking it for about 20 minutes, a fracture occurred with a plane surface quite similar to that in the cable.

According to a test carried out by the Government Laboratory at Copenhagen, the wire contained only 0·05 per cent. of phosphorus.

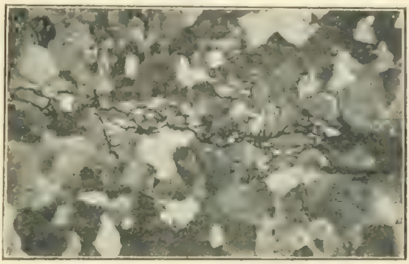


Fig. 1. Section of Wire. × 100.

All these tests, together with the fact that the cable has not been interrupted after being moved some few miles (eastward) in November, 1909, indicate that these curious fractures may have been caused by some outside circumstances.

The managing director of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Mr. Gray, thinks it is possible that the cable might have been laid too tightly in the locality where the breaks occurred, and as this was off the mouth of the Tsien Tang Kiang River, alterations in the flow may have been the cause of the vibrations which broke the cable. He also points out that there are numerous examples of breaks in cables off the mouths of rivers which have been difficult to explain satisfactorily. On a sloping beach gravitation must produce a slight slipping of the muddy bottom from shallow to deep water, and the friction of the flowing mud will eventually produce a heavy tensile strain on the cable. Mr. Gray mentions one case off Bombay where the copper conductor broke inside the cable while this was otherwise perfect, and another similar case close to Senegal.

Mr. Petley, of the Telegraph Construction and Maintenance Co., has had cases in the North Sea where cables buried in sand broke by a sudden jerk, showing fractures similar to those of the Gutzlaff-Amoy cable.

The Great Northern Telegraph Co. have themselves experienced a case in the North Sea somewhat analogous to those mentioned by Mr. Gray. During the picking-up of the cable, which was well buried in hard sand, and therefore exposed to heavy strain and violent vibrations, the telegraphic communication with the cable hut was suddenly interrupted, and on examination the core was found broken in two different places, although the sheathing (12 No. 3 wires) was not damaged in the least. The copper strand as well as the gutta-percha, which were quite sound, had the appearance of having been cut with a sharp knife.

Prof. E. Suenson (Royal Polytechnic College, Copenhagen), who has written the above article for the Danish technical paper, *Ingeniören*, thinks that, as repeated twistings generally produce a fracture with a screw surface, and as the fracture in this case had a plane surface, the breaks must have been caused by either stress or bending tensions. Such tensions might be due to the flood carrying the cable toward the coast and the ebb drawing it out again, but the number of these movements would be far too few in the short time the cable has been lying in this track to be of any consequence. If, on the other hand, the cable had been suspended between two submarine rocks, it is just feasible that the out-flowing mud could have acted on the cable in the same way as the violin bow acts on the string, by carrying it along until the strain grows so heavy that the cable springs back, when it would again be seized by the out-flowing mud, and so on. In this way the number of repeated tensions would be considerable in the course of a short time; but Prof. Suenson thinks that even this would not account for the fractures in this instance.

NOTES ON VACUUM CLEANERS.

[COMMUNICATED.]

The danger of dust as a harbour and vehicle of transit for bacteria, and hence as a factor in the spread of disease and the contamination of food, cannot be exaggerated. Ordinary methods of dusting and sweeping merely displace dust and dirt into the folds of a textile material or into more or less open receptacles. The mechanical forces exerted in the operation "raise" a considerable percentage of the fine dust particles, which "settle" again after floating for a time, and of the remainder, some is pressed into the pores and interstices of the material on which it lies.

The general principle of vacuum cleaning is well known —a reduced pressure is created at the mouth of a nozzle (the cleaning "tool"), and the strong current of inrushing air thus created carries with it all the loose dust and dirt present in its path and deposits this in settling and filter chambers, or discharges it, mixed with water to a sludge, into the sewerage system.

Apart from the hygienic merits of the vacuum process, there is a great saving in the labour of house cleaning; spots are accessible to suction which can be reached by no other means, and dirt is *lifted* instead of being pushed down and along. A little practice enables the various cleaning tools to be used correctly, expeditiously and with a minimum of changes. The uses to which vacuum plant can be applied include all domestic dirt-removing processes, hair drying, &c., and the economical shifting of large quantities of grain, sand, ashes, and so forth.

The desiderata of vacuum cleaners include suitability for, and rapid and thorough action on, all classes of work to be dealt with. There are two distinct actions to be provided, viz., "sweeping" and "cleaning." Surface dirt requires for its removal a sweeping action caused by the displacement of large volumes of air at high speed and low vacuum, and this case is excellently met by centrifugal exhaust fans. True "cleaning" action—the removal of dirt more or less entangled in and below fabrics—requires a much greater working vacuum, and for this purpose diaphragm pumps are superior to centrifugal fans. Large pieces of string and paper are lifted with comparative ease, but in the removal of such light but clinging materials as lengths of cotton thread, ordinary brush sweepers (such as the Bissel machine) are better than any vacuum cleaner; the tremendous draught required for their removal by suction naturally damages the nap of carpets and other fabrics.

Portable v. Stationary Cleaners.—Portable cleaners are very tempting for ordinary domestic work, but it is difficult, if not impossible, to provide sufficient mechanical strength to cover the conditions of everyday unskilled usage and sufficient power to allow of all classes of cleaning while keeping the weight of the apparatus within such limits that it is really portable and so light as not to damage carpets, polished flooring and so on. The weight of "portable" sets of really satisfactory power, strength and efficiency rises to 0·5-0·75 cwt.

For reliability, satisfactory operation and low running costs, a stationary pumping plant should be installed and connected by permanent piping to nozzles, in rooms and corridors, to which flexible hosing and cleaning tools are connected in the ordinary way. Such installations are naturally more costly than portable cleaners, but the additional outlay is not commensurate with the more satisfactory operation secured. At present, an equipment which is very cheap in first cost is likely to prove very costly in repairs, while affording poor cleaning.

Types of Pumps.—The nature of the work makes it very desirable to avoid valves in the exhauster, and, for this reason, centrifugal fans or multi-stage turbines are mostly employed. A simple centrifugal pump will not, however, provide a sufficiently high vacuum to accomplish thorough *cleaning*, though the characteristics of the fan are admirably suited to sweeping operations. If the intake becomes almost or wholly closed (by close pressing of the tool on its work), a pump exhauster continues to maintain a vacuum of 7 in. to 10 in. of mercury, and does not overload the driving motor. On the other hand, a rotary blower produces a much higher vacuum and seriously overloads the motor. Rotary pumps produce negligible vibration, and special foundations are unnecessary, but reciprocating pumps require a heavy fly-wheel to avoid excessive speed variation, and vibration is usually troublesome (the reciprocating masses forming a high percentage of the total weight).

Typical vacuum-displacement curves for portable cleaning sets are shown in fig. 1; curve A applies to reciprocating pumps and curve B to centrifugal pumps. It is clearly advantageous to work on the steep part of the curve in the former case, the displacement then varying little over a wide range of vacuum.

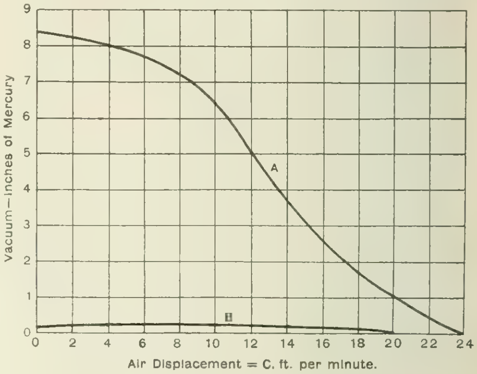


FIG. 1.—PERFORMANCE OF AIR PUMPS.

Driving Motors.—A few vacuum cleaners are built for hand operation, but it is unlikely that these will ever become very popular. The labour entailed in carpet sweeping is, if not greater, at least more apparent than when using ordinary rotary-brush sweepers, and, in cleaning bookshelves, cornices and the like, it is very desirable to have both hands free for the manipulation of the cleaning tool and for steadying oneself. Finally, the cost of hand-operated cleaners is not sufficiently less than that of electrically-driven sets, to compensate for the above disadvantages. Hand operation of really large cleaners is out of the question.

In factories and the like, it may be convenient to drive the vacuum pump by belting from a main—or counter—shaft, but usually it is preferable to employ an independent, direct-coupled motor. Wherever possible a D.C. shunt machine should be employed, but, in case of necessity, a three-phase induction motor (with slip-rings if over 1 or 2 H.P.), or a single-phase repulsion motor may satisfactorily be employed.

In many small portable cleaners, an alarming temperature rise is allowed in the motor. This is very likely to lead to ultimate trouble, and the purchaser of such a set should insist on a good life guarantee.

Little latitude is available in the disposition of the driving motor in run-about portable cleaners; gearing should be rigorously eschewed. Where space is limited a vertical-shaft motor should be directly coupled to a vertical-shaft rotary pump, but if over 5 H.P. is required, it is generally preferable to use a horizontal set. A minor but appreciable advantage of the vertical disposition is that the pump rotor is "floated" by the air passing and the load on the footstep bearing is thus considerably reduced.

Cleaning sets for house-to-house use or for use away from an electric power supply may conveniently and economically be driven by petrol or oil engines.

Vacuum ; Air Displacement ; Horse-Power.—"Sweeping" operations require very low vacua, the cleaning nozzle being held slightly above the surface cleaned and thus practically in free air. For rug cleaning, a vacuum not less than 2 in. to 3 in. of mercury is necessary ; a 1-in. vacuum gives very poor results, but too high a vacuum (*e.g.*, 5 in.-10 in. mercury), leads to injury of the "pile" and soon produces a threadbare appearance by removing the nap. The cleaning of very light fabrics (such as lace curtains) amounts to a "sweeping" operation.

A nozzle vacuum of 1 in. mercury produces an air velocity of about 1,000 ft. per minute, and of 3 in. about 2,600 ft. per minute. The volumetric air displacement required in the pump obviously depends on the area of the nozzle opening, on the vacuum required and on the number of nozzles in simultaneous use. With a single $\frac{3}{4}$-in. diameter nozzle in free air (sweeping), a portable cleaner should displace 1,200-1,800 cb. ft. per hour, and a stationary cleaner some 2,000-2,500 cb. ft. per hour. Corresponding figures when "cleaning" at 3 in. (mercury) vacuum are 700-1,000 cb. ft. and 2,000 cb. ft. per hour. With free-air suction and discharge, a 1-H.P. stationary central pumping plant should displace 2,000-2,500 cb. ft. per hour, and a 10-H.P. plant 9,000-10,000 cb. ft. per hour.

Small centrifugal portable cleaners consume from to 100-300 watts, and the largest portable sets require 700-1,000 watts. Central stationary suction plant is designed on a more liberal scale, and from 1 to 2 H.P. is allowed for working one hose at a time, 10 H.P. for four points, 50 H.P. for 20 points, and 100 H.P. for 40 points. The largest stationary cleaning equipments yet built are the 120-H.P. "Otovacum" turbine exhausters for operating 50-70 cleaning sets at one time.

Costs and Weights.—Hand-operated portable cleaners are available which weigh from 10 to 15 lb., and cost from £2 to £7 each (including the smallest possible set of accessories). The lightest motor-driven portable cleaners weigh from 10 to 15 lb., and cost £10-£12 complete with the usual accessories. Larger and more powerful portable cleaners, mounted on trolley trucks and suitable for cleaning carriages, &c., weigh from 300 lb. complete (1 H.P.) to 1,800 lb. (7 to 10 H.P.). The stationary "Vortex" equipment weighs from 300 lb. net in the 1-H.P. size to 1,300 lb. in the 7·5 to 9·5-H.P. size, the overall space occupied (including motor, pump and tanks), ranging from 12 cb. ft. to 50 cb. ft., and the cost, excluding accessories, from £50 to £250.

A portable cleaner costing £12, and consuming 200 watts, is not to be compared in efficiency and overall running cost with a 1-H.P. stationary plant costing £30 net (to which must be added the comparatively small cost of the necessary permanent piping about the building).

Hosing and Piping.—A 1·25-in. rubber hosing is suitable for ordinary domestic use, and should be reinforced by a spiral steel wire armouring ; the diameter should be increased to 2 in. where a long length (say, over 30 ft.) of hosing is to be used at one cleaning point, or where large quantities of dirt are to be handled. Flexible steel hosing should be used for hot ashes or similar materials.

Too much care cannot be devoted to the permanent piping in a central suction installation. Gas or steam piping with a smooth internal bore of not less 1·5 in. to 2·0 in. diameter should be employed, and easy changes of direction should be employed in its erection. Sharp elbows must never be employed ; where the desired deflection cannot be obtained by varying the set of the pipe, bends of large radius must be used. Crevices or other lodging points for dust must be avoided at joints, and special care must be taken in the arrangement of cross-connections that dirt cannot be carried by its inertia into an opposite cross-pipe (thus blocking the latter), instead of being drawn down the main pipe. The diameter of the various sections of the piping should increase as the central suction plant is approached.

It is not generally realised how great is the air friction in piping ; much of the power lost in overcoming this resistance may be avoided (and the useful capacity of a given pump correspondingly increased) by liberality in the matter of pipe diameter, and by avoiding bends, constrictions and obstructions.

Connections between flexible hosing and wall nozzles in the permanent piping should be by bayonet or other easily fitted locking catches and conical seatings. A spring shield should be provided to cover each connecting nozzle when not in use ; in case of emergency, the latter, or any other opening or leakage, can be temporarily sealed by a sheet of tough paper of suitable size and thickness.

Cleaning Tools Required.—It is impossible to meet the many conditions of house cleaning by the use of a single suction nozzle or tool. For flat, wide surfaces, a rectangular nozzle 10 in. to 12 in. wide (fig. 2A for carpets, &c.), or 15 in. to 24 in. wide (fig. 2B for bare floors, walls, &c.), should be employed ; in the latter case, the nozzle should be surrounded by felt (for floors), or good bristle-brush bristles, (for wall paper). A narrower (say 5 in.) rectangular tool is suitable for furniture upholstery, and a round or short rectangular brush nozzle (fig. 2C) is convenient for miscellaneous upholstery and small work. A suction hand brush 6 in.—8 in. long is shown in fig. 2D ; a 90° cornice brush in fig. 2E ; and a rubber "tufting" nozzle in fig. 2F.

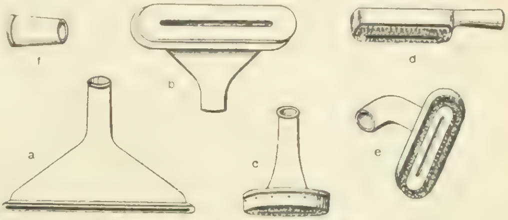


FIG. 2.—VACUUM-CLEANING TOOLS.

The width of the suction opening in rectangular tools varies from $\frac{1}{8}$ in. to $\frac{3}{8}$ in., the area of the opening ranging from 0·5 to 2·0 sq. in., according to the size of the cleaner. In the best cleaning equipments, provision is made for regulating the vacuum at the nozzle by simple valve gear in the guiding handle ; the latter is of tubing, built up to any reasonable length from bayonet-jointed sections.

In several types of portable cleaner, it is possible to disconnect the pump discharge from the collecting bag or tank and couple it to a length of flexible hose terminating in an appropriate blowing tool (usually with a simple rectangular slit, and often with the addition of a brush). The intake of the cleaner being in free air, a jet of clean air is blown from the nozzle and is very useful in cleaning books, dynamo windings, pianos, and so on. Of course, the dust displaced is now *raised* and must be collected by suction after it has settled on the surroundings.

Disposal of Refuse.—It is an important advantage of vacuum-cleaning plant that the dirt is entirely removed from the locality of its collection. In portable cleaners, a dust bag and filter forms a light and satisfactory equipment, the filtered exhaust being discharged into the surrounding air (often at quite a high temperature, owing to heating by the motor windings).

It is necessary in all but the cheapest equipments to provide for the centrifugal separation (usually by a single sharp bend) of large pieces of paper and string in "intercepting" tanks placed immediately before the suction pump, and preferably also between the various room nozzles and the main piping ystem. Dust which is not deposited in these chambers may afely pass through the rotary suction pump (providing the airways of the latter are made large, smooth and simple) and either be (1) mixed to a sludge with water, as in the Siemens "Vortex" system, or (2) arrested by filter screens, or (3) deposited in a centrifugal separator, the foul air being discharged to a sewer or chimney, as in the "Otovacum" system.

Intercepting chambers require emptying at intervals, depending on the class of cleaning performed, and dust bags and tanks require emptying daily or more frequently, according to their capacity. There is no doubt that the Vortex sludging system, as arranged for automatic water supply (at the rate of about 1 gallon per 1,000 cb. ft. of air per hour) and sewer discharge is the most convenient and hygienic for stationary and large portable equipments. For small portable cleaners a dust-bag collector is lighter and more convenient.

PROCEEDINGS IN AN ARBITRATION.

[By a Legal Contributor.]

The electrical engineer who is called upon to act as arbitrator finds himself in a new atmosphere. Although he has frequent occasion to use the judicial faculty in the course of his professional duties, when he sits as arbitrator he must be a judge in the strict sense of the term. Excluding any element of personal bias, which the parties have been careful to eliminate by the judicious selection of the arbitrator, it is manifest that other causes may be at work to prevent a man from hearing and determining according to the evidence. He may rely too much on a preconceived opinion, or he may decide the case before him in accordance with some obsolete or fanciful theory of his own. The question at issue may be: Has the contractor installed an efficient plant? That is a question to be decided after both sides have been fully heard. While an arbitrator should not allow his mind to be warped by mere prejudice against any particular method of construction or design which was not shared by the witnesses called before him, he may rely upon his own skill and judgment to some extent. In the circumstances a few notes relating to the duties of an arbitrator may be found useful.

Broadly speaking, it may be stated that the proceedings before an arbitrator are similar to those in a court of justice. The arbitrator appoints the time and places of meeting and adjournment, but they must be reasonable and notice must be given to both parties, or the award will be void. It is usual, of course, to consult both parties before fixing the time and place.

In the conduct of the proceedings, an arbitrator should be guided by the principles of fair-play, which will lead him to decide the case impartially. Thus, he should not hear one party in the absence of the other, nor should he exclude the witnesses of one party from the room where he is sitting, unless those on the other side are also excluded. Failure to observe principles such as these may have serious results. Thus, an award may be set aside:—

1. If the arbitrator hears one party and refuses to hear the other.
2. If the arbitrator holds private communication with one of the parties on the subject matter of the reference.
3. Where the arbitrator, unless justifiably proceeding *ex parte*, examines one of the parties or the witnesses on one side in the absence of the other party; or receives information from the one party in the absence of the other.
4. Where the arbitrator examines witnesses in the absence of both parties.

In any of the above cases the award runs grave risks of being set aside, notwithstanding that the arbitrator may swear that the evidence thus received had no effect upon his award. The arbitrator, in his capacity as judge, is bound to hear and determine, and must not determine until he has given a fair and patient hearing to both sides. He should bear in mind the precept of Marcus Aurelius, who wrote: "To be patient is a branch of justice."

To the rule that the arbitrator must not hear one party in the absence of the other there is an obvious exception, namely, that if one of the parties is deliberately keeping out of the way, or keeping back his evidence to delay the reference, the arbitrator may proceed *ex parte*. The arbitrator should endeavour to suit the convenience of the parties in arranging for times for the hearing. If counsel are employed, their convenience is usually met in fixing the time and place of the hearing, which may, of course, last for several days. It will often be desirable with a view to accommodating the legal gentlemen employed to fix the hearing at 4 o'clock, and to sit on Saturday afternoon, or at other times when the Courts are not sitting.

An arbitrator should refrain from accepting the hospitality of one party, lest the invitation may be given with the intent, or have the effect, of inducing him to act unfairly. It has, however, been decided that for an arbitrator to lunch or to dine with one of the parties in the absence of the other is not of itself sufficient to invalidate an award. The practice, however, is undesirable, and should be avoided.

The evidence which may be adduced before an arbitrator is to all intents and purposes the same as the evidence which will be received in a court of justice. The arbitrator is the judge of the admissibility of evidence so far as the competency of the witnesses is concerned, and if he receives evidence which is not admissible the party aggrieved has no remedy unless, indeed, he make an application to the Court before the award is issued. For the Court has power to revoke the arbitrator's authority if he admit improper evidence or refuse to admit evidence which is legally admissible. For instance, hearsay evidence is inadmissible in a court of justice, except under very special circumstances.

A valid award must extend to all the matters which are submitted, and if the arbitrator refuse to hear the evidence or to decide a particular point, the party aggrieved may go to the Court and say, "All the matters in issue have not been decided, and I therefore claim to have the proceedings set aside."

The principal statutes providing for the reference of disputes to arbitration allow witnesses to be examined on oath. In general, evidence should be so taken unless both parties dispense with it. Where the agreement to refer requires the evidence to be on oath, the arbitrator may not dispense with this formality without the consent, express or implied, of the parties. Where the submission requires the witnesses to be examined on oath the arbitrator cannot receive evidence on affidavit, as the witnesses must be examined *viva voce*.

The reason for this rule will be apparent when it is remembered that the evidence of nearly every witness is valueless unless he is subjected to cross-examination. If he makes a statement in an affidavit, or in answer to questions on behalf of the party by whom he is called, he may quite unintentionally omit to mention many facts which are material.

An arbitrator may consult men of science in every department where it becomes necessary, and although he may not agree beforehand to be bound by whatever opinion another may give, as that would be a delegation of his authority, he may submit a question to another person of skill or science, and adopt the opinion given thereto as his own. This power to consult may often prove serviceable to an arbitrator who may have to decide upon questions with which he is not familiar. It is also important for the lay (as distinct from the legal arbitrator) to know that he may consult a solicitor or counsel as to the admissibility of evidence, or as to the framing of his award, or he may take counsel's opinion on a point of law. He should not, however, employ a solicitor of either party as his legal adviser.

MESSRS. R. WAYGOOD & CO.'S NEW WORKS.

On Tuesday the new works of Messrs. R. Waygood & Co., Ltd., in Falmouth Road, London, S.E., were formally opened by the Mayor of Southwark. The new building forms an extension of one of their existing shops, in which it is intended to concentrate the whole of the construction and fitting of the electrically-driven apparatus for which the firm is justly famed; the department has a clear ground floor area of 15,500 sq. ft., with first and second floor galleries of 11,000 sq. ft., and a basement of 6,000 sq. ft. The cubic content of the shop amounts to 750,000 cb. ft., and in view of the large dimensions, special attention has been given to the design and construction of the building, which is fire-resisting throughout, with staircases both inside and out. Special heating and ventilating arrangements have been provided, and the shop is of course electrically driven throughout, with power from the Southwark Electricity Works; for this purpose four 50-H.P. motors made by Messrs. Vickers, Ltd., have been installed in motor rooms in the basement, and drive line shafts in trenches, with supplementary shafts overhead. A 5-ton electric crane serves the space between the galleries, and electric cranes are also fitted in two of the side bays. A "Waygood Standard" electric lift is provided at one end of the building, for goods and passengers, and the other end is served by a new patent "Electroil" lift which the firm has recently introduced. The total capacity of the buildings occupied by the company now amounts to 1,700,000 cb. ft.

The business was founded by Mr. Richard Waygood early in the last century, and the manufacture of lifts was begun in 1865, manual power being then employed. The introduction of hydraulic power gave a great impetus to the use of passenger lifts, and was quickly followed by the application of electricity to this purpose.

The first electric lift made by the company was exhibited at the Crystal Palace in 1890; since then over 10,000 electric and hydraulic lifts have been installed by Messrs. Waygood, many of them being of the automatic type, of which the firm makes a special feature. The present output is over 1,000 lifts and cranes per annum, and the company has over 1,000 employés. In the course of the opening ceremony silver cups, each containing a £10 note, were presented to two employés who had been in the service of the company for 58 years. Mr. H. C. Walker, chairman of the directors, has himself been with the firm for 47 years, and the sales manager, Mr. H. Harmsworth, for 30 years. The most kindly relations obtain between the firm and their employés.

PROCEEDINGS OF INSTITUTIONS.

Air Resistance to Trains in Tube Tunnels.

In a paper read before the American Society of Civil Engineers on May 15th, Mr. J. V. Davies describes the results of investigations he has made into the subject above-named, in connection with the Hudson and Manhattan Railroad tunnels, including tests in the open on the Pennsylvania Railroad.

The tunnels are lined respectively with concrete and iron segments, the former being 14 ft. wide and the latter 15 ft. 3 in. in diameter inside the lining-plate flanges. The net internal area of the concrete tunnel is 166 sq. ft., and that of the iron tunnel 160 sq. ft.

For trains in the open, at speeds up to 32 m.p.h., the total resistance due to the air was found to correspond with that given by the following formula:—

$P = 0{\cdot}0672\,D\,A\,V^2(1{\cdot}772 - 0{\cdot}0382\,V)$, and for speeds above 32 m.p.h.—

$P = 0{\cdot}0672\,D\,A\,V^2(0{\cdot}0182\,V - 0{\cdot}03)$, where

P is the total air resistance in pounds,

V the train speed in miles per hour,

D the weight of the air in pounds per cubic foot, and

A the cross-sectional area of the car in sq. ft.

The cars were flat-ended. All other resistances, when running on straight level track, were given by the formula:—

$$p = 4 + 0{\cdot}1\,V,$$

where p is the resistance in pounds per ton.

The air resistance in tunnels is divided into two components: that due to "impact" of the train on the air, and that due to the "static" friction of the displaced air on the walls of the tunnel.

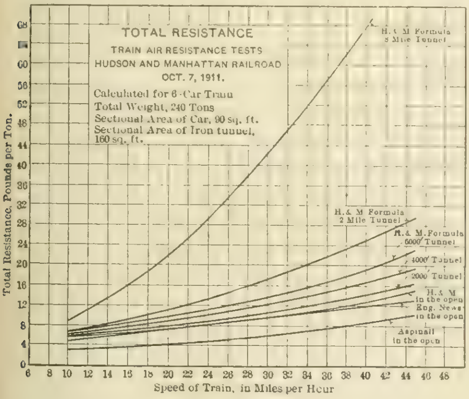


Fig. 1.

The "impact" resistance is independent of the length of the tunnel; its value was found to be given for iron tunnels by:—

$$P = 0{\cdot}0761\,V^2(12{\cdot}75 - 0{\cdot}1809\,V),$$

where P is the total resistance in pounds, between 18 and 28 m.p.h. (probably correct from 15 to 40 m.p.h.).

The "static" resistance was given by:—

$$P = 0{\cdot}000205\,L\,V^2$$

where L is the length of tunnel between train and air outlet, in ft. In the tunnels in which the tests were made the greatest values of L were 4,000 ft. (concrete lined) and 6,600 ft. (iron lined). The total air resistance was the sum of the two components given above, to which must be added the miscellaneous tractive resistances given by $p = 4 + 0{\cdot}1\,V$ (pounds per ton).

In the case of concrete-lined tunnels the formulæ were respectively $P = 0{\cdot}0745\,V^2(12{\cdot}75 - 0{\cdot}1809\,V)$ and $P = 0{\cdot}000016\,L\,V^2$.

Various curves of total resistance to trains are plotted in fig. 1. The discrepancy between the curve given by Mr. J. A. F. Aspinall and that obtained on the Hudson and Manhattan Railroad may be due to the difference in type of rolling stock.

In the case of an iron tunnel 2 miles long between air exits, at 5 m.p.h., the total resistance is 30 lb. per ton, and with a six-car train weighing 240 tons, allowing for a loss of 25 per cent. in transmission, the electric horse-power required would be 1,200 h.p.

In the Simplon Tunnel a locomotive weighed 62 tons, and was rated at 900 to 2,300 h.p.; it was found that the power required to haul a train at 43·5 m.p.h. through the tunnel was 400 h.p. greater than that required in the open.

To reduce this great resistance in tunnels, the author considers five possible methods. Of these, the use of blowing and exhausting engines at the ends of the tunnel would be costly, but the size and cost of car motors would be reduced, and in some instances the saving would balance the cost of installation. If more than one train is in the tunnel at once, the resistance per train will be reduced. The use of a wind shield on the leading car would save about 25 per cent. of the power as compared with a flat front in the open, and this would be a very important economy; in some cases it might be absolutely essential. The ventilation of the tunnel, however, would be adversely affected. Probably at least 20 per cent. of the power would be saved by lining the segments of an iron tunnel with concrete, so as to present a smooth surface, but the cost would be too great. Increase in the diameter of the tunnel (in new construction) would be far more costly than the saving effected.

The Shape of Scales Required for Reflecting Instruments with Concave Mirrors.

By E. H. Rayner, M.A

(*Abstract of paper read before the* Optical Convention. *June*, 1912.)

The accuracy of reading certain types of deflecting instruments, which operate without any static friction, can be greatly improved by observing their deflections by the reflection of a beam of light from a concave mirror having a radius of curvature of several feet When the angular deflection is large, the shape of the scale for such an instrument is somewhat similar to a cardioid, varying according to the relative values of the radius of curvature of the mirror and the distance of the source.

A special case is discussed when the curve approximates (over a large arc) exceedingly closely to a circle of definite radius. In general the radius of a similar circle may be calculated, which will approximate sufficiently accurately to the true curve.

The experience which emphasised the importance of the subject dealt with in this paper has been gained by the arrangements adopted at the National Physical Laboratory for the precision apparatus for alternating-current measurements. These have to be of the deflecting type, and to enable readings to be made to an accuracy of one or two parts in ten thousand, it is necessary to have a scale length of some 20 ft. or more, the instrument being at about 10 ft. from the centre of the scale.

Of the instruments in use the two most important are a Kelvin electrostatic voltmeter of the single-quadrant type, and a specially designed quadrant electrometer used as a standard wattmeter. Of these the voltmeter has much the larger torque, and has oil damping; and it is interesting to note, as the result of several years' experience of this type of instrument, that there has never been any tendency to "sticktion," provided the oil surface be kept dust free; full advantage is obtained of the magnification 50-fold above that for which the instrument was intended. The other instrument is specially designed with sufficient air friction to bring it to rest in the most suitable time.

A concave mirror is employed, and a real image of an artificial source of light is projected on to a translucent or opaque white scale, on which suitable marks are drawn. A Nernst lamp and a condensing lens with a fine vertical wire in front of it form a suitable source of light, producing on the scale a circular bright spot with a fine line across the vertical diameter.

The paper deals with the shape of the scale required in order to have the vertical wire always sharply in focus, while the concave mirror rotates about a vertical axis. If the angular deflection be only a few degrees, a straight scale is commonly used; but it becomes unsatisfactory if the deflection is considerable. Neither does a circular scale with the mirror at the centre sufficiently approximate to the proper curve for instruments reading by a reflected ray of light whose working deflection may reach 120°.

From the diagram given (page 116) it will be seen that the scale has to approach continually the mirror as the angle of incidence increases, and that for deflections of 90° from the incident ray the distance may be reduced to one-half.

Nomenclature.

u = distance from object to mirror.

r_o = distance from mirror to scale when the angle of incidence in a horizontal plane is zero. The angle in a vertical plane is assumed to be zero. In practice it should be kept as small as convenient; r_o is measured along the axis of symmetry of the curve and intersects the scale at its "centre."

r_θ = distance from mirror to scale when the reflected beam makes an angle θ with the incident beam. The angle of incidence = $\theta/2$.

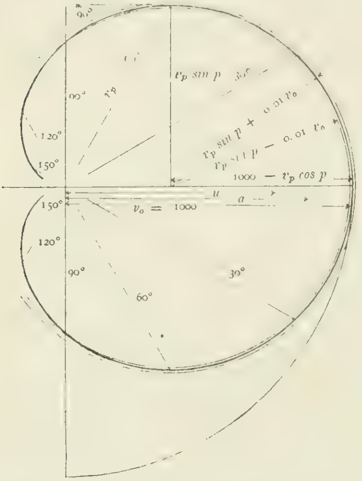
m = magnification = r_o/u.

a = radius of curvature of the mirror.

Then $\dfrac{1}{r_\theta} + \dfrac{1}{u} = \dfrac{2}{a\cos\theta/2}$, which, when $\theta = 0$, reduces to the ordinary equation of the concave mirror.

If any convenient value, r_o, has been chosen for the distance between the instrument and "centre" of the scale, the value of u

can at once be calculated when the curvature of the mirror is known; and, therefore, also the value of v_θ from point to point along the scale. For any permanent installation, this is worth doing, drawing out the curve full size and bending the scale to it. For ordinary purposes, however, a circle may be drawn which will agree sufficiently accurately with the proper curve. The radius of this circle may be taken as the perpendicular to the axis of symmetry from the point where the curve is parallel to that axis, the centre of the circle being on the axis of symmetry at a distance from the intersection of the scale and the axis equal to the above radius. For about 60° on each side of the axis of symmetry, a circle so drawn will lie within or without the true curve according as the magnification is less or greater than about 1·37. When, however, the curve is parallel to the axis of symmetry at the point where $\theta = 60°$, the coincidence between the circle so drawn and the true curve is exceedingly close. In this case, the perpendicular to the axis of symmetry, from the point where the curve is parallel to that axis, is exactly equal to the distance from the foot of the perpendicular to the point where the axis of symmetry cuts the scale at right angles. We thus have the circle touching the true curve at $\theta = 0$, and also at two points on each side, where $\theta = 60°$; and intermediately the two curves do not diverge from one another by 2 parts in 1,000.



Magnification = 1·3660; $v_o = 1,000$; $u = 732·0$; $a = 845·3$; $p = 60°$; $1,000 - r_p \cos p = 634·0$; $v_p . \sin p = 634·0$.

Fig. 1.

Throughout the paper, the distance r_0 between the scale ($\theta = 0$) and the mirror has been taken as 1,000. In this special case u, the distance between source and mirror, is $1,000\,(\sqrt{3} - 1) = 732·05$ and $a = 1,000 \times \frac{2}{3}\,(3 - \sqrt{3}) = 845·298$.

$$\text{The magnification } v_o/u = \frac{3}{2\,(3 - \sqrt{3})} = 1·36603.$$

Fig. 1 gives the curve for this case, and the agreement with a circle drawn as described is so near that it is quite impossible to distinguish between them for about 70° on each side of the axis of symmetry, except when drawn on a very large scale. Two other circles have been drawn instead, one longer by 1 per cent. of v_o and the other shorter by the same amount, to show how close the coincidence is. It is, therefore, desirable to choose, if convenient, the values for v_o, u and a in the ratio of 1,000, 732 and 845, as described above, using a radius of 634 for the curvature of the scale.

m.	0	1·0	1·36603	1·6	1·8	2·0
r_0	1,000	1,000	1,000	1,000	1,000	1,000
u	∞	1,000	732·05	625	555·5	500
a	2,000	1,000	845·30	769·2	714·3	666·6
θ	r_θ	r_θ	r_θ	r_θ	r_θ	r_θ
0	1,000·0	1,000·0	1,000·0	1,000·0	1,000·0	1,000·0
10	996·2	992·5	991·1	990·2	989·4	988·7
20	984·8	970·1	964·8	961·4	958·6	955·8
30	965·9	934·1	922·9	916·0	910·1	904·2
40	939·7	886·2	868·1	857·0	847·7	838·5
50	906·3	828·6	805·3	788·1	775·5	763·2
60	866·0	764·3	732·1	713·1	698·2	683·0
70	819·2	693·7	656·9	635·3	618·0	601·5
80	766·0	620·8	580·5	557·4	539·0	521·9
90	707·1	547·2	505·0	481·5	463·0	445·9
p	70° 31·7′	62° 11·6′	60° 0′	58° 44·8′	57° 45·2′	56° 49·2′
r_p	816·5	748·7	732·1	722·7	715·5	708·8
$r_p \sin p$	769·8	662·3	634·0	617·8	605·2	593·3
$1,000 - r_p \cos p$	727·8	650·7	634·0	625·4	618·2	612·2

The angle at which the curve is parallel to the axis of symmetry being p, at a distance r_p from the mirror, $r_p \sin p$ is the perpendicular distance to the axis of symmetry from the point of the curve; and $r_o - r_p \cos p$ is the distance from the centre of the scale to this point. As mentioned above, these are equal when $p = 60°$, and the difference between them increases as p diverges from 60°.

As the mirrors commonly used are small compared with their distance from the source and image, the "depth of focus" is considerable, and it will generally be found quite sufficient to use a circular scale of radius $r_p \sin p$ which will be satisfactory over about 70° on each side of the axis of symmetry. The difference between $r_p \sin p$ and $1,000 - r_p \cos p$ will give an indication of the divergence of the circle from the true curve. If a less angle than 70° on each side of the axis of symmetry be sufficient, a slightly different circle will fit the curve somewhat better.

It is generally essential to enclose instruments completely to avoid entrance of dust and disturbance by air currents. Some transparent window must, therefore, be provided, and for moderate deflections plane parallel glass will probably be found most satisfactory. For large deflections a curved window is necessary, and mica is the most convenient material.

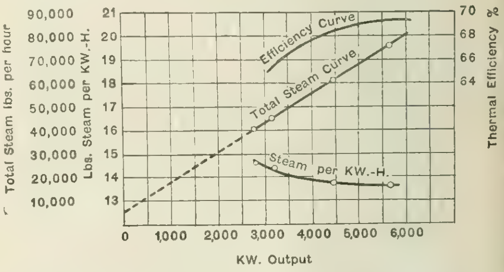
This should be split into as thin a sheet as possible (thin paper seems to be the best tool to use) and it should not be bent to a small radius. If the material is thick or the curvature sharp the definition will be seriously impaired. In any case curvature will cause the mica to act as a lens, and modify appreciably the focal length of the system as calculated from the mirror alone, especially when the latter has a radius of curvature of 5 or 10 ft. The focal length of the combination should, therefore, be determined and used in any calculations.

The accompanying table gives the distances from the mirror to the scale for every 10° of deflection of the reflected beam from its original direction. The values for various magnifications (m) are given. It will be seen that though to obtain a large length of scale a magnification of two or three times may be desirable, it would generally be preferable to lengthen the radius of curvature of the mirror, as the scale will then not approach the instrument so much.

Values are also given for $r_p \sin p$, this being half the breadth of the curve; and this length may often be used as the radius of a circular curve sufficiently accurate for many purposes.

TESTS OF A CURTIS 5,000-KW. TURBO-ALTERNATOR.

By the courtesy of Mr. C. P. Sparks, chief engineer of the County of London Electric Supply Co., Ltd., we are enabled to reproduce a set of curves relating to tests on a 5,000-kw. Curtis turbo-alternator built by the British Thomson-Houston Co., Ltd., Rugby, and installed at the City Road station of the County of London Electric Supply Co., Ltd. These curves show a very low steam consumption per kw.-hour at different loads. At 4,500 kw. the steam consumption is 13.7, and at 5,600 kw. it is 13·6 lb. per kw.-hour. The thermal efficiency, which includes the generator losses, is at full load 68·9 per cent., and at overload over 69 per cent. These figures are particularly good for a turbine of 5,000 kw. capacity, as the superheat is not as high as is generally the case when high efficiencies are obtained. This turbo-alternator was illustrated and described in our issue of April 12th last.



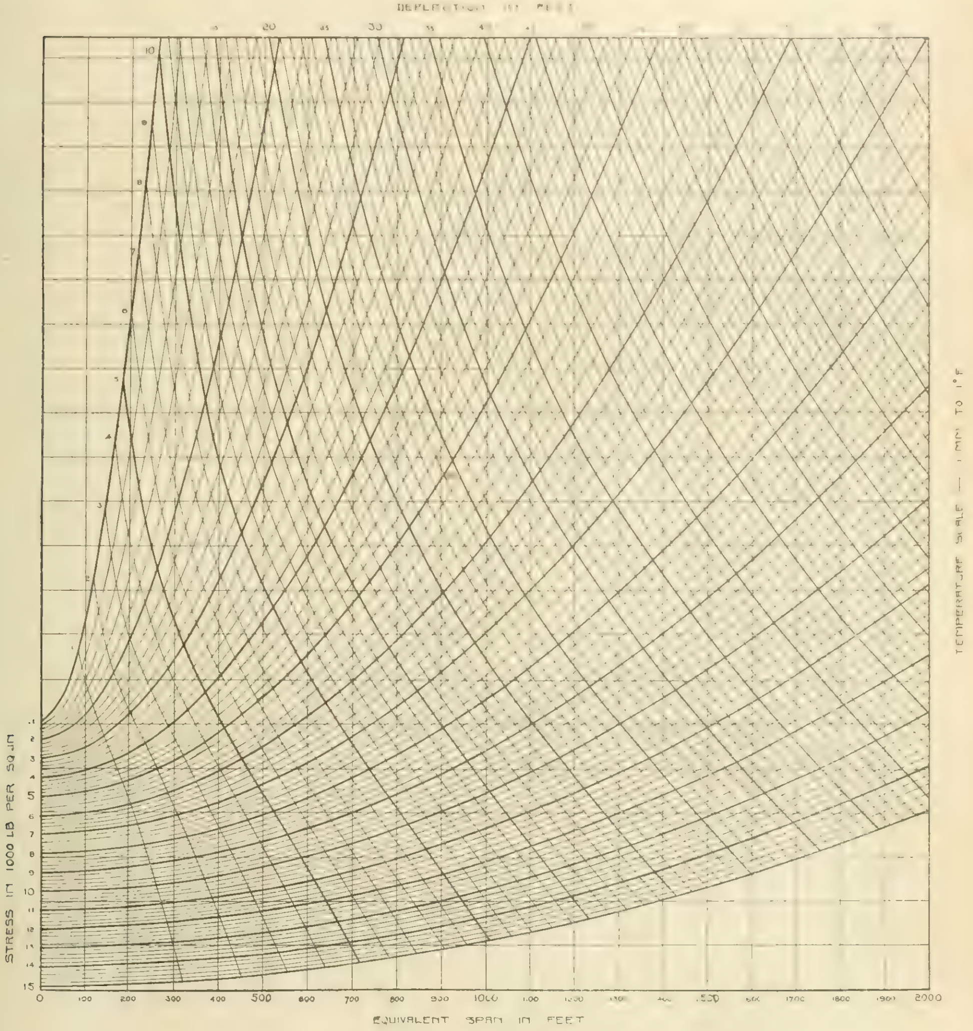
Electric Fan Accident.—Edward Jones (25), of Blackpool, sustained serious injury to several fingers, on July 11th, through a mishap with an electric fan. Jones had been working near an electric fan, when his hand was caught in the blades, which cut off his first finger, nearly severed the second and badly damaged the third.

ALUMINIUM OVERHEAD CONDUCTORS.

We have received from the British Aluminium Co., Ltd., of 109, Queen Victoria Street, E.C., a copy of a remarkable chart which the company has developed for the purpose of determining the deflection and stress in overhead conductors of aluminium. The use of this metal is rapidly extending, and in view of the importance of the subject we have obtained permission to reproduce the chart, of which the company retains the copyright.

The company claims that this is the first logically correct means of determining the physical characteristics of aluminium conductors that has yet been issued in this country, and it should take the place of the calculations, often only rough approximations, which have hitherto served. Information not found on the chart will be readily supplied by the company; a useful and complete comparison between copper and aluminium conductors will also be found in the article by Mr. E. V. Pannell, which we published in our issues of May 10th and 17th, 1912.

N.B.—It is important to note that the chart as here reproduced is reduced in the ratio 5 : 2; the temperature scale is therefore modified, and each division represents 20 mm., or 20° F.



Universal Stress-Deflection Chart for Stranded Aluminium Overhead Conductors.

Based upon the Laws of the Elastic Catenary.

Modulus of elasticity 9,000,000 lb. per sq. in. Coefficient of linear expansion 0·0000130 per 1° F. Weight per sq. in. per ft. run 1·175 lb.

1. At constant temperature the intercept of the ordinate of the span with the curve of required stress will give the corresponding deflection; *e.g.*, span 700 ft., stress 10,000 lb. per sq. in. Deflection 7·2 ft.

2. To allow for [illegible] temperature from the [illegible] (1 mm. to 1° F.) [illegible] of 7[illegible] [illegible], stress 6,100 lb. per sq. in.

3. Again, as example 1, but taking into [illegible] sq. ft. on a conductor of 0·6 sq. in., the stress [illegible] to the appropriate [illegible] 2·3 [illegible] as before, [illegible] 7 ft.

4. The deflection on the line in still [illegible] horizontal line [illegible] until it intercepts the ordinate corresponding to the true span of 700 ft., giving a deflection of 13·6 ft., and a stress of 5,300 lb. per sq. in.

The value of "*q*" is the ratio of the total loading per ft. run to the weight of conductor per ft. run. [illegible] wind pressure per ft. run of projected area [illegible] factor 0·6, then [illegible] + *p* [illegible].

Cross-sec. of conductor, sq. in.		0·1	·2	0·4	0·6	0·8	1·0	1·2	1·4	1·6
Value of "*q*"	30 lb. per sq. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1·82	[illegible]	1·71	1·64
with wind	20 lb. per sq. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1·41	1·36	1·32
pressure of	10 lb. per sq. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1·14	1·12	1·10	1·09

The Coal Mines Act (1911).—The Coal Mines Act (1911) came into operation on July 1st, embodying the new rules to govern the use of electricity in mines. Sec. 60 of the Act, which applies specially to electricity, states that electricity shall not be used in any part of a mine where, on account of the risk of explosion of gas or coal dust, its use would be dangerous to life, and lays down the conditions where risk occurs:—"If at any time in any place in the mine the percentage of inflammable gas in the general body of air in that place is found to exceed 1¼ per cent., the electric current shall at once be cut off from all cables and other electrical apparatus in that place, and shall not be switched on again as long as the percentage of inflammable gas exceeds that amount, provided that nothing in this sub-section shall apply to any telephone or signalling wires or instruments, as long as the conditions prescribed with reference to the installation and use of such wires and instruments are complied with, nor to any electric hand-lamps of a type for the time being approved."

BROWETT-LINDLEY FOUR-CYLINDER VERTICAL GAS ENGINE.

Messrs. Browett, Lindley & Co., Ltd., have recently completed and shipped one of their standard four-cylinder vertical gas engines, of which we give below a brief description :—

The engine is of the Otto or four-cycle type, and has four inverted cylinders mounted on a frame enclosing the crankshaft and motion work, similar to their high-speed steam engines It was built for a tramway power station in New Zealand, and is coupled by means of a flexible coupling to an E.C.C. 225-kw. dynamo; the engine is to work with a Mond-type pressure gas producer, using local coal.

The normal output of the engine is 400 b.h.p. continuously and 440 b.h.p. maximum load for half an hour, at a speed of 250 r.p.m. One of the special features of this engine is the total separation of the gas and air, and the provision of a double valve for the inlet. This arrangement absolutely obviates any risk of back fires, which in an engine of this size might be serious.

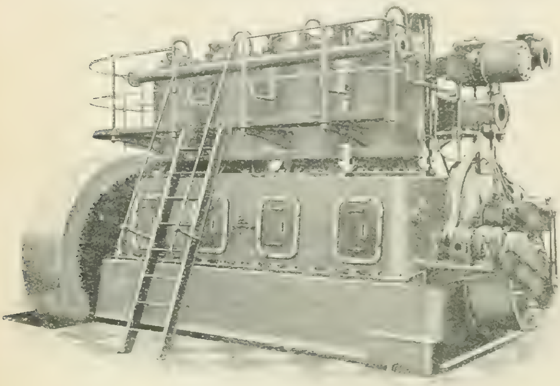


Fig. 1.—Browett-Lindley 400-b.h.p. Gas Engine.

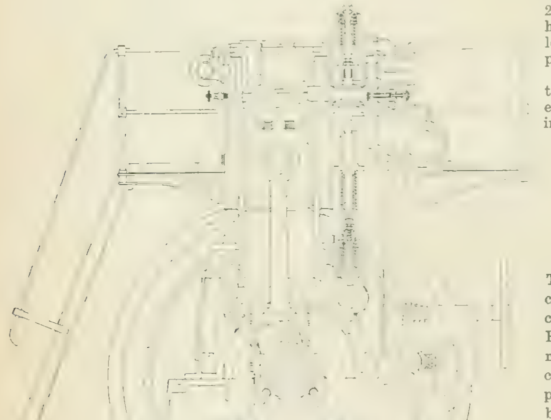


Fig. 2.—Vertical Transverse Section of Engine.

The main inlet valve has a supplementary valve mounted loosely on its spindle, and this valve is held against the seat of the gas port by means of a short spring. A collar on the main valve spindle opens this gas valve, and by adjusting its position a certain amount of lag can be given, so that air enters the cylinder first, and then, by further travel of the main valve, the gas valve opens and the combined charge is taken in.

Starting is effected by means of compressed air, and is entirely automatic. No compression release is provided, as this is unnecessary under the system adopted. By opening the main compressed-air valve, compressed air is admitted to two valve boxes placed underneath the cam shaft, and raises the valves against their levers and cam. Should the swell on the cam be opposite a lever, as it will be if the engine is in correct starting position, the valve cannot close, and the compressed air then passes to the cylinder through the check valve on the face of the cylinder, and the engine at once commences to revolve. The provision of the automatic check valve on the cylinders allows a charge of mixture to be taken in on the second stroke, and firing takes place immediately. When the pressure of the explosion in the cylinder is greater than the pressure of air tending to open the valve, the valve remains closed and no more air is used. When firing commences, therefore, it suffices to close the main compressed-air valve, and the operation of starting is completed.

The governing of the engine is effected by varying the quantity of both the gas and the air admitted to the engine, and is controlled by a standard high-speed engine-type shaft governor. The whole of the governor valves, together with the ports, are carried in a removable liner in the governor valve casing, so that they can be very easily removed for cleaning, should the gas contain tar or other impurities.

Forced lubrication is fitted throughout all bearings and guides, the oil under pressure being supplied by two valveless pumps, either of which is able to maintain the working pressure of oil. Duplicate strainers are provided, and the act of removing a strainer for cleaning causes an automatic valve to close, so that it is impossible for the pumps to draw unfiltered oil.

Particular care has been taken in the design to keep the cylinder covers free from any gear or piping, and to remove the cylinder cover only the small water joints which are necessary for the water-cooling of the cover, and which are specially arranged to be horizontal, have to be broken. The covers joint with the cylinders by a metal joint, and by this means cleaning of the pistons and inspection of the cylinders is rendered a very easy operation. The covers are provided with small supplementary covers, so that the water space can be freed of any deposit from the cooling water. The cooling water is circulated by a small Albany pump driven by means of a Morse chain from the end of the governor shaft. The cylinders, together with the outer jacket, are cast in one piece, but to obviate any temperature strains and risk of fracture, the end of the water jacket is free from the liner, an expansion joint being provided at the lower end.

Duplicate ignition has been provided. Lodge high-tension ignition is used on one set of plugs, and Bosch high-tension ignition for the other.

The engine was tested on April 27th by Mr. W. A. Tookey. The specified full-load test was 225 kw. for six hours, and the actual load carried was 229 kw. At the end of the six hours' full-load test the load was raised to slightly over the specified overload of 247·5 kw., which load was carried for the specified period of half an hour. In the governing tests the momentary rise from full load to no load was 4 per cent., and the permanent rise was 2·8 per cent.

The accompanying illustrations show the engine as completed, together with a section through one of the cylinders. A similar engine, but with six cylinders, is being constructed for a works in Scotland.

BRITISH TRADE WITH BULGARIA.

There is no doubt that various classes of British goods if sold on credit, their qualities and prices being clearly stated in terms comprehensible to the native buyer, would find a ready sale in Bulgaria. Amongst such goods are unquestionably all kinds of machinery and electrical appliances. British articles, as a rule, can compete with similar goods of foreign manufacture, both as to price and quality, and even in cases where cheaper goods are quoted by Austrian and German firms, the superior quality of British goods is recognised. There is little doubt, in fact, that though the country is flooded with cheap inferior wares, many native firms would gladly purchase British goods if offered on the same conditions as those of foreign manufacture.

The British Consul at Sofia, in a recent report, points out that, thanks to her advantageous geographical position, which enables her to pour goods into the country both by rail and Danube steamer, and still more to the energy she displays in her efforts to capture the market, Austria-Hungary seems likely to out-distance all her foreign competitors, save Germany, her most dangerous rival. Her commercial travellers, who make extensive tours, invade even the hamlets hidden in the remotest recesses of the Balkans. The Banque Balkanique, created under the auspices of the Wiener Bank Verein, with headquarters at Sofia and branches in the provinces, gives valuable assistance in promoting trade relations and providing information as to the credit of local firms. The Austro-Hungarian Museum, established in the capital with provincial branches, continues to facilitate the purchase of Austro-Hungarian goods, samples of which may be seen and handled by native buyers. The Austro-Hungarian commercial community in Sofia and the principal provincial towns, is more numerous than that of any other foreign country, and includes many important firms and commission agents, &c., who assist greatly in fostering Austro-Hungarian trade.

Germany, whose share of the imports shows an increase of £196,000, is displaying similar energy, and though placed at a disadvantage as regards distance and transport rates, she can in many cases undersell her less industrially developed neighbour. Her commercial travellers are numerous and active, and the Banque de Crédit, a German concern, renders assistance to German traders. German activity is shown particularly in tendering for Government contracts—she has agents resident in Sofia in close touch with the various Ministries concerned—and her share of the imports is largely increased by Government orders.

Turning from the successes of our rivals, it is well to examine the causes of the decline of British trade with Bulgaria, and to suggest means for improving it in future. The apathy of the British trader, so far as Bulgaria is concerned, is no doubt due, in some degree, to the smallness of the market compared with the wider field to which his energies are mainly directed. He fails to note that, owing to the lack of native industries, Bulgaria takes a proportionately larger share of foreign manufactured goods than many countries of greater size with which he is more familiar. Moreover, the starting of new industries which is at present being witnessed and is actively encouraged by the Government itself, creates a demand for machinery and other similar goods which will undoubtedly increase. The material for Government contracts, too, forms a very large demand which is supplied almost entirely from abroad. Important orders for railway materials, harbour plant, electric lighting and other municipal undertakings are constantly being given as a result of the economic advance of the country and they continually go to Continental firms. The demand for manufactured articles of every kind, in fact, is steadily growing as the country develops, and the excellent harvests of last year, combined with the cessation of unrest, which so frequently produces a depressing effect on trade, should indicate the moment as being especially propitious for the adoption of new methods in order to compensate for some of our errors of the past.

It is going over well-trodden ground to say that the lack of commercial travellers, severe insistence of cash payments, defective trade catalogues and the non-existence of a British bank, are the chief causes of our failure to keep pace with our foreign rivals. As our shortcomings in these respects, however, are as evident to-day as they have been in the past, it is necessary to allude to them again. As regards commercial travellers, the following figures tell their own tale. Out of a total of 183 licences granted to commercial travellers in 1910 (of whom 16 remain unaccounted for), 89 were taken out by Austrians, 35 by Germans, and only nine by British subjects. It is, moreover, to be remarked that the former in many cases make prolonged tours in the country, gain an intimate knowledge of the people's wants, and return later with fresh samples suitable for the country. British travellers, if they wish to meet with any success, should speak either French or German, preferably a little of both, and should be provided with suitable catalogues. Flying visits will generally be of little avail.

As has been so often pointed out before, catalogues, to be of any use, should be printed in French or German, and should give quotations in francs with metric weights and measures. Such would not only be suitable for Bulgaria, but also for many other Continental countries, and seeing the large amounts which are expended on catalogues by British firms, it is difficult to understand why the requirements of the foreign customer should be thus ignored.

It is unnecessary to say much at present as to the enormous advantage held by our foreign rivals in the granting of credit. It is, of course, desirable to exercise more caution than is shown by many foreign firms, who, through the indiscriminate granting of credit, are often hard hit by the bankruptcies of native firms, but, where possible, at least three or four months' credit must be given if we are to compete on even terms with our rivals.

A great deal of risk may be avoided, however, by appointing reliable agents on the spot. Great care should be shown in their selection, and in case of doubt the Consul is prepared to give hints as to the standing of those it is proposed to select. Though information on this subject is given with all reserve and subject to the Consul's discretion, and though it is not possible on all occasions to speak authoritatively as to the reliability of the firms in question, yet it is generally possible to determine what parties are obviously undesirable. There are not a few of the latter kind, who, possessing neither capital nor business morality, will combine with the buyer to defraud the foreign exporter. The references given are often valueless or invented, and it is a point to note that whenever a commission agent professes himself to be unable to extract payment from a local importer, who is of the same religion as himself, immediate recourse should be had to a lawyer of a different religion. Complaints are sometimes heard of the dishonesty of Bulgarian traders, but if the question be more closely examined, it will often be found that the dishonesty proceeds from the commission agent, a man whose stock-in-trade consists of a chair and a little stationery, and the right to sit in some co-religionist's office in return for his cleaning it out in the evening.

A list of the principal commission agents in Bulgaria is kept at all the British Consulates in the country, or can be seen by British firms at the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

Particular attention should also be paid to Government and municipal contracts, of which many, both large and small, are announced annually. Amongst the most important of these may be mentioned contracts for rolling stock and railway material of every kind, harbour works, coal, electric lighting and tramways, bridges, road rollers, telegraph wires, motor boats, &c. Electrical appliances, too, are often required from time to time for minor contracts. Local agents are necessary in tendering for Government and municipal contracts, but in the case of large contracts it is preferable for any British firms wishing to tender to send out its own representative, as is often done by other foreign firms, who thereby greatly increase their chances of success.

On the subject of public contracts in Bulgaria, however, a word of warning is necessary. Experience has shown that the Government's methods both in awarding its orders and in interpreting the terms of contracts are sometimes the subject of criticism. Cases have occurred in which contracts have been arbitrarily awarded. Complaints are also heard of the uncompromising attitude adopted by the State authorities towards parties who have unintentionally deviated from the exact terms of the specifications. Firms tendering, therefore, should be most careful to adhere rigidly to the conditions laid down, for they may expect that where any case of doubt arises they will be held rigidly to the letter of the law. For similar reasons parties applying for concessions should exercise caution in leaving nothing to chance if they wish to avoid future difficulties.

Frequent complaints are heard on the part of British merchants as to the treatment of their goods by the Bulgarian Customs, and in view of this fact it is necessary to state clearly that in case of wrong declaration of goods, not only is the higher duty levied, but an additional fine is imposed. The fact that the wrong declaration was made without any intention to defraud is immaterial. Consequently, should a firm have any doubt as to the tariff number under which the goods should be declared, they should make sure by applying to the Customs Department of the Ministry of Finance, sending samples, if possible, or, in any case, drawings and full descriptions, with the request that the case should be submitted to the expert Commission attached to the Ministry, and their classification fixed. In cases where goods are held to be wrongly declared, a protest on behalf of the buyer may be inserted in the Customs declaration; if this protest is without result, an appeal to the Ministry of Finance that the case may be submitted to the Revisionary Commission may be made. If the decision of the latter is unfavourable, no further appeal is admitted, and the deposit of the extra duty and fine is forfeited. It may be mentioned that the custom prevalent in commercial circles between buyer and seller is that the party who is responsible for the wrong declaration is also responsible for the resulting loss.

Glasgow Electricity Accounts.—The annual accounts and balance-sheet of the electricity department of the T.C. have just been issued. From these it appears that the gross revenue amounted to £276,659, and the working expenditure to £115,610, leaving a balance of £161,049, from which loan charges, &c., absorbed £99,697, and depreciation £46,242; whilst special depreciation for the Kelvinside plant and for mains, accounted for £8,585, leaving a surplus on the year's operations of £6,524, which has been transferred to reserve, which now amounts to £34,870. The total capital expenditure as at May 31st, 1912, less depreciation written off, stood at £1,893,443. During the year the scheme of giving domestic consumers a supply of energy for cooking, heating, and other domestic uses, at a rate of 1d. per unit, as compared with 3d. per unit for lighting, without separate wiring, was continued, with favourable results, the number of consumers taking advantage of the scheme amounting to 560. Notwithstanding that contracts had been entered into for the supply of coal at an estimated increased expenditure of £10,000 as compared with the previous year, the Committee recommended that the maximum demand number of hours for consumers at present on the 3½d. per unit rate be reduced from 730 hours to 650 hours per annum, other rates remaining unchanged. The quantity of electricity sold to private consumers during the past year was 42,721,349 units, as compared with 39,063,540 units during the previous 12 months, an increase of 9·36 per cent. Of these 42,721,349 units, 16,294,645 were sold for lighting at £169,736, and 26,426,704 for power and heating at £264,405. The number of consumers at May 31st, 1912, was 22,645, as compared with 21,166 at May 31st, 1911, being an increase of 1,479, or 7 per cent. during the year. The total number of motors in use and supplied off the Corporation mains as at May 31st, 1912, was 6,018, with a total H.P. of 40,045, as compared with 5,375, with a total H.P. of 36,831, as at May 31st, 1911. The number of units consumed for power purposes was 26,011,574, of which 6,400,116 were sold at 1½d. per unit, 1,636,904 at 1d. per unit, 8,294,274 at ¾d. per unit, and 9,680,280 at ½d. per unit. The total number of arc and incandescent lamps erected and in regular use in the streets as at May 31st, 1912, was 861, the same number as last year. The quantity of electricity consumed for street and stair lighting was 1,771,281 units, as compared with 1,759,550 units during the preceding year. The Committee, in conjunction with the Watching and Lighting Committee, had directed their attention to improving the electric lighting of streets, and had now erected 400 flame arc lamps in some of the principal streets of the city. The maximum load on the generating stations during the winter was 25,624 KW. on December 16th last, compared with 23,524 KW. in the previous year. For the year 1910-11, 3·470 lb. of coal were used per unit generated. This year the figure was 3·258 lb., which was equivalent to a saving of 5,200 tons of coal.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,270. "Electric-circuit interrupters." H. T. Barnett. July 1st.

15,275. "Electrical heating elements." Simplex Conduits, Ltd., L. M. Waterhouse and T. Birkett. July 1st.

15,281. "Arc lamps." Korting & Mathiesen Akt.-Ges. (Convention date, August 12th, 1911, Germany.) July 1st. (Complete.)

15,292. "Telephone exchange systems and the like." W. Aitken. July 1st.

15,291. "Telephone microphones." W. Aitken. July 1st.

15,309. "Device for comparing and measuring the magnetic properties of magnets and the like." W. Laurie. July 1st.

15,324. "Means for attaching electric wires and cables to insulators." T. Taylor. July 1st.

15,342. "Leading-in conductors for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 1st.

15,362. "Devices for measuring electric resistances." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 1st. (Complete.)

15,366. "Electric switches." Venner Time Switches, Ltd., and R. C. Griesbach. July 1st. (Complete.)

15,378. "Electric signalling contrivances." A. Orling. July 1st.

15,381. "Electrically-operated telphers and tracks therefor." R. P. Strachan and Strachan & Henshaw, Ltd. July 1st.

15,386. "Telephone lid." V. Baron-Parke. July 2nd.

15,388. "Device for locking an electric incandescent lamp of the bayonet type to its holder." H. T. Worrall. July 2nd.

15,402. "Radio action and arrangements therefor." G. J. Einstein. July 2nd.

15,404. "Storage batteries." E. Sokal. July 2nd. (Complete.)

15,418. "Electrolysis of metallic solutions." J. A. Romer. July 2nd.

15,419. "Dictaphone and like sound-recording instruments." A. C. Fuller. July 2nd.

15,429. "Electric heater." H. W. Puble. July 2nd.

15,448. "Means applicable for photographic print boxes for producing photographic prints by electric light." E. H. Spinney and E. R. Capel. July 2nd.

15,456. "Candle lamps and the like." C. Damey and C. M. Escare and P. F. Escare. July 2nd.

15,469. "Methods for compensating the fluctuations in the load in electric power installations." Siemens Schuckertwerke G.m.b.H. (Convention date July 8th, 1911, Germany.) July 2nd. (Complete.)

15,471. "Brush-holders for dynamo-electric machines." Pintsch's Electric Manufacturing Co., Ltd., and C. H. Vidal. July 2nd. (Complete.)

15,479. "Processes and apparatus for electric welding." L. W. Chubb. (Convention date, February 16th, 1912, United States.) July 2nd. (Complete.)

15,483. "Arc light electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 2nd.

15,485. "Supporting devices for filaments or wires in incandescent metal-filament lamps." J. Pintsch Akt.-Ges. (Convention date, November 18th, 1911, Germany.) July 2nd. (Complete.)

15,486. "Supporting devices for incandescent metal-filament lamps." J. Pintsch Akt.-Ges. (Convention date, November 21st, 1911, Germany.) July 2nd. (Complete.)

15,492. "Electro-deposition of metals and like electrolytic processes and apparatus or appliances to be used in connection therewith." A. Round and F. Fisher. July 3rd. (Complete.)

15,532. "Process for the manufacture of iron alloys for dynamo-electric purposes." W. Rubel. (Addition to 12,483, 1911. Convention date, July 11th, 1911, Germany.) July 3rd. (Complete.)

15,589. "Dynamo-electric machine." Allgemeine Electricitats Ges. (Addition to 9,577, 1908. Convention date, July 3rd, 1911, Germany.) July 3rd. (Complete.)

15,591. Telegraphic apparatus." H. Knudsen. July 3rd.

15,604. "Electric arc lamps." A. T. Dowdell. July 4th.

15,616. "Method of and means for illuminating by electric lamps." W. H. Walton. July 4th.

15,638. "Electrically-driven tilling machines." W. Wortmann. July 4th. (Complete)

15,643. "Metal connection for joining wires electrically and mechanically." Watlington & Co., Ltd., and A. M. Pooley. July 4th.

15,647. "Electrical transformers." Siemens Schuckertwerke G.m.b.H. (Convention date, July 4th, 1911, Germany.) July 4th. (Complete.)

15,649. "Electric candle lamp, bayonet cap and holder." S. A. Rouse. July 4th.

15,656. "Driving installations comprising internal combustion engine and electrical machines." Gasmotoren Fabrik Deutz. (Convention date, July 5th, 1911, Germany.) July 4th. (Complete.)

15,659. "Electromagnetically operated switches, cut-outs and the like." Siemens Bros. Dynamo Works, Ltd., and R. Brooks. July 4th.

15,660. "Photometers or the like." Siemens Bros. Dynamo Works, Ltd., and S. H. Callow. July 4th.

15,662. "Making connections to commutator segments of dynamo-electric machinery." Siemens Schuckertwerke G.m.b.H. (Convention date, July 4th, 1911, Germany.) July 4th. (Complete.)

15,667. "Electric balance system." J. M. Smith. July 4th.

15,672. "Multiplex telegraphy." K. H. Warfvinge and A. Hasselberg. (Convention date, July 5th, 1911, Sweden.) July 4th. (Complete.)

15,677. "Detectors of combustible gases." A. Philip and L. J. Steele. July 4th.

15,686. "Electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 4th.

15,704. "Magneto machines." C. W. Hinksman. July 5th.

15,706. "Electrical distribution junction boxes or apparatus." British Insulated and Helsby Cables, Ltd., and H. Allwood. July 5th.

15,727. "Electric furnaces and apparatus for the volatilising of metals." E. M. Bailey, A. Baxter and T. Middleton. July 5th.

15,750. "Röntgen-ray examination table for gynæcological and like purposes." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) July 5th. (Complete.)

15,757. "Electric arc lights." General Composing Co., G.m.b.H. (Addition to 8,907, 1912, Convention date, June 15th, 1912, Germany.) July 5th. (Complete.)

15,760. "Electrical rheostats, starters or controllers." H. Snowdon and Resisto Electrical Manufacturing Co., Ltd. July 5th.

15,774. "Magnetic or electric fields." M. Plohl. (Convention date, July 11th, 1911, Austria.) July 5th. (Complete.)

15,776. "Electric switches." British Thomson-Houston Co., Ltd. and J. M. Wallace. July 5th.

15,823. "Electro-deposition and refining of lead." S. O. Cowper-Coles. July 6th.

15,635. "Resinous bodies." British Thomson-Houston Co., Ltd. (General Electric Co., United States). July 6th. (Complete.)

15,836. "Socket terminal." Robert Bosch (firm of). (Convention date April 3rd, 1912, Germany). July 6th. (Complete.)

15,841. "Name-plate and electric press buttons." B. Bonnin. July 6th.

15,843. "Advertising systems for electric tram-cars." M. P. Schlesinger. July 6th.

15,851. "Time-controlled valves." Venner Time Switches, Ltd., and R. C. Griesbach. July 6th. (Complete.)

15,852. "Manufacture of electrodes." A. E. Gibbs. July 6th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electrically-Operated Reversing Gear. K. Brull. 9,255. April 12th.

Telephone Systems. S. G. S. Dicker. (Automatic Electric Co.) 9,577. April 19th.

Electrical Servo and Tele Motors and their Modes of Application. L. Rottenburg. 14,175. June 15th.

Magneto Generating Machines, Particularly Applicable for Providing Electric Current for Lighting and Ignition Purposes on Motor Cycles and other Motor Vehicles. E. Vaughan. 14,860. June 16th.

Automatic Electric Fire Alarm. S. W. H. Edwards. 14,439. June 19th.

Electric Transportation Systems. G. G. Vaughan. (Sturgis.) 14,505. June 19th.

Storage Battery Plates. W. E. Lake. (United States Light and Heating Co.) 14,938. June 26th.

Electric Time Alarm. W. H. Boorne. 15,804. July 7th.

Electrically-Heated Cooking Apparatus. W. P. Perry. 17,007. July 25th.

Manufacture of Electric Steels. W. Stobie. 17.179. July 27th.

Visible Electrical Signals in Connection with Colliery Winding Engines. T. Charlton and P. F. Smith. 17,430. July 31st.

Telephones. B. Gwozdz. 18,080. (Convention date not granted. Addition to No. 11,234 of 1911.) August 9th.

Electric Controlling or Synchronising Pendulums. R. Milne. 18,322. August 14th.

Double-Pole Electrical Switches. Midland Electric Manufacturing Co. and W. L. Barber. 20,311. September 13th.

Apparatus for Heating Water or other Liquid by Means of Electricity. Naamloze Vennootschap Fabriek van Instrumenten en Electrische Apparaten "Inventa." 25,091. November 10th. (July 20th, 1911.)

Magnetic Tachometers. W. P. Thompson. (Akt.-Ges. Mix & Genest Telephon and Telegraphenwerke.) 25,488. November 15th.

Electrical Signalling Apparatus. Fabryka Akumulatorow "Systemu Dr. Z. Staneckiego" Dr. Zdzislaw Stanecki (Firm of). 28,611. December 19th. (December 27th, 1910.)

1912.

Lightning Arresters. K. W. G. L. Stoffels and J. B. Van Der Sprenkel. 4,885. February 27th.

Means for Connecting Electrodes for Electric Furnaces. Geb. Siemens and Co. 6,248. March 13th. (March 28th, 1911.)

Electric Connection Box with Revolving Contacts. L. M. Waterhouse and Simplex Conduits, Ltd. 6,961. March 21st.

Arrangements for Starting Groups of Electrical Machines Consisting of a Synchronous and an Asynchronous Machine Connected in Cascade with it. W. P. Thompson. (Ateliers de Constructions Electriques de Charleroi). 7,135. March 23rd.

Electric Ignition Apparatus for Internal Combustion Engines. C. F. Kettering. 7,428 and 7,430. March 27th. (March 12th, 1910. Divided application on 5,902 of 1911. March 9th.)

Brush Holders for Dynamo-Electric Machinery. Akt.-Ges. Brown, Boverie et Cie. 7,578. March 28th. (June 22nd, 1911.)

Electric Arc Lamps. Siemens Bros. Dynamo Works. (Siemens Schuckertwerke Ges.) 955. January 12th.

Fire and Temperature Alarms. W. B. Hughes. 1,781. January 22nd.

Electric Telegraphy. Dr. A. Muirhead and Muirhead & Co. 2,049. January 25th.

Electrolytic Apparatus. Hazard-Flamand, L.H.A.B.M. 2,124. January 26th. (February 6th, 1911.)

Electric Boat-Hoisting Apparatus. J. Fielding. 2,979. February 6th.

Electrically-Driven Clocks. P. A. Bentley. 3,236. February 8th.

Arrangements for Accelerating the Variation of a Magnetic Field in Dynamo-Electric Machines. Allmanna Svenska Elektriska Aktie-Bolaget. 4,283. February 20th. (February 24th, 1912.)

Method of Suspending Electric Conductors between Supports. Pohlig Akt.-Ges. and W. Ellingen. 4,779. February 26th.

Multiple Electric Arc Lamps. Ges. fur Maschinen und Metall Industrie. 5,301. March 2nd. (March 2nd, 1911.)

Pyrometers. F. Rogers. 6,364. March 14th.

Electric Circuit-Breakers and the like. E. A. Fagerlund. 9,647. April 23rd. (April 24th, 1911.)

Disk Armatures for Continuous-Current Electric Meters. Siemen Schuckertwerke Ges. 9,823. April 25th. April 26th, 1911.)

Electric Brick Mould Drying.—One of the obstacles to the use of electric driving in brick works has been the necessity for steam to dry the brick moulds. In a moulding machine having a capacity of 22,000 bricks per day, satisfactory electric heating has been provided by the heating elements from eight 500-watt flat irons. The motors used in the plant total 60 H.P., and the drying heater consumes 4 KW. for 10 hours a day. The improvised electric heating system proved the turning point in securing the motor load. The wages of an engineer and fireman have been saved by the adoption of electric drive; the speed and output of the machines have been increased 5 to 6 per cent.; and the current bill practically equals the old fuel and supplies cost. A damaged mould heating element can be replaced without dismantling the machine.—*Electrical World.*

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GOVERNMENT INTERFERENCE.

It was once written by a surly critic of modern literature: "When a new book comes out, I read an old one!" Might not the same principle be adopted in relation to other matters, even to matters of greater importance than modern literature? The industrial world has been much troubled of late years by Government interference. New principles of political economy appear to have been evolved. When a new principle of political economy is devised, consider it in the light of an old one! It is by no means uninstructive to consider those new principles in the light of the precepts laid down by one of our leading economists in the middle of the last century. We refer, of course, to John Stuart Mill. He devotes a whole chapter of his "Principles of Political Economy" (bk. 5, chap. XI) to the "Limits of the Province of Government." Here one may discover precepts which, having regard to existing events, appear to be enshrouded with the magic of prophecy. "The intervention of Government," wrote the Great Philosopher, "may extend to controlling the free agency of individuals . . . but there are large departments of human life from which it must be unreservedly and imperiously excluded. Whatever theory we adopt regarding the foundation of the social union, and under whatever political institutions we live, there is a circle round every individual human being which no Government, be it that of one, of a few, or of the many, ought to be permitted to overstep; there is a part of the life of every person who has come to years of discretion within which the individuality of that person ought to reign uncontrolled either by any other individual or the public collectively."

Since the days of Mill, the magic circle which he described with the compass of a master draughtsman has been all too frequently encroached upon. We have, during the last 60 years, seen Government encroachment in many and various forms. The *vis a tergo* animating the movement has been described as "liberty"; but if this be true liberty, it would be small wonder if many people were to prefer to remain in chains.

Wholly apart from measures passed for the suppression of crime and for the maintenance and benefit of the public health, we have been subjected during the period mentioned to a series of measures all of which most seriously interfere with the liberty of the subject. When the history of the last 50 years comes to be written, it will probably be described as "the age of the development of taxation of and Government interference with employment in all its forms."

The Factory Acts, for which, of course, there is much to be said on the ground that they benefit the public health, have now become so interwoven with the life of the community that they have ceased to call for much comment. Nevertheless, the owner of a factory, his managers and foremen are continually made aware of the existence of such a person as the Factory Inspector. The provision of additional sanitary arrangements, additional air-space and the fencing of machinery may all be very good things and beneficial, but they involve interference with liberty, expenditure of money, and increased cost of production. A more forcible example of Government interference is afforded by the Workmen's Compensation Acts. The principle of universal compensation has been gradually evolved since the early eighties, and the statutory protection of workmen has been so sedulously developed that the old common law liability of master to servants for accidents happening during the employment has almost ceased to be discussed in the Courts. Nor is it possible to contract out of the obligation to pay compensation. No agreement to dispense with compensation is binding on the employé. The beneficial results of this legislature may be real; but so far as the worker is concerned they are certainly not very apparent. No doubt the disabled worker has something to be thankful for; but there are thousands of older workmen who are kept out of employment through inherent liability to suffer grievously from an accident. As for the employer, he seeks refuge in insurance. The burden is transferred from his to other shoulders, and the result is the loosening of the friendly tie which formerly connected the master and the servant.

Many other examples of restriction upon employment might be culled from the Statute book. The miner may not work for more than eight hours a day. The shopkeeper may not keep open on one afternoon a week—even if he keep no assistant; and last, but not least, it is provided by the Insurance Act that practically every contract of service in the kingdom is to be modified by the compulsory payment of insurance premiums.

Enough has been said to show that the Legislature has by direct statutory enactment seriously interfered with the freedom of contract. The indictment, however, does not end with the enumeration of certain Acts of State, in relation to matters which, according to the canons of political economy already alluded to, might properly be left to private enterprise. What are the legitimate functions of Governments? Is it certain that at the present day, the Government leaves nothing undone which should be done? We have recently seen that with a view to aiding and abetting the forces of trade unionism, the Government is unwilling to exert its legitimate powers for the protection of the man who is willing to work. "Free Labour" has become a thing of the past.

It is passing strange that these things should be, under the rule of a Government alleged to be the most democratic that the world has ever seen. But Mill was far-seeing enough to prophesy that your democrat can, if occasion suit him, also be an autocrat! "Experience," wrote the philosopher, "proves that the depositaries of power who are mere delegates of the people, that is of a majority, are quite as ready (when they think they can count on popular support) as any organs of oligarchy to assume arbitrary power, and to encroach unduly on the liberty of private life. . . and the present civilisation tends so strongly to make the power of persons acting in masses the only substantial power in society, that there never was more necessity for surrounding individual independence of thought, speech and conduct, with the most powerful defences, in order to maintain the originality of mind and individuality of character, which are the only source of any real progress and of most of the qualities which make the human race much superior to any herd of animals."

Of course, no one will be heard to dispute that there are certain interferences with complete liberty which every Government may properly impose.

In the matter of education the intervention of the Government is justifiable, because the case is not one in which the interest and judgment of the consumer are a sufficient security for the goodness of the commodity. But a good Government should give all its aid in such a shape as to encourage and nurture any rudiments it may find of a spirit of individual exertion. It were scarcely necessary to insist upon that part of the functions of Government which all admit to be indispensable, namely, the function of prohibiting and punishing such conduct on the part of individuals in the exercise of their freedom as is clearly injurious to other persons, whether the case be one of force, fraud, or negligence. It is the illegitimate interference with individual effort, which one looks upon with dismay and apprehension. Let us, in conclusion, quote Mill once more:—

"To be prevented from doing what one is inclined to or from acting according to one's own judgment of what is desirable is not only always irksome, but always tends, *pro tanto*, to starve the development of some portion of the bodily or mental faculties, either sensitive or active, and unless the conscience of the individual goes freely with the legal restraint, it partakes either in a great or in a small degree of the degradation of slavery. Scarcely any degree of utility, short of absolute necessity, will justify a prohibitory regulation, unless it can also be made to recommend itself to the general conscience; unless persons of ordinary good intentions either believe already, or can be induced to believe, that the thing is one which they ought not to wish to do."

The Frame Thomson Lecture.

The Frame Thomson lecture on the principles and practice of accountancy in relation to engineering design and work was this year delivered at the Institution of Civil Engineers, by Mr. Frame Thomson, the founder of the lectureship. Terse expressions, in terminology probably more familiar to engineers than to accountants, formed a notable feature of the lecture, which, though only dealing in the main with first principles of common practice, bore the impress of careful and exact study and preparation, and should appeal to all engineers whose knowledge of the construction of accounts has perforce suffered neglect by reason of the exigencies and superior demands of their profession. After sketching in outline the financial history of a successful enterprise, the lecturer introduced the subject of accountancy, indicating as the different processes composing it—constructive or creative, productive or operative—destructive and reconstructive or reproductive.

The subject was succinctly treated from a basic point of view, and the lecturer is to be congratulated on his able exposition of the subject. Sir William Plender and Mr. L. W. Hawkins, professional accountants, contributed a few observations of elementary importance to the discussion.

Mr. Thomson hopes to be able to give next year a lecture on similar broad lines dealing with legal knowledge. Thereafter it is proposed that the annual lecture should be delivered by a lawyer or an accountant, treating of some of the special features of their respective professions with which engineers should be familiar.

If we may say so, it would emphasise the broad lines if some of the prominent or able members of the other several societies of accountants were invited to contribute some phases of their experience of, and impressions on, engineering accounts and costs, &c.

Spontaneous Combustion of Coal.

A memorandum by the chief engineer surveyor of Lloyd's upon the spontaneous ignition of bunker coal will be interesting to engineers of large power stations whose bunkers have features similar to those of a ship, viz., exposure to high temperatures, as where placed above boilers. Coal has long been supposed to owe its danger of spontaneous ignition to pyrites, but this has now been disproved. In 1911, of 127 reported cases of ships with coal on fire, only 24 were fires of the coal cargo, and 103 were bunker fires. Cross bunkers appear more liable to fire than side bunkers.

The investigation for the foregoing cases did not apparently afford much material for a report, and so the present memorandum is based on past knowledge, and the reports of special commissioners, starting from that of 1875, which is now regarded as more wrong than right in its conclusions; though Dr. Percy and Prof. Abel were correct on the point of oxygen absorption, they were wrong in their suspicions as to pyrites. Since pyrites oxidises more quickly when damp, it was thought that damp coal was more likely to fire than dry coal, and therefore that damping coal should not be practised, forgetting that the water would act as a heat-absorbing agent and also by evaporating would displace oxygen and thus deprive the fire of food. A few years later than the above date one Henri Fayol, of Commentry, France, gave details of observations and experiments on coal of eighteen varieties. He showed that between 25 and 100 C. under the action of air all the coals first lost weight, after which they more than fully recovered the loss. The recovery was due to the absorption of oxygen. After a certain period diminution of weight set in again. This, of course, was due to slow combustion of the coal by the absorbed oxygen. Coal was found to absorb as much as 100 times its own volume of oxygen. In the course of the experiments, heaps of coal of about 3 cb. yards capacity were piled up in conical form, heated to 100° C. and covered with a bell, through which, at the top and bottom, were holes for the passage of air. When the holes were closed the temperature fell. If some holes were left open the temperature rose steadily until ignition took place. When the bell was removed the mass cooled down. Air was shown to be essential in a certain quantity, but the quantity must be limited, for given plenty of air, this carried away more heat than was produced. Fayol found that moisture was more of a safeguard than a danger, nor could he trace any special effect to pyrites.

He laid stress only on air absorption, and as air or oxygen absorption is a surface action, small coal is necessarily far more dangerous than large coal. Thus, the conditions for safety are large coal and complete absence of air, or else a very good flow of air. The latter cannot so well be secured with small coal, for it packs closely, and hence small coal offers a double danger, for it has bigger surfaces of absorption and affords less passages for the free flow of air. The lesson is that small coal should be enclosed in air-tight bunkers—a matter of no little difficulty. Towards this point, however, bunker doors should be kept closed below when not in use. Since heat assists oxygen absorption, that coal which is nearest the boilers should be used first, so as to get it out of danger. Fayol advises the damping of small coal when bunkered. It may be recollected that some years ago a favourable report appeared in certain technical journals upon the good effect of burying bottles of liquid CO_2 in masses of coal. By some means, possibly fusible metal plugs, when the coal heated, the CO_2 was allowed to discharge into the mass of coal, and this appeared to stay further mischief and there was no recurrence of heating.

It would appear to be a good plan to lay a perforated water-pipe through the mass of coal in a bunker; the pipe could be used for the insertion of a tell-tale thermometer or for water injection. Coal in a fine state of division is very absorptive of oxygen, and is reduced to CO_2 by slow combustion. Some years ago at the hotel at Cranbrook, in Sussex, a well 200 ft. deep and about 4 ft. in diameter was put down in the Ashdown Sand formation. As is well known, this sandstone is highly carboniferous and carries many fine veins of coal, some of them as much as $\frac{1}{16}$ in. thick. While the barometer was rising, men could enter the well and work at the bottom of it, but when the barometer fell, the air imprisoned in the porous sandy rock expanded and flowed out of the well. The mouth of the well was half inside the pantry of the house and half in the open air. The doorway was over the well mouth, and the door was absent.

Yet with all this ventilation a candle on a shelf in the pantry, 3 ft. high, was extinguished by the "air" flowing out of the well, and it was quite impossible to introduce a lighted candle below the cover boards of the well. Every change in the barometer produces alternate inflow and outflow of air at every well which enters porous strata, and the thin coal seams were thus exposed to constantly renewed supplies of oxygen, with the result that much CO_2 was formed.

Fayol, though finding great differences in the ease with which different coals will ignite spontaneously, says that all coal, not excepting even anthracite, is liable to spontaneous ignition.

It is really so simple to place trial tubes in every bunker, and take thermometer readings, that it should be possible to prevent the temperature reaching such a point as to be dangerous. One safeguard would be to avoid extreme length of bunker; water-space division bulkheads might be used to separate them into moderate lengths, so that any specially heating division could, if necessary, be damped or completely drowned.

ROTHERHAM ELECTRIC LIGHT, POWER AND TRAMWAYS UNDERTAKING.

Built to the designs of Prof. Kennedy in 1900, the Rotherham Corporation electricity works bids fair to become a purely turbine-driven station in the near future, and as good an example of modern concentration of power within small compass as it has been in the past of the use of small engine-driven sets and the generous allocation of floor space.

The original equipment comprised two 90-kw. Allen sets and two 2 × 13-kw. steam balancers, and subsequently there were installed two 165-kw. Allen sets and one each 320-kw. Allen-Allen and Allen-Siemens sets (see figs. 2 and 3, pp. 124-5). Where the steam balancers once stood, there is now working a 500-kw. Westinghouse turbo-dynamo with radial commutator and Morganite brushes. During the past 18 months this generator has averaged 19 hours' running per day; it is only at week-ends that the commutator can be thoroughly cleaned, yet no sparking or other troubles are experienced. In place of the steam balancers, a 70-kw. Siemens motor balancer is now employed. The 256-cell 250-amp.-hour battery merely "floats" on the lighting bus-bars.

The 500-kw. turbo set being fully loaded soon after its installation (in 1909), it became necessary to provide further generator capacity. The existing equipment completely filled the effective floor space in the engine room (110 ft. × 40 ft. overall), and building extensions being prevented by the destructor and by the gas works, at the respective ends of the power house, increased capacity could only be secured by replacing the older plant by turbo-sets. Following this plan, a 950-h.p. engine-driven surface condenser plant has just been replaced by a 1,000-kw. horizontal Westinghouse turbo-alternator (three-phase 3,300-volt, 50 cycles, 3,000 r.p.m.) and its auxiliaries, and a duplicate steam-driven condenser set will be similarly replaced in the immediate future.

The lay-out of the present extension unit (see figs. 1-3) provides for the future installation of a similar machine on the adjacent bed, with a minimum of derangement or alteration to existing pipework, &c. The most striking feature of its general design is the small floor space occupied (5 ft. 6 in. × 17 ft. 6 in. overall), this being secured by employing a high-pressure impulse turbine. A velocity wheel in the initial stage is followed by seven Rateau stages—an arrangement which secures efficient utilisation of the high-pressure steam (140 lb. per sq. in. at the stop valve), while reducing the pressure to which the turbine casing is exposed to about 40 lb. per sq. in. Fig. 1 clearly shows the arrangement of the main and auxiliary parts of the set, which is further shown in course of erection in figs. 2 and 3.

At a power factor of 0·8 the alternator has a continuous full-load output of 1,000 kw. and an overload capacity of 25 per cent. for two hours and of 50 per cent. momentarily, without special adjustment, or for 10 minutes with the aid of a by-pass supply. The turbine is at present supplied with steam at 140 lb. per sq. in. and 100° F. superheat, but it is so designed and built that the inlet temperature of the steam may safely be raised to 560° F., if desired; a 28-in. vacuum is maintained when the barometer stands at 30 in.

The surface condenser and circulating pump were supplied by Messrs. Allen, and the air and extractor pumps by the Westinghouse Co.; for the arrangement of these auxiliaries and their driving motors, see fig. 1. The Leblanc air pump has been adopted on account of its great simplicity and high volumetric efficiency, which is, moreover, practically constant at all vacua. Approximately one volume of water is required per 6 to 10 volumes of air.

The alternator is of the latest Westinghouse standard design. The slot-wound field structure is shrunk on to the shaft, and designed with a view to its permanent rigidity and balance in service and thorough ventilation in all parts. The armature winding is contained in wedge-closed slots, and is provided with special bracing of the end coils to guard against displacement of the latter by the mechanical forces set up under short-circuit conditions. Ventilation is effected by means of fans mounted on the generator shaft;

cool air is drawn through a "Buffalo" filter in the rotary room (fig. 1), and a system of ducts XX (fig. 1), and is expelled from the top of the alternator housing. An "overhung" exciter with radial commutator allows of complete alternator regulation by means of the exciter field rheostat in conjunction with a Brown-Boveri automatic regulator.

The guaranteed overall efficiency of the generating set, and the actual performance realised during the recent official tests at the maker's works, were as follows (see also fig. 4). Conditions :—Stop-valve pressure 140 lb. per sq. in. gauge ; superheat 100° F. ; vacuum, 28 in. ; barometer, 30 in.

Load.	Lb. steam per KW.-hour at 0·8 p.f. Guaranteed.	Test.
1¼	17·0	15·8
Full	17·0	16·1
¾	18·2	(17 2)
½	20·8	19 3
¼	28·5	(23·5)

(Bracketed figures interpolated.)

The whole of the extension plant and its erection was executed to the specification and under the supervision of Mr. E. Cross, engineer and manager of the undertaking. The specification issued to tendering firms wisely left a number of details of manufacture and design to be specified by these firms, with a reservation that such recommendations would not be accepted if inconsistent with the general requirements of the department, thus at once securing the interests of the latter while taking full advantage of the special experience of makers.

In addition to the duplicate turbo-alternator which must soon be required, a 500-KW. rotary converter is now on order. Further converters will be installed as required in a room adjoining the power house. As still greater generator capacity becomes necessary, the reciprocating engines will be successively replaced by turbo-alternators, supplying converters in the main and sub-stations ; when the engine room is full of turbo sets a fresh site will be secured, with ample room for extensions, and the station will be entirely rebuilt.

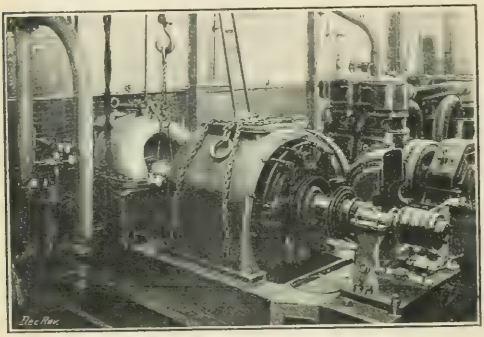
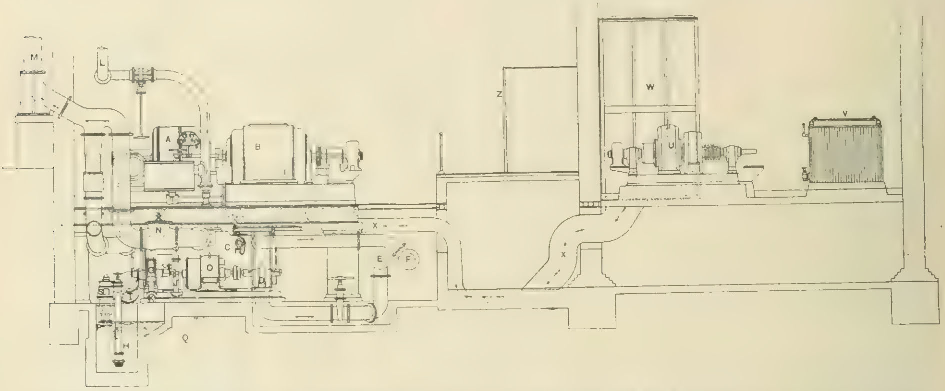


Fig. 2.—Westinghouse Turbo-alternator in Course of Erection.

The seven Lancashire boilers already installed (totalling 35,000 lb. per hour evaporative capacity) have never yet been worked to their full capacity, and, in view of the great steam economy effected by the turbine plant (19·5 lb. per KW.-hour on the 500-KW. turbo set and 16·0 lb. on the 1,000-KW. unit, as against 30 lb. per KW.-hour on the largest reciprocating engines, condensing in every case), it is improbable that boiler extensions will be needed for some time to come.



A, turbine ; B, alternator ; C, condenser ; D, circulating pump (E suction, F discharge) ; G, air pump (H seal water suction, J air suction, K discharge) ; L, main steam pipe ; M, atmo. exhaust ; N, automatic valve ; O, motor ; P, extraction pump (Q suction, R discharge) ; S, motor ; T, oil cooler ; U, rotary converter ; V, transformer ; W, air filter ; X, air duct ; Z, switchboard.

Fig. 1.—Arrangement of New Plant in Rotherham Electricity Works.

A two-unit (three cells each) Heenan-Froude refuse destructor, heating two Babcock & Wilcox boilers, is worked by the sanitary department in a building immediately adjoining the electricity works. The refuse handled is rich in cinders, and is delivered over a weigh-bridge, being paid for at 1s. per ton by the electricity department. The steam raised is not metered, but from 60 to 70 tons of refuse (of average evaporative value 2·075 lb. per lb., from and at 212° F. with feed at 175° F.) are destroyed per day. Clinkers from the destructor are ground down by two 40-H.P. electrically-driven mills, and conveyed by barge to the sewage filter beds.

Town water at 10d. per 1,000 gallons is used for feed purposes, the canal water being so corrosive that the surface condensers need "tubing" once weekly. For the privilege of drawing this fluid through a 12-in. pipe, the department pays £150 per annum, though the whole of the circulating water is, of course, returned !

The surface condensers on the turbo-sets are highly efficient, but the remaining 950-H.P. steam-driven condenser serving the Allen engines gives negligible vacuum when the latter are on full load, owing partly to leakage in the exhaust line, but mainly to corrosion of the circulating tubes ; nevertheless, the condenser is useful in restricting the consumption of town feed water.

The supply area covered by the Corporation's order is of straggling shape and totals about 9·4 sq. miles, of which two-thirds is open country ; of the more densely populated area, two-thirds is provided with mains, and special supply is given to the Home Office testing station at Greasborough and to two works in Tinsley. The station is situated 600 yards north of the centre of the town, and the most remote consumer is at a distance of 3·25 miles ; 24 miles of lighting and power cables and 10 miles of traction feeders are now laid.

Hitherto it has been impracticable to supply large power loads at remote parts of the supply area (the maximum station voltage being 520 volts D.C.). Similarly, it has been unprofitable to lay special cables for small consumers, so that the development of the undertaking, as regards industrial supply, has been considerably hampered. Matters came to a crisis with the demand for 500-600 H.P. by a large tube works at Wincobank, near Tinsley. To avoid the necessity of transferring the area concerned to the Sheffield Electricity

Department, and in order to demonstrate the economy to be derived from the use of electric power, the Rotherham Corporation removed one of its 250-H.P. Allen sets to the new consumer's works, where it has been running satisfactorily for 18 months past, steam being supplied from a special boiler, and the electricity department paying the coal and stokers' bill and charging about 0·76d. per unit for the energy delivered. Simultaneously, arrangements were made for the installation of a 1,000-KW. turbo-alternator at the Rotherham station, and henceforth high-pressure supply of the above and other bulk consumers will be a simple matter, and, in contrast to the present Wincobank plant, will yield a reasonable profit to the department. The temporary installation at Wincobank will be dismantled at an early date and replaced by a 250-KW. converter supplying such motors as are necessarily of D.C. type; three-phase motors will be employed wherever possible.

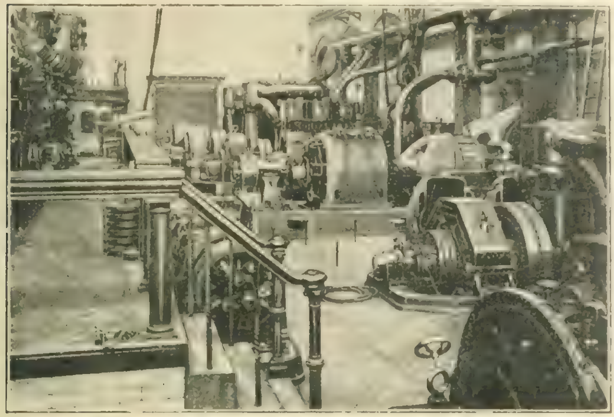


Fig. 3.—Rotherham Electricity Works: Engine Room.

So far as can be foreseen, high-pressure supply will be entirely by underground cable. On the Wincobank route, three-core armoured Callender cables are drawn into conduit and the line is already complete except at railway bridges. Seven of the latter have to be traversed, and incredible difficulty has been encountered in securing the necessary wayleaves from the owners.

For D.C. distribution, Glover's lead-covered diatrine cables are laid solid and in Sykes conduits; Callender single V.B. cables are also employed, but the old concentric cables have been almost entirely replaced, with a great reduction in the frequency of faults.

The latest available returns show that a generator capacity of 2,650 KW. supplies 3,746 KW. connections, and a maximum demand of 745 KW. non-traction and 742 KW. traction load (1,487 KW. total). The total sales by meter during the years ending March, 1910-11-12, were as follows:—

	B.T.U. 1911-12.	B.T.U. 1910-11.	B.T.U. 1909-10.
Lighting	370,292	335,378	303,362
Power	1,118,912	991,395	465,553
Traction	1,414,449	1,342,954	1,209,097
Total ...	2,903,653	2,669,727	1,978,012

It will be seen that the total sales are rising rapidly, mainly owing to the increasing power demand. The annual load factor of the station is now 23 per cent., as against 25 per cent. in 1910-11 and 21·3 per cent. in 1909-10. Already there is a valuable over-lapping of the evening traction and non-traction loads, so that the peak demand (1,300 KW.) lasts from 4 p.m. to 8 p.m. (in winter), with crests at 4.45 and 6.30 p.m.

Although the traction demand is steadily increasing and will be considerably augmented by the opening of various railless trolley routes, it is in the power sales of the undertaking that the greatest expansion is likely to be attained. The area served is teeming with industrial works of every description, and the availability of high-pressure A.C. for distributing purposes will render their electrical supply profitable to all parties concerned.

The present routes served by the Rotherham Corporation tramways have a total length of 9·39 miles (equivalent to 13·48 miles single track). The maximum gradient is 1 in 10·5 (on the Kimberworth route), and, taken as a whole, the conditions are not severe.

Extensions which are in immediate prospect include 7 furlongs to the important colliery village of Thrybergh (7,000 population tapped); and 1 mile 1 furlong to the borough boundary along the existing Broom Road route (tapping a population of 3,170). The latter line, serving a residential area, has so far been a source of serious loss to the department, but, by the inauguration of a 4·75 miles railless-trolley route from the borough boundary to Maltby (serving about 10,000 inhabitants in the district traversed), it is hoped to realise a large net profit from the route. If the service proves remunerative, one of the most extensive railless systems in the country will immediately be inaugurated.*

The tariffs levied are 4·0d. per unit for lighting supply, less 2·5 per cent. for cash, or 10 per cent. if the consumption exceeds 10,000 B.T.U. per annum, up to 30 per cent. discount for over 40,000 units per annum. Small power consumers are supplied at 1·5d. per unit; consumers demanding not less than 5 H.P. steadily during working hours are supplied at 1·0d. per unit, less discounts varying from 5 per cent. to 40 per cent. for consumptions exceeding 10,000 or 750,000 units per annum respectively.

The average price obtained for all sales was 1·525d. per unit during 1911-12, leaving a gross surplus of 0·60d. per unit generated. The gross profit on the electricity undertaking during the same period was 10·85 per cent. (and 6·88 per cent. on the traction system). These results were the most satisfactory obtained since the commencement of supply. The net profit was 4·78 per cent. in 1911-12.

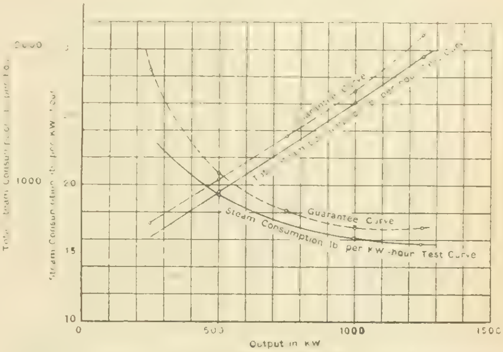


Fig. 4.—Tests of Westinghouse 1,000-KW. Turbo-Alternator

Our best thanks are due to Mr. Ed. Cross, engineer and manager of the Rotherham Corporation Electricity and Tramways Department, and to his chief assistant, Mr. J. Williams, for their courteous assistance in the collection of the above notes, at a time when they were busily engaged on the extensions described.

Patent Application.—Application has been made for restoration of Patent No. 24,411, of 1905, for "Improvements in and relating to the regulation of the supply of liquid fuel to internal combustion motors," granted to Georg Brandstetter.

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* The Corporation has Parliamentary powers for a further total length of route 9½ miles.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trouble with the Trolley Head.

Mr. Geo. Spooner's remarks are quite correct so far as systems with centre running trolleys are concerned, but where the overhead equipment is erected on bracket arms for swivel-headed trolleys, the bow collector would be of no use, and the great majority of tramways are equipped with the trolley wires in anything but a centre-running position. In the case of a centre-running trolley, the deviation from the centre line does not allow of more than about 2 ft., whereas with a side-running trolley the trolley wire need be only approximately parallel to the track and as far from the centre as the length of the trolley-arm will permit.

R. A. Pickmere.

London, E., *July 20th*, 1912.

Vacuum Cleaners.

The "Notes on Vacuum Cleaners," appearing on pages 112 and 113 of your last week's issue, have been of considerable interest to us. It seems to us that whilst your correspondent is well informed on general grounds, he loses sight of one important issue.

There are, broading speaking, two types of vacuum cleaners :—Type "A," high-vacuum machines, *i.e.*, machines operating with a small volume of air at a high vacuum; and Type "B," low vacuum large-air displacement machines, *i.e.*, machines relying upon a large volume of air in place of a high vacuum.

We think vacuum cleaner construction during the last few years, both here and abroad, proves beyond all doubt that the latter principle is the correct one. Let us look into the merits of each type :—

A. *High-Vacuum Machines.*—It may be readily claimed for this type that they effectively clean floor coverings, and that they are equally suitable for the removal of dust from cornices, walls, &c., if maintained in a high state of efficiency, and if they are used with more than ordinary intelligence, and these advantages may be claimed for both domestic and industrial use, and where employed for industrial use, they are, in our opinion, preferable to low-vacuum machines. But let us look into the disadvantages :—

1. Mechanical damage to floor coverings resulting from the cutting action of the intake nozzle, since it is necessary to maintain very close contact with the floor covering in order to obtain sufficient suction.
2. Damage to the pile of floor coverings from the excessive suction, which in the absence of a sweeping volume of air is necessary for effective cleaning (ask your carpet dealer whether the high-vacuum cleaner is not his best friend).
3. The small intake nozzle necessary to maintain a high vacuum prevents the removal of the rubbish met with on the ordinary carpet in the house, restaurant, club smoke-room, &c.
4. The absolute impossibility to construct a self-contained really portable apparatus, which leaves the operator free to work both hands.
5. The great weakness of the delicate suction mechanism, and the impossibility of obtaining even ordinary repairs from an ordinary engineer.

There are many other disadvantages, but the above will serve to show the most important of them.

Low-Vacuum Large Air Displacement Type.—The advantages of cleaners of this type as compared with the type previously dealt with are many :—

1. The simple construction, *i.e.*, absolute absence of delicate mechanism.
2. The possibility of constructing self-contained movable machines on wheels of a weight and type securing comfortable transport to every part of the house by the lady or maid.
3. Automatic compensation of the large volume of air in place of a high vacuum when the machine is not kept actually on the floor covering. (As the vacuum is reduced the volume of air is increased, and equally effective work is secured.)
4. The absolute harmlessness of continuous use, owing to the low vacuum, and owing to the fact that it is unnecessary to maintain a hard-rubbing action with the floor covering.
5. Large intake nozzles, admitting of the reception of ordinary rubbish—such as pieces of paper, cigar and cigarette ends, matches, &c.; thus the machine possesses all the advantages of the ordinary carpet sweeper.
6. The automatic ventilation of the motor which prevents an undue temperature rise, and thus assists towards long life.
7. The reduced exertion required in the use of a small self-contained machine, compared with the continued operation of the nozzle of high-vacuum machines, which must be kept in perfect contact with the floor covering.
8. The possibility of using the machine as an ordinary fan or as a blower for bedding renovating purposes, &c.
9. And this, perhaps, is the prime advantage—"The adaptability and usefulness of a small self-contained cleaner for its prime purpose, *i.e.*, *the cleaning of floor coverings.*"

The first consideration in the design of a vacuum cleaner surely lies in the question as to where it is to be used, and it will appeal to the ordinary intelligence that at least 75 per cent. (in actual practice it is probably 90 per cent. or 95 per cent.) of all the work expected from it is on the floor, and if this is admitted it is necessary to construct an apparatus which will efficiently, conveniently and thoroughly do this work.

It may be claimed for machines of the high vacuum type that they are more effective in actual use than low vacuum and large air displacement types, but if we remember that a small portable machine will be used with the same regularity as the brush or carpet sweeper in the home, we must come to the conclusion that we obtain reliable cleaning work from a suitable small and portable machine.

We claim all the advantages enumerated above for the "Magic," which, especially for domestic use, may be relied upon to do all its work, and to do it continuously and well, and when it is remembered that the complete equipment, including a set of attachments which answers every possible application, is supplied at the moderate price of £13 to the public, the average householder will require much convincing that a stationary plant, costing, as your correspondent points out, say, £30, which, however, before it is fixed, *i.e.*, before the necessary piping in a house of even average size has been provided, is more likely to cost from £120 to £150, is a more suitable appliance for him.

We are hopeful that we shall have an opportunity of demonstrating the use of the "Magic" in open competition with some of the high-priced high-vacuum machines at some future date.

The popular fallacy that a high vacuum is necessary in order to efficiently remove dust and other impurities is rapidly going to pieces.

For **Magic Appliances, Ltd.,**
J. SCHMAHL, *Managing Director.*

London, E.C., *July 23rd*, 1912.

Electricity in the Restaurant.—Mr. Hilary Quertier, of Wellington, has invented an electric waiter for hotels and restaurants, which is worked by the customer in direct communication with the kitchen. On each table is a wooden frame bearing the menu card, and opposite each item of the bill of fare is a button. Having chosen his dish, the customer presses the button, and immediately the number of the table and the order are displayed on a recorder in the kitchen, while an electric alarm bell is rung to attract the notice of the cook or attendant. The apparatus in the kitchen automatically issues a ticket with the number of the table in the restaurant, the nature of the order and the amount to be collected from the diner. A duplicate of the ticket is kept on an endless tape, so that an absolute check may be kept on both money and goods. When the ticket is dropped from the electric printer in the kitchen into the tray, the order can be prepared and delivered with the bill by the waitress at once. Where it has been used in New Zealand, the electric waiter has proved a great success.—*Brit. Aus.*

PARLIAMENTARY.

Metropolitan Railway Bill.

The Metropolitan Railway Co.'s Bill, which passed the House of Commons' Committee a few weeks ago, came on July 16th and 17th before Lord Falkland's Select Committee of the House of Lords. As originally drafted, the Bill asked for powers to construct a new railway at Hammersmith to join up with the authorised line of the Great Western Railway to Ealing, and also for powers to construct a new line from Rickmansworth to Watford, and thus to create a new route from the latter town to the metropolis. The Ealing proposal was rejected by the House of Commons' Committee, and consequently the chief matter before the Lords' Committee was the extension to Watford, which was opposed by the London and North-Western Railway Co.

Mr. R. H. Selbie, general manager of the Metropolitan Co., gave evidence in support of the Bill, stating that at present between Baker Street and Harrow the company now run about 200 trains daily, and these trains could be extended to Watford as the traffic demanded.

Evidence of a local character was also called on behalf of the proposal.

Mr. F. Rea, general manager of the London and North-Western Railway, whose line is being electrified to Watford, contended that, in view of the facilities now given and intended to be given, the extension was not required.

The Committee passed the preamble of the Bill, subject to a clause being inserted to provide for the construction of a bridge by the Metropolitan Co., which will permit of the extension of the London and North-Western Co.'s line from Croxley Green. Widenings of the Metropolitan Co.'s line between Finchley Road and Kilburn were also passed. The proposal of a subway for foot passengers at King's Cross was withdrawn.

Midland Railway (London, Tilbury and Southend Railway Purchase) Bill.—Having passed the preamble of the above Bill, Sir J. Compton Rickett's Committee sat on July 16th to further consider the clauses, and were chiefly concerned in dealing with the running powers of the Great Northern Railway Co. over the line. The Committee decided to confine such powers to the dock traffic or to any future docks that the Port of London Authority might construct on the northern side of the river. The promoters asked the Committee to insert a clause to the effect that the Great Northern Co. should be obliged to electrify their trains running over the Tilbury line when the Midland Railway adopted electric haulage, but the Committee considered this was a matter which should be left to agreement or to the decision of the Railway Commissioners.

Light Railways Bill. Answering a question by Mr. Munro on Monday, the Prime Minister said he was aware of the desirability of the early passage into law of the Light Railways Bill, but he was not sure that it could be taken before the autumn adjournment. He was aware that at least one railway in the north of Scotland, which had the support of the Board of Trade, was being delayed by the non-passing of the Bill.

Second and Third Readings.—In the House of Lords on July 23rd the National Electric Construction Co.'s Bill was read a second time, and the Preston, Chorley and Horwich Tramways Bill passed third reading.

LEGAL.

British Westinghouse Electric and Manufacturing Co Ltd., v. The Underground Electric Railways Co. of London.

In the House of Lords on Friday, July 19th, the Lord Chancellor, and Lords Ashbourne, Macnaughton and Atkinson delivered their reserved judgment in the appeal by the plaintiffs in this action, seeking to reverse the decision of the Court of Appeal in favour of the respondents with reference to arbitration proceedings. The matter had reference to a contract for the supply of £225,000 worth of plant for generating the electric energy required for the working of the defendants' railways. This plant included eight turbines, which were admittedly not satisfactory on a given coal consumption, and the respondents substituted Parsons machines for them. The appellants claimed for £83,000, the balance of the purchase price of the turbines supplied under the contract, and the respondents thereupon counterclaimed for damages for breach of contract. The matter was referred to arbitration, and the arbitrator found that the respondents were entitled to £15,000. The appellants contending that they were liable only in nominal damages, and were entitled to the full balance of the purchase money, took the matter to a Divisional Court, which held that that contention was not well founded, and that the respondents were entitled to recover from the appellants, as damages, the purchase and installation of the Parsons machines. The matter was thereupon referred back to the arbitrator, who made his award on February 23rd, 1911, finding that the appellants were not entitled to recover anything from the respondents, while the respondents, on the basis of the decision of the Divisional Court, were entitled to recover from the appellants £15,394. The appellants moved the Divisional Court to set aside that award, but the Court were of opinion that they were bound by the previous decision. The matter then went to the Court of Appeal, which, by a majority upheld the award.

The Lord Chancellor, who read the judgment of the House of Lords, said two questions were raised before the Court of Appeal. One was whether it was competent for that Court to review the opinions given by the Divisional Court to the arbitrator. Lords Justices Vaughan Williams and Kennedy had come to the conclusion that the action of the respondents in purchasing the new machines had given them advantages in the conduct of their business subsequent to the breach of contract, but the appellants were not entitled to claim the benefit. On the other hand, Lord Justice Buckley had thought that the appellants were entitled to have a decision of the arbitrator as to whether the purchase of the new machines was reasonable and prudent for the purpose of mitigating the damages apart from its prudence for their own pecuniary advantage, and whether it was the only reasonable and prudent course which they could have taken to mitigate the damages. For instance, they could have purchased Parsons machines of 5,500-kw., which was the standard efficiency, under the contract, instead of purchasing, as they in fact did, Parsons machines of 6,000 kw. On that point, Lord Justice Buckley had considered the appellants had had no decision of the arbitrator, and were entitled to it. He (the Lord Chancellor) was unable to agree with the majority of the Court of Appeal, but he could not wholly agree with the view taken by Lord Justice Buckley. The arbitrator had found clearly that the effect of the superiority of the Parsons machines and their efficiency in reducing working expenses was, in point of fact, such that all loss was extinguished and that actually the respondents made a profit on the course they took; though not bound to purchase machines of a greater power than those contracted for, they, in fact, took a wise course in doing so, and with pecuniary advantage to themselves. Moreover, they had used the appellants' machines for several years, and had recovered compensation for loss occasioned by these machines not being up to the standard specified in the contract. The arbitrator had found that after that period it was a reasonable and prudent course to purchase the more powerful machines, and thereby all the remaining loss and damage had been wiped out. There were, however, certain broad principles that were well settled. Anyone who had proved a breach of bargain must, so far as money could do it, be placed in as good a position as if the contract had been performed, but that, however, was qualified by an obligation on the plaintiffs to take all reasonable steps to mitigate the loss consequent on the breach, and he was debarred from claiming any part of the damage arising from his neglect to take such steps. In his (the Lord Chancellor's) opinion the principle which applied in this case was that which made it right for a jury or arbitrator to look at what actually happened and balance the loss and gain. Apart from the breach of contract, the lapse of time had rendered the appellants' machines obsolete, and, as men of business, the respondents would be doing the only thing they could properly do in replacing them with new and up-to-date machines. For those reasons the special case stated by the arbitrator on the points of law had been wrongly answered by the Courts below, and the result was that the award could not stand, but must be sent back to the arbitrator with a declaration that the contention of the appellants so far—but only so far—as they contended that the several facts relied upon by them were relevant matter to be considered in assessing the damages was right, and the contention of the respondents on the second question was wrong.

The appeal was accordingly allowed, with costs, the appellants being also awarded the costs in the Court of Appeal and the Divisional Court upon the motion to set aside the award.

The Telephone Arbitration.

(*Continued from page 89.*)

The Attorney-General, at this juncture, said he was pleased to inform the Court that Mr. Danckwerts and himself had agreed upon the terms of an interim award. It was unnecessary to trouble the Court about the details. They would all be found in the document he intended to hand up. It was signed by his learned friend, Mr. Danckwerts and himself, and he proposed to ask the Court to make the award in the terms of the document. The document in question was then handed up to Mr. Justice Lawrence, and was perused by the Commissioners. Its contents were not disclosed.

Mr. Justice Lawrence said be supposed it would be necessary for the Court to make the award, and the Attorney-General replied in the affirmative, and said its object was that the Post Office might pay over to the Telephone Co. at once the amount due under the award.

[It will be remembered that a few days previously the question of an interim award was mentioned to the Court, and in connection with it, a sum of £3,500,000 was mentioned, the parties having agreed upon certain figures in the plant items. Sir Alfred Cripps, K.C., mentioned at the time that the company were anxious to obtain the sum to pay over to the preference shareholders, and on behalf of the Postmaster-General, no objection was raised to an interim award, Sir J. Simon stating that if such award were made the Postmaster-General would avoid paying some 5 per cent. interest on the money up till the time the final award was made, and that interest would represent a large sum of money.]

Mr. Cook, assistant engineer-in-chief to the company, was recalled and gave further details as to figures of plant cost, &c.

The first witness called on behalf of the Postmaster-General was Mr. J. F. C. Snell, M.I.C.E., who said his firm were advisers on all telegraphic and telephonic matters to the South African Government, the New Zealand Government, and the Crown Agents for the Colonies. In company with Mr. Andrew Young, chief valuer to the L.C.C., and officials of the Post Office, he had prepared the tables of figures which he now put forward. Witness had supervised the preparation of the fundamental prices on which the reinstatement cost was arrived at. The quantities used were agreed quantities. He had taken the fundamental prices for each of the classes of material scheduled in the inventory on the prevailing market prices at or about December 31st, 1911, the date of the sale of the system. Then for the actual contract work he had taken the records of the Post Office based upon actual contracts—not hypothetical tenders—carried out for work exactly comparable with the work which they were now valuing. Those contracts included all the items the contractor charged—contingencies, insurances, contractors' profits, and ordering and storing material—but in some of the materials he had to make adjustments in order to get at the proper costs by altering some of them, so as to bring them into exact alignment with the specifications of the company. Then he had added engineering fees, for supervision and designing, and the total represented the cost of construction. Dealing with the item of iron piping, witness said he thought £121 was a fair price for a mile run of 3-in. cast-iron piping delivered free on rail at the works, or 1s. 4½d. per yard. Witness gave further evidence with regard to figures for materials and freight charges. He said that there were 68 centres throughout the company's system which he had investigated on behalf of the Post Office with regard to freight charges. He had taken the actual length of piping used in each centre, and had converted it into weight. Then he had taken three actual sources of supply for this piping—viz., foundries in Wolverhampton, Nottingham and Sheffield—and by this means had arrived at the station-to-station rate between the foundries and the 68 centres in question. The calculation was not based on mere assumption but on actual material supplied to the various centres. Taking the whole of the 68 centres, he arrived at a total weight figure of 38,099·27 tons and a total freight charge of £15,126 2s. 8d., or an average of practically 8s. per ton.

Sir J. Simon said the National Telephone Co. relied upon what they said was their experience in arriving at their figures under this head. They had assumed that a certain proportion of the material would be carried in small parcels and another percentage in 2-ton lots and another in 4-ton lots. The Post Office, whether they were right or wrong, had assumed that they would get this material carried in substantial quantities, and therefore their figure for station-to-station rates was based on the calculation that the lots carried were 4-ton lots. In arriving at the source of supply for cast-iron piping, they had relied on experience and geography, and he did not think there was any error in that direction.

Sir A. Cripps said the substantial point between the parties was whether this station-to-station rate could be applied in all cases, subject, of course, to the question of quantities carried.

Mr. Buckmaster said that witness's tables showed the figures for 4-ton, 2-ton and 1-ton lots, all differently dealt with, and Sir Alfred Cripps could see at once the average figure obtained per ton.

Mr. Justice Lawrence said he was living in hopes that some agreement might be arrived at with regard to the freight question.

Sir J. Simon assured the Court that both sides were working in that direction.

Sir A. Cripps said that a point between them was whether the whole calculation should be worked out on the 4-ton basis.

Witness added that in arriving at a figure of 8s. per ton, they had not lost sight of the fact that in certain cases the lots of material dispatched might be less than four tons, but taking this into consideration they considered the 8s. to be a fair figure.

Witness, further explaining the method he had adopted in valuing the plant, said he had fixed the total cost of construction at £1,372,469. For supervision he would add 5 per cent., which was the general engineering percentage for supervising and administering construction.

The Solicitor-General: By making that addition you arrive at the figure which adequately represents the reinstatement cost?—Yes, I think the total of £1,441,093 is a fair cost for this particular section.

Counsel then proceeded to contrast the company's figures with those of the Postmaster-General and asked witness if the company's figure for the estimated cost of construction of 3,428·6 miles of single duct as on December 31st, 1911, was £2,840,755, or £828 per mile, and the Postmaster-General's figure, £1,441,093, or £420 odd per mile of single duct?—Witness agreed.

Witness said his tables in respect of wrought-iron piping were based on the actual prices taken from contracts, and the same remark applied to the laying of the conduit in the earth. Mr. Snell then proceeded to deal with the cable cost, &c., and gave figures with regard to the 68 centres for 600-pair dry-core lead-covered underground cable. He based his figures as on December 31st last. He worked out the actual cost per mile of this particular class of cable at £966·058. Witness, continuing, said that these figures were arrived at with the assistance of eminent cable manufacturers, including Messrs. Callender. Their instructions were that the prices obtained were to be for cables strictly in accordance with the N.T. Co.'s specifications. The materials were also to be based on the market prices ruling for copper, lead, tin, &c., on the nearest dates available to the date of sale. Those dates were December 2nd, 1911, and January 2nd, 1912. The prices were to include the testing of the cables at the maker's works, the coiling of the cables on the drums, the packing of the drums, the manufacturer's usual special charges and profit, and delivery at the works. In this way they arrived at the figure of £966·058 per mile, and he had checked it by quotations submitted to his firm for the delivery of practically the same cables to a Colonial Government. They had also gone so far as to obtain an independent tender from an eminent firm of cable makers.

Sir A. Cripps said that he admitted the prices given were fair as based on December 31st, but the question between the parties was whether that was a fair basis to calculate upon. There was also a dispute between them as to the question of wastage.

Proceeding with his evidence, Mr. Snell dealt with the question of wastage. The waste allowance per mile was 4 ft. multiplied by 20 joints. As a rule in contract work, cables were ordered, if they were of a large size, to suit the particular distances between the manholes which had already been constructed. Therefore there ought to be nothing but a very trivial waste upon what might be termed the manufacturer's length of the cable. The conduits and manholes were put in on the plans, and the cable ordered accordingly. The parties had agreed on the number of joints in a mile, viz., 20, and these were the places at which the cable had to be cut; allowing a length of 2 ft. wastage at each end of the cable at every joint, that made 4 ft. wastage per joint. He considered that was an ample allowance, and would not be exceeded in actual practice. Of the wastage, 75 per cent. was recoverable from the manufacturer. Making further comparisons between the company's figures and those of the Postmaster-General, witness said he estimated the cost of constructing the company's underground cables at £1,962,659 odd; that included supervision and consulting engineers' charges.

Mr. Buckmaster: It is roughly £2,000,000 on our side, and £3,500,000 on the company's side.—Witness said he estimated the cost of poles, including engineering charges, at £1,662,981, or an average of £3,889 per pole, compared with the company's figures of £2,614,444, or £6,115 per pole. The distribution wiring was in shorter lengths than what he might call the ordinary "straight through" wiring and that obviously necessitated more labour, also the wiring on house tops incurred more labour than wiring from the ground level. Therefore, in arriving at his figures for wiring, he had added 10 per cent. on the ordinary "straight through" work for the shorter distribution work and 20 per cent. for the more difficult over house work. These figures were, of course, largely arrived at by judgment, but he thought they were fair.

In reply to Sir James Woodhouse, Mr. Buckmaster said the most serious difference between the parties was the question of freight. The Post Office had calculated the weight of material as being at the centres, whilst the company contended that it should have been taken at the distributing townships round the centres.

Sir A. Cripps said there was a question of special rates and class rates to be considered.

Mr. Justice Lawrence: I think the parties would be very wise if they could adjust the difference. It is no good fighting a broad view to the last penny.

Witness said the total figure for the cost of construction of bare wire was £2,037,811, to which had to be added consulting engineers' charges of 5 per cent., making a grand total of £2,139,702, or £8·3 per single mile. The company's figures were £3,348,651, or £12·97 per mile. The total cost of aerial cables was estimated at £497,987, or £9·406 per mile, as against the company's estimate of £1,017,055, or £19 per mile. There were 98 centres. The figures for exchange equipment were estimated on behalf of the Postmaster-General at £1,505,139.

The Solicitor-General pointed out that this figure did not include the Glasgow exchange, because the Postmaster-General took exception to acquiring that exchange altogether.

Witness, continuing, said the company's figure, including the Glasgow exchange, was £2,642,344.

In the course of further evidence, Mr. Snell said the estimated cost of subscribers' instruments, &c., was put by the Post Office at £2,369,735, compared with the company's claim of £3,759,393. With regard to the total contractors' costs, witness said there were only 2½ millions difference between the parties, but when they came to arrive at the total cost of construction, the company added charges which increased the difference to over eight millions. In other words, the figure for the total cost of construction was put by the G.P.O. at £11,617,166, whilst the company estimated it at £19,499,309. Dealing with insurance and maintenance charges, witness said that the period of contractors' insurance and maintenance charges of an exchange slightly overlapped the period when the exchange became revenue-earning, because it was customary to begin to employ the exchange before it actually left the contractors' hands or was finished.

(To be continued.)

SUNDERLAND DISTRICT ELECTRIC TRAMWAYS, LTD

In the Chancery Division on Tuesday, July 23rd, Mr. Justice Swinfen Eady had before him a petition by the company to sanction a scheme for the rearrangement of certain portions of the capital. There was also a summons taken out in a debenture-holder's action to sanction an agreement by which the proposed new issue under the scheme was to be under-written.

Mr. Gore Browne, K.C., for the company, said it was formed in 1903 for the purpose of working the tramways in the colliery districts adjoining Sunderland. Owing to subsidences in the soil difficulties had arisen which necessitated very important and expensive repairs. The ordinary capital of the company was not affected by the scheme, but subsequent classes of capital were. Five per cent. debentures to the amount of £160,000 were issued in 1903, and there were also a number of loans secured by a charge dated December, 1906. Such loans amounted to £19,700. In December, 1907, with the sanction of the debenture-holders and the holders of various charges, £20,000 of prior lien bonds at 5 per cent. were put in front of them and secured by a deed. The bonds were redeemable at 5 per cent. bonus. The company earned sufficient profits to pay interest upon its securities down to 1910, but did not earn sufficient to pay any dividend upon its share capital. On May 28th, 1910, the holders of the £160,000 5 per cent. debentures commenced a debenture-holder's action on the ground that the company's property was in jeopardy, and Mr. Eves was appointed Receiver. In 1910 Mr. Eves was also appointed Receiver for the prior lien bondholders, and the actions were consolidated. The tramway was worked until May, 1911, by the Receiver, and had since been worked by the directors; but the Receiver had been paid the money. Altogether there was a balance in hand of £16,000. The certificate showed that the outstanding prior lien bonds to the amount of £11,025 had been issued, and £160,000 of debentures, in addition to the loan of £19,700 secured by a third charge. No interest had been paid since December, 1910. A considerable sum was now required to put the line into proper order, owing to sinkages which had occurred. It was proposed to create an issue of 5½ per cent. new prior lien bonds, but to issue only £20,000 of it at present, and out of the proceeds of that issue to pay off in full the whole of the existing prior lien bonds. For the rest it was proposed to create first income bonds up to £72,000 carrying interest at 5 per cent., such interest being subject, among other things, to payment of a sinking fund. The capital was to be charged further by the creation of a second series of debenture bonds at 5 per cent. to an amount not exceeding £12,000.

His Lordship sanctioned the scheme, and also the agreement by which the underwriter agreed to underwrite the new classes of securities to be issued under the scheme.

The Reason Manufacturing Co., Ltd.

In the Chancery Division, on Monday, Mr. Justice Swinfen Eady heard a petition by this company to sanction a reduction of capital by wiping off the amount of a debit balance of £32,000.

Mr. Ashton Cross appeared for the company, and said the reduction did not involve any diminution of liability on the unpaid shares. The company was formed in 1900 to take over the business of an old electrical company. For the first few years it was a very successful concern, and paid dividends ranging up to 10 per cent. Then came a change in the fortunes of the company. It was unsuccessful, and as a result of its trading it found itself with a debit balance. This balance went on increasing until now the company were anxious to get rid of it. It was proposed to reduce the capital from £70,000 divided into £1 shares, to £37,533 divided into 61,803 shares of 9s. 6d. each and 16,394 share of 10s. each. The reduction was to be effected by cancelling capital lost or unrepresented by available assets to the extent of 10s. 6d. on each of the 61,803 £1 issued shares, and by converting the remaining 8,197 unissued shares of £1 into 16,894 shares of 10s. each. It was proposed at the same time to issue these 16,894 shares and call them preference shares bearing interest at 6 per cent.

His Lordship sanctioned the scheme.

Indian Electric Supply and Traction Co., Ltd.

In the Chancery Division on Tuesday, Mr. Justice Swinfen Eady had before him a petition by the company to confirm a reduction of capital. It was explained by Mr. Gibson for the petitioners that the company was incorporated in 1905 to establish electric tramways and work electrical enterprises generally in India. It was formed with a capital of £600,000 divided into 120,000 shares of £5 each. Of these the company had issued 26,009 shares fully paid up, making the issued capital £130,035, and it was proposed to reduce the shares from £5 to £3, and thus wipe out a loss of £52,014.

His Lordship sanctioned the scheme.

Workmen's Compensation Case.

Giving judgment in a stated case in an appeal under the Workmen's Compensation Act, between the Wemyss Coal Co, Ltd., and John K. Symon Buckhaven, who was injured in attempting to board a car, Lord Justice Clark said the boy left a fixed stopping place and went towards the coming car. No one invited him to go forward and meet the running car and get on while it was going at 5 miles an hour. His Lordship could not assent to the view that because a boy might not run much risk in mounting a car moving at that rate any accident which occurred was to be regarded as incident to his employment. The rule as to stopping-places was established because there was danger, and the person who broke the rule did so at his own risk. The act was not necessary to the fulfilment of his duty, and in no way facilitated his employers' business

Barnstaple Lighting.—The T.C. has decided to extend the mains so as to supply current for the lighting of Pilton Church.

BUSINESS NOTES.

A Perpetual Calendar.—Messrs. Everett, Edgcumbe and Co., Ltd., of 117, Victoria Street, S.W., have sent us a very ingenious perpetual calendar, mounted on a representation of one of their 6-in. dial ammeters. The numbers representing the dates of the month are printed on a movable chart in such a way that, on setting the first day of the month against the correct day of the week, the calendar is right for the whole month; it is easily adjusted at the beginning of each month, and is printed in bold, clear figures. The idea appears to be quite novel in this form. Messrs. Everett, Edgcumbe are distributing the calendars to their friends, and will be pleased to forward one to any of our readers.

Annual Holidays.—Messrs. E. Brook, Ltd., of Colne Road, Huddersfield, announce that their works will be closed from Friday night, August 2nd, to Monday morning, August 12th, for the holidays.

The Midland Electric Manufacturing Co., Ltd., of Rea Street, South Birmingham, will close from Saturday, August 3rd, to Monday morning, August 12th.

The British Prometheus Co., Ltd., of Birmingham, are closing down their works for the annual holidays and stock-taking on Wednesday, 31st inst., and will reopen on August 12th. The London showrooms will be open as usual.

Messrs. Willans & Robinson, Ltd., of Rugby, announce that their works and offices will be closed from August 2nd until August 12th.

Messrs. Muirhead & Co., Ltd., of Elmers End, Kent, will close their works from August 3rd to 15th inclusive.

The Westinghouse Brake Co., Ltd., of York Road, London, N., will likewise be closed for the annual holidays from the evening of August 2nd until the morning of August 12th.

In all the above cases a small office staff will deal with correspondence.

Russia.—The Russian Customs authorities have lately issued an amendment with regard to the import duty on electric incandescent lamps with metal-filaments, the duty having been increased from 30 to 65 roubles per pood in the case of lamps (*a*) mounted, and from 60 to 90 roubles as regards (*b*) not mounted lamps. A rouble is approximately 2s. 1½d., and a pood 36 lb.

Veritys' Glasgow Depôt.—Owing to an increase in their Scottish business of a specially encouraging nature, Messrs. Veritys, Ltd., have opened a supplies department and machinery and fixture showrooms on an extensive scale at 51, Waterloo Street, Glasgow. The depôt, both in external appearance and internal arrangements, is very similar to their head depôt at 31, King Street, Covent Garden, London. of which we gave an account in our issue of October 20th, 1911. At the entrance one comes across an extensive display of the productions of their engineering department—"Aston" motors, ready for delivery—a complete range of "Aston" switchgear, "Aston" arc lamps, and other interesting adjuncts. From this one passes to the supplies department, fitted up in the usual manner for the ready handling of over-counter trade, which is such an important item in a busy metropolis like Glasgow. The showroom has been built into the depôt, and has been laid out and decorated by Messrs. Wiley and Lockhead. Here, not only have the firm displayed their lighting fixtures in their periodised manner, but they have also arranged an exhibition of lighting fixtures to show the application of up-to-date principles of light distribution—an important feature with the public to-day. In addition to the above, there is also a display of radiant lanterns, and other street-lighting apparatus, also of "Aston" heating and cooking appliances, calculated to appeal to the public. We are informed that large stocks are being kept at this depôt in order to give prompt delivery. and these stocks are backed by the completed extension of the works, which was in

The Entrance to Veritys' Showroom at Glasgow.

hand last year, enabling them to give quick deliveries of "Aston" motors and switchgear, and, finally, supported by their new large delivering warehouse in London, where some thousands of pounds worth of stock has been accumulating for quick dispatch to any part of the country.

Meeting of Creditors.—H. G. Norton & Co., Ltd., cycle, motor and electrical engineers, Cheltenham and Gloucester.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of creditors of the above was held on 17th inst. at the Imperial Hotel, Birmingham. The chair was occupied by Mr. G. G. Poppleton, of Messrs. Poppleton & Appleby, chartered accountants, Corporation Street, Birmingham, who had been appointed to act as joint liquidator of the company as the representative of the trade creditors. According to the statement of affairs presented the liabilities amounted to £13,517, while the assets were estimated to realise £9,245, or a deficiency as regarded the unsecured creditors of £4,272. As regarded the contributories there was a deficiency of £13,774. That loss was principally due to two items which had not previously been written off—bad debts and differences in the value of the stock. The company had never paid any dividends, and had been hampered from the start by lack of capital and heavy expenses. The principal creditors were Humber, Ltd., whose claim amounted to £2,300. Their claim was quite in order, although a counterclaim was made against them. After some discussion a resolution was passed in favour of the voluntary liquidation of the company with Mr. G. G. Poppleton and Mr. L. Vizard as joint liquidators. A committee of the principal creditors was elected, and the liquidators were authorised, if the necessity arose, to take proceedings to set aside debentures to the extent of £3,200 issued to the vendor.

Catalogues and Lists.—Messrs. F. Darton & Co., 142, St. John Street, London, E.C.—48 pp. catalogue, giving illustrations and prices of a variety of electric novelties, including miniature lamps, flash lamps, table lamps and other small electric lighting sets, dry batteries, small motors and dynamos and parts of same, demonstration motors, bells, telephones, advertising novelties, medical coils, vacuum tubes, &c.

Messrs. W. Geipel & Co., St. Thomas Street, London, S.E.—Four-page illustrated list, giving particulars and prices of vulcanised rubber insulated aluminium electrical conductors, from 1/22 to 37/14 S.W.G. A table is given, compiled by Mr. Geipel, showing diameters, areas, resistances, weights and current for wires of various S.W.Gs. Owing to the present price of copper, a saving of from 5 to 25 per cent. (according to the size of the conductor) can be shown by the use of aluminium insulated conductors of the same power transmitted and the same drop in the line.

The Brush Electrical Engineering Co., Ltd., Loughborough.—Art brochure of 70 pages, with coloured frontispiece, entitled "The Book of the Steam Turbine." The book is profusely illustrated giving views of complete turbines and parts of same, and it describes the principles of the machines.

Messrs. Adnil Electric Co., Ltd., Adnil Buildings, Artillery Lane, London, E.C.—8-page illustrated pamphlet showing a variety of telephone and signalling apparatus for coal and gold mines, railways, ships, and works.

The British Thomson-Houston Co., Ltd., Rugby.—20-page price list (No. 363) giving very full particulars of the B.T.-H. "Fabriol" pinions. A number of pages give detailed tables of prices of various sizes, and there are also rules for determining dimensions of spur pinions, diagrams showing velocity at pitch line and H.P. per in. of face, and a data sheet.

Messrs. Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—New complete list (over 40 pages) relating to switchboard instruments, divided by a thumb index into five sections as follows: Electromagnetic instruments for D.C. or A.C.; moving-coil instruments for D.C.; electro-dynamometric ampere, volt and wattmeters and power factor indicators; induction Ferraris type A.C. instruments, and electrostatic voltmeters. The list is fully illustrated, and prices and code-words are clearly set out in tabular form.

Messrs. Seear, Page & Co., 16 and 17, Devonshire Square, London, E.C.—Small pamphlet explaining what Plas-mica is (a soluble form of mica), and its uses and price.

The London Electrical Trading Co., Ltd., Palmerston House, Old Broad Street, London, E.C.—Catalogue comprising a number of leaflets, giving first general and then descriptive illustrated and price information relating to Bastian electric-heating apparatus. The contents include:—The Bastian "A," "F," "FF" and "G" type heaters, standard heater frame, the lantern-type heater, ships' heaters, "Exchange" and "Admiralty" types, table heater or toaster, kettles and saucepans, hot-plates and ovens. Special attention may be directed to the "Pygmy" heater, which is a very cheap line to run from the house lighting circuits for many household and nursery purposes. It is described as cheaper than the methylated spirit lamp, and it will cost for half an hour per day, with electricity at 6d. per unit on the lighting circuit, less than 3d. per week, or for one hour per day on the heating circuit at 1d. per unit less than 1d. per week.

Messrs. Kanson & Co., 1, Argyll Street, Oxford Circus, London, W.—Card giving prices of Cross metal-filament lamps.

Messrs. Simplex Conduits, Ltd., Charing Cross Road, London, W.C.—Supplementary list D.10 giving particulars of their motor service and house service fuse-boxes. They are the usual split type of box with bushed inlets and outlets, and a type with a boss at either end which can be drilled and tapped for screwed conduits: both may be obtained designed for ordinary fuse wire, or for Simplex enclosed fuses. Those for 500-volt circuits are for cartridge fuses only. Prices are stated. The double-pole fuse with a double switch mounted complete on teak board, is also illustrated in this leaflet.

The Electrical Co., Ltd., of Charing Cross Road, W.C., have announced reduced prices of flat-irons of from 4½ to 10 lb. weight.

The Edison and Swan United Electric Light Co., Ltd., 36 and 37, Queen Street, Cheapside, London, E.C.—The company has issued a hanging showcard very effectively depicting one of its "Ediswan" fans, also several pieces of publicity literature relating to these manufactures, among them being No. H 2,248, giving a brief specification and illustrations with prices of the firm's special types of convertible table or bracket pattern, with swivel and trunnion movement, and ring or porthole fans.

Messrs. Elliott Brothers, Central Buildings, Westminster, S.W.—Two new lists have been issued. No. 51 (20 pages) contains a general specification, illustrations, prices, and so forth of D.C. switchboard instruments, moving-coil type (round, edgewise and sector patterns), shunts and resistances for ditto, also soft iron types (round and edgewise patterns). The prices show a large reduction on those in previous lists. No. 57 (16 pages) deals with portable testing sets, and several new patterns of these are listed.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—Reference was made here some months ago to the firm's framed cartoons "Selling the Tantalum Lamp," and "Making the 'Wotan' Lamp." These are now being supplied to contractors doing business in these lamps, and the firm will be pleased to forward a pair upon request.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—List describing with illustrations, and giving prices of, wireless china "Sunlite," the reflecting surface of which is of white glazed china. Instructions for fixing are included.

The Power Plant Co., Ltd., West Drayton.—Booklet No. 4, dealing with double helical gearing and its application in electric generating stations.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—16-page catalogue of electro-medical apparatus, giving illustrations and prices of induction coils, electrodes for medical coils, magneto machines, electric vibrators, &c.

The Hart Manufacturing Co., 77, Rochester Row, Westminster, London, S.W.—Leaflet describing the Hart series-parallel heater switches (three heats) for use on heating and cooking apparatus. A connections diagram and statement of prices are given.

The Anti-Window-Steaming Co., Ltd., 52, Gracechurch Street, London, E.C.—Small pamphlet relating to an electrically-operated apparatus for the prevention of steamy windows. A centrifugal blower forces cold air through a nozzle on to the surface of the window preventing accumulation of moisture.

Japan.—The Allgemeine Electricitäts Gesellschaft have recently supplied the cable required to connect up the central station at Kobe, Japan, with two sub-stations for the Kobe Electric Light Co. The cable is iron tape armoured, and consists of asphalted lead cable with paper insulation and three sector-shaped, stranded copper conductors, each having a section of 64·52 sq. mm., and transmitting current at a pressure of 11,000 volts. The A.E.G. have also supplied 10 single-phase oil transformers for the sub-stations as well as the switchgear for the main and sub-stations.

Osrams at the Palace.—We have received from the General Electric Co. an interesting illustration showing the superbly-decorated and brilliantly-illuminated interior of the Palace Theatre, London, as arranged for the recent visit of Their Majesties King George and Queen Mary. The floral decorations of the auditorium were illuminated mainly by Osram lamps, of 25 and 32 C.P., about 2,000 being supplied for that purpose. The dome of flowers taking about 600 Osrams, and the centre light, composed of about 100 Osrams, were particularly effective.

Book Notices.—*The University of Liverpool Engineering Society Journal*, of which the first number has just issued from the University Press of Liverpool (price 1s. 6d. net), is produced in a manner worthy of its origin; it is intended to provide a record of the transactions of the Society, with papers and articles on engineering matters, and is edited by Mr. J. F. Gill, M.Sc., with the aid of an advisory board comprising other members of the University staff, including Profs. Marchant, Perrott and Watkinson, and the President of the Society, Mr. E. L. V. Dakin. A serial by Mr. E. J. Rimmer on "The Law Affecting the Engineer" is begun in this issue, and several abstracts and articles are included.

Everyday Uses of Portland Cement. London: Associated Portland Cement Manufacturers (1900), Ltd. Price 1s. 6d. net.—This is the second edition of a useful treatise, bringing together a great deal of valuable information as to the nature and qualities of Portland cement, its treatment and applications. The book is abundantly illustrated, and contains the most detailed instructions and memoranda, together with numerous examples of concrete construction, showing the extraordinary versatility of the material. Amongst other items of interest to electrical engineers may be mentioned concrete telegraph and transmission line posts and standards, telpher line supports, chimney shafts, water towers, coal bunkers, water mains, and buildings of every description.

"Red Book," No. 166, of the British Fire Prevention Committee describes fire tests with glass, the subject being the "Copperlite" glazing of Messrs. Hayward Bros. & Eckstein, Ltd. It was found that this glazing afforded a most useful amount of protection from the effect of an external fire—provided that the glazing was properly fixed.

The Valveless Car Handbook is an admirable account of the construction and working of the "Valveless" motors, issued by Messrs.

David Brown & Sons (Huddersfield), Ltd. The ingenious engine which forms the chief feature of the system has two cylinders side by side, with shafts geared together, and works on the two-stroke cycle, and, if not actually innocent of valves, comes as near to that condition as is conceivably possible. The description of the mechanism is clear and well illustrated.

"The Post Office Electrical Engineers' Journal." Vol. 5, Part 2. July, 1912. Special Number. London H. Alabaster, Gatehouse and Co. Price 2s. net.

"*Journal* of the Franklin Institute." Vol. CLXXIV, No. 1. July, 1912. Philadelphia: The Institute. Price 50 cents.

"Boletin de la Sociedad de Fomento Fabril." May, 1912. Santiago, Chile: The Society.

"*Journal* of the American Society of Mechanical Engineers." Vol. 34, No. 7. July, 1912. New York: The Society. Price 35 cents.

"*Bulletin* of the Association des Ingenieurs Electriciens." June 29th, 1912. Liége: The Association.

Meter Testing.—In our advertisement pages to-day will be found a full statement of the rules and scale of fees proposed by the L.C.C. in connection with the testing by the Council of electricity meters, in place of those now in force.

Electric Irons.—As as example of the durability of electric irons we quote the following:—Over five years ago the G.E. Co. supplied to one of their customers a 4-lb., 100-volt Domestic electric iron, which, it is reported, has ever since been in almost daily use until a week or so ago, when it was returned to the company owing to its owner moving to a district served at a higher voltage. In spite of its hard life, it is still in perfect working condition, and can now be seen in operation at the showrooms of the company in Queen Victoria Street.

Bankruptcy Proceedings.—ROBERT EDWIN WALKER, Eign Road, and 16, Widemarsh Street, Hereford, electrical engineer, &c.—An application was made by Mr. F. Carver (Messrs. Allen and Carver), to his Honour Judge Harris Lea, sitting at the Shire Hall, Hereford, last Tuesday week, for the discharge from bankruptcy of the above debtor. He said that the debtor sold a half share of the business to a Mr. Vickery, at which time his assets were valued at £320, and, if they had been properly realised, they would have been sufficient to pay over 20s. in the £, the liabilities being only £229, but although the affairs went into the hands of a solicitor, they got into such a muddle that the assets realised only £128, instead of £181, as estimated. Debtor was pressed by a creditor and filed his petition. A dividend of 5s. 9d. in the £ was paid on proofs for £223. The debtor attributed his failure to complications arising in consequence of entering into a partnership which prevented him from paying his own debts, whilst at the same time his partnership and other assets were insufficient. The Official Receiver made no objection to the application. The Judge remarked that the debtor's mistake was in selling his half share, and he had evidently been more sinned against than sinning. His Honour gave a full discharge on his paying £5.

GEORGE EDWARD HERVEY, 24, Susans Road, Eastbourne, gas and electrical engineer and ironmonger. The public examination of the above-named debtor was held at the Town Hall, Eastbourne, on Tuesday last week, when the debtor was legally represented by Mr. Reed. He stated that he started business with a partner in 1906, but had since paid him out. His liabilities amounted to £241, and the book debts totalled about £20, and the stock could realise £50. During the past two years he had paid something like £856 to his creditors, and had received about £1,530 during that time. The balance would have been paid in wages and other expenses. The failure was attributed to lack of capital, depression in trade, bad debts, and depreciation of stock. The case was formally adjourned for the signing of notes.

HENRY HALLIFIELD OXLEY (otherwise Oliver Huxley), consulting engineer, 22, Uxbridge Road, Hanwell, late 120, Coldershaw Road, Ealing.—The first meeting of the creditors of the above was held on Monday, at the offices of the Official Receiver, 14, Bedford Row, W.C., Mr. Cecil Mercer presiding. According to the statement of affairs the gross liabilities amounted to £1,424, all of which were expected to rank, while the assets were valued at £117, or a deficiency of £1,307. The debtor attributed his failure to want of employment and losses over attempted flotations of companies. The deficiency account showed that the debtor had lost £1,411 through bad debts, while he had incurred liabilities of £550 on behalf of a company. The receiving order was made on the petition of a creditor, the act of bankruptcy alleged being the debtor's failure to comply with the requirements of a bankruptcy notice. The debtor, aged 29, was appointed managing director of a company in January of the present year, and filled that position up to June 24th last. He was now acting as manager of the British and Foreign Investments Corporation, Ltd., at a salary of £500 per annum. Between November, 1910, and January last, he had earned commission by introducing capital to various concerns, and he had tried to float the Electrical Power Users' Association, Ltd. He was not successful, and followed that up with the Imperial Crown Insurance Co., Ltd., which was not successful as far as he was concerned. He lost about £1,000 in the flotation of these two companies. A solicitor who appeared for the debtor asked for the meeting to be adjourned, as it was proposed to bring in a scheme with the object of paying the creditors a cash composition of 7s. 6d. in the £. The money necessary for the payment of the composition would be found by friends. In addition, three of the creditors would release their debts. The Chairman pointed out that it would have to be an absolute release, and there must be nothing underhanded about it. The solicitor said he understood that and sufficient money would be lodged in cash to pay 7s. 6d. in the £, and the whole of the expenses. In answer to questions, the debtor stated that he had spent about £800 on one company. The Chairman remarked that at the date of the receiving order several creditors had obtained judgment, and executions had been levied. The debtor had himself admitted that he had been frequently sued during the last four years. Asked regarding his losses on the two companies, he said that one company was the development of another. The household furniture belonged to his wife. Some of it was given her by her father, and the rest she purchased with her own money. She had means of her own, as her father made her an allowance. Last year that allowance came to more than £1,000. Acting on his recommendation, his wife put £700 in a company, and that money was lost, but certain proceedings were pending. The Chairman remarked that it appeared to be a very foolish investment, and it would have been better had the money been put into the bank. The Chairman then asked what the British and Foreign Investments Corporation did, and inquired whether it was a company which lent or spent money. The debtor replied that it did both, but it dealt chiefly with investments. The Chairman: It invests other people's money does it? The Debtor: Yes. Replying to further questions, the debtor said he did not think the fact of a receiving order being made against him would cause him to lose his position with the Corporation. The Chairman said that the Court might make an order for a portion of the salary to be set aside, but if the composition was paid that question would not arise. The meeting was adjourned to enable the offer to be formulated

At the Court House, Half Acre, Brentford, on Tuesday, the debtor appeared before Mr. Registrar Ruston for his public examination.

Answering the Deputy Official Receiver, the debtor said that for about 15 months he was employed in Sheffield teaching engineering at a salary and commission. He then took the name of Oliver Huxley, in the hope that the name of Huxley would produce more pupils than he otherwise would get. In January, 1912, having a number of influential friends, he introduced certain companies, in the flotation of which he had expended about £800, most of which belonged to his wife. He never received any salary or expenses in regard to the Electrical Power Users' Association, nor the Imperial Crown Insurance Co., but as managing director of the British and Foreign Investments Corporation he obtained a salary of £500 a year. He was not now managing director of that Association, but was manager at that salary; he retired from the managing directorship automatically, but he expected to be reinstated. He had agreed to take up 100 £1 preference shares in that company, and 1,000 1s. deferred shares, but they had not been paid for at the present time, although he had received the letter of allotment. In connection with the other two companies, more than the £800 he had mentioned had been lost, but that was approximately the amount lost by himself and his wife; the creditors had also lost their money in that way. To find the total loss it would be necessary to add the amounts claimed by the biggest creditors mentioned in his statement of affairs, and there were also several others.

The Deputy Official Receiver: Do you think you were justified in in incurring these liabilities?—I had four good directors who promised to support me, but who did not. Proceeding, he explained that he had attributed his failure partly to unemployment, because when he found the two companies were failures, he spent some time in looking for a berth. He was embarrassed about four years ago, but it was not until the Official Receiver pointed it out on the previous day that he recognised that he must have been insolvent at that time.

You have been sued several times during the last six months?—Yes.

And executions have been levied against your goods?—Yes.

As far back as May 29th, 1909, Messrs. Waring & Gillow obtained a judgment and costs against you, and on June 2nd served you with a bankruptcy notice?—Yes.

That notice was served out of the Manchester Court?—I think that is so.

Where were you living at that time?—In Manchester.

What did you do when you received that bankruptcy notice?—I went around and saw them, and told them I would do what I could in the matter.

Then did you leave Manchester?—Shortly after that.

What became of the bankruptcy notice?—I do not know.

At all events a petition was not served upon you subsequently?—No, Sir.

Mr. Stone has obtained judgment against you?—That is right.

For £65 1s. 6d.?—Yes.

Did you defend the action brought against you by Mr. Stone?—No, Sir.

Are you quite certain?—Yes.

Judgment went against you by default?—Yes.

Was judgment obtained against you and Sir Paynton Piggot?—Yes.

Was he a director of your company?—No, but he was connected with it.

Application was made afterwards to set aside the judgment against Sir Paynton Piggot?—Yes.

Mr. Anderson has obtained judgment against you, has he not?—Yes. Debtor stated that that was in respect of £250 money lent for the requirements in connection with the flotation of a company. Mr. Anderson filed a bankruptcy notice against him in the High Court a long time before Christmas, but did not file a petition. Mr. George Stone had filed a petition against him in the High Court, which was pending against him at the time of this receiving order. When he heard of the receiving order, he did not proceed further with it.

So that, to put the matter shortly, you borrowed a very considerable amount of money in connection with the flotation of these companies, and you have been continually sued for some years ?—No, not for some years, but this year, and particularly during the last six months.

And in 1909 by Waring & Gillow ?—Yes. Proceeding, he said that, in his statement of affairs, he returned no furniture, as that was claimed by his wife ; some she had obtained by purchase, some by gift and some by hire. His wife had an allowance from her father, but that amount had been considerably exceeded during the past year.

Did you hire furniture from John Harrop, Ltd., of Manchester ?—No. I had some furniture years ago, but that was seized for rent.

Messrs. Harrop, Ltd., hired certain furniture to you ?—They hired it to me four years ago, but it was seized.

These agreements of September 8th and September 12th, 1906, were entered into by you ?—Yes.

What became of the furniture ?—It was seized for rent, and they did not object.

Messrs. Waring & Gillow obtained judgment against you in 1909 for furniture supplied in 1908 ?—That was seized at the time Harrop's was. I left it behind and never saw it any more.

Where was that ?—At Chorlton-cum-Hardy, near Manchester.

Did you leave it behind and never inquire about it ?—There was the bankruptcy notice when I came away.

Whose was that ?—Messrs. Waring & Gillows.

You are quite certain that a receiving order was not made ?—Yes, quite sure, because I saw them within a very few weeks afterwards: I did not leave Manchester right away. I remained there at another address for some months, and saw them two or three times, but no receiving order was made.

Did you take any steps to ascertain anything about it ?—I did when Harrop's kicked up a row about it.

I am talking of Messrs. Waring & Gillows ?—Apparently it was seized in execution.

They say you still owe the amount of judgment with costs ?—I do not know, I think I got some of it back, but at the moment I really do not know what was the end of the matter.

Messrs. Waring & Gillow state :—"We obtained judgment against this debtor on May 28th, 1909, but the debtor fled and we were unable to find him." You cannot assist me further ? Are you quite sure that you have not any furniture belonging to you in your possession ?—Quite. The officers of this Court have exhausted that matter two or three times recently.

Do you remember writing on August 30th to Messrs. Turner and Osman speaking of making some arrangement ? You say : "I am married with a good house of furniture and effects, and hold a good permanent berth" ?—It was not my furniture : that was a misstatement.

It was fair to assume that you had a good house of furniture at that time ?—I daresay I could have got my wife to be security for me.

Did you discuss it with your wife ?—Yes.

Did she say she would be willing to help you ?—She did not ; she said she would rather find the money herself.

Answering further questions, the debtor said he borrowed small sums of money from his wife in connection with the flotation of companies and certain debts. The British and Foreign Investments Corporation owed him about £100, which would be paid. A book debt of £1,500, put down to the Electrical Power Users' Association, Ltd., was in connection with the preliminary expenses of flotation ; he had never received any salary or any return of money expended ; that debt was bad, because he did not think that concern had got the capital. He was prepared to make an offer of 7s. 6d. in the £, and his creditors adjourned their meeting of the previous day (Monday) until August 12th, to enable him to make a proposal.

The Deputy Official Receiver : Who is to guarantee payment ?

Debtor's Solicitor : It will be paid into the hands of the Official Receiver.

Debtor : The money will be paid by someone, not myself.

After a few further questions the examination was adjourned.

John William Garsden (trading as J. W. Garsden & Co.), electrical engineer, 24, Preston New Road, Blackburn.—The first meeting of creditors herein was held on July 18th, at the Official Receiver's offices, Byrom Street, Manchester. Mr. Chas. H. Plant, the Official Receiver for the Preston and Blackburn districts, presided. The statement of affairs disclosed liabilities amounting to £5,036, and assets estimated to produce £925 net, leaving a deficiency of £4,111. The debtor attributed his failure to being made jointly and severally liable for a sum of £1,100 in connection with a previous partnership dissolved at the end of 1909, and for which he never considered himself liable. The chairman explained that when he came into possession of the estate there were a number of contracts which required to be completed, and he considered it advisable to carry on the business and work out the contracts. For that purpose a special manager was appointed and the business continued. It was hoped, he added, that the business might be sold as a going concern. Debtor having no offer to make the meeting appointed Mr. Joseph Smith, I.A., of Blackburn, as trustee with a committee of inspection. The debtor first commenced business about nine years ago with a Mr. Wesley Sutton, and a Mr. Samuel Lord, trading as the Howe Electrical Engineering Co. Debtor put £700 into the business, money given him by his father. Sutton and Lord were previously carrying on the business, and the £700 purchased a third share. The business was not successful, and at the end of 1909 it was turned into a limited company, Sutton going out and a Mr. Sington coming in and bringing in further capital to the extent of £1,000. The limited company traded in the same name, but the business was not successful, and in February of last year it was wound up, no dividend being paid. The company had a branch business at Blackburn, and this the debtor took over in February, 1911, paying £155 for the goodwill and stock. This money he got from the bank, his father guaranteeing his account to the extent of £200, afterwards increased to £300. This business at Blackburn has, according to the debtor, been a paying one, and he made about £3 a week net profit out of it. He would have continued to make it pay, but a judgment was obtained against him for £1,118 and costs in June last, in connection with money which had been brought in or advanced to the partnership of which he was formerly a member. Debtor stated that he had never considered himself liable for this money, and that it was lent to and brought in by one of the partners personally. Judgment, however, was obtained against the debtor, and he was compelled to file his petition. In March last a balance-sheet was prepared, showing that he was solvent save as to the moneys advanced by his father and brother-in-law. The amount due to the father is £2,156, part of that being for rent.

Trade Announcements. — The Lord-Howe Electrical Engineeeing Co., Ltd., of 18, James Street, Liverpool, who have had the agency for the National Telewriter Co., Ltd., for Liverpool, for some time, have been appointed agents for all Lancashire and Cheshire, and have opened a branch office at 5, Cathedral Yard, Manchester. Telephone, "No. 3300 City."

Messrs. Jaeger Bros , 18, Christopher Street, Finsbury Square, London, E.C., have been appointed sole agents for the British Isles for the Swiss Cable Works, Ltd., and they are accumulating large stocks in London for immediate delivery.

Messrs. Krupka & Jacoby have purchased in Westminster a very large property, consisting of offices, warehouse and factory, built on up-to-date lines and fitted with all modern improvements, where they will carry much larger stocks enabling them to deal more expeditiously with orders.

The business of Mr. E. J. West, electrical engineer, 47a, Market Street, Bacup, has been taken over by the executors of J. Birtwistle, of Waterfoot.

Liquidations.—Beck Flame Lamp, Ltd.—Creditors must send particulars of their debts, &c., to Messrs. H. J. Page and G. E. Corfield, 21, Ironmonger Lane, E.C., the joint liquidators, by August 26th.

Liverpool International Exhibition (1912) Co., Ltd.—A meeting is called for August 27th at 1, Vernon House, Bloomsbury Square, London, W.C., to hear an account of the winding up.

Vaughan Engineering Installations, Ltd.—A meeting is called for August 29th, at 60, Oakley Street, S.E., to hear an account of the winding up from the liquidator, Mr. W. Purchas.

Meter Approved.—The B. of T. has approved of the Adnil single-phase two-wire A.C. watthour meter, type B E, deposited by the Adnil Electric Co., Ltd., in August, 1909.

Lamps for Lagos.—We understand that Siemens Bros. Dynamo Works, Ltd., have just supplied about 400 tantalum traction lamps for use on the new pontoon dock for Lagos Harbour, where they will, of course, be used in positions where vibration is very severe. These were supplied through Messrs. Swan Hunter and Wigham Richardson, Ltd., of Newcastle.

For Sale.—The Wallasey Corporation electricity department has for disposal about 200 Schallenberger ampere-hour meters. See our advertisement pages to-day.

Spain.—The following information is from the report by H.M. Consul at Bilbao (Lord H. Hervey) on the trade of that district in 1911, which will shortly be issued :—The total imports of electrical machinery into Bilbao during 1911 amounted to 271 tons as compared with 284 tons in 1910. Of this amount, only 37 tons came from the United Kingdom. It is exceedingly difficult for British firms to compete in the Bilbao market with other foreign makers, who, with good showrooms carrying heavy stocks, and with complete staffs of engineers and travellers, neglect no opportunities of monopolising the trade.—*Board of Trade Journal.*

LIGHTING and POWER NOTES.

Acton.—At last week's meeting of the U.D.C. Public Health Committee, the deputy surveyor, Mr. C. J. Yoratt, presented a report showing the cost of lighting the isolation hospital and dust destructor by electricity with the Council's own installation, as compared with electricity as now supplied by the company, or gas supplied by the Brentford Gas Co. The figures showed that at present the cost of lighting the hospital (electricity) and dust destructor (gas) amounts to £170. If the hospital were lighted by gas, the cost was estimated at £165 ; and with generating plant installed at the dust destructor for lighting both buildings, the cost worked out at £161 per annum. The prime cost of the installation would be £1,500 (£121 per annum repayments), and the other items amounted to £40.—In reply to Councillor Poulton, the Surveyor said the gas company would not consent to carcase the building with pipes, and consequently £75 had been allowed for that. Councillor Poulton: If a private firm wished it, they would do it.—The Surveyor: The gas company were pressed on the matter, but refused to consent. The clerk pointed out that the estimated saving of £8 a year was based on the present rate of electricity paid to the company—5d. per unit. The price was, he thought, likely to go down. It was decided to adjourn further consideration of the report for three months, and that in the meantime the wiring at the hospital be tested.

Argentina.—The Municipality of Trelew (Chubut) is negotiating with a Buenos Ayres firm for the installation of electric light. The municipality of Laboulaye (Cordoba) has signed a contract for the lighting of the whole town by electricity. The Nogoyá Municipality have under consideration a proposal for installing electric light, made to them by Mr. M. Grut. Mr. C. Ella has applied for a concession for installing a telephone exchange. The president of the Compania Italo-Argentina de Electricidad, Engineer J. Carosio, accompanied by his legal adviser, has paid a visit to the Mayor of the City of Buenos Ayres, advising him of the formation of the company with Argentine, Italian. French, Belgian and German capital. He stated that it was the intention of the company to establish power houses in the Federal Capital, and that in the course of a few days a scheme would be presented to the authorities.—*Review of the River Plate.*

Barrow-in-Furness.—Mr. T. C. Ekin held a L.G.B. inquiry on Tuesday, into the application of the Corporation to borrow £22,000 for the purposes of their electrical undertaking. Mr. H. R. Burnett, borough electrical engineer, pointed out that there was a steadily increasing demand for electricity for lighting and power. The Corporation was also desirous of providing for eventualities in connection with two or three large works in the borough. There was no opposition to the application.

Barrowford.—At a Council meeting on July 18th, a letter from Newton-in-Makerfield Council relative to the refusal of the Board of Trade to grant an electric light order to that Council having been read, it was resolved—"That the clerk communicate with the member for the Clitheroe Division requesting him to support Lord Wolmer, M.P., in his endeavour to get the Board of Trade to reconsider the application or to state definitely what will satisfy the Board's requirements before they consent to grant the order." Rishton and other East Lancashire Councils have taken similar action.

Batley.—Some time ago the Council authorised an expenditure of £16,000 on a scheme for the extension and remodelling of the electricity works. Subsequently, however, negotiations were entered into with a private power company in regard to a supply of current in bulk to the Corporation. After considering the question for some time the Electricity Committee has come to the conclusion that the best interests of the town will be served by extending the present works, at an estimated cost of £17,000—£18,000, and the sub-Committee has been authorised to institute inquiries with a view to the adoption of the best possible scheme.

Belfast.—The report of Mr. Bloxam, electrical engineer to the Corporation, on the proposed extension of the plant, &c., has been received, together with that of Mr. S. L. Pearce. Mr. Bloxam gives the following estimate of the cost of the plant for a new station: Two turbo-generators, with spare armature, condensing plant, air and circulating pumps, motors, valves, &c., £14,500; four boilers, superheaters, mechanical stokers, economisers, motors, &c., £13,689; pipes, pumps, tanks, &c., £5,100; switchgear, £1,180; coal-handling machinery, £6,200; engine room travelling crane, £800; three sub-stations, motor-generators, £10,410; switchgear, £2,370; cables, E.H.T. feeders and L.T. distributors, laid complete with boxes, £30,720; with 5 per cent. added for contingencies. Mr. Bloxam's report anticipates a demand for 15,600 H.P. in 1920, plus 10,000 H.P. which may be secured from large firms which at present generate their own current. The present plant can be increased only to 11,400 H.P. Mr. Pearce's report deals with proposed extensions to the existing station as follows: Six Babcock and Wilcox boilers with economisers and superheaters, £9,000; three 1,500-KW. turbo-generators with condensing plant, £14,000; extra-high-tension and low-tension switchgear and cabling, £3,000; housing for same, £500; three cooling towers, motors, foundations, £3,000; pipework, £500; removing old plant and preparing foundations for new, £1,500; with 5 per cent. for contingencies. No discussion on these proposals has yet taken place.

Bexhill.—The assessment of the electric light works is to be appealed against. The Assessment Committee recently raised the amount from £440 to £1,600.

Bideford.—Mr. J. A. W. Purves, of Exeter, has informed the T.C. that he intends applying for a prov. order for E.L. The Council has deferred consideration of the matter.

Bolton.—Important developments are contemplated in connection with the Corporation electricity undertaking, instructions having been given to the engineer to prepare plans and estimates for a proposed new generating station at Back-o'-the-Bank.

Bradford-on-Avon.—Messrs. J. and W. Purves having informed the U.D.C. that they are applying for a prov. order for E.L., the Council has decided to obtain full information of the scheme, as it is desirous that the town should have an electrical supply.

Burford.—The P.C. has invited the E.L. company and the gas company to tender for public lighting for the district.

Bury.—The T.C. has decided to apply to the B. of T. for permission to use overhead wires for the supply of current to the new works of Ashworth and Parkers, Woodhill Road.

Chalfont St. Peter.—Mr. R. E. H. Fisher, of Lincoln's Inn, W.C., has given notice to the Amersham R.D.C. of his intention to apply for a prov. order for electric lighting in part of the parish. The Council has resolved to offer no opposition.

Chester.—The accounts of the electricity department (Mr. S. E. Britton, engineer) for the year ending March 25th, show an output of over 2,000,000 units sold, at an average cost of 0·946d. per unit; the works cost was 0·678d. The total income was £23,023, and the expenditure £11,499, leaving a gross profit of £11,524; interest and sinking fund absorbed £7,332. £1,441 was transferred to the rates, and £2,810 was put to reserve. During the year £3,575 out of the reserve fund was expended on renewals, and the fund now stands at £12,429, as against £13,207 last year.

Chile.—A 10 years' concession has been granted to Don Arturo Vicuna for the erection of a central generating station, to supply electric light for the town of Bulnes. The installation must be completed in 12 months.—*Board of Trade Journal.*

Christchurch (Hants).—It has been decided to obtain estimates for installing electric light throughout the workhouse.

Continental Notes.—BELGIUM.—The Belgian State Railway authorities have decided to put down electric lighting installations at the railway stations at Louvain and Namur, and at the railway workshops at Louvain.

HUNGARY.—The establishment of central electric lighting stations in the Hungarian towns of Antalfaloa and Szelistze has lately been decided upon.

FRANCE.—A central electric lighting station is to be established in the mining town of Bethune.

A scheme to light the towns of Montceaux, Marmagne, Saint Symphorien, Broye, Mesvres and Etang, Department of Saône-et-Loire, by electricity has been submitted by a society just formed at the first-named place.—*La Lumière Electrique.*

GERMANY.—The parish church on the Klosterstrasse, in Berlin, with its famous 200-year old bells, is the first church in Berlin to be fitted with electric ringing appliances. This ingenious apparatus is the invention of a Cologne firm, and has already been installed in some 30 churches in the Rheinland and Westphalia, as also in the Cathedral at Limburg, and in the Marien-Kirche at Landau-pfalz, where bells of a total weight of 11,500 kg. are set in motion. The special advantage of the apparatus is that it gives a two-sided pull on the bells, whereby an absolutely precise and uniform stroke of the hammer is made, without shake or shocks. The current consumption is small.

The great increase in consumption of current has induced the T.C. of Düsseldorf to construct a second power house. The new establishment will be of ample structural proportions, and its output capacity will be 42,000 KW., equal to 60,000 H.P. The station will be steam driven, having as first equipment two 8,500-H.P. turbines, increased later by three of 10,000 KW. each. The steam plant of the old station will also be modernised, its present plant being replaced by modern turbines of a total capacity of 20,000 KW.

A society, composed of capitalists and large manufacturers, has been formed at Düsseldorf, whose object is to open up and develop the mountainous district of the Eifel, by the establishment of electric stations on its numerous watercourses, and the creation of an iron industry. The Government has lent its assistance to the scheme, and the provincial governor has accepted the presidency of the group.

An electrical exhibition with the object of popularising the use of electrical apparatus in the house, in trades and in husbandry, is to be held at Nuremberg from September 1st to 30th.

RUSSIA.—The municipal authorities at Kronstadt have decided to light the public streets of the town with electricity.

TURKEY.—The formation of the Constantinople Electric Society, to supply the Turkish capital with light and power, has already been announced. The works of construction are now in full swing. The generating station, of a capacity of 15,000 KW. is in course of construction at the mouth of the river Silightar, where it empties into the Golden Horn. The works are being carried out by two companies. The Gesellschaft Ganz, of Budapesth, are supplying the machinery equipment, electrical and mechanical; and the Société Générale d'Enterprises of Paris, are constructing the power-house, canals, roads, offices and sub-stations. It also supplies and installs the distributing network. The buildings are on foundations of armoured concrete 1 metre thick, the buildings themselves consisting of a metal framework with walls of iron and brick. Water for the boilers and for condensation is drawn from the river Silightar and conducted to the station by a canal 150 metres long of armoured cement. Waste water is discharged into the Golden Horn by means of another canal of armoured cement. For the landing of the material and fuel a quay has been built on piles. The network, underground throughout, has a total extent of 350 km. The cables are being made by the Canalisation Electrique Co., at their works at St. Maurice and Dijon, and will be laid so soon as they are delivered. The Société Générale d'Enterprises has built a brick works near the Golden Horn, and equipped it with petrol motors, where the cement and sand bricks are being made for use in the construction of the station, &c. The sand itself is brought from a quarry in Asia, on the shore of the Black Sea, and imported specially for the purpose.—*La Lumière Electrique.*

ITALY.—A Milan company has applied for a concession to utilise the water-power of the River Plane at Mel, in the Prefecture of

Belluno. It is proposed to put down an electricity generating plant of about 6,000 H.P., the current being distributed for lighting and power purposes in the provinces of Vicenzo, Padua and Treviso. The plant is estimated to cost about £200,000.

Erith. The U.D.C. has received from the L.G.B. sanction to the following loans: £8,000 for mains; £2,070 for transformers and sub-stations; £1,200 for house services; £230 for excess expenditure on house services and sub-stations, and £170 for a coal bunker—a total of £11,670. The L.G.B. declined to sanction a loan of £300 for electric heaters and cookers, which, they considered, should be paid for out of revenue account.

Exeter.—At the last meeting of the Electricity Committee, a letter from the city electrical engineer was read, in which he suggested that, in view of the resignation of the official canvasser, this position should be abolished, and that, instead, a commission of 6d. per point for lighting and 2s. 6d. per H.P. for motors should be offered to wiring contractors for duly signed applications brought in by them. The engineer said that practically all these contractors put in sanitary and water fittings, and therefore had the earliest information as to new premises, &c. It was resolved that these suggestions be adopted.

The Committee has decided that, in future, the charges for energy for power and heating shall range from 2d. to 1d. per unit.

Faversham.—The T.C. has arranged to supply electricity to the new residence being erected in London Road by Capt. O'Brien.

Finchley.—In connection with the scheme for the removal of the centre tramway poles in Great North Road, the Highways Committee of the Council reports that it appears to be an opportune time for the question of improving the lighting to be considered, so that any alterations that the Council may deem necessary may be carried out concurrently with the removal of such poles. The electrical engineer has prepared several schemes, and out of these the Committee thinks that it would be in the best interests of the Council to adopt the one for the erection of 25 arc lamps at a total cost of £1,341. The lamps used would give 3,000 C.P. each and would be fitted with dioptric diffusers. The annual extra cost of this scheme is put at £448. At a meeting of the Council this work was approved of, and the Committee was further authorised to submit a report on the question of improved lighting at Church End. At this meeting the debate on the electric lighting balance-sheet (reported in our issue of June 28th) was resumed. It was stated by the chairman that from the beginning of the undertaking a deficit had been shown in three annual balance-sheets, the others showing a profit. The excess of profit over loss amounted to £1.093, and, in addition, they had repaid £25,000 capital and paid £30,000 interest.

Fishguard.—The Fishguard Development Syndicate, of Essex Street, Strand, have intimated to the Haverfordwest R.D.C. that they intend applying for a prov. order for the supply of electricity within part of the rural district.

Gellygaer.—The U.D.C. has appointed a committee to consider a scheme for lighting the Bedlinog district by gas or electricity. It is suggested that electricity could be produced at a cheap rate by harnessing the river.

Grays.—The County of London Electric Supply Co. has informed the U.D.C. that it intends applying for a prov. order for electric lighting. When the matter came before the Council, the chairman remarked that they did not want the threatened competition, and the clerk was instructed to draw up a report on the matter.

Greenock.—For the 12 months ending June 30th the units sold by the electricity department were as follows:—Private and public lighting, 1,135,153; power, 8,038,531; traction, 1,030,601. This is an increase of 3,000,000 units as compared with the previous year.

Messrs. Fleming Reid & Co. have consented to the terms as to the guarantee for a supply of electricity to their mills for 14 years at £70 per annum, and the engineer has been authorised to lay the necessary high-pressure cable at a cost of £751.

Hendon.—The R.D.C. has decided to oppose the application proposed to be made to the Board of Trade by the Colne Valley Electric Supply Co., Ltd., for a provisional order for supplying electricity within the district.

Hertford.—The Herts. C.C. has decided to have an electric lift installed at the Shire Hall, at an estimated cost of £120.

Heston and Isleworth.—The electricity mains are to be extended for a distance of about 1,700 yards, at an estimated cost of £850.

India.—The work of laying over 60 miles of three-core 6,600-volt cable, for connecting up the new Cossipore power station and Calcutta sub-stations, has, according to the *Indian and Eastern Engineer*, been completed—the jointing by Messrs. W. T. Glover and Co., and the laying by the Calcutta E.S. Corporation. The cable is paper insulated, lead sheathed and wire armoured, and is laid solid in cast-iron troughing. Some 600 drums were shipped by Messrs. Glover to Calcutta. We gather that the Cossipore Works, situated near both river and railway, are equipped with three 3,000-KW. high-pressure and one 800-KW. mixed-pressure turbine sets by the Oerlikon Co., and condensing plant by Messrs. W. H. Allen, Son & Co., who also supplied four 80-B.H.P. vertical-spindle electrically driven centrifugal pumps for supplying circulating water to the condensers. The main switchboard at the power station and all the switchboard work at sub-stations has been carried out by the B.T.-H. Co. Of the existing stations of the Electric Supply Corporation, three—at Alipore, Ultadanga and Howrah—are being converted into sub-stations, and, in addition, there will be new sub-stations at Princep Street, Wellesley Street and Jackson's Lane. At the Princep Street sub-station there are being installed six Bruce-Peebles motor-converters, each set having a capacity of 500 H.P., and the Wellesley Street, Jackson's Lane and Howrah sub-stations are equipped with similar plant, each having three sets.

Kingston.—In his annual report, Mr. J. E. Edgcome states that there was a net loss on the year of only £60 as compared with £1,193 in the previous year. The net loss on the undertaking up to the present has been £15,274.

Kingswood.—The B. of T. have informed the U.D.C. that they propose to revoke the Electric Lighting Order of 1904, as the undertakers have not yet made the deposit of £500, nor have they executed the compulsory works specified in the order.

London.—ST. PANCRAS.—The Electricity Committee of the Borough Council reports having had before it a scheme from the chief electrical engineer, submitting proposals for the extension of the boiler house and boiler plant at the King's Road electricity station at an estimated cost of £35,460. In respect of this proposal, the Finance Committee did not see its way to submit an estimate of cost to the Council for the reason that the scheme presented difficulties. The engineer informed the Committee that it was absolutely necessary either that further boiler plant should be provided at the station without delay, or that some scheme of much larger magnitude should be undertaken in the direction of providing a new generating station with a siding where coal could be obtained and handled more easily and cheaply, and where ample space would be available for extensions. For a number of years past, the generating of electricity in the borough had been carried on under extreme difficulties owing to the absence of sufficient and properly arranged boiler and coal-handling plant, and it was the general opinion that unless steps were taken to regain lost ground, it would be impossible to generate electricity at the Council's existing stations at anything like such low prices as those obtained in other boroughs. It was suggested by the engineer that now that the proposed small extension of the boiler house and plant at the King's Road station had been adjourned, it would be better to go more fully into the possibility of a larger extension on the above lines, with a view of placing the St. Pancras electricity undertaking again to the fore and enabling it to generate and place its electricity on the market at more attractive prices. The Committee thinks, before further considering the subject, that information should be obtained with regard to some of the more modern electricity stations, and for this purpose it has appointed a small sub-committee to consider fully the question of the future generating and supply of electricity, with instructions to visit some modern works to ascertain at first hand the advantage to be obtained by a bolder handling of the problem under discussion. Mains are to be extended in various streets at a cost of £640.

LEWISHAM.—The B.G. has decided to have the electric light installed at the infirmary laundry.

STOKE NEWINGTON.—At the last meeting of the B.C., Dr. White said that he hoped before the dissolution of the Council in November next to bring up some proposals for the reduction of the electric lighting charges from a flat rate of 5d. to, say, 4½d. Some concessions, too, could be made to users of power.

ISLINGTON.—Mains are to be extended in various parts of the borough at a cost of £580.

STEPNEY.—The accounts of the electricity supply department for the year ended March 31st show that the year has been the most satisfactory yet experienced. The sales of energy have increased by over 31 per cent., to 11,972,955 units; the net surplus, after paying capital charges, is £12,757, as against £1,769 last year, in spite of a reduction in price representing £5,400, and an increase in capital charges of £4,500. The total amount available for allocation is £14,854, of which £673 will be allotted to capital expenditure, £1,426 written off capital account, £250 reserved for bad debts, £10,251 placed to renewals of machinery, and £2,254 carried forward. The statement embodies the first complete year's working of the turbine generating station at Limehouse, under condensing conditions, and the load has been transferred almost wholly from the Whitechapel station. The effect of the change, combined with a 100 per cent. increase in output during the past two years, has been an actual reduction in the cost of coal (partly due also to delivery by barge instead of carting) from £12,290 to £11,995, and of the cost of coal per unit generated from 0·436d. to 0·210d.

The works cost per unit sold has dropped from 0·86d. in 1909-10 to 0·56d. for the past year, and Mr. Tapper points out that Stepney's works cost per unit sold is now the lowest yet attained in the County of London. The load has increased so rapidly that the margin of plant capacity has already been absorbed, but, thanks to the provision of a 1,000-KW. stand-by supply from Poplar, extensions will not be required for the coming winter. The power load connected now represents nearly 11,500 H.P., and the total connections amount to the equivalent of 536,068 30-watt lamps.

Mansfield.—At a meeting of the T.C. on Friday last, the Electricity Committee reported a gross profit for the year of £5,342, as compared with £4,343 last year. After payment of interest on loans (£2,241) and contributions to sinking fund (£1,710) there remained a net profit of £1,391, against £466 last year. The number of consumers was 682, compared with 590 customers at March, 1911. The total number of units sold was 1,127,139, compared with 938,330 ; 562,221 units were for general supply, and the balance for the tramways. The number of private motors connected was 127, of 416 H.P. compared with 99 and 306 H.P. The Committee was fortunate in anticipating the miners' strike, and the provision made was adequate to enable full service to be maintained during the whole period. The distribution system had been extended in various directions, particularly in the rapidly-growing eastern side of the town. The output of the works, by far the largest since they were opened, indicated that the increase in customers had neutralised the effect of the metallic-filament lamps, while the tramway extension had brought up the consumption on this account to a figure reasonably compatible with the capacity of the plant and mains which had been specially provided. The increase in the output, totalling roundly 200,000 units, had been produced with but a very small increase in expenditure.

Councillor J. H. Collins, in moving the adoption of the report, remarked that the net profit of £1,400 was the highest that had been made up to the present. It had been decided to establish a reserve fund, towards which £790 would be paid. The Committee would in a short time supply the township of Woodhouse with electricity. There would not be a great deal of profit attached to this extension, but he was convinced that there would be no loss.

The town clerk reported that the L.G.B. had sanctioned the Corporation's application to borrow £4,000 in connection with the work of electrical extension.

Middlesbrough.—The Corporation Electricity Committee has adopted the recommendation of the electrical engineer (Mr. H. M. Taylor) that electric flat-irons should be lent, with free wiring, to customers prepared to use them on lighting rates.

Norwich.—The revenue of the electricity undertaking for the past year was £45,941, while the working expenses were £23,530, leaving a rough profit of £22,411. The charges for interest and sinking fund were £15,733, and the balance carried to appropriation account was £6,678, increasing the amount at the credit of that account to £16,151. The cost of production per unit during the year was 5 per cent. less than the corresponding cost for 1910-11. It is expected that the increase in the price of coal will affect the net revenue for the 1912-13 year to the extent of at least £1,500, but it is not proposed to increase the price of energy. The renewal of old mains laid in the early stages of the undertaking has been proceeded with, and 6 miles 600 yd. of new mains have been laid.

Oldham.—On the 17th inst., Mr. T. C. Ekin held a L.G.B. inquiry into an application of the Corporation for sanction to borrow £22,983 for the purposes of the electricity undertaking. Mr. Newington, the borough electrical engineer, pointed out that the extension of the plant was necessary, owing to the demand having been increased by the coal strike. The inspector said he had found that throughout the country the coal strike had been a great blessing to electricity. It was subsequently agreed to add £3,000 to the amount for which sanction is being sought.

Ramsbottom.—The Lancashire Electric Power Co. are extending the electric mains from Woodhey, Holcombe Brook into Summerseat. Primarily, this is to provide motive power for pumping in connection with the extension of the sewage works for the D.C. It is also understood that electric lighting will be installed in several premises, including the new Summerseat Liberal Club.

Rawtenstall.—With reference to the scheme for the lighting of the main roads by electricity, a Special Sub-Committee, after going over the roads, has given the borough electrical and tramways engineer instructions with regard to the positions of the proposed 90 lamps between Queen's Square, Rawtenstall, and the borough boundary at the Thrutch, Waterfoot.

Redruth.—The U.D.C. has granted permission for the Cornwall Electric Power Co. to erect an overhead line for the transmission of current from the power station to Tresavean Mine.

Rishton.—At a meeting of the T.C. on July 18th, a notice was read from Mr. J. W. Speight, consulting electrician of St. Annes-on-Sea, stating that he intended on behalf of the Rishton Electric Supply Co., Ltd., to apply to the B. of T. for a prov. order to authorise the supply of electricity within the district.

Rugely.—A meeting of ratepayers has been held for the purpose of considering the scheme for the lighting of the town by electricity. It was moved that the scheme put forward by Mr. Balbiani should be adopted, but, after some discussion, the motion was defeated by an overwhelming majority.

Sidmouth.—The U.D.C. has sealed a notice to the Gas and Electricity Co. of the Council's intention to purchase the undertaking.

South Africa.—The Imperial Trade Correspondent at Durban (Mr. A. D. C. Agnew) reports that the Pietermaritzburg Corporation is applying for powers to borrow £42,000 for additions to electric lighting plant, and that the Ladysmith Corporation is making application for £22,000 for the same purpose.

Sunderland.—The report of Mr. A. S. Blackman for the year ending March 31st states that 12,373,429 units were sold, an increase of 21 per cent. ; the works cost was reduced from 0·525 to 0·475d., and the load factor rose to 24·59 per cent. Fuel cost was 0·17d., and total cost 1·17d. per unit. Motors connected amounted to 3,178 H.P., and the power units sold were 8¼ millions, as well as 1¾ millions for traction. The total income amounted to £63,134, and expenditure to £28,586, leaving a gross profit, with £112 brought forward from last year, of £34,660 ; after deducting capital charges, £1,126 was paid to the rates in repayment of an amount transferred in 1908-9, and £2,832 was carried to the depreciation and renewals fund. The outstanding debt amounts to £297,641, and the depreciation and renewals fund (from which £575 was drawn during the year) stands at £2,257. The maximum demand was 5,740 KW.

At the T.C. meeting on 16th inst., Alderman Bruce moved the adoption of the Electricity Committee's report. Mr. G. S. Lawson criticised the preferential tariff allowed to tradesmen who used electric light only, and said that in the event of a breakdown at the generating station, the shopkeepers would be without a light. As to the sales department, it was not right for the Corporation to carry on the business, which at any time might plunge the ratepayers into great legal expense. He also drew attention to the fact that in the finance report, the shares of Messrs. Laing, the shipbuilding firm, valued at £2,477, were carried forward at their full value, and considering the state of the company's affairs, he thought they should not be put down at more than 5s. per share. Mr. F. Nicholson said that £2,257 had been placed to reserve, and would cover any difference there might be in the value of Messrs. Laing's shares. After a short discussion, the report, as submitted, was approved and carried.

Truro.—The T.C. has received notice of the intention of Messrs. J. & W. Purves, the Truro Gas Co., and Messrs. W. & T. Pressland, of London (on behalf of a prospective company) to apply for prov. orders for electric lighting.

West Ham.—The report of Mr. H. H. Couzens on the working of the electricity department for the year ended March 31st shows that the output was 24,147,890 units, an increase of 1½ millions ; the total connections amount to 15,637 KW., as compared with 13,334 last year, the increase being mainly in power connections. The average price obtained increased, almost for the first time, from 0·93d. to 0·96d. per unit, the price obtained for power alone rising from 0·6d. to 0·63d. Strikes increased the cost of fuel by over £2,500, and higher rates and wages, as well as special breakdowns, raised the cost of labour by £1,000. The sales department shows an increase in the gross profit of £450, although the capital charges are heavy on account of the short period of the loan (three years), the capital engaged being £7,000. The surplus on the year's working of the whole undertaking amounts to £3,389, as against £3,996 last year, in spite of the special extras amounting to £4,820. A 3,000-KW. turbo-alternator has been installed, bringing the total capacity of the generating plant up to 14,100 KW. The current year will be burdened with the balance of the results of the miners' strike and the Thames dock strike, and the supply of electricity to the Port of London Authority has been delayed for the same reason.

The maximum demand on the station was 10,826 K.V.A. (9,341 KW.) ; motors connected number 1,338, aggregating 13,928 H.P. Total units generated were 30½ millions, of which 2½ millions were sold for private lighting, ¾ million for public lighting, 15 millions for power and heating, and 5½ millions for traction. The load factor was 29·5 per cent. The capital expenditure amounted to £531,951, of which £368,932 was outstanding. The total revenue was £95,548, and the gross profit £38,122. The works cost was 0·571d. per unit, and total cost 0·917d.

Willesden.—According to the accounts of the electricity undertaking for the year ended March 31st last, there was an expenditure of £17,412, as against an income of £31,296, leaving a gross profit of £13,883. After allowing for interest on loans (£3,919), instalments of loans (£4,664), and depreciation (£115), and adding £115 on the income for interest on bank balances, there remains a net profit on the year's working of £5,339. The cost of distribution during the year amounted to £1,783, or ·152d. per unit, while £11,916, or 1·016d. per unit, was expended in the purchase of energy in bulk. There was an income of £3,042 from public street lighting, and £26,454 from the sale of energy. The output during the year amounted to 2,815,129 units (2,459,200 for private supply, and 355,929 for public lighting), as against 2,638,766 units during 1911. The total working costs amounted to £17,412, or 1·485d. per unit, as against £18,303, or 1·665d. in the previous year. The maximum supply demanded during the year amounted to 1,502 KW., as against 1,509. There was total expenditure on capital account to March 31st of £203,770 (£4,731 of which was expended during the year under review), compared with £199,039 last year. An income of £1,058 was realised from meter rents.

Yeovil.—Messrs. J. & W. Purves have informed the T.C. that they intend applying for a prov. order for electric lighting. The Council has decided to take no action in the matter. A previous application by the same firm was opposed by the Corporation.

TRAMWAY and RAILWAY NOTES.

Bath.—Meters are being fitted on the tramcars running in the city.

Bingley.—The D.C.'s surveyor has been instructed to prepare estimates of the cost of the various improvements entailed in the proposed tramway from Bingley through Nab Wood. A meeting of the Council is to be held to consider the position, and to decide whether it would be advisable to proceed with the work.

Birmingham.—Arrangements have been made for securing the necessary materials for the new Hagley Road tramway. It is expected that the work of constructing the track will be commenced in October.

Bradford.—The question of tramway accommodation has again been brought before the City Council by the tramways manager (Mr. C. J. Spencer), who advocates a scheme of building a large new central depôt at Longlands at a cost of £46,500. An alternative scheme is the rebuilding of the temporary depôts, &c. (costing £22,408), but it is suggested that this would not be so economical. The Committee has decided to recommend to the City Council the suggestion for the establishment of a large central depôt. If the scheme is carried through certain of the present out-district depôts will be retained, whilst others will be dismantled.

Chester.—The accounts of the Corporation tramways for the year ending March 25th show total income £12,820, working expenses £7,952, and gross profit with bank interest £4,963; interest and sinking fund absorbed £3,791, and £1,172 was placed to reserve. The car-mileage was 347,904, and passengers carried 3,078,564.

Continental Notes.—Germany.—A novelty in the matter of electric traction is furnished in the city of Altona, where an electric towing railway service has been established. In a steep street of the city, 600 metres long, with a rise of 15 per cent., where there is a daily traffic of some 200 vehicles with loads of from 5 to 10 tons, electric locomotives worked by direct current at 550 volts from overhead lines are used to tow two or three wagons at a time up the hill. The horses remain with the wagons, the towing coupling being simply attached and dropped when the top of the hill is reached; the locomotives descend the hill on the return journey without current. The equipment is supplied by the Gesellschaft für Gleisbahnen (Max. Schiemann and Co.) of Wurzen, I.S. The charge for the towing is from 0·5 to 2 marks for loads of from 2·5 to 7·5 tons, and a discount is allowed for several wagons of 20 per cent.—*E.T.Z.*

A beginning has been made with the building of the electric railway from Opladen to Burscheid, which step will hasten the construction of the section Burscheid-Hilgen and Wemmelskirchen; as also that to Witzheiden and Solingen. With the completion of these several lines, Solingen, the Sheffield district of Germany, will be fully catered for in the matter of electric railway facilities.—*Elek. Nachrichten.*

France.—The company owning the Nord-Sud underground electric railway in Paris, the first section of which was opened at the beginning of November, 1910, had 7·4 miles in operation by the end of 1911. The gross receipts last year amounted to £285,000. After defraying working expenses and paying £16,000 as the share of the City of Paris, the accounts show net profits and balance forward of £81,000, which sum allows of the distribution of a dividend of 2½ per cent. on the ordinary share capital of £3,000,000. The proportion of working expenses to gross receipts was 52 per cent., this comparing with 42 per cent. in the case of the older Metropolitan railway. When fully completed, the Nord-Sud railway will have a total length of 12·4 miles and the total outlay will presumably be £6,400,000. A loan of £1,400,000 is in circulation, and the directors are already authorised to raise a further loan of £1,400,000, whilst the balance of £600,000 is expected to be obtained with the assistance of the banks associated with the company.

The Midi of France Railway Co. is reported to be studying the adoption of electric traction on the railway between Toulouse and Bayonne.

In the Department of the Lot, a Government inquiry has just been held regarding a scheme to build six separate lines of electric tramway. A line 15-km. long has also been officially inspected to link up Ervy and Chaource, in the Department of the Aube. *La Lumière Electrique.*

Hungary.—Losonez is to be provided with an electric tramway system, a concession having been secured for this purpose by the Engineer Desider Frank, who intends to form a company for the realisation of the scheme.—*Elek. und Maschinenbau.*

Austria.—A preliminary concession has lately been granted in respect of a projected narrow-gauge electric railway between Alttersee and Unterack.

Italy.—The *Gazzetta Ufficiale* (Rome) contains a decree whereby a concession is granted to the communal authorities of Modena for the construction and working of three sections of electric tramway in Modena. *Board of Trade Journal.*

Sweden.—The existing railway between the fashionable seaside resort of Saltsjöbaden and Stockholm is to be electrified, thus bringing it within 25 minutes' ride of the capital instead of one hour. The line is to be worked from the Stockholm municipal power house, three-phase current at 6,000 volts and 25 periodicity being supplied to a centrally situated transformer station, where it will be transformed into direct current at 1,200 volts pressure and distributed by an overhead network. Orders for the rolling stock and the whole electrical equipment have been placed with the Allmänna Svenska Elektriska Aktie-Bolag, of Westeraas. It is expected that the line will be in full working by next summer (1913).—*Elek. und Maschinenbau.*

Italy.—The Consiglio dei Ministri has authorised the concession to the Società Varesina per Imprese Elettriche for the construction of an electric railway from Ghirla to Ponte Tresa, of a length of 9,030 m The line forms a branch of the same company's existing line running from Bettole di Varese to Luino. Its estimated cost, including rolling stock, is 1,687,480 lire, but the Government gives a yearly subvention of 6,487 lire per km. for 50 years.—*L'Ingegneria Ferroviaria.*

Coventry.—The B. of T. has sanctioned the borrowing by the Corporation of £220,538 for the purchase of the tramways and incidental matters. The Committee which has the matter in hand recommends the Council to expend £20,475 on the purchase of 10 additional cars and new construction works, which do not include any lengthening of existing lines.

Dewsbury.—At a special meeting of the T.C. last week, it was decided to apply to the Board of Trade for a provisional order for the purpose of reviving and extending the time for the exercise of the powers of the Dewsbury Corporation Tramways Order, 1911.

Doncaster.—An inquiry was held by the Light Railway Commissioners on Saturday last into the Corporation's application for powers to borrow £40,700 for tramway extensions in the directions of Brodsworth and Warmsworth. Consideration of the matter has been adjourned.

Halesworth.—An inquiry was held here on July 16th by the Light Railway Commissioners relative to the Light Railway Co.'s proposal to construct a line between Halesworth and Cratfield, which will complete the service between Haughley and Halesworth. The estimated cost is £36,109. The Commissioners will report in favour of the order.

Huddersfield.—The Tramways Committee has instructed the town clerk to promote a Bill to obtain Parliamentary powers for the construction of tramways in the following districts: Brighouse, Elland, Marsden, Mirfield, Longwood (Dod Lea), Crosland Hill Road, and Kirkheaton Railway Bridge.

Japan.—The work of electrifying the Karuizawa section of the Japanese State Railways has just been completed. The line passes through 26 tunnels, which were very objectionable to passengers, owing to the smoke from the engines. By the adoption of electric traction all trouble from this cause is avoided, and greater speed is attained.

Liverpool.—On Wednesday, the 17th inst., a tramcar got out of control while descending James Street. On the way down it crashed into another car proceeding in the same direction. Six people were injured, one seriously.

Mexico.—H.M. Consul at Tampico reports that the concession for an electric tramway system there has recently been acquired by British capitalists, and active work on construction will be started immediately. The same company have also purchased both of the existing electric light plants and intend constructing a central power station for the lighting of the city, as well as for working the electric tramways.

The British Vice-Consul at San Luis Potosi reports that a very favourable concession has recently been granted by the State Legislature to a British company for the construction and working of an electric street railway in that town.—*Board of Trade Journal.*

Portsmouth.—The general manager of the Corporation Tramways, Mr. W. R. Spaven, reports that the working of the system for the year ending March 31st resulted in an income of £112,602, an increase of £8,097; the expenses were £51,879, leaving a gross profit of £60,723, which, together with bank interest, amounted to £61,412 (£6,671 increase). Capital charges absorbed £39,365, leaving a balance, with £1,989 brought forward, of £24,035 (£7,351 increase). Of this, £8,694 was transferred to the renewals fund, £2,000 to reserve and insurance, £4,000 to the rates, and £8,068 was carried forward. The revenue worked out at 12·261d. per car-mile, an increase of 0·626d., and expenses at 5·649d., compared with 5·567d. Power cost 0·467d. per car-mile. Passengers carried were over 25 millions, an increase of two millions, and the total car-mileage was 2,204,042.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Government intends to make compulsory the introduction of wireless equipments on all passenger boats. A Bill has been introduced into the Chamber making the wireless service up to 1,000 km. from the Argentine Coast a State monopoly.—*Elek. Nachrichten.*

Australia.—It is reported that the Marconi Co., which some months ago commenced an action against the Postmaster-General for alleged infringement of patent rights, has now offered to sell its rights to the Federal Government.

France.—The Compagnie Générale Radio-Télégraphique has just carried out experiments with a special musical spark arrangement on board the *Savoie*, of the Transports Maritimes Co. The results are said to have been satisfactory, and to demonstrate the advantages of the new method. The company will shortly install wireless apparatus on the *Paul Local* and the *Chili*, ships of the Messageries Maritimes Co. Eight mail boats of the Compagnie sud Atlantique are likewise to be equipped with wireless apparatus.—*Journal des Postes.*

French Indo-China.—A sum of about £30,000 has been allotted by the Government for the erection of wireless stations in French Indo-China. The installations comprise a chief station at Saigon, on which £24,000 is to be spent and a dependent station at Hué to cost £4,000. The range of the Saigon station will cover the Indian Ocean and the Pacific, and it will act in the extreme East the rôle of the Eiffel Tower in Europe. Besides communicating with ships to and from China, Australia and the Suez Canal, it will supply the correct time and forward Press and exchange news, meteorological telegrams, &c. The Saigon station will cover a radius of 8,000 km., and the electric equipment will be exactly the same as that of the Eiffel Tower.

Germany.—The Postal Authorities have decided to copy the Swedish example and to install automatic telephones in some of the busiest and noisiest thoroughfares of Berlin, with a view to testing the innovation under the worst conditions. Should the results be satisfactory, automatic telephones will be installed throughout the city.—*Elek. Nachrichten.*

Imperial Wireless Stations.—The agreement between the Postmaster-General and Marconi's Wireless Telegraph Co., Ltd., was published on Tuesday, together with an official explanation of the policy of the Government. It is stated that the Governments concerned will own and work the stations on their respective territories. In view of the facts that the Marconi Co. possessed unique experience in the transmission of long-distance wireless messages, and that foreign Governments were commencing the erection of long-distance installations, so that prompt action was essential, the Government decided to secure the assistance of the company in carrying out at once the necessary works. The Postmaster-General, acting for the Governments concerned, will provide the sites, on which the company will erect the installations in accordance with specifications drawn up by the Postmaster-General. If other commercial stations having a range of at least 2,000 miles are required during a period of five years by any of the Governments taking part in the agreement, the company will have the exclusive right of providing them, at a cost of £60,000 each. All the patents and information at the disposal of the company will have to be placed at the service of the Postmaster-General during the "royalty period," but if the Government adopts another system not using any of the Marconi patents, it may terminate the "royalty period" at any time. Subject to this proviso, the agreement and royalty period will run for 18 years, and if not then terminated, for 28 years. A speed of 20 words a minute under the duplex ordinary system, and 50 words on the simplex automatic system, is provided for. During the royalty period, besides paying for the sites, plant and buildings, and the cost of trial working, the Goverment will pay the company a royalty of 10 per cent. of the gross receipts.

London Telephone Service.—In reply to a question in the House of Commons last week, the Postmaster-General stated that he did not regard the present situation as satisfactory; but the provision of extensions to existing exchanges and the construction of new exchanges to make good the deficiencies were being pushed on as quickly as possible. The staff available was not sufficient to cope with the demand for telephones, and the amount of work involved in the extension of exchanges and the transfer of overhead wires to underground lines was abnormal. Additional men had been employed, but the use of partially skilled assistance in the endeavour to meet the requirements had, to some extent, increased the difficulties. The trained staff was being increased as rapidly as possible. Complaints regarding the giving of "engaged" signals when the lines were possibly not engaged numbered only 0·05 per cent. during the month of June, and complaints of false calls amounted to 2,857 out of 8,295,030 calls in that month. The average time taken to answer signals observed during the latter half of 1911 was 7·1 secs., and during the first half of 1912 it was 6·9 secs. The percentages of irregular cut-offs to total calls observed during the same periods were respectively 0·75 and 0·62. Since December, 17 exchanges had been closed, 8,142 subscribers being transferred to other exchanges, and six new exchanges had been opened. Five entirely new exchanges were in course of erection, and seven new exchanges to replace existing boards. Eight extensions had been completed since the beginning of this year, and 20 were in progress. Eight further extensions were about to be applied for.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—July 29th. (*a*) Additional plant at the generating station; (*b*) construction and equipment of tramways and railless system for the U.D.C. See "Official Notices" July 5th.

Ashton-under-Lyne.—July 30th. One 400-KW. motor-generator, one fuel economiser, two boiler feed pumps, coal elevator and conveyor and ash elevator, for the Corporation. See "Official Notices" July 5th.

Atherton.—July 31st. One 250-KW. single-phase transformer, for the U.D.C. See "Official Notices" July 19th.

Australia.—New South Wales.—August 27th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" to-day.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st. — Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day

August 6th.—9,200 yd. of ·2 sq. in. concentric cable, and 2,200 yd. of ·1 sq. in. concentric cable for the Melbourne City Council. See "Official Notices" to-day.

New South Wales.—September 11th. Telegraph, telephone and electric material for a year, for the P.M.G.'s Department.

Barton-upon-Humber.—The Lighting Committee of the U.D.C. is inviting tenders for the lighting of the town by gas, electricity or otherwise during the coming winter months.

Belgium.—August 3rd. The Ghent Exhibition Co. is inviting tenders for the supply, installation and maintenance of the high-tension cables, telephone cables and transformer boxes required in connection with the Exhibition. Particulars may be obtained from, and tenders are to be sent to, La Société de l'Exposition, Rue des Moineaux, Ghent.

August 3rd.—The Belgian Post and Telegraph authorities at La Bourse, Brussels, are inviting tenders for the supply of a quantity of telephone cable.

Blackburn.—August 3rd. Steam coal, for the Corporation Electricity Department, for a year. Mr. P. P. Wheelwright, electrical engineer, Jubilee Street.

Bradford.—July 30th. Electric lighting and sundry other work for the new premises of the Bradford District Bank in Commercial Street and Cheapside, Halifax. Messrs. Richard Horsfall and Son, architects, 22A, Commercial Street, Halifax.

Bulgaria.—Sophia.—Supply of electric lamps, measuring instruments, arc lamp pillars, machine tools, &c. Railway and Port Administration, Sophia.

Canada.—August 1st. One 500-KW. steam-driven generating set, for the City Commissioners, Moose Jaw, Sask. See "Official Notices" July 12th.

Canary Islands.—Tenders have just been invited by the municipal authorities of Telde, Las Palmas, for the concession for the electric lighting of the town during a period of 30 years.

China.—August 13th. High and low-tension sub-station switchgear, for the Shanghai Municipal Council. See "Official Notices" to-day.

Dublin.—August 7th. High-tension switchgear and accessories for the Corporation. See "Official Notices" to-day.

August 7th.—Oerlikon and Westinghouse motors and pumps, for the Corporation. See "Official Notices" to-day.

Halifax.—August 5th. Portable X-ray switchboard, &c., for the Guardians. See "Official Notices" to-day.

Hull.—July 31st. Steam and water pipes, pumps, &c., for the Corporation Electricity Department. See "Official Notices" July 19th.

Italy.—Rome.—July 31st. Supply and erection of electric light and mechanical fittings in the new building of the Ministry of Agriculture, Industry and Trade, at an estimated cost of £2,000. Guarantee deposit, £100, and eventually one-tenth of total cost.

London.—L.C.C.—July 30th. Electrical installation at the County Secondary School, Streatham. See "Official Notices" July 19th.

A committee is about to invite offers for water level indicators for the new engine-house at the Abbey Mills pumping station, and a telephone apparatus and electric wiring for use in connection therewith.

New Zealand.—August 16th. Electric motor and induced-draught fan for Christchurch City Council. Tenders to City Surveyor. Deposit £5. Copy of specification can be seen at Board of Trade Commercial Intelligence Department, London, E.C.

Nottingham.—The Electricity Committee wants tenders for coal required at the Talbot Street and the St. Ann's Well Road generating stations for 12 months. Mr. H. Talbot electrical engineer.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Russia.—According to an advertisement appearing in the *Times* on July 23rd, the St. Petersburg C.C. will, on August 1st, consider tenders for erecting at the principal water-pipe station a station for distributing filtered and ozonated water over the free grounds existing at the principal station and also on the grounds which will become free after the demolition of the group of English filters. The successful contractor will also have charge of the working of the ozonated filtered station during a period of two years. A guarantee of 400,000 roubles is to be paid.

Spain.—July 31st. The municipal authorities of Merida (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of 15 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Merida, Badajoz.

August 3rd.—The municipal authorities of Telde invite tenders for a 30 years' concession for the provision of electric light and power for the town.

August 10th.—Tenders are also invited by the "Dirección General de Telegrafos," Madrid, for the installation and working of a telephone system in Cestro Urdiales (Santander). The *Board of Trade Journal* states that although these contracts will doubtless be awarded to Spanish firms, the carrying out of the work may involve the purchase of some materials out of Spain.

Sunderland.—August 1st. Two steam-driven boiler feed pumps, one air compressor, one motor-driven centrifugal pump, pipework and valves, for the Corporation. See "Official Notices" July 19th.

Swansea.—July 30th. Alterations and additions to suction and discharge pipes, work for suction chambers, strainers, &c., for the Corporation Electricity Department. See "Official Notices" July 19th.

Turkey.—CRETE.—October 21st. Tenders will be received at the "Bureau de la Mairie," Canea, for a 50 years' concession to construct and work an overhead system of electric tramways in Canea and the neighbourhood. Copies of the *Cretan Official Gazette*, containing the conditions and further particulars regarding these concessions, may be seen at the C.I. Branch of the Board of Trade, London. E.C.

Walsall.—July 30th. High and low-tension switchgear for the Corporation. See "Official Notices" July 12th.

West Ham.—August 1st. Electric light installation (800 points) at the Forest Gate Sick Home, for the B.G. See "Official Notices" July 19th.

CLOSED.

Bath.—The T.C. has accepted the tender of Messrs. Hughes & Stirling for a dust destructor, at £4,069.

Bexhill.—The Council has accepted the tender of Messrs. Denham, Fawcus & Co. for 1,000 tons of Tibshelf Peas or Shipley Peas, at 18s. 9d. per ton.

Coventry.—The General Committee of the Coventry and Warwickshire Hospital has accepted the tender of Messrs. Lee, Beesley & Co., of Coventry, for installing the electric light in the new wing, at £912; and that of Waygoods, Ltd., for a lift, at £404.

Dundalk.—The Guardians received the following tenders for the electric lighting installation at the workhouse:—

Gask'n Bros.	(accepted)	£133
P. J. Watters		£153
J. C. Meldon		£144

Durham.—The Rural Council has accepted the tender of the Durham County Electrical Power Distribution Co. for installing the electric light at Honghall Hospital, at £83.

Germany.—The Allgemeine Electricitats Gesellschaft, of Berlin, has secured a contract for the establishment of a central electric lighting station in the town of Hameln.

Greenock.—The Corporation has accepted the tender of Messrs. Chamberlain & Hookham, for meters.

London.—HACKNEY.—The Electricity Committee received the following tenders in connection with the extension of the generating station:—

Boiler house plant.

Babcock & Wilcox, Ltd.	(recommended)	£7,105
Clark, Chapman & Co., Ltd.		7,327
Howden Boiler Co.		8,000
Bennis & Co., Ltd.		1,813

Induced-draught plant.

Howden Boiler Co.		£500
Matthews & Yates, Ltd.		794
Babcock & Wilcox, Ltd.	(recommended)	869

The engineer, in reporting, pointed out reasons why in this case the highest tender should be accepted. It complies in every respect with the specification, and includes far more substantial plant than that offered by the next tenderer. The motor fan is more powerful, and the chimney weighs 13 tons as against 7½ tons. The Howden tender could only have been accepted if the whole of the Howden system of generating plant had been adopted.

Economiser.

Babcock & Wilcox, Ltd.	(recommended)	£1,405
E. Green & Sons, Ltd.		1,417

Both tenders comply with specification, and in either case the economiser would be manufactured by the patentees, E. Green and Son, Ltd.

Feed pumps.

J. P. Hall & Sons, Ltd.	£499
F. Friedenthal	502
Nicholls Bros.	566
Babcock & Wilcox, Ltd. (for J. P. Hall or other approved pump)	574
Foster Bros., Ltd. (for Hall pump)	593
Foster Bros., Ltd. (for Nicholls pump)	621
G. & J. Weir	690
Isaac Storey & Co.	698
Clark, Chapman & Co., Ltd.	718
Foster Bros., Ltd. (for Weir pump)	763
British Westinghouse Electric and Manufacturing Co., Ltd.	774

The specification called for "Weir" or other approved pumps. The engineer says:—"The lowest tender for 'Weir pumps' is that of the makers, G. & J. Weir (£690). There are three lower tenders, viz., J. P. Hall & Sons, Ltd., £499; F. Friedenthal, £502; and Nicholls Bros., £566. All these pumps are of lighter construction than the Weir, weighing 50½ cwt., 60 cwt. and 48 cwt. respectively, as against 84 cwt. for the Weir. Hall's pumps, however, have a good reputation. Excellent service has been obtained from, and we have spent very little money on maintaining, our Weir pumps, which have been in use for a large number of years. I recommend that the tender either of G. & J. Weir, Ltd. (£690), or of J. P. Hall & Co., Ltd. (£499), be accepted."

Coaling plant and bunkers.

E. Bennis & Co., Ltd.	£7,122
W. J. Jenkins & Co., Ltd.	7,518
Strachan & Henshaw, Ltd.	7,550
Spencer & Co., Ltd.	7,609
Babcock & Wilcox, Ltd.	7,631
New Conveyor Co., Ltd.	7,953
Robert Dempster & Sons, Ltd.	8,993
Heenan & Froude, Ltd.	9,170
Mechan & Sons, Ltd.	11,853

These tenders may be divided into two main classes:—(*a*) Those in which the telpher runs on the top of a rail, called top-rail systems; (*b*) those in which the telpher runs on the bottom flanges of an I section runway, called bottom-rail systems. The engineer says:—"It is a debatable point which of these two methods is to be preferred, and the best method does not at present appear to have been definitely decided by practice. I have studied the matter very carefully, however, and am inclined to the opinion that the top-rail system will be the more economical in maintenance, and will operate faster round curves and over switches of the system, which will be unavoidable in connection with further extensions of the coaling plant at a later date. Four of the tenders are for the top-rail system, and four are for the bottom-rail system, while one offers both alternatives." The engineer states why he does not recommend the acceptance of the lowest tender, and recommends that the tender of W. J. Jenkins & Co., Ltd., Retford, or that of Strachan & Henshaw, Ltd., Bristol, who have erected a similar plant at Stepney, be accepted for the plant.

Pipework and valves.

Brightside Foundry and Engineering Co., Ltd.	£3,958
John Spencer, Ltd.	4,105
Foster Bros., Ltd.	4,774
Aiton & Co.	4,798
Babcock & Wilcox, Ltd.	5,223
Edward Le Bas & Co.	6,680

The engineer recommends that the tender (£4,105) of John Spencer, Ltd., or that (at £3,958) of the Brightside Foundry and Engineering Co., Ltd., be accepted.

Travelling crane.

Chatteris Engineering Works Co.	£816
Sir William Arrol & Co., Ltd.	866
S. H. Heywood & Co., Ltd.	881
Royce, Ltd.	920
Carrick & Ritchie, Ltd.	921
Babcock & Wilcox, Ltd.	937
Herbert Morris, Ltd.	937
John Smith (Keighley), Ltd.	970

The engineer, after comparing the tenders, says that it is very difficult to decide between the two lowest tenders, but he recommends that a final decision should be given in favour of either the tender of the Chatteris Engineering Co., Ltd., or that of Sir William Arrol & Co., Ltd.

Turbine-alternator, exciter and condensing plant.

Willans & Robinson, Ltd.	£7,950
Belliss & Morcom, Ltd.	8,660
James Howden & Co., Ltd.	9,087
Brush Electrical Engineering Co., Ltd.	9,326
Dick, Kerr & Co., Ltd.	9,450
British Westinghouse Electric and Manufacturing Co., Ltd.	10,234
Richardsons, Westgarth & Co., Ltd.	10,638
British Thomson-Houston Co., Ltd.	10,867
C. A. Parsons & Co., Ltd.	11,875
A.E.G. Electrical Co., Ltd. (tender opened July 11th, 1912)	9,400

(*Continued on page* 143.)

ELECTRICITY IN A SPANISH LEAD MINE.

[By our Berlin Correspondent.]

One of the Spanish mines where electrical operation has been adopted on a large scale is that of El Guindo, in the southern range of the Sierra Morena, which contains abundant deposits of lead ore.

Fig. 1 illustrates the plant recently installed there by the A.E.G. On the extreme left are seen the winding tower and building for the winding engine; on the right (not seen in the view) is the transformer station connected to the high-tension transmission line, while the centre is taken up by the separating plant, which, in view of the large quantity of material worked in the mine, plays an important part. It is practically impossible to form any more than a mere conjecture as to the actual value of a lead ore deposit. Whenever the vein is lost sight of, the only thing to be done is to drive a shaft for some depth and to make cross-cuts to the right and left at various levels, until the ore is again encountered. In lead mining it is therefore necessary to start with a small mechanical equipment, and only to extend the plant quite gradually. As, moreover, the El Guindo Mine is situate at about 7 to 8 km. from the nearest railway station, the question of economy as regards the actual consumption of fuel had to be considered much more carefully than is usually the case.

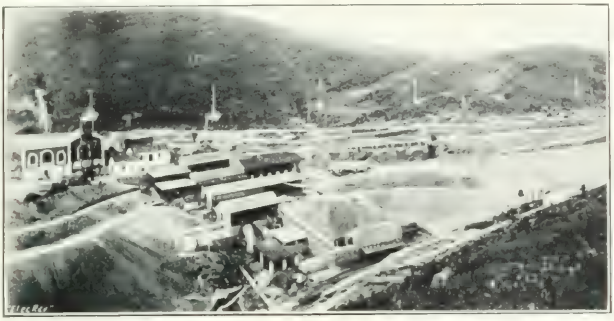


Fig. 1.—Headworks of El Guindo Mine.

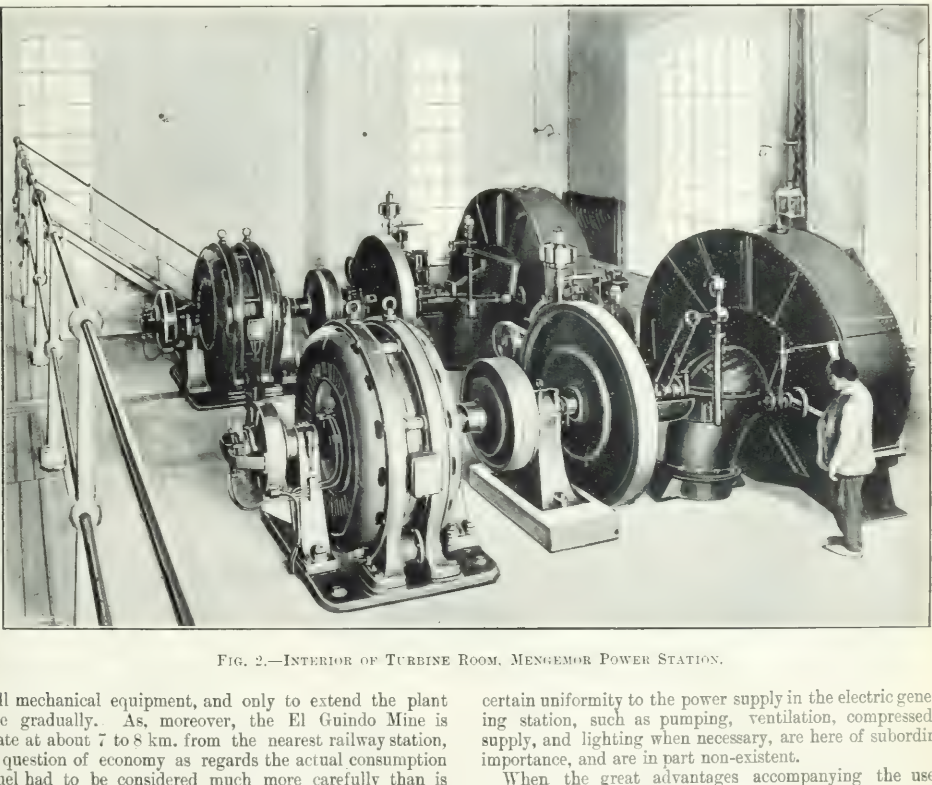


Fig. 2.—Interior of Turbine Room, Mengemor Power Station.

However, the electrification of the mine was facilitated by the hydro-electric power house of the Mengemor Electric Supply Co., installed by the A.E.G. on the Guadalinar, a tributary of the Guadalquivir. In fig. 2 the interior of the turbine room with the two 450-k.v.a. turbo-generators may be seen. The company undertook to supply the mines with electrical energy at the comparatively low price of 12 centimos per kw.-hour, but under two rather onerous conditions, namely, that the mines would bind themselves to a minimum consumption per year, and at the same time agree not to exceed a given amperage. These conditions are particularly difficult to fulfil with a service similar to that described here. By far the greater quantity of energy is consumed by motors working very intermittently, such as those for winding and the driving of the stamp mills, washers, &c. Forms of service which otherwise, as, for example, in coal mining, give a certain uniformity to the power supply in the electric generating station, such as pumping, ventilation, compressed-air supply, and lighting when necessary, are here of subordinate importance, and are in part non-existent.

When the great advantages accompanying the use of electric power for working the mines in question had begun to be realised, it was at first decided to replace the largest coal consumers, viz., the various small steam engines driving the washers and stamp mills, and a number of small pumps working underground, by electric motors, and the first electric generating station which was erected at the Guindo mine consisted of some flue boilers and two 150-H.P. Sulzer steam engines, from each of which a continuous-current generator and a three-phase machine were driven by belts. Continuous-current motors were preferred for certain operations on account of their more economical speed regulation, while three-phase motors, on account of the advantages of higher voltages in transmitting power to long distances, were considered preferable for other purposes.

As soon as the Mengemor Electricity Co. began its operations, the mine authorities commenced the electrification of their plant on a larger scale. It was first necessary to erect an efficient steam power station to serve as a stand-by in the event of a failure in the supply derived from the Mengemor Co. In spite of the most careful planning of the water-power station and its steam reserve, a power distributing plant of this kind necessarily comprises an element which can never be relied upon absolutely, in its transmission line 20 kilometres in length, which is carried over mountains and valleys through very desolate districts. The reserve station was erected at the Manzana mine and consists of a portable engine of an output of approximately 500 H.P., supplied by Messrs. R. Wolf, of Magdeburg, which drives a 400-K.V.A., 1,150-volt, three-phase generator at 600 R.P.M. by means of two pulleys constructed as fly-wheels. This set is illustrated in fig. 3.

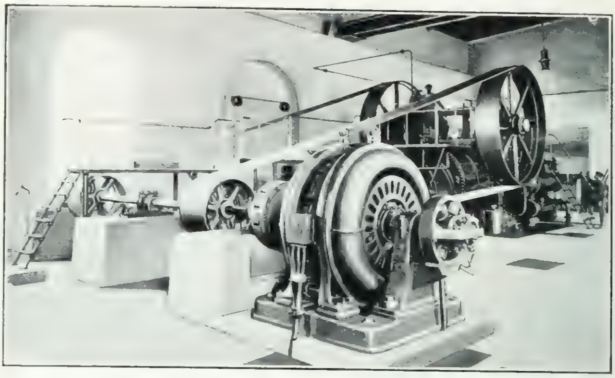


FIG. 3.—RESERVE STEAM PLANT AT MANZANA MINE.

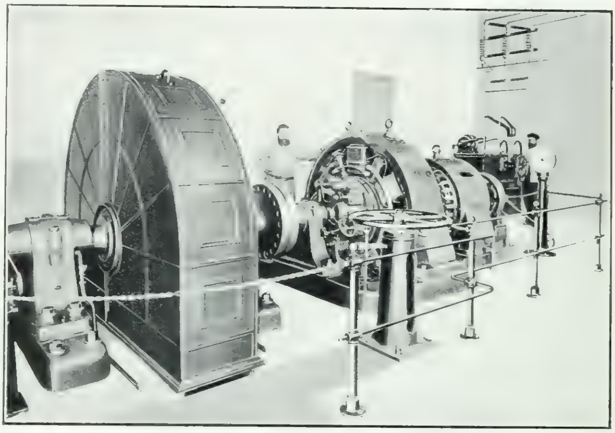


FIG 4.—ILGNER PLANT AT EL GUINDO MINE.

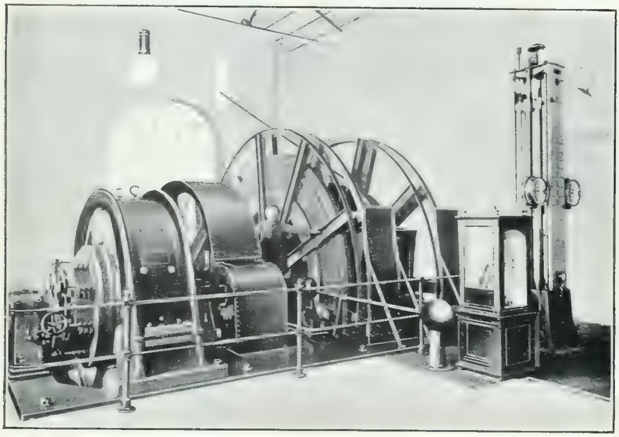


FIG. 5.—ELECTRIC WINDING ENGINE.

These two steam stations are, of course, only reserve stations, electrical energy being usually obtained from the Mengemor Co. This company supplies three-phase current at a pressure of 22,500 volts, which is transformed down to the pressure of 1,150 volts used on the mines by means of transformers. At each of the three mine shafts there is a transformer station containing one or more transformers, with output ranging from 200 to 300 K.V.A., together with the necessary accessories, such as switchgear, excess voltage dischargers, lightning arresters, meters, &c., which are placed on the various floors of the transformer stations. To supplement the plant a converter set has also been provided, which serves the double purpose of generating about 20 K.V.A. continuous current for lighting and for driving the continuous-current motor still in use on the one hand, and improving the power factor on the other hand, for which purpose a 150-K.V.A. three-phase synchronous motor has been selected. The question of the power factor is one of special importance in the present instance, as the conditions under which the energy is supplied prohibit the current taken from exceeding a certain fixed value (and not the output).

The most important winding plant, as above stated, is installed at the Guindo shaft. In spite of the considerable advantages of electrically-operated winding engines (greater safety in operation, permanent readiness without any necessity of keeping a boiler under steam, and remarkable economy due to a reduction in the staff), the electrification of the main pit winding plant was postponed for a considerable time, mainly because of the uncertainty with regard to the extent of the available ore deposits. When, however, the appearance of the Mengemor Co. placed electrical energy within easy reach, at a relatively low price, the advantages of electrical winding were found to be so considerable that this mode of operation was soon adopted. Provision was made to compensate any fluctuations in load by means of the well-known A.E.G. Ilgner-Leonard system.

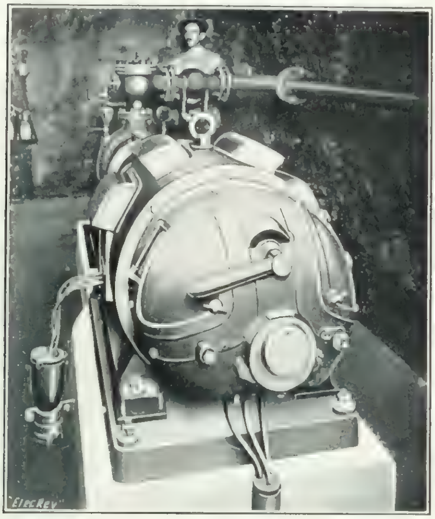


Fig. 6.—A.E.G. 3,000-R.P.M. Motor and Pump.

In fig. 4 is shown the Ilgner plant installed at the Guindo shaft, and in fig. 5 the winding engine, inclusive of the motor and auxiliary apparatus. The three-phase motor of the converter (farthest to the right in the figure) works at 1,150 volts, 50 cycles; the continuous - current dynamo (in the middle of the figure) yields an average of 180 KW., and during some three minutes 360 KW., the pressure being controlled between plus and minus 450 volts. The flywheel, which is enclosed in a sheet metal housing (to the left in fig. 4), so as to diminish losses by air friction, is 5 tons in weight. The whole set can be controlled between 730 and 600 R.P.M.

The winding motor absorbs on an average an input of 225 H.P. and temporarily 450 H.P. at 120 R.P.M. The mechanical part of the winding engine has been supplied by Messrs. Gebrüder Weissmüller, of Frankfort-on-Main. The engine is designed on the following data :—

Maximum useful load...	2,500 kilogrammes.
Maximum winding load	3,500 „
Maximum depth (to be reached in a few years)	600 metres.
Winding speed	4 „ per sec.
Number of winding trips per hour ...	10

An electrical winding capstan of about 30 H.P. has been installed in the same shaft for supervision trips and similar purposes.

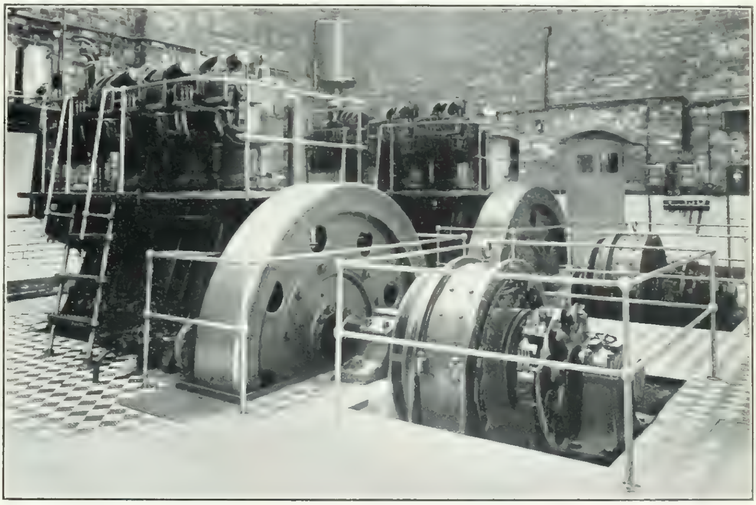
The pumping presents some difficulties, though this mine, like most other mines in the same district, only contains relatively little water. Still, the fact that small amounts of water have to be raised to considerable heights makes the operation of centrifugal pumps uneconomical. Furthermore, the depth of the shaft increases from year to year as the working advances, so that centrifugal pumps designed for a given head could not immediately be used. On the other hand, however, there could be no question of installing expensive piston pump sets. These difficulties were solved by adopting a special 3,000-R.P.M. three-phase motor of the A.E.G.

At this high speed of revolution, centrifugal pumps raising small amounts of water to considerable heights could be constructed, while the low price of such machines allowed a number of them to be installed at different levels, so that the water pumping could be effected by stages. Some small piston pumps driven by electricity were used to supplement this installation.

Two centrifugal pumps, each of 150 H.P., raising as a maximum 800 litres per minute against a head of 465 metres, have been installed at El Guindo. In the neighbouring Manzana shaft there are two sets of 100 H.P. each, for 700 litres per minute against a head of 290 metres, one of which is shown in fig. 6. Finally, the Urbana shaft employs a similar plant of 100 H.P., but for 1,500 litres per minute against a head of 180 metres.

All the auxiliary machinery is operated by electricity. The separating plant of the Guindo and Manzana mines comprises a number of motors driving stamp mills, washers and sieves. In both these mines there are further installed piston compressors supplying compressed air for the automatic stone drills, each of which is operated by a 60-H.P. motor. There are further a number of motors for the workshops, &c.

Finally, there is in course of construction a wire-rope railway 8 kilometres in length connecting the mines with La Carolina. This will be operated by a 30-H.P. electric motor.

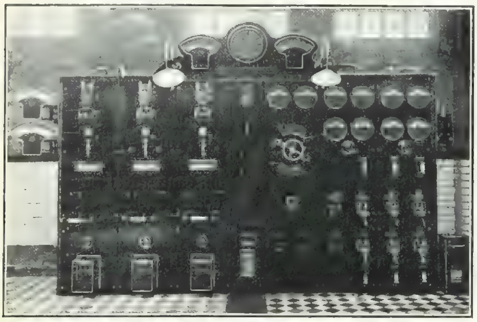


Dundalk Electricity Works: Mirrlees-Diesel Engines and Siemens Dynamos.

DUNDALK ELECTRIC LIGHTING.

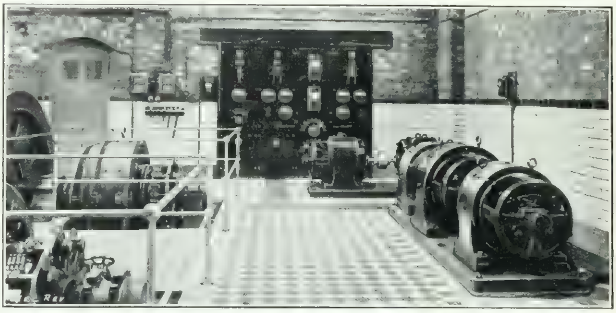
The history of electricity in Dundalk dates from the year 1896, when a syndicate was formed, with the principal object of establishing an electric tramway system between Dundalk and Blackrock. An application for a provisional order was made by the Town Commissioners in that year, on the understanding that the syndicate would pay the expenses of the order, and the matter in due course was brought before the Grand Jury, and sanctioned by them.

The total length of the tramways was 5$\frac{7}{8}$ miles, and the estimated cost of the undertaking was £40,000.



Dundalk : Main Switchboard.

In 1900 an extension of the order was applied for, as it was found that the enormous increase in the price of the materials had upset the calculations of the promoters. The extension was granted, but the scheme eventually fell through, after a considerable amount of expense had been incurred. The Council at a later date unanimously proceeded to promote a Bill in Parliament for the present electric lighting scheme.



Balancer and Battery Switchboard.

In September, 1907, the Urban Council retained Messrs. Miller, Wilson & Pegg, consulting electrical engineers, of Belfast and Liverpool, to make an inspection of the town and draw up a report on the prospects of a scheme of electric lighting. This report was furnished, and considered by the Council, and the financial prospects of the undertaking as a probable commercial success being considered satisfactory, steps were taken to secure the necessary borrowing powers, which were granted on application to Parliament. Resolved upon making no mistake, the Council accepted schemes from several other engineers, and finally referred all the schemes submitted to the arbitrament of Sir A. B. W. Kennedy; acting on his advice, they unanimously adopted the scheme proposed by Messrs. Miller, Wilson & Pegg.

The Electric Lighting Bill was in May, 1908, read the third time in the House of Commons, and in March, 1910, a Local Government Board inquiry was held, when the scheme was vigorously opposed by the Dundalk Gas Co. and a number of large ratepayers. It was mainly owing to this opposition that a subsequent Board of Trade inquiry was held, when the opposition strongly criticised some of the features of the scheme, such as overhead wires in secondary thoroughfares. The Board of Trade approved of the scheme, reserving power to review the circumstances as regards the overhead lines upon the expiration of a period of five years. In a letter to the Council they stated that, having regard to the nature of the soil of Dundalk, no better kind of electrical mains could be used than those proposed, no other system being better able to resist damage by heavy traction-engine traffic or from the effects of escaping gas or water. The Local Government Board also granted their sanction to the loan of £20,000 for the purpose of carrying out the scheme.

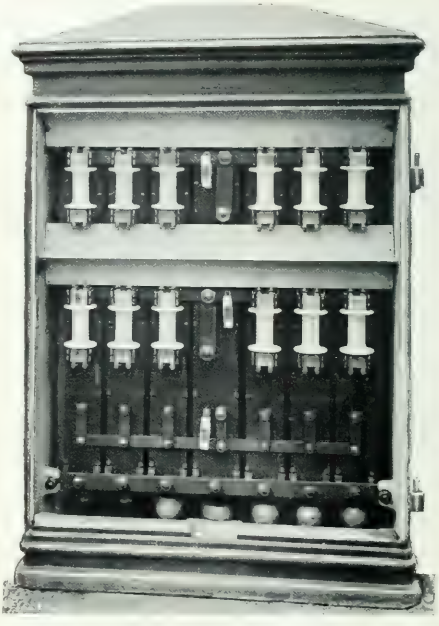
The work is now complete, and Dundalk can lay claim to the possession of one of the finest and most up-to-date electrical installations of any town of a similar size in the United Kingdom.

The generating station, which is adjacent to the Technical Schools, is picturesquely situated on the old Grammar School garden, and centrally located in the supply area. The building of the station was commenced on September 1st by Mr. James McAdorey, contractor, Dundalk. Messrs. Siemens Bros. & Co., Ltd., who obtained the mains contract, commenced the work of laying the underground cables on December 12th, 1911.

The generating plant consists of two Mirrlees, Bickerton and Day Diesel oil engines, running at 250 revolutions per minute, and direct-coupled to Siemens generators, the full-load output being 400 amps. at 250 volts. In May last both these generating sets were subjected by the engineers to exhaustive tests at half-load, full load and overload; some particulars of these tests are given below. A third generating set, identical with the above, has been provided for, and will be erected within the next four months.

The main and battery switchboards were made by Messrs. Brooke, Hirst & Co., and the balancer and booster by the British Westinghouse Co. The storage battery, supplied by the Sandycroft Foundry Co., consists of 126 cells, and is capable of giving a normal discharge of 200 amps. for 3 hours, or 400 amps. for one hour, with an emergency discharge of 720 amps. for half an hour. The general scheme provides for direct-current three-wire supply at 220-110 volts. The underground feeders and distributors are Siemens three-core paper-insulated, lead-covered and steel-tape armoured cables. These are laid direct in the ground, and wherever possible are placed under the footpaths. There are 9 miles of overhead mains, and 2$\frac{1}{2}$ miles of underground mains.

There are 335 street lamps, varying from 20-c.p. in the back streets, and 50-c.p. and 75-c.p. in the main streets, up to 400-c.p. in the market-place. The lamp standards and



Feeder Pillar.

brackets are of the Haydn Harrison pattern. The street lighting from the overhead mains is divided into seven groups, in order to facilitate the control of the public lighting. The feeder pillar, shown on p. 142, is for one three-wire feeder, with twelve 200-ampere switch-fuses for six three-wire distributors. There are already over 150 applications for a supply, and of this number 101 premises are already supplied from the underground mains, and 15 premises from the overhead mains. It is owing to this large number of applications, considerably in excess of those anticipated, that the Council has decided at once to put in hand the third generating set as mentioned above. About 50 H.P. of motors has already been connected, and it is anticipated that over 200 H.P. in motors will be connected to the mains within the next six months. The new picture theatre, which is to be opened this month, will also be supplied from the town mains.

The charge for lighting purposes is 6d. per unit, with a sliding scale, and for power purposes from 2½d. down to 1d., according to the amount consumed. The works are under the capable management of Mr. P. A. Spalding, A.M.Inst.C.E., A.M.I.E.E., who came from Galway to take up the position of resident electrical engineer, and the entire scheme was carried out under the supervision of Mr. H. V. Pegg, M.I.E.E., A.M.Inst.C.E., of Belfast.

TESTS OF GENERATING PLANT

Consumption of Fuel Oil, in lb. per kw.-hour.

	No. 1 set.	No. 2 set.
Full load	·647 lb.	·648 lb.
Half load	·704 lb.	·726 lb.

Average thermal value of the crude oil by analysis, 19,376 B.TH.U.

B.TH.U. per KW.-hour : No. 1 set, 12,526 ; No. 2 set, 12,514.

Remarks.—Both engines and dynamos ran very well throughout all tests; the exhaust from the engines was smokeless. Four samples of oil were taken during the full-load tests, and two samples were taken during the half-load tests.

Effect of sudden removal of full load on engine :—

Steady voltage at full load	247
Momentary voltage at instant full load was removed	255

Increase = 8 volts = 3·24 per cent.

	Temperature rise on dynamo.	
	After completion of 6 hours' full load.	After completion of 1 hour overload.
Commutator ..	46° F.	35° F.
Armature coils ...	51° F.	44° F.
Shunt coils .	68° F	56° F.

CONTRACTS CLOSED.

(*Concluded from page* 138.)

Hackney (*continued*).—After briefly summarising these tenders, the engineer advises the acceptance either of the tender of Willans and Robinson, Ltd., or that of Belliss & Morcom, Ltd.

Motor-generator or motor-converter.

General Electric Co., Ltd.		£2,421
Brush Electrical Engineering Co., Ltd.		2,832
Vickers, Ltd.		2,967
Electrical Construction Co., Ltd.		3,325
Bruce Peebles & Co., Ltd.		3,355
Bruce Peebles & Co., Ltd.	(recommended)	3,500
British Westinghouse Electric and Manufacturing Co., Ltd.		3,760
British Thomson-Houston Co.		3,841
Siemens Bros. Dynamo Works, Ltd. .		4,015
Dick, Kerr & Co., Ltd. . . .		4,068

Switchgear and connections.

British Westinghouse Electric and Manufacturing Co., Ltd.		£1,385
Siemens Bros. Dynamo Works, Ltd.		1,790
British Thomson-Houston Co., Ltd.		1,960
Spagnoletti, Ltd.		2,123
Ferranti, Ltd.	(recommended at £1,613)	2,258
Electrical Construction Co.		2,307
Johnson & Phillips, Ltd.		2,822
Whipp & Bourne, Ltd.		2,724

In referring to these tenders, the engineer recommends the acceptance of that of Ferranti, Ltd., at £1,613, the reasons being that, allowing for the reduction due in view of the switchgear being required for a motor-converter, the tender becomes £2,000. It is the lowest tender which approximates to compliance with the specification, and the firm are willing to make a further reduction, in view of the fact that a mistake was made in measuring the cables off the drawings. With these modifications, the tender becomes £1,613, and is the lowest complete and satisfactory tender.

It is also recommended that a contract be entered into with the Tudor Accumulator Co. for the renovation of the storage battery, at £2,379, and for its maintenance for 10 years, at £385 per annum.

The Council recently accepted the tender of Messrs. T. Wragg and Co. for 2¼-in. and 1¾-in. U-shaped earthenware troughs This firm now intimate that they are unable to accept the contract, and that of the Leeds Fire Clay Co., Ltd., is to be accepted, at 42s. 9d. and 36s. respectively per 100 yd. run laid.

Poplar.—The B.C. has received the following tenders for the supply of a works switchboard, to control the motors for driving the auxiliary plant now being erected in conection with generating station extensions :—

Pooley & Austin (accepted)	£210	General Electric Co.	£261
Crompton & Co. ..	279	E. F. Moy, Ltd.	349

British Westinghouse Co., £356.

L.C.C.—The Highways Committee recommends the acceptance of the tender of Messrs. W. Cory & Son, Ltd., for the removal of ashes from the Greenwich generating station for one year, at 1s. 5d. per cubic yard.

Mansfield.—The T.C. has accepted the tender of the Western Electric Co. for cables, &c., for the extension of the mains to Woodhouse.

Norwich.—The Electricity Committee of the T.C. has accepted the following tenders for coal :—

T. Moy, Ltd.—300 tons of Hucknall Main slack, 14s. 9d. per ton.
Wm. Cory & Son, Ltd.—6,000 tons of washed peas, 10s. per ton.

The Electricity Committee has accepted the tender of Messrs. Brackett & Co., Colchester, for a self-cleaning water screen, at £278.

Sutton Coldfield.—The Corporation Electricity Department has provisionally accepted the following tenders :—

Le Blanc jet condensing plant and Worthington steel cooling tower.—British Westinghouse Electric & Manufacturing Co.
150-kw. steam balancing generator (with G.E.C. dynamos).—Belliss and Morcom, Ltd.

Walsall.—The T.C. has accepted the tender of Messrs. Vickers for a rotary transformer, at £692; and that of the Westinghouse Co., Ltd., for switchgear and connections, at £275.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Yorkshire Local Section).—Saturday, July 27th. Visit to the Acton Hall Colliery, Featherstone. Leave Central Station, Leeds (L. & Y. Railway), at 2.7 p.m.

NOTES.

The Marylebone Bonus.—The Electric Supply Committee of the Marylebone Council reports having taken counsel's opinion with regard to the payment of a bonus of £519 to officers mentioned in a recommendation brought up by it at the last meeting of the Council. By an agreement between Mr. Seabrook and the Council the former receives a bonus equal to a percentage of the surplus revenue of the electrical undertaking, but this is subject to a proviso which provides that the Council shall not be bound to pay any bonus in respect of any year unless (1) the number of units sold increases during the continuance of the agreement at the average rate of 500,000 per annum, and (2) the average price charged during the year in respect of which the bonus is proposed to be paid is less by 5 per cent. than the average price charged in the preceding year. In the year ended March 31st, 1912, the Committee states that there was a substantial surplus, in respect of which the bonus would have been payable if the two conditions laid down had been complied with. The condition as to the increase in the number of units was amply complied with, but not the condition with regard to the reduction of price, as although the average annual reduction since the commencement of the agreement exceeds 5 per cent., the actual reduction of last year from the preceding year amounted to only 4·41 per cent. In these circumstances it seems quite clear that Mr. Seabrook cannot claim the bonus. Counsel was accordingly requested to advise (1) whether the Council can legally pay the bonus in accordance with the recommendation of the Electric Supply Committee ; (2) whether the case comes within Sec. 64 of the Metropolis Management Act, 1855 ; (3) generally. The counsel's opinion is that if the Council, after due consideration, should decide to pay the bonus, it would be legally entitled to do so, and the Court would not interfere. With regard to Sec. 64 of the Metropolis Management Act, 1855, Mr. Seabrook is not concerned or interested in a contract with the Council within the meaning of the first part of that section, and in counsel's opinion, the second part of the section does not apply, for the bonus is part of Mr. Seabrook's proper salary . . . and allowances, for it is part of the sum which the Council has agreed to pay him in return for his services. On the whole, therefore, he is of opinion that the Council may pay the bonus if it thinks fit. As the 5 per cent. average reduction in the price per unit was not reached, and as an error occurred in respect of an over-credit in the adjustment on interest on bank balances, the Committee has decided to withdraw its previous recommendation, and has recommended the payment of a bonus of £450.

Fatalities.—An inquest was held at Failsworth Town Hall by Mr. W. Sellers, County Coroner, on Friday, on the body of George Henry Gibson (56), an electrician, who met with his death on the morning of the 17th inst. at Failsworth, whilst working in an electrical manhole.

Henry Gibson, deceased's son, identified the body of his father, who, he said, had worked for the Corporation for 17 or 18 years.

On the Wednesday morning his father was apparently in good health, and witness had never known him to have a doctor.

John Greenwood, a labourer, said that on Wednesday he was working with the deceased, painting and cleaning cables in the manhole. At 11.15, while he was above ground, he heard Gibson, who was in the manhole, shout "George!" He looked down, and saw that Gibson had his hand on a red cable covered with rubber. Witness pulled deceased off the cable, and saw that he was apparently dying. He ran for a doctor and other assistance, and when he got back with a policeman Gibson was dead.

The Coroner: Was the deceased wearing gloves?—No.

Jas. Walvin, a collier, of Ashton Road, Failsworth, said he helped to get the body out of the manhole.

Mr. Lee, mains engineer to the Electricity Department, said he visited the scene about two hours after the accident. It was quite probable that Gibson might have had a shock, but not a severe one. In that manhole they did not consider it possible for a man in ordinary health to receive a shock sufficient to cause death As a matter of fact, they had 30 to 35 men engaged in such work as the deceased was doing every day, and they did not consider there was any danger, or it would not be allowed. The deceased was working in his ordinary boots, though the men had definite verbal instructions that when engaged in such duties, they must wear rubber shoes. Gibson had been cautioned and reprimanded on the 14th inst. for not wearing rubber shoes in a similar box, and new shoes had been supplied to him. At 2 o'clock witness tested the cables, and found that the voltage was 240, which was normal. In answer to a juror, witness said the department did not insist on the men wearing gloves, but they did insist on the use of rubber shoes. He had never seen a man working without such shoes. Witness did not think Gibson got a shock from the cable on which he had his hand when seen by Greenwood.

Dr. Heslop, who made a post-mortem examination of the body, was able to tell the jury that death was due to a sudden arrest of the act of breathing, which he said might have been caused by an electric shock. Both hands were clenched and the lower extremities of the body showed marked rigidity. There were no marks of burns. He could not account for the arrest of the breathing except by the shock. The deceased had a very weak heart. A shock would have much more effect on a man in that condition than on a man with a normal heart.

The jury returned a verdict that death was due to a shock and suffocation, the result of an electrical shock, and that there was no negligence by the Corporation.

A man named David Roberts was killed, and another man was severely burnt, at Messrs. Renton & Fisher's engineering works at Bathgate, on 7th inst., through a crane coming into contact with a live wire.

The Blyth Coroner was on Saturday notified of the death at Wallsend on Friday night of a boy named Charles Wilfrid Evans. A man found the body near Glover's Row. It was badly burnt about the left side of the neck and the left arm and hand, and was in contact with a live line.

At Messrs. Johnson's wire works, Forge Lane, Bradford, Manchester, on Sunday, Albert Thornton, a young man, newly married, of Windermere Street, Ashton Old Road, received a fatal shock whilst repairing a dynamo.

At an inquest at Fenton, Staffs., on Tuesday, it was stated that a gang of workmen were putting an iron girder into position at the Glebe Colliery, when it came into contact with an electric wire and rubbed off the insulating material. A 500-volt current went through the unfortunate men to the earth. Edward Roberts, the foreman, was standing on an iron plate, and was killed. The other men, who were on dry coal-dust, escaped fatal injuries.

On Wednesday Robert Riches, a labourer in the employ of Messrs. Blackwell & Co., contractors, of Westminster, was repairing the overhead wires on the electric railway, near Tulse Hill Station, when his hand came in contact with a live wire, causing instant death.

Annual Outings and Sports.—The Linolite Co.'s sixth annual outing took place on Saturday, July 13th. The party (numbering about 30), which consisted of the works and office staffs, Mr. A. S. E. Ackermann, engineer and manager, Mr. R. L. Matthews, assistant manager, and Mrs. Ackermann, drove from the company's offices in Westminster to Kingston, then through Surbiton and Esher to Oxshot, which was reached at noon. Luncheon and tea were served *al fresco* in a delightful garden, with a great variety of flowers and fruit at their best. After luncheon the party walked to Oxshot Heath, where a keenly-contested cricket match was played between the works and office staffs, resulting in a victory for the office. After tea the party drove back to London.

On Saturday, July 13th the head office staff and friends of the Armorduct Manufacturing Co., Ltd., went for their sixth annual outing, a party of between 60 and 70 going, as on previous occasions, for an up-river trip. Boarding the launch *Princess Beatrice* at Richmond they went to Walton, luncheon being served *en route*. In the afternoon during the return to Richmond tea was served, and shortly after 8 p.m. the company sat down to dinner at the Greyhound Hotel. Several toasts were drunk, and an impromptu concert was held. Mr. Marchant, the secretary, proposed the toast of the managing director, and Mr. Schmahl responded, calling attention to the fact that their staff had doubled in five or six years.

The annual outing of the White Electrical Instrument Co. took place in propitious weather on Saturday last, Brighton being the place visited, and a most enjoyable day was spent. Dinner was served at the Royal Pavilion Hotel. In replying to the toast proposed by Mr. T. Johnson of "The Health of Mr. White and the continued Prosperity of the Firm," Mr. White referred to the many advantages given by the new works, and attributed the increasing prosperity of the firm to the special facilities and up-to-date appliances they now possessed.

Upwards of 40 employés of Electrical Installations, Ltd., spent their annual outing on Saturday last, 20th inst., at Ramsgate. Luncheon was served at the Victoria Hotel. The afternoon was taken up by a brake ride through the country to Minster, where tea was served at one of the well-known tea gardens. The weather was all that could be desired, and a very enjoyable day was spent.

The Grantham employés of the Urban Electric Supply Co., Ltd., accompanied by Mr. J. E. Edmonds, went for their annual outing to Yarmouth on Saturday, and were joined by members of the Cromer staff

M.E. Tramway Sports.—On Thursday afternoon last week the M.E.T. Athletic and Social Club held its annual athletic sports meeting at Oakleigh Park, Whetstone. This is the fifth of these annual events, and this year, for the first time, the Tufnell Park Athletic Grounds was not the place of meeting. The change to Oakleigh Park was more than justified by the very large gathering of members and friends of the club and their wives and children. The club is a strong and excellently organised Institution with a membership of about 600. It has cricket and football sections, recreation rooms provided by the company and equipped for billiards, &c., by the club, and a military band, whose performances at the Alexandra Palace have already received praise in these columns. In the cricket section a challenge shield has been presented to the club by Mr. W. E. Hammond, traffic manager, to be competed for by the different branches; and in the football section Mr. A. H. Pott, the chief engineer, has presented a challenge shield for a similar competition. Among those present on the ground last week were Messrs. A. L. Barber (secretary to the company and chairman of the Sports Committee), W. B. Bruce, W. E. Hammond, Gordon C. Innes, R. Johnston, J. McLeod, A. H. Pott, O. Robson and B. G. West, all of whom acted as judges, and Mr. W. P. Sparks, who acted as time-keeper and handicapper. The aforesaid military band, under Bandmaster E. Wallace, rendered efficient service during the carrying out of the very interesting programme of events.

The latter included running and walking races, potato race, three-legged races, tug-of-war contests between the several branches of the Club, in which the men competed with an earnestness and determination which it was good to witness, this good old-fashioned sport sustaining both a keen and prolonged interest, and at times excitement; a veterans' handicap, races for the ladies, and for little boys and girls, and many other events, giving an opportunity for members and their families, even down to youngsters of five years of age, to demonstrate their abilities. We were going to mention "all the winners," but space fails us. The programme wound up with a Fire Drill Competition, and a consolation race. In the former, the competing teams were the Finchley, Wood Green, Edmonton, Hendon, and Stonebridge branches, also shops and staff. In the result "Wood Green" succeeded in winning the Challenge Cup from "Finchley," who had previously held it. A highly successful day wound up with the distribution of prizes by Mr. Henry Burt, J.P., the vice-chairman of the Middlesex County Council, and chairman of the Light Railways and Tramways Committee of that Council. Mr. Burt was first introduced by Mr. James Devonshire, the president of the Club, after which he, in a short speech, complimented the competitors on the close finishes, and the keen sportsmanship displayed by the members of the Club.

The Proposed Engineers' Club, Manchester.—A general meeting of those who had intimated their desire to join the proposed Manchester Engineers' Club was held in the Memorial Hall, Manchester, on the 16th inst. Mr. Daniel Adamson was elected chairman, and Mr. A. L. Green secretary (*pro tem.*). The chairman reported that the number of applications for membership exceeded 500, which was the figure suggested in the original circular issued by the Provisional Committee. It was unanimously resolved:—(1) To form an Engineers' Club; (2) to elect a committee of 12, with power to add; (3) to extend the date for applications as original members without entrance fee up to the end of July. The following are the names of the gentlemen elected to form the Committee, viz.:—Mr. Daniel Adamson, Mr. Julius Frith, Mr Henry N. Allott, Mr. Geo. Hughes, Mr. A. E. L. Chorlton, Mr. G. Layton, Mr. R. H. Clayton, Mr. Frank Nasmith, Mr. Wm. Cramp, Mr. S. L. Pearce, Dr. G. J. Fowler, Mr. J. H. Stubbs.

Educational Notes. — NORTHAMPTON POLYTECHNIC INSTITUTE, LONDON, E.C.—Full day courses in mechanical and electrical engineering, and courses in technical optics, commence on September 30th. For further particulars see our advertisement pages in this issue.

UNIVERSITY OF LONDON, KING'S COLLEGE.—Notice is given in our advertisement pages of a series of advanced lectures in engineering to be given next session. The following subjects will be dealt with:—(1) Internal-Combustion Engines, Petrol and Kerosene Engines; (2) Applications of Chemistry to Engineering; (3) Electrical Traction; (4) Irrigation; and (5) Design, Organisation and Operation of Central Electrical Stations.

An announcement is also made regarding courses of study in the Faculty of Engineering.

Legal.—CONDUITS FOR CANADA.—At the Birmingham Assizes last week, Mr. Justice Avory and a special jury heard the case of the Perfecta Seamless Steel Tube and Conduit Co., Ltd., *v.* Veritys, Ltd., in which plaintiffs sought to recover £345, the price of goods supplied. Defendants pleaded that the goods were not delivered within the 14 days specified in the contract; that they were not in accordance with the specifications; and that they were not of a marketable quality and saleable in Canada. They counter-claimed £178 for expenses and loss of profit; £66 for loss of freight and insurance, and £101 for loss of profit. After a hearing extending over two days, his Lordship summed up. According to a report in the *Birmingham Daily Post*, he said that the only question for the jury was whether the goods supplied were in accordance with the contract of May 23rd, 1911. "He did not see any ground whatever for imputing to either of the parties any want of honesty. He saw no cause for imputing to the defendants that they were trying to get out of payment for that which they ought to have paid for, or, on the other hand, to the plaintiffs, that they had not put forward this claim in the perfectly honest belief that they were entitled to be paid for the goods. His Lordship quoted a letter written by the plaintiffs before the order was given, in which, whilst willing to guarantee the tubes as complying with the Canadian underwriters' specifications, and to submit the goods to inspection to satisfy the defendants as to that, they declined to undertake that the tubes should pass the inspection of any inspector of the Fire Underwriters' Board in Canada. The ground for this stipulation was stated as being that some of these inspectors represented American fire offices, and were biased in favour of American manufacturers. His Lordship went on to say that he did not think the defendants were entitled to reject the tubes on the ground that an American or Canadian inspector had refused to pass them. The fact that a Canadian inspector, who might be presumed to be honest, had refused to pass the tubes was evidence for their consideration, but it was evidence only, and could not in itself be conclusive of the rights of the parties in that case. The broad lines upon which the defendants appeared to object to paying for the tubes was that the enamelling was defective, and that the inside was not sufficiently smooth." The jury, after lengthy deliberation, were unable to agree, and they were discharged.

Appointments Vacant.—Assistant installation inspector, for the Shanghai Municipal Council (£25 per month): evening class teacher in electrical engineering at the Leeds Technical School; chief assistant engineer (£180) and draughtsman (55s.), for the Coventry Electric Tramways; assistant telegraph engineer, for the Federated Malay States Government (£360 and £75 duty allowance). See our advertisement pages to-day.

The Birmingham Electric Supply Committee, in its report to be presented to the City Council on July 30th, is recommending the appointment of an assistant to Mr. Chattock, as constructional engineer. The commencing salary is to be £400 per annum, rising to a maximum of £500 per annum at the discretion of the Committee.

The Dundee Meeting of the B.A.—According to Press announcements we gather that the following are among the matters that are to come before the meeting of the British Association, which opens at Dundee in the first week in September:—

Mr. B. P. Haigh, B.Sc., on "A New Machine for Alternating Load Tests."
Prof. Coker on "Optical and Electrical Methods of Determining the Stress Distribution in Springs and Other Bodies."
Prof. A. E. Kennelly on "Telephone Circuits."
Dr. T. F. Wall on "The Hysteresis Loss in Iron due to a combined Pulsating and Rotating Magnetic Field," the paper bearing on the subject of commutator motors.
Prof. E. Wilson on "Magnetic Hysteresis."
Mr. R. S. Whipple on a "New Coal Calorimeter."

It is also stated that Dr. J. A. Fleming will open a discussion on wireless telegraphy, and Messrs. Dugald Clerk and Holzwarth (of Mannheim) one on the gas turbine.

A Model Home.—Through the courtesy of the directors of Gidea Park, Ltd., we were recently enabled to inspect the model house which is on view at the Latin-British Exhibition, Shepherd's Bush, W. The house is a replica of a number which have been built at Gidea Park, near Romford. The rooms are furnished in the styles of different periods, and suitable electrical fittings have been supplied by Messrs. Veritys, Ltd. The dining and living rooms are illuminated by artistic candle fittings, the three bedrooms by two-light pendants and single bracket fittings, while in the hall are two ceiling lights.

We understand that there is at present no electric supply at Gidea Park, but powers are being sought by the company to erect a generating station to supply the estate, and to supply electricity to the town of Romford.

Copper.—Noticing a reduction in price of this metal, one naturally looks for increased supplies, and the figures in Messrs. Merton's mid-monthly circular in the present case bear out the theory. The stocks in England and France, and afloat from Chile and Australia on July 18th, stood at 43,339 tons, an increase of 1,746 tons over the quantity registered for June 29th. Of this 1,355 tons are at Havre, and a further 825 tons increase in Chile shipments outweighs the 200 tons decrease in Australian, and the withdrawals from English ports. Rotterdam has, however, dropped 550 tons, and Hamburg 249 tons, so that the change in quantities may be local. The American supplies showed a drop of 2,358 tons from the end of May to the end of June, and the world's supplies 5,353 tons for the same period. Turning to detailed supplies, we find North America to Europe considerably below average, Spain and Portugal also low, Chile well above, and Australia also high. Deliveries are unusually low, which may possibly be due to the modern conditions under which a surplus of willing hands results in no work being done.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. R. S. [illegible], late assistant engineer at Fareham, has taken up an appointment as station superintendent under the Chichester Electric Light and Power Co., Ltd.

The Mansfield Council has adopted the recommendation of the Committee that the salary of the engineer be increased from £275 to £300 per annum.

It is recommended by the Stepney Electricity Committee that Mr. W. Young be transferred to the official staff of the Council and appointed as resident electrical engineer at £275 per annum, rising in 12 months to £300, together with residence, coals, water and light at 27, Osborn Street.

Mr. Plowman, shift engineer to the Poplar undertaking, has been placed under the Scale V of the Council's grading scheme at a commencing salary of £150, rising by annual increments of £12 10s. to a maximum of £185 per annum.

The Hampstead B.C. has given consent enabling Mr. Couzens to act as consulting engineer to the West Ham Corporation for a period not exceeding six months.

Tramway Officials.—The Leith Council has resolved to increase the salary of its tramway manager by £50 this year, and by £25 per annum in each of the two succeeding years.

General.—On Friday evening, 19th inst., at the Criterion Restaurant, Devonport, a smoker and musical evening was held, at which a presentation was made to Mr. F. O. Trotman, the mains and distribution supervisor of the electrical engineers' department of H.M. Dockyard, Devonport, in recognition of his marriage, which takes place to-morrow. Mr. P. J. Watts, the first assistant to the electrical engineer, presided, and tendered the best wishes of the chief electrical engineer, Mr. Z. H. Kingdon, who was unable to be present, and also of Mr. E. E. Benham, first assistant to the electrical engineer, who was unfortunately ill, and also of Mr. G. R. Battle, second assistant to the electrical engineer, who was also unable to be present. Mr. Watts referred appreciatively to the services of Mr. Trotman since he had been in the department, and wished him and his consort every happiness. Mr. Trotman suitably responded. The presents included a large silver tray (suitably inscribed), silver forks and spoons, silver-mounted pipe, and an autograph album containing the signatures of the subscribers

Mr. Alfred Still, who left England in the early part of last year to take up the position of electrical engineer to the Lake Superior Power Co., of Sault-Ste-Marie, Ontario, Canada, has lately been appointed chief electrical engineer to the mining department of the Algoma Steel Corporation. His headquarters will be at Magpie Mine, Ontario, where he will have charge of the very complete and up-to-date electric power equipments at the various mines controlled by the company, and will also be responsible for the completion and operation of the 4,000-H.P. hydro-electric generating station connected to the mines through an 18-mile three-phase overhead transmission. Mr. Still is an Assoc M.Inst.C.E., and a member of both the American and British Institutions of Electrical Engineers. He is the author of books on electrical engineering subjects, and a frequent contributor of technical articles to the electrical journals.

Mr. John Murray Crawford, A.M.I.E.E., late of the Engineering Department of the British Post Office, has just sailed for Melbourne to take up the position of assistant electrical engineer in the Postmaster-General's Department, Commonwealth of Australia.

According to *Indian Engineering*, Mr. M. G. Simpson, electrical engineer-in-chief, Telegraph Department, has left Simla for Calcutta

Mr. R. R. G. Mann, A.C.G.I., has recently been appointed provisional telegraph officer in Southern Nigeria at a salary of £360 per annum, and he sails for West Africa on July 31st. After being 5½ years with the Eastern Telegraph Co., Mr. Mann spent a year at Finsbury Technical College and entered the City and Guilds (Engineering) College as a second-year student in 1910. At the close of the past session he was awarded the diploma of the College (A.C.G.I.) in electrical engineering.

Obituary.—The death is announced, at the age of 73 years, of Mr. Henry Lea, M.I.C.E., senior partner in the firm of Henry Lea & Son, Bennett's Hill, Birmingham.

Henri Poincare.—The lamented death of Prof. Poincaré, on July 17th, has removed from us one of the most eminent mathematicians of the age, whose influence, especially in France, where he was Professor of Mathematical Astronomy in the University of Paris, was very great. The original work which he accomplished is worthy to rank with that of Kelvin and Heaviside, and his investigations in connection with Hertzian waves and wireless telegraphy, as well as the electromagnetic theory of light and electrical oscillations in general, are of permanent value. His genius covered the whole range of mathematical physics, and his breadth of view, doubtless due in part to his early training as a mining engineer, enabled him to link together subjects of the widest dissimilarity. His age was only 58 years.

CITY NOTES.

Electric Construction Co., Ltd.

Sir Irving Courtenay (chairman) presided at Winchester House, E.C., on July 18th, over the nineteenth annual general meeting of the above company.

The Chairman first referred with regret to the death of Mr. W. S. B. McLaren, M.P., who was the chairman of the company for five years, and moved a vote of condolence with Mrs. McLaren, which was passed in silence.

In moving the adoption of the report (see Electrical Review, page 64), the Chairman said the directors had done him the honour of electing him to the chair, and, while he had great hesitation in accepting office, he was influenced by the fact that they had a managing director who devoted his whole time to this company's business and its allied undertakings. He appreciated the honour highly, and no effort would be spared on his part to discharge efficiently the duties which devolved upon him. He had peculiar pleasure, on the first occasion of presiding at the general meeting, in presenting accounts which showed a net profit approaching that of their earlier years. Indeed, on comparing the results of last year with the past, he was somewhat surprised to find that the net profit earned exceeded some of the years when they distributed a larger dividend. After the protracted period of depression through which they had passed, however, the board felt that they were consulting the best interests of the company in providing liberally for reserves, and they therefore recommended the distribution of 3¾ per cent. on the ordinary shares, as compared with 2½ per cent. last year. As stated in the report, the works had been fully employed throughout the year (the number of machines produced again forming a record), and he was pleased to say that their products continued to enjoy their reputation for high-class design and workmanship. They were steadily increasing their exports to foreign markets, and the growing demand for electrical machinery at home warranted them in expecting a continuance of the enhanced profits earned during the past two years. Notwithstanding the general industrial unrest which had prevailed, the relations with the workmen continued to be of the most satisfactory character. Like everybody else they felt the result of the coal strike, but, having secured a good stock of fuel and raw material, they were able to keep the works going without cessation, although considerable inconvenience was suffered and extra expense incurred. With the view of economising the supply of fuel during the strike, the management at the works introduced what was known as the "one break system," and so satisfactory did this prove that it was decided to adopt it permanently. Under this system the works did not open until 7.30 a.m., the interval for breakfast being abolished. The total number of hours worked per week was now 50, as compared with 53 formerly, but careful investigation had shown that there had been no reduction in the amount of work produced, and there was little or no time lost through unpunctuality. The change was very popular with the workpeople, and he was satisfied that it would tend to confirm the feeling of contentment which was vital to the welfare of such a concern. The Insurance Act would involve a considerable increase in their standing charges, and whether, as alleged, they would receive a *quid pro quo* in increased efficiency, experience alone would prove. However, as behoved every good citizen, they would do all that they could to administer the Act in a proper spirit, recognising that its principles were sound and that anything that was done to ameliorate the conditions of the infirm or unemployed must be for the general good. Since the end of the financial year the board had redeemed £7,700 of the company's debenture stock. The stock redeemed would be kept alive (like the previous purchases) for the purpose of reissue, if required, but this they regarded as only a precautionary measure. The total amount of debenture stock outstanding was now £175,000, as compared with £250,000 three years ago. The gradual reduction of the company's indebtedness enhanced the value of the preference and ordinary shares, and it was the intention of the board, if opportunity offered to reduce still further the amount of debenture stock outstanding. Dealing with the accounts, there was really very little that he could say. All the items in the profit and loss account were strictly comparable with last year, the outstanding feature being an increase in income of £6,418, while the expenditure had only increased £1,095. This proved again what they had always said, that they looked to increased overturn for increased profits, seeing that a large volume of business could be handled without any material increase in expenses. The balance-sheet exemplified their strong financial position. The prudent and gradual realisation of the holdings in other companies had enabled them to discharge a good part of the debenture debt, and the attention to reserves had put them in possession of liquid investments which enabled them to view with equanimity any recurrence of the acute depression which prevailed a few years ago. Of such recurrence there was no indication at the moment. He would not attempt to prophesy, but he was entitled to say that the prospects for the new year were satisfactory, and they had every reason to hope they would come next year with a report as good as, if not better, than the one now presented.

Sir H. C. Mance seconded the motion.

Mr. Ball asked how the company's investments in the Madras Electric Tramways Co. and the Electrical Power Storage Co. now stood.

Mr. Jas. Gray (managing director) said the company's holding in the Madras Electric Tramways amounted at the date of the accounts to something like £17,500, but since the close of the accounts they had realised part of their holding. They were only interested in the 6 per cent. cumulative preference shares, but the company had paid 2 per cent. on its ordinary shares. Their holding in the Electrical Power Storage Co. was valued in the books at approximately £55,000. They had received no dividend from that concern for the past two years.

The report was adopted, and the retiring directors and auditors were re-elected.

Mr. P. E. Beachcroft, on behalf of both the board and the shareholders, proposed a vote of thanks to the staff and employés of the company for their services during the year. He remarked that there were two essential qualifications for the success of a manufacturing company, viz., efficiency and good management, and the first was dependent on the second. They had a managing director who threw his whole heart into the work week in and week out, whilst under Mr. W. Bullock, their works manager, they had a technical staff which he considered second to none in the electrical industry of the country. They had also in Mr. Willock, their secretary, a man who not only devoted his energies to the secretarial work, but also went into the highways and byways and compelled orders to come in. Last, but not least, they had a bond of good feeling and harmony existing between employer and employé which in these days of industrial unrest was so essential for the successful carrying on of the business. He believed unless anything unforeseen happened, that the current year would be more successful than the past.

Mr. Johnson, as a shareholder, seconded the motion, and said that having watched the progress of the company for the last 20 years, he was glad to see they had emerged from the dark days owing to successful management at both the offices and the works, and were now again in the forefront of the electrical industry.

The motion was carried and acknowledged by Mr. J. Gray, who said that the staff would continue to give their best services to the company with the knowledge that their efforts were appreciated.

Lanarkshire Tramways Co.

The directors' report for the half-year ended June 30th, 1912, shows that the revenue was £37,101, and the expenses were £21,473, leaving £15,627, less contributions payable to local authorities, £822; interest on debentures, £904; interest account, £624 = £13.248, plus £1,385 brought forward, leaving a balance of £14,633, which is to be disposed of as follows:—£9,432 to dividend at the rate of 5½ per cent. per annum for the half-year on the issued capital, carrying £5.200 to revenue new account. The traffic receipts for the half-year show an increase of £568 and the expenses an increase of £2,113 as compared with the corresponding half-year of 1911. The traffic receipts were considerably affected by the coal strike, and it is estimated that but for the strike the takings would have shown a further increase of fully £2,500. The directors have arranged that in the event of the Lanark County Council obtaining powers to construct the uncompleted lines authorised by the 1903 Order, the County Council will construct the same and the company will work them, paying interest to the County Council on the amount of the cost of construction. The arrangement also provides for the County Council and other local authorities purchasing the company's undertaking at any time before 1928 at a price to be agreed upon with the company, but should this option not be exercised within two years from the opening of the new lines for public traffic the company will purchase the new lines from the County Council at cost price. The directors will, as usual, provide for depreciation in the accounts to December 31st next.

Prospectuses.—*The Egham and Staines Electricity Co., Ltd.*—The list was to close yesterday in an issue of 1,000 participating 5 per cent. cumulative preference shares, and 1,000 ordinary shares, all of £5 each offered at par, in all £10,000. A new station equipped with two Diesel engine sets of 100 kw. each, to the designs of Messrs. Handcock & Dykes, was completed in February last. The money is required for providing for the capital expenditure necessary to meet the growing demand.

Buenos Ayres Lacroze Tramways Co.—The list closes to-morrow (Saturday) in an issue of £500,000 5 per cent. consolidated mortgage debentures. The expansion of the business renders further works necessary, and the proceeds of the issue will go to the purchase of rolling stock, additional car-sheds and repair shops, extensions, and other improvements.

Metropolitan Railway Co.—The directors announce, subject to final audit, a dividend upon the ordinary stock for the past half-year at the rate of 1½ per cent. per annum, carrying forward £4,500 to the next half-year's account, and placing £7,500 aside for electrical renewal and depreciation.

Great Northern and City Railway Co.—The report of the directors, according to the *Times*, is very satisfactory, as, for the first time for several years, the company is able to pay the full dividend on its debenture stock without any outside help, and to carry a small balance forward. The number of passengers carried shows an increase of 532,716, and the receipts an increase of £2,613. The expenses show an increase of £1,140; the largest item is under "locomotive generating power," in which there is an increase of £897 for coal.

Central London Railway Co.—The directors announce dividends at a rate of 3 per cent. per annum on the ordinary stock, at the rate of 4 per cent. per annum on the preference stock, and at the rate of 2 per cent. per annum on the deferred stock, leaving £23,776 to be carried forward. The dividends a year ago were at the same rates, and the carry forward was £30,655.

Brush Electrical Engineering Co., Ltd.

Mr. E. Garcke, chairman, presided on Monday at the offices of the Electrical Federation, 1, Kingsway, W.C., over the annual general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 104), said he had had the honour of appearing as chairman of the company in three successive years. When he first took the chairmanship, in 1909, he did so in the expectation that it would be only for a year or two, for the purpose of assisting to carry out a much-needed rearrangement of capital. He was sorry, however, that the delay in bringing about this desirable change had been greater than he anticipated, but the progress towards a better state of things, although slow, had, nevertheless, been very clear and definite. For 1909, their gross profits were just under £20,000 ; for 1910, they were over £28,000, and last year (1911) they were £35,500, and the standing charges, which were very materially reduced three years ago, had only gone up by about 4 per cent., although the gross profits had very nearly doubled. Four years ago, the directors had to record a loss on working for the year of close on £40,000. The following year the loss was about £20,000. Last year they reported a loss of £10,800, and this year they showed a loss of £5,688. They had, therefore, made steady progress during the past four years, although of a negative kind. If they continued their progress in this way, there was reasonable hope that the accounts for the current year would, at any rate, show an equilibrium between profits and expenses, including all debenture interest and other charges. The directors, therefore, considered that the present time was opportune for carrying out the long-delayed reorganisation of the capital account, and the accounts had been made up with the view to showing what, in the opinion of the directors, should be the reduction of capital. Whenever this matter had been mentioned at previous meetings the view had been expressed by the shareholders that the reduction of capital when made should be drastic, so as to avoid the necessity of the operation being repeated. He hoped shareholders would agree that the writing down which the directors proposed, or that they indicated, was as drastic and as complete as was practicable. To do more than they proposed would, they thought, be asking the shareholders to make an unnecessary sacrifice. The company had in the past been confronted by many difficulties, and it had weathered many storms, and he had recollections of the company having enjoyed periods of prosperity, and saw no reason whatever why shareholders should not look forward to the company enjoying some measure of prosperity again ; at any rate, it was the duty of all concerned to combine in the endeavour to carry the company through its present difficulties with a view to its again becoming prosperous. They proposed to carry out a reduction of capital so as to place the balance-sheet on a proper footing, and to write off the accumulated losses of the past years, in order that the profits which they hoped to make in future years might be available for distribution as dividend to the shareholders, and simultaneously they proposed to raise a little further capital, so as to discharge the outstanding loans and to provide some working capital. They had raised some temporary loans and had given a second prior lien charge as security, but these loans and this charge would be merged or disposed of in some way in the new arrangement. The problem of raising fresh capital was not an easy one, and, in order that they might be able to submit a scheme to them with a prospect of their being able to accept it, they suggested that a committee of shareholders and debenture-holders should be appointed in order to confer with the directors on the scheme, which they were prepared to submit to and discuss with such Committee. They had invited shareholders who were willing to serve on the Committee to communicate with them, and they proposed to ask the shareholders to appoint as a Committee all the gentlemen who had expressed their willingness to serve. This would make rather a large Committee, but, having asked gentlemen to come forward, it would be better that all should be appointed rather than that they should discriminate between them. They were Messrs. F. J. Marchmont (solicitor), Wm. Parker (representing several trust companies), Wm. Geipel (electrical engineer), J. J. Bisgood (manager of Edinburgh Life Office), Gerard H. Perryn (civil engineer), R. V. Greene, J. G. Lorrain (engineer and patent agent), and C. H. Dade (manager of the British Electric Traction Co.), with Mr. J. B. Braithwaite (of Messrs. Foster & Braithwaite) and Mr. J. Cecil Bull to represent the debenture-holders. In 1911 the benefit of reviving trade was felt generally in the engineering industry. Better business, however, brought with it the usual accompaniments of labour troubles. The railway strike in August, 1911, had effects altogether disproportionate to the period of its duration. Other local strikes followed, and in the spring of the present year the coal strike and a general strike of steel moulders in the Sheffield district were severely felt. One of the results of these strikes was that in many branches, and particularly in the iron and steel industries, the various works were much behind with deliveries, and it was very difficult to carry out time contracts. The moral of this was that buyers should in their own interests endeavour to place their orders well ahead of the actual requirements whenever possible, instead of, as was too often the case, leaving them over until the machinery was urgently wanted. He was glad to say that there were signs that buyers were beginning to realise the importance of doing this, and they had lately booked orders for delivery as far forward as in the latter part of next year. He was pleased to say also that the prices of steam and electrical machinery were stiffening somewhat, although they were still far below what was required to give the manufacturer a reasonable return—having regard to the highly skilled character of the work and the unavoidable risks of the business. Prices of commodities were going up all round. Coal was 2s. to 3s. per ton higher, and other raw and partially finished materials showed advances. All manufacturers of electrical machinery would have to follow suit, because their profit margins were already so narrow that they would not be able to stand anything in the way of increased cost. On the other hand, they must not forget that increased prices would strengthen the competition from abroad, so long as they admitted the manufactured imports free of duty. In the report, reference was made to the great advance in popularity of the steam turbine. This advance had been so marked that the turbine now practically held the field where large generating units were required. They had now been building turbines for a good many years, and had latterly had more orders than they could conveniently deal with, having regard to the abnormal conditions which he had already explained. They furnished these turbine sets, not only for central power stations, but also for many industrial applications, and they had them in successful operation so far away as Japan, New Zealand, South America, and South Africa. The demand for plant of this description appeared likely to increase, and they were very desirous of being able to take full advantage of the favourable position they occupied as makers of turbine machinery. On the rolling stock side, they had an improved turnover in 1911, and he was glad to report that the orders in hand, and in prospect, were satisfactory. They had executed, and had in hand, important contracts for main-line passenger and freight rolling stock for Brazil, Siam, Egypt, and Chile, and had just been successful in securing an order for coaches for the Central London Tube Railway. Tramcar orders in 1911 were not good, but there had been an improvement during the present year, and they were now fairly busy in that department. They were also building motor-omnibus bodies for all the leading companies, including the London General Omnibus Co., the Tramways (M.E.T.) Omnibus Co., the Central Omnibus Co., British Automobile Traction Co., and this was a branch of business in which they looked for an increasing demand. He could speak to them at great length on the general condition of the electrical industry in this country ; on the legislative obstacles which had been placed in the way of its development ; on the frequent recurrence of labour troubles ; on the absurd encouragement of competition from abroad, with consequent reduction of profit leading to still keener competition among the home manufacturers. He might also say something about the ever-increasing rates and taxes, but he would only have to repeat what had been already stated on former occasions. All they could do was to continue to the best of their abilities along the path of their duty in the full conviction that improvement in the conditions must follow, and while they were grateful to the shareholders for the patience they had shown, they hoped that an early improvement in the position would reward them for their forbearance, and diminish some of the anxieties and troubles which directors and officers carrying on an electrical manufacturing concern in this country experienced.

Mr. W. L. Madgen seconded the motion.

Mr. Bush pointed out that the gross profits were £35,000 odd, which seemed very small, considering the large capital the company had. He did not know what the percentage of gross profit was, but he assumed, in a manufacturing business like theirs, they would want 25 to 35 per cent., which would give a turnover of £150,000. But even with a turnover of £200,000, the amount of gross profit was ridiculously small with the capital of the company. He saw the chairman smiling, which probably meant that their turnover was much greater, but if so it was obvious that they must do the work at very low prices and probably some at a loss. He suggested that the directors might consider the inadvisability of taking so much work if they were doing it at a loss, and considered the shareholders should be told what relationship the gross profit bore to the turnover. The chairman had given no details of the suggested re-organisation of capital, and it appeared to him that what was really required was a re-organisation of management. He failed to see how the re-organisation of capital could give them bigger profits ; what they wanted was more profitable business.

The Chairman said the turnover was much greater than that mentioned by Mr. Bush, whilst the profits were very much smaller than they considered reasonable. Their complaint was that the profits were so small owing to the reduction in prices over which they had no control. The prices for the commodities were determined by competition which was very keen. They were opposed to the competition of powerful manufacturers abroad who had protection in their home market and who were able to dump their goods into this country at a low price. It was true that the foreign importation was not so big as it was because the low prices had made the business unprofitable, but the moment they put up prices they would bring in foreign goods again. They were doing a large volume of business, and the management was most careful, but the margin of profit was very small. They were bound to take a large volume of business to cover standing charges.

Mr. Abbott remarked that the most prosperous time the company had was when they had a profit-sharing scheme with the employés, and he suggested that the directors might consider the advisability of re-establishing such a scheme.

Mr. Cathcart thought they stood a chance of the ordinary capital being further wiped out by reconstruction. It seemed to him that £19,000 for administrative expenses was very high, whilst £4,250 for advertising and London expenses appeared very large.

The Chairman said advertising expenses were higher that year, owing to their having taken a stand at the Olympia Exhibition Still, if they did not advertise, they could not attract the business they required, and they did not spend more on advertising than other firms. He admitted that the expenses seemed high in comparison to the profits, but if they could once increase the rate of profit, then all the figures would assume their right proportions. He was afraid that employés would not appreciate a profit-sharing scheme when there were no profits, but the board would consider the question, although it was not an easy one.

Mr. R. V. Greene withdrew his name from the suggested Committee, in view of the number who were prepared to serve, and remarked that it did not seem fair that the British Electric Traction Co. should have such voting power as to have practical control of the company. It seemed to him that they would be liable to a reduction of capital in respect of the prior lien bonds issued some years ago.

The Chairman said the scheme was by no means cut and dried, and he thought it better to refrain from mentioning what was in the minds of the directors until they met the committee, when they could thoroughly discuss the whole matter. Afterwards the shareholders would have an opportunity of expressing their views. He did not quite know what Mr. Greene meant by his reference to the British Electric Traction Co. That company were large shareholders, but they were no more.

Mr. Greene said what he meant was that if the whole of the other shareholders were of one mind, they would not have sufficient voting power to equal that of the British Electric Traction Co

The Chairman said the B.E.T. Co. had never exercised their voting power to the detriment of the company. In fact, there had never been any dissension amongst the shareholders. They were all in the same boat, and had to work together. So far from the shareholders having been prejudiced by the association of the B.E.T. Co., it was entirely due to the assistance of that company that the position of the Brush Co. was not worse than it was.

Replying to Mr. Roberts, the Chairman said the British Electric Traction Co. held some of the first prior lien bonds, which they took up when they were offered by the company, and they also held the whole of the second prior lien bonds, against the advance made by them during the year.

The report was then adopted, and the retiring directors were re-elected.

, Mr. Bisgood said he wanted it to be understood that he was going on the Commiteee simply as a private shareholder. The Edinburgh Life Co. had no interest whatever in the company.

Crompton & Co., Ltd.

The twenty-fourth annual general meeting was held on Monday at Salisbury House, London Wall, E.C., Mr. John Trotter presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 105), said that when he addressed them on the last occasion low prices and the depressed condition of the electrical manufacturing industry had produced a state of affairs in the company which gave them all cause to take a depressing view of the situation, and whilst they did not now consider the results which had been obtained in the past year by any means satisfactory, still he thought they had turned the corner, and that they were entitled to take a more optimistic view of the future. A few words might not be amiss in explanation of the fluctuations which had appeared in the results of the company. For a good many years past the competition in the electrical trade had been very keen, and there had been a good deal of cutting of prices. In those circumstances, to make profits it was necessary that the manufactory should be kept well supplied with orders. With that end in view, a considerable amount of contract work was done by the company, which in turn brought business to the company's works. In 1909 the contract work fell off, and that coinciding with a scarcity of orders at the works, resulted in a serious diminution in the gross profits, which in the year ended March, 1910-11, and the first half of the year under review, were not sufficient to cover expenses. In order to do the extensive turnover, which reached its maximum in the year ending March, 1908, the directors made temporary arrangements for a loan from the company's bankers until such time as further capital could be arranged. Subsequent depression made the idea of raising further capital out of the question, and the board were compelled to restrict the company's business in certain directions in order to permit of the bank loan being reduced. This restriction, which was more particularly in the direction of refusing to take on any business which would tend to lock up the company's capital, coming at a time when orders on more satisfactory terms were few and far between, resulted in many orders being taken during that period at a price which left but little margin for standing charges. Those standing charges were reduced somewhat, but a heavier loss still would have been incurred had the selling staff been further reduced, as the output at the works would obviously have dropped away still more. Some of the business which was taken a year or more ago, when orders were difficult to obtain, was completed in the first half of the year under review, but such business brought little or nothing in the way of profit to go against standing charges, and that accounted for the bad results obtained in the first half of the year. It was very satisfactory to be able to say that they had come to the end of the orders taken under such conditions. The demand for goods of the company's manufacture was steadily improving. That improvement was shown in the fact that in the second half of the year the results were so much better, and he was glad to say that, in one department, where the want of orders was most severely felt, they had, during the first quarter of the current year, secured business to a value of 40 per cent. in excess of the orders secured in the corresponding period of last year. The sales of machines covered by the C.M.B. patents continued to be satisfactory. It might interest shareholders to know that, so far as they had been able to ascertain, the company's selling prices were, generally speaking, about the average of those ruling in the trade. In some particular sizes of machines, that did not quite suit their standards, their price came out above the average, but in other cases their prices were fairly low, and the increase in the orders received during the last few months was pretty good evidence that the company's prices were about right. With regard to foreign and Colonial business, the directors would of course like to see the business abroad increased. In one or two directions openings presented themselves at the present time, but in the more important markets a certain amount of stock was required to be held, and much as they would like to cultivate such markets, the directors did not feel justified at present with the company's limited working capital in embarking on such business. At the last meeting he told them that there were two contracts in dispute. He was glad to say that in one case the dispute had been settled satisfactorily in the company's favour without litigation. The other case involved a dispute with the Government of India, and the matter was not likely to be cleared up for another 12 months. He was glad to say that the company's relations with their customers were excellent, and during a year when there had been labour disputes on every hand, it was satisfactory to be able to report that their relations with their workmen were all that might be desired. He might say that the Insurance Act would probably cost them between £800 and £1,000 a year. Turning to the balance-sheet, the short term notes which appeared on the liability side of the account at £9,375 had been reduced by £3,900 since March 31st. Sundry creditors had been reduced by £2,000 during the year, and the bank loan by £4,000, and they were within a few months of seeing a further considerable decrease in the bank loan. On the other side of the account, plant, tools, &c., were reduced by £2,271, due to the usual writing off. Trade debtors amounted to £105,555, as against £125,819. That reduction was satisfactory, as showing that the policy which was indicated last year of concentrating business and not taking orders which would tend unduly to lock up capital, had had its effect. In regard to the Electric Supply Corporation, it was satisfactory to find that the shares of that concern which they had had to hold for so many years, had at last paid a dividend and began to show signs of life. In the profit and loss account there was an increase of £1,200 in trading expenses due to the increased turnover. On the other hand, there was a decrease of £1,850 in administration due to economies effected in many directions. The gross profit showed an improvement of over 33⅓, or £11,000. There still remained the disagreeable fact that there was a loss to revenue account of £1,500, but that compared with a loss of £14,000 last year. He had great hopes that on the next occasion they would be able to show much better results. In the last six months they had covered the debenture interest and other charges against revenue, and the same position of things was being maintained up to the present, and had it not been for the first six months they would not have had to show any further increase in the debit balance, which was now £58,000, as against £48,000 last year.

Col. Clibborn seconded the motion.

The Chairman, in reply to questions, said that there would be various ways eventually of dealing with the company's finances, and amalgamation might be one of them. He did not, however, think the present was an opportune time to talk about amalgamation, because obviously things were on the mend, and they would get a very much better price a little while ahead than if they attempted to amalgamate with anybody at the present time.

The report was adopted.

Austrian Manufacturing Companies.

The report of the *Austrian Siemens-Schuckert Works, of Vienna,* states that a considerable increase in the orders took place in 1911. The works were employed to the full extent of their capacity, and extensions became necessary. Owing, however, to the prevalence of keen competition, it was difficult to obtain satisfactory sale prices. After placing £58,000 to depreciation, the accounts show net profits of £75,000, as compared with £56,000 in 1910, and a dividend of 6 per cent. has been declared, being the same rate as in the previous year. The favourable degree of activity has continued in the present year, and work is on hand for a long time forward.

The *Ver. Gluhlampen und Elektrizitats Gesellschaft, of Neupest,* reports that the departments for telephony and railway safety appliances were abundantly provided with work in 1911, and the existing orders will also assure uniformly good employment in the present year. On the other hand, a further decrease in orders was experienced by the carbon-filament lamp factory through the extended use of wire lamps. The wire lamp factory was enlarged, and the capacity of production was doubled. After allocating £14,000 to depreciation, the accounts exhibit net profits of £42,000 for 1911, as contrasted with £35,000 in the preceding year. It is proposed to pay a dividend of 10½ per cent., as compared with 9 per cent. in 1910.

Metropolitan District Railway Co.—The directors, after setting aside £10,000 as reserve for renewals, recommend a dividend on the 4 per cent. guaranteed stock for the past six months, at the rate of 4 per cent. per annum, a dividend on the first preference stock for the six months at the rate of 4½ per cent. per annum, and a dividend on the second preference stock for the six months at the rate of 2 cent. per annum, as against no payment in the corresponding period of last year. The carry-forward is £6,300.

Insurance Amalgamation.—It is announced, says the *Times*, that a provisional agreement has been entered into for the acquisition by the Royal Insurance Co. of the shares of the British Engine, Boiler, and Electrical Insurance Co., of Manchester.

City and South London Railway Co.

The fifty-sixth ordinary general meeting of this company was held on Tuesday at the offices 71, Finsbury Pavement, E.C., the Right Hon. C. B. Stuart Wortley, K.C., M.P., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 107), said he did not think they would expect him to take up much time in confessing or explaining that this half-year was, and was sure to be, a very different half-year to that which they had to discuss a year ago. The events of that half-year were unusual, they produced financial results that were unusual, and they had to recommend unusual measures for dealing with those results. In all the circumstances they might well be glad of the foresight that was showed last year, by reason of which they stood to-day a good deal better than without it they would have done. Gross receipts were down by the large sum of £5,947. But that adverse fact was neutralised by the fact that the expenses had been kept down, and showed a net decrease of £153. The result was that the balance to net revenue was down by £5,794. That situation was mitigated to the extent of £1,827 by the facts that they brought forward from the December, 1911, account, £1,027 more than they did from December, 1910, and that they passed to renewal account £1,500 this year as of old, instead of the £2,300 that they thought it well to put to that account last year, when they had some very exceptional incomings to deal with. Charges for interest were less by £612, and this added to the £1,827, reduced by £2,439 the decrease on net revenue, and gave them a sum available for dividends of £32,694, against the record sum of £36,049 that they had last year. They had, however, to pay more by £949 than they had last year in dividend on 1903 preference, with the final result that for dividend on the ordinary stock they had less by £4,304 than in July, 1911. Paying 10s. per cent. less dividend on the ordinary stock would save £3,700, and if they agreed to this proposal, it enabled them to recommend a final carry-over reduced by no more than £604 from the unusually large sum of £2,798 that they carried forward 12 months ago. Compared with what might have been expected, this result might well have been worse. The June receipts of 1911 were swollen by the extraordinary traffic of the Coronation period, and there were no strikes in that half-year. The June half-year of 1912 had seen two strikes, one of which raised the price of fuel, and both of which interfered with the employment of the classes from which their passengers were drawn, and reduced their spending power alike on journeys to and from work and on excursions in search of pleasure. Then, again, the national game of cricket seemed to some extent to be losing popularity as an attraction to spectators. The matches at the Oval were not attended by the multitudes whose fares were formerly so beneficial to their gross receipts. The number of passsengers carried was only 12,510,728, against 13,318,622 in the Coronation half-year, but was nevertheless greater than in any other June half-year in their history. It was too soon to say whether they had got to the worst of the omnibus competition. So long as their tramway rivals had not the direct access which they had to the heart of the City at the Bank, it seemed that there must remain a large and perhaps a growing class of people to whom their service was indispensable, and whose patronage nothing could take away from them so long as they could hold their own in the matter of speed. It had been made known to them already that this important matter of speed was occupying their practical attention; and he might go so far now as to say that improved speed seemed assured to them as a matter of mechanical possibility, and that its realisation was only a question of finance. A new subway had been built to give access from their own Moorgate Street Station to those of the Metropolitan and the Great Northern and City lines. The policy of this subway was that of keeping their customer underground when they had got him—of giving him facilities for continuing his journey without coming to the surface and there encountering temptations not addressed to him in the interest of underground railways. Their relations with their wage-earning staff continued to be as good as they could wish. They had henceforward to provide some £500 a year as employer's pence under the Health and the Unemployment portions of the National Insurance Act. It certainly seemed strange that contributions for insurance against unemployment should have to be taken from either masters or men in the case of employment which was so little casual or precarious as employment under a railway company. It was an employment which, subject only to good behaviour, a man enjoyed in practical permanence. They had, indeed, men now in their employment who had been with them for no less than 22 years, the whole period the undertaking had existed. He said something last January about his own desire that something should happen to them that might remove some of the bad effects of competition, and make them partners in some cases where now they were rivals and antagonists. They had doubtless seen that the speculating public had chosen to assume that that something was much more imminent than it really was. They formed that opinion not, as he believed, in consequence of what he said, but as an inference from considerations which were of the same sort as those which he had in mind when he spoke. Those considerations were really the public property of all observant men. All he could say was that his colleagues and he remained of the same mind now as then, and that he had nothing either to add or to take away from what he then said on that point. He could not report any newly-arisen prospect, but he could say that nothing had happened to close any door or make their position or prospects otherwise worse.

Mr. Seymour Grenfell seconded the motion.

Mr. White criticised the management of the line and deprecated the expenditure that had been made upon extensions.

Col. Perry said he was in favour of still further extensions if the line was to hold its own. He would like to see a branch leading direct from Victoria to the Oval.

Mr. Highton urged the directors to do what they could to give an improved service and expressed the hope that when the question of accelerating the speed of the trains was taken into consideration the board would use less powerful engines, which would enable them to run lighter trains in the middle of the day.

The Chairman, in reply, said the directors certainly did not contemplate any extension to Victoria. With regard to running lighter trains, their difficulty was that they had not the facilities for breaking up the trains, and they had satisfied themselves that it was more economical to continue the present practice rather than acquire ground for giving them those facilities.

The report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Babcock & Wilcox, Ltd.—Further issue of [illegible] ordinary shares of £1 each fully paid.

And to allow the following securities to be quoted in the Official List:—

Georgia Light, Power and Railways.—$2,230,000 first lien 5 per cent. 30 year gold bonds of $1,000 each (Nos. 1 to 2,230), and 60,000 common shares of $100 each fully paid.

The Committee have appointed special settling days as under:—

Thursday, August 1st.—Shawinigan Water and Power Co.—Further issue of $1,000,000 capital stock, in shares of $100 each.

And ordered the under-mentioned securities to be quoted in the Official List:—

Metropolitan Railway Co.—Further issue of £729,706 consolidated stock, and £25,000 3½ per cent. convertible preference stock.

Shawinigan Water and Power Co.—Further issue of $1,000,000 capital stock in shares of $100 each; and a further issue of £205,480 4½ per cent. perpetual consolidated mortgage debenture stock.

Metropolitan Electric Tramways, Ltd.—A circular has been issued by the secretary relating to a scheme for consolidating the ordinary and deferred shares. The board proposes the conversion of the issued deferred shares into ordinary shares on the basis of one fully-paid ordinary share of for four fully-paid deferred shares of £1 each, such new ordinary shares to be entitled to dividend from January 1st next, but in all other respects to rank *pari passu* with the existing ordinary shares. It is stated that the average market prices of the ordinary and deferred shares for the past year were 18s. 6d. and 3s. 6d. respectively. The proposal involves the reduction of the company's issued capital to the extent of 15s. in respect of each of the issued 314,016 deferred shares, representing £235,512, to which extent the capital of the company is unrepresented by available assets. It is also proposed to cancel the 185,984 deferred shares which have never been issued. Meetings of the shareholders to consider the scheme have been called for to-day, July 26th.

The German South American Cable.—The ordinary share capital of the Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, is to be increased by £125,000 to £625,000 for the purpose of defraying part of the expenditure for extending the company's cable from Monrovia *via* Togo to the Cameroons, whilst the remainder is to be raised by the issue of a loan of £192,000. A financial group headed by the Schaaffhausen Bank Verein is to take over the shares at par, and offer them to existing shareholders at the price of 105 per cent. The concession for the extension has already been granted, and the cable working agreement with the Imperial Post Office authorities, which is generally based upon the same financial principles as that for the Borkum-Teneriffe-Monrovia-Pernambuco connection, is on the point of being completed.

Vickers, Ltd.—The directors have declared interim dividends for the half-year to June 30th of 2½ per cent. (less income-tax) on the preferred 5 per cent. stock and 5 per cent. preference shares, and 1s. per share (free of income-tax) on the ordinary shares.

Dublin United Tramways Co. (1896), Ltd.—The directors report that the amount available for division is £57,829, out of which it is recommended that dividends be paid for the half-year at the rate of 6 per cent. per annum, less income-tax, on both the preference and ordinary shares. £10,000 is to be set aside towards the renewal of permanent way, and £1,000 to accident insurance reserve. £11,234 is to be carried forward.

Liverpool Overhead Railway Co.—The accounts for the half-year ended June 30th last, show an available balance of £13,528, and the directors have resolved to recommend the payment of dividends at the rate of 5 per cent. per annum on the preference shares and 2 per cent. per annum on the ordinary shares, leaving £4,852 to be carried forward.

County of London Electric Supply Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 6 per cent. per annum, and an interim dividend on the ordinary shares at the rate of 4 per cent. per annum, both for the half-year ended June and both less income-tax.

City of London Electric Lighting Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (6s. per share), less income-tax, on the ordinary shares for the past half-year.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	July 17	3,427	+ 109	7	10,864	326	14·4	..
Ayr	" 20	1,660	+ 99	9	4,156	+ 194	8	..
†Bath	" 13	1,103	+ 78	28	23,937	+ 1,540	..	..
Birkenhead	" 21	2,400	— 33	15	18,484	610	13·68	..
Birmingham Corp.	" 13	21,570	+ 3,332	15	168,756	+ 43,577	57·17	..
Blackburn	" 17	2,661	+ 197	16 3/7	19,888	+ 916	14·62	..
†Blackpool Corp.	" 11	2,663	+ 554	..	21,064	+ 8,216	11·87	..
Blackpool-Fleetw'd	" 20	2,601	+ 18	2	3,997	— 177	8	..
Bournemouth	" 17	4 020	+ 142	15 3/7	28,542	+ 816	21·95	..
Bradford	" 18	11,732	+ 251	15	85,142	— 1,256	56	1·2
Brighton	" 21	2,354	40	16	16,654	495	9·5	..
Bristol	" 19	15,622	+ 1,326	..	194,690	+ 16,745	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	" 12	699	+ 218	28	8,173	+ 2,105	3·65	..
Barnsley	" 12	401	+ 43	"	4,723	289	..	..
Barrow	" 12	956	+ 213	"	10,096	+ 2,472	5·37	..
Devonport	" 12	1,103	— 17	"	14,895	+ 1,891	8·85	..
Gateshead	" 12	2,182	— 13	"	28,414	— 95	11·25	..
Gravesend	" 12	407	— 65	"	5,634	— 39	6·5	..
Greenock	" 12	1,712	+ 76	"	21,808	+ 2,432	7·25	..
Hartlepool	" 12	532	— 130	"	6,938	— 66	6·72	..
Kidderminster	" 12	302	+ 10	"	3,084	+ 95	..	..
‡Leamington	" 12	615	+ 68	"	4,825	+ 387	..	..
Merthyr	" 12	418	— 51	"	5,346	— 362	2·9	..
Metropolitan	" 12	18,896	— 1,308	"	245,581	+ 6,155	22	..
Middleton	" 12	783	+ 13	"	9,120	— 86	8·5	..
Mid. Joint Com'tee	" 12	6,766	+ 431	"	88,184	+ 3,540	..	..
Oldham—Ashton	" 12	1,807	+ 111	"	16,862	+ 1,265	9·13	..
Peterborough	" 12	511	+ 20	"	3,712	+ 267	5·31	..
Potteries	" 12	4,880	+ 328	"	51,565	— 2,024	29	..
Rothesay	" 12	983	+ 9	"	4,187	+ 91	2·75	..
Southport	" 12	789	— 21	"	7,999	— 92	8·17	..
S. Metropolitan	" 12	1,911	218	"	23,297	+ 83	..	..
Swansea	" 12	2,447	— 61	"	30,901	— 55	12·5	..
Tynemouth	" 12	685	96	"	5,949	- 274	8·75	..
Weston-s-Mare	" 12	565	— 145	"	2,605	420	8	..
‡Worcester	" 12	699	— 8	"	7,766	— 83	5·75	..
Wrexham	" 12	259	+ 87	"	3,033	+ 807	..	..
Yorks. Wool. Dist.	" 12	2,395	+ 217	"	29,855	+ 1,064	17	..
Miscellaneous	" 12	565	+ 20	"	6,252	+ 216	..	..
Burnley	" 20	2,946	+ 261	..	..	.	11·78	..
†Burton-on-Trent	" 14	297	+ 5	15	3,961	— 241	6·6	..
Bury	" 21	2,793	+ 130	16	21,501	+ 315	22·5	..
Cardiff	" 13	5,158	- 430	15	35,819	— 2,783	17·35	..
Chatham and Dist.	" 18	1,837	+ 5	29	23,982	+ 198	14·98	..
Cork	" 18	1,145	— 49	29	13,875	— 311	9·89	..
Croydon	" 12	3,862	- 149	15	28,248	- 245	11·6	·75
†Darlington	" 20	257	— 6	16	3,598	+ 62	4·87	..
Darwen	" 19	579	+ 45	16	4,531	+ 113	4·56	..
Dover	" 13	577	— 14	15	3,653	— 221	4·76	..
Dublin	" 19	13 348	— 5,195	..	17,657	— 6,835	54·25	..
East Ham	" 20	2,218	— 34	16	47,104	294	7·87	..
Exeter	" 19	719	— 80	16	5,506	585	5·5	..
Glasgow	" 20	31,138	— 952	..	134,884	— 4,623	98	·25
Hastings	" 18	2,452	— 29	..	..	— 1,087	19·3	..
Huddersfield	" 20	4,361	+ 345	16	32,569	+ 759	29·5	·5
Hull	" 20	5,976	+ 189	16	45 914	— 355	13·5	—1
†Ilkeston	" 18	137	+ 6	16	1,598	650	..	..
†Ipswich	" 13	528	+ 20	15	6,762	+ 78	10·5	..
†Kilmarnock	" 13	174	— 28	8	1,403	— 49	4·25	..
Lancashire United	" 17	3,178	+ 250	29	37,852	89	89	..
Leeds	" 20	16,832	+ 810	16	126,212	+ 527	112·7	..
†Leicester	" 13	2,858	+ 163	..	..	..	20	..
Leith	" 10	1,764	+ 9	9 3/7	7,009	+ 177	8·72	..
Liverpool	" 13	25,781	+ 626	27 4/7	330,665	+ 11,014	116	..
‡L.C.C.	" 10	87,146	— 6,660	.	683,588	— 15,686	140·6	..
London United	" 20	14,725	— 1,097	..	181,928	— 6,298	..	..
Lowestoft	" 20	607	+ 53	42	6,861	— 344	8·5	..
Manchester	" 20	35,453	+ 2,806	16	272,335	+ 10,956	105	..
Newcastle	" 20	8,788	+ 318	..	70,765	+ 495	31·3	..
†Newport	" 6	738	— 12	14	9,618	— 897	7·25	..
Oldham	" 21	4.418	+ 280	17	85,277	+ 956	28	..
Pontypridd	" 20	810	— 97	16	5,898	— 1,026	5·5	..
Portsmouth	" 13	6,565	+ 207	15	33,257	— 2,175	15·75	..
Preston	" 17	1,711	+ 108	16	13,060	+ 336	10	..
Rotherham	" 17	1,583	+ 290	15 3/7	11,021	+ 580	12	..
Salford	" 22	10 388	+ 449	16½	83,845	+ 2.668	41	..
†Sheffield	" 13	6 669	+ 251	..	111,525	+ 2,907	40	..
Southampton	" 17	2 814	+ 63	15	19,729	+ 400	11	..
Southend-on-Sea	" 17	2,040	+ 386	16	12 231	+ 1,162	7	..
South Shields	" 20	1,356	+ 8	16	10,060	- 98	10·25	..
Tyneside	" 17	1,063	- 25	3	1,237	— 196	11	..
Wallasey	" 20	2,553	+ 122	15 5/7	18,202	— 331	8·72	..
Walthamstow	" 20	1.738	+ 43	16	12,940	+ 112	9	.
West Ham	" 11	5 288	— 498	14 4/7	39,640	— 1,170	16·25	1
Wolverhampton	" 17	2,307	+ 102	16	16,057	+ 142	13·75	.
Cen. London Rly.	" 20	8 388	— 1,188	[illegible]	12,778	— 1,846	6·82	..
City & S. Lon. Rly.	" 21	5 658	— 669	3	8,611	— 807	7·26	..
Dublin-Lucan Rly.	" 19	344	— 14	3	458	— 71	7	..
G.N. and City Rly.	" 20	2,780	+ 41	3	4,259	+ 102	8·5	..
L'pool Overh'd Rly.	" 21	3,417	+ 200	..	5,104	+ 260	6·6	..
Llandudno-Col. Bay	" 19	1,029	— 82	33½	7,653	+ 306	6·5	..
Lond. Elec. Ry. Co.	" 20	24.905	695	3	38,375	— 6,298	21·25	..
Mersey Railway	" 20	4 071	+ 167	3	5,988	+ 223	4·5	..
Metropolitan Rly.	" 21	34.766	+ 231	3	52,679	+ 254	26·75	..
Met. District Rly.	" 20	24 390	+ 933	[illegible]	37,359	+ 1,518	[illegible]	..
Anglo-Argentine	" 15	98 980	+ 2,706	..	1,490,122	+ 62 041	.	..
§Auckland	June 28	16,989	+ 1,662	..	227,976	+ 18,822	23·81	..
Bombay (B.E.T.)	" 21	3,860	+ 240	25	75,410	+ 4,875	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	.	..	.	..	..	..	..	..
Calcutta	July 23	8,099	+ 346	..	..	..	..	..
Cape Electric T. Ld.		.	..	.		..	..	..
§Kalgoorlie, W.A.	June	8,151	..	6	18,657	..	20·5	..
§Lisbon	..	..	..	..	..			..
Madras	July 15	1.681	+ 145	..	21,468	+ 2,502	13·5	·75
§Montevideo	June	26 559	+ 4 639	8	288,422	+ 34.176	..	..
Perth (W.A.)	July 5	8 557	+ 529	..	50,458	+ 7,071	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE principal factor in Stock Exchange markets since last we wrote has been continued and acute flatness of Consols. This has begun to react on most of the gilt-edged markets, spreading to Debenture stocks and the like, incidentally bringing down prices of bank shares. The Home Railway market, in addition, has to endure with what grace it may the poor dividend declarations as well as the labour trouble, but amongst Latin-Canadian issues there is pronounced activity.

It is somewhat astonishing, perhaps, but none the less true, that in these summer days, when most Stock Exchange firms are complaining of the want of business, a few engaged in the foreign traction market are so busy that their staffs are working up to midnight almost without intermission, and have been so for many weeks past.

The English electricity supply department has fallen upon its summer somnolence. City of London Electric Ordinary, however, provide an exception to the prevailing quietude. On a recurrence of the former buying, the price added another £1 last Saturday, jumping to 20, though this invited profit-takers, and the quotation slipped back to its former level of 19. Counties are also a shade easier at 11⅜ middle. The interim dividend is at the rate of 4 per cent. A small issue by the Egham and Staines Company attracted little attention in the market.

Some of the electric lighting companies are, despite the time of year, extremely busy in those departments where the new Insurance Bill makes itself felt. It is said that the mere mention of Section 2 in certain of these offices is sufficient to cause a smart rise in the temperature.

Home Railways, on the whole, are fairly steady, so far as the electrical companies are concerned. City and South London rallied 1½ after its long fall. Metropolitans gained ½, and Districts ¾. At least part of the recent heavy fall in Metropolitans is thought to be due to the re-marketing of part of the £750,000 stock which the company sold a little while ago. At the time, the issue was absorbed with apparent ease, but it is now evident that, at all events, some of the recent buying of "Mets." was of the ragged order, and the weak bull element does not seem to be eliminated entirely from the market even yet. The dividend at the rate of 1½ per cent., against 2 per cent. a year ago, is considered poor. Central London Deferred shed 2 points on sales by some who had expected a better dividend declaration, and the announcement of the Underground Electric Railways also caused some disappointment, although the stocks of the latter company have not suffered. London Electric Railways 4 per cent. Debenture eased off a little, and District prior lien is a point down. London United Tramways Preference shares have recovered substantially, the price rising 7s. 6d. to 5½. Metropolitan Electric Tramways have been strong, but the Ordinary slipped back $\frac{3}{32}$, upon digestion of the scheme which has been put forward for reorganisation of the capital. The Deferred shares, after touching 5s. 6d., lost 1s., but the Preference shares keep steady, at 18s. 3d. Buying of the British Electric Traction issues has this week been noticeable mostly in the 7 per cent. Preferred stock, which shows a rise of 3. There is no alteration in Brush stocks. Monday's meeting elicited a cautiously hopeful speech from the chairman.

Notwithstanding the volume of trade in Latin-Canadians, the actual price changes are comparatively slight. Mexico Trams have gone back 1½, but Mexican Light and Power Common are unaltered. Rio Trams, where there is an enormous amount of business going on, have lost the three points which they picked up last week, and Sao Paulo, at 263½, is four points lower, some criticism having been directed to the arrangement for amalgamating these two with the Sao Paulo Electric Company. British Columbia Electric Railway stocks are a trifle easier. The Indian group keeps very firm. A few movements of ¼ to ½ have occurred amongst the various bond issues, rises and falls being distributed pretty equally.

Marconi's, after being 5¾ bid, slipped back to 5¼, from which there was a recovery to 5½. The market now is a good deal at the mercy of two speculative groups, which are pulling in opposite directions. National Telephone Deferred is for the time being a somewhat dull market, results being awaited from the arbitration proceedings. The Third Preference shares have fallen ⅛. They are to be paid off on July 31st, at par, without prejudice to whatever other rights they may be adjudged to possess. West India and Panama Telegraphs again dwindled, but Anglo-American Deferred, at 25⅞, is up ¼, American Telephone and Telegraph capital stock also being a little better. Eastern Extensions have recovered part of their dividend, and a 10s. rise in Great Northerns took the price to 28¼. Reuters are not so good, easing off to 11¼.

Henley's continue to be in request, and show a rise of ¼; Callender's Preference fell ⅛. Electric Construction Ordinary shed $\frac{1}{16}$, the fraction being picked up by the Preference. Inquiries for British Westinghouse 4 per cent. Debenture have been persistent, and the price is 2 higher. British Aluminium 5 per cent. Debenture went back 1½ after its recent steady improvement. Babcock and Wilcox are also duller, the selling coming apparently from the North of England and from Scotland, while Dick, Kerrs, at $\frac{13}{16}$, are about 2s. down. General Electrics maintain their good rise, and the new Preference shares are ¼ premium, this being one of the few recent new issues to be materially over-subscribed.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 23rd.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	6½	9¾ — 10¼		5 2 4
Do. 4½ % Pref.	10	4½	4½	9 — 10		4 10 0
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8⅜ — 8⅝	..	5 12 8
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 8⅛	..	4 6 3
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 — 100	..	4 0 0
Charing Cross, West End & City	5	5	5	4¾ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¼ — 4½	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	..	4 10 0
City of London, Ord.	10	7	8	18 — 20	..	4 0 0
Do. 6 % Cum. Pref.	10	6	6	16 — 16½	..	3 12 9
Do. 5 % Deb.	Stock	5	5	118 — 122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 3
County of London, Ord.	10	5	6	11½ — 11¾	⅛	5 3 3
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	106 — 108	.	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	[illegible]		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87 xd	..	5 3 6
Folkestone	5	6	6	4¾ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	94 — 97	..	4 12 9
Hove	5	9	9	7¾ — 8		5 12 6

NAME.	Stock or Share.	Dividend for		Closing Quotations July 23rd.	Rise + or Fall	Present Yield p.c.
	*	1910	1911			£ s. d
Kensington & Knightsbridge, Ord	5	9	9	7½ — 7¾	..	5 16 3
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82 xd	..	5 9 9
London Electric, Ord.	8	2	2½	[illegible]	..	4 [illegible]
Do. 6 % Pref.	5	6	6	[illegible] — 5½	..	5 9 1
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 [illegible]
Metropolitan	5	5	4	3½ — 4	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4½		4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 — 102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	85½ — 87½	.	4 [illegible]
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	[illegible]	..	4 [illegible]
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½ — 5	..	5 0 0
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103		4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8¾	..	5 14 3
Do. 7 % Pref.	5	7	7	[illegible] — 7¾		4 15 0
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1⅝	..	..
South London, Ord.	4	5	5	3 — 3½		5 14 [illegible]
Do. 5 % First Mort. Deb.	100	5	5	98 — 101		4 [illegible] 6
South Metropolitan, 7 % Pref.	1	7	7	[illegible]	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	[illegible]	5	..	[illegible]	..	.
Do. 5 % Cum. Pref.	5	5	2	2½ — 3		3 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½		5 1 [illegible]
Westminster, Ord.	5	10	10	8¼ — 8¾	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — [illegible]	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅝	.	5 2 2
Calcutta, Ord.	5	8½	8½	7⅜ — 7⅝		5 8 0
Do. 5 % Pref.	5	5	5	5 — 5¼	.	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	+ ½	5 2 [illegible]
Canadian Gen. El. Com.	$100	7	7†	114 — 119		5 17 8
Do. 7 % Pref.	$100	7	7	120 — 124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	[illegible]	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	+ 1	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ¼		Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 — 108		4 14 4
Madras, Ord.	5	.	..	[illegible]	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 104	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	— ½	5 10 0
Mexican Lt. & Power, Common	$100	4	4	94 — 97 xd	..	4 2 6
Do. 7 % Cum. Pref.	$100	7	7	108 — 111	+ 1	6 6 2
Do 5 % 1st Mort. Gold Bds.	..	5	5	99 — 101	— 1	4 19 0

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90 xd	..	[illegible] 11 1
Montreal, Lt., H. and Power	$100	7	8	[illegible]	.	3 [illegible] 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	40 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 — [illegible]	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 — 114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	[illegible] xd		3 [illegible]
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 — 110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 — 106	..	4 [illegible]
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 — 101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90 — 92		[illegible] 1
Victoria Falls Power, Pref.	1	Nil	11⅔d	[illegible]	.	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ — 107½	..	[illegible] 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½ — 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	148 — 150	+ ½	5 6 8
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	8¾	8	65½ — 67½	..	4 9 0
Do. 6 % Pref.	Do.	6	6	111¼ — 112¼	..	5 6 6
Do. Def.	Do.	30/-	30/-	25½ — 26½	+ ¼	5 14 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½ — 104½	..	4 16 2
Chili Telephone	5	7	..	7½ — 7¾ xd	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	..	4 15 3
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅛ — 7⅝	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100		4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128 — 131 xd	..	5 6 10
Do. 3½ % Pref. Stock	Do.	3½	3½	77½ — 79½	+ ½	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	98½ — 100½	..	3 19 7
Eastern Extension	10	7	5†	12¾ — 13¼ xd	+ ⅛	5 5 8
Do. 4 % Deb.	Stock	4	4	99 — 101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 — 100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	10¾ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	12½ — 13½	..	4 11 5
Great Northern Telegraph	10	18	18	27¼ — 28¼	+ ¼	6 5 2
Indo-European Telegraph	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	[illegible]	¼	3 13 6
Do. 7 % Cum. Partic. Pref.	1	16	17	[illegible]	— [illegible]	3 9 8

Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 3
National Telephone, Pref.	Stock	6	6	101½ — 104½	..	..
Do. Def.	Do.	6	6	143 — 145	— 2	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	[illegible]	— ⅛	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99½ — 100½	+ ¼	4 9 7
Oriental Telep. and Elec.	1	8	8	[illegible]	..	4 13 0
Do. 6 % Cum. Pref.	1	6	6	[illegible]	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	3 18 5
Reuter's	8	5	5†	11 — 11¼	— ¼	3 3 7
Submarine Cables Trust	Cert.	6	6	127 — 130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 — 101	..	4 9 1
United River Plate Telephone	5	8	8	[illegible]	[illegible]	5 2 [illegible]
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 11 0
West Coast of America	2½	2½	2½	[illegible]	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	[illegible]	[illegible]		1 16 4
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10¾	.	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	100½ — 102½	..	4 17 7
Western Telegraph, Ltd.	10	7	6†	13 — 13½	..	5 3 [illegible]
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 — 103	..	4 7 [illegible]

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

HARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 23rd.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32— 11/32	..	Nil
Do. 5 % Pref.	1	5	5	11/16— 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	42 — 45	+ 2½	..
Do. 5 % Perp. Deb. ..	100	5	5	95 — 99	..	5 1 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	74 — 76	..	3 19 0
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	2	73 — 75	2	2 13 4
Do. 4 % Deb.	100	4	4	99 —101	— 1	3 19 3
City & South London, Ord. ..	100	1½	1⅝	34½— 35½	+ 1½	4 11 7
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	104 —106	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1903	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10¾— 11¾	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1¾— 2	..	Nil
Hastings Trams, 6 % Pref. ..	5	Nil	6	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	— 1	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	5¼— 5¾	+ ¾	..
Do. 4 % Deb.	100	4	4	73 — 77	— ½	5 4 0
Metropolitan Railway Consol. ..	100	1⅜	1⅞	54½— 55	+ ½	3 8 2
Do. Surplus Lands	100	2¾	2⅞	67 — 69	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88xd	—1	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	86 — 88	..	3 18 8
Metropolitan District Ord. ..	100	Nil	Nil	88½— 89	+ ¾	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	98 —100	—1	4 0 0
Do. 4½ % First Pref.	100	3¾	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	— 3/32	5 6 8
Do. Def.	1	Nil	..	3/16— ¼	..	Nil
Do. 5 % Pref.	1	5	5	⅞— 1 1/32	..	5 4 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16— 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16— ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅛— 4⅜	..	Nil
Do. "A"	1/-	..	..	⅝— 11/16	..	.
Do. 4½ % Bonds	100	4½	4½	99 —101	+1	4 9 1
Do. 6 % Income	100	1	1½†	88 — 90	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	½— ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞— 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	78 — 82	..	5 9 9

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends 1910.	Dividends 1911.	Closing Quotations July 23rd.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5 3/16— 5 7/16	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 15/16— 5 3/16	..	5 6 0
Do. 4 % Deb.	100	4	4	94½— 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	99½—101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11½— 12¼	..	4 18 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	+ ½	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞— 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102	.	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	135 —140	1	5 14 4
Do. Pref. Ord.	100	6	6	117 —122	—1	4 18 4
Do. 5 % Pref.	100	5	5	105½—108½ xd	— ½	4 12 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105 xd	..	4 5 9
Do. 4¼ % Con. Deb.	100	4½	4½	102½—104½	..	4 6 2
Calcutta Trams, Ord.	5	6	7	6⅛— 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝— ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5 9/16— 5 13/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103 xd	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½— 43½ xd	..	6 18 0
La Plata Elec. Trms, Ord. ..	1	..	..	½— ¾	..	..
Do. Pref.	1	6	6	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	123 —126 xd	—1½	5 11 1
Do. Gen. Con. 5 % Bonds ..	..	5	5	100 —102	..	4 18 0
Do. 6 % Bonds	100	6	6	102½—104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7¼— 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16— 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼— 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	152 —155 xd	—3	3 5 9
Do. 1st Mort. 5 % Bonds ..	..	5	5	103 —104	— ¼	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	99¾—100¾	..	4 19 8
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	261 —266	—4	3 15 2
Do. 5 % 1st Deb.	$500	5	5	106 —108	..	4 12 7
Singapore Trams, 5 % Deb. ..	100	5	5	82½— 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100	+1	5 0 0
Un. Elec. Trams Monte Video ..	5	6	7	5⅜— 5⅞	..	5 19 2
Do. 6 % Pref.	5	6	6	4⅞— 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½—106½	..	4 4 6

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends 1910.	Dividends 1911.	Closing Quotations July 23rd.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	Nil	6	⅝— ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	1 1/16— 1 3/16	..	7 7 8
Babcock & Wilcox	1	26	28	2⅞— 3⅛	— 3/16	4 9 7
Do. Pref.	1	6	6	1⅜— 1⅝	..	4 0 0
British Aluminium, Ord. ..	1	..	..	9/16— 13/16	..	..
Do. 6 % Cum. Pref.	1	..	..	⅜— ⅝	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 88	—1½	5 13 8
B.I. & Helsby Cables	5	10	10	7¾— 8¼	..	6 1 3
Do. Pref.	5	6	6	6¼— 6¾	..	4 9 0
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	3	Nil	..	7/16— 11/16	..	Nil
Do. Deb...	100	4	4	59 — 62	+2	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10½— 11¼	..	6 13 4
Do. Pref.	5	5	5	4¾— 5	— ¼	5 0 0
Do. Deb...	100	4½	4½	98½—100½	..	4 9 6
Castner-Kellner	1	17½	20	3⅝— 3¾	..	5 6 8
Do. Deb...	100	4½	4½	104 —108	..	4 10 7
Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾— ⅞	— 3/32	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16— 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅝— 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	13/16— 1 1/16	— 1/16	6 19 6
Do. Pref.	2	7	7	1 13/16— 2 1/16	+ 1/16	6 15 7
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾	+ ¼	5 16 8
Do. Pref.	5	4½	4½	4 15/16— 5 3/16	..	4 6 9
Do. Deb...	100	4½	4½	102 —104	+1	4 6 7
India-Rubber, G. & T.	10	10	..	8¼— 9¼	..	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	20	10†	32½— 34½ xd	..	6 16 6
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1912.

The returns for the month of June again show a substantial increase in exports, as compared with the previous month, and still more in comparison with June last year; imports, however, have declined to the lowest figure touched this year, and re-exports also show a heavy drop, the figures being:—

	Exports.	Imports.	Re-exports.
June, 1911	£366,614	£183,260	£28,688
May, 1912	428,655	206,301	30,806
June, 1912	**461,777**	**171,032**	**19,036**

The average monthly returns for the six months of 1912 now completed, compared with the corresponding half of 1911, are as follows:—

	Exports.	Imports.	Re-exports.
Jan.-June 1911 ...	£364,938	£205,804	£23,592
" 1912 ...	**496,825**	**212,497**	**25,862**

These figures confirm the reports of manufacturing companies which have lately assumed a more healthy complexion.

During the month exports and imports of glow lamps fell off very considerably, no doubt a seasonal effect; machinery exports went up, and imports down. There was an exceptionally heavy export of carbons to the Cape, and an item of £52,000 worth of submarine cable to Italy.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	627	672	142	32	12	255	4,064	4,605	...	...	32	905	11,346
Germany	1,295	7,154	32	...	976	3	1,166	...	2	112	12	149	10,901
Netherlands, Java and Dutch Indies ...	304	1,781	263	324	120	214	989	152	...	...	30	658	4,835
Belgium	220	391	41	13	601	1	4,666	1,094	..	...	1,384	4	8,415
France	1,532	40	1,414	...	...	112	5,541	350	...	30	1,180	129	10,328
Portugal	101	73	9	103	...	11	272	...	18	2	101	45	735
Spain, Canary Isles and Spanish N. Africa...	319	65	52	...	33	94	2,537	527	...	...	5	2,504	6,166
Switzerland, Italy and Austria-Hungary ...	224	65	148	...	62	170	2,588	350	...	78	121	52,090	55,896
Greece, Bulgaria, Roumania and Turkey ...	343	144	...	...	...	142	1,094	...	...	...	70	...	1,793
Channel Isles, Gibraltar, Malta and Cyprus...	20	...	13	...	...	19	6,140	...	153	...	...	12	6,357
U.S.A., Philippines and Cuba	244	...	...	46	...	24	104	40	...	29	7	12,359	12,853
Canada and Newfoundland	564	10,104	483	386	...	2,169	8,210	939	116	53	...	998	24,022
British West Indies, British Guiana and British Honduras	54	13	55	32	13	12	115	...	23	...	25	663	1,005
Mexico and Central America	...	...	...	19	...	...	39	...	...	...	160	...	248
Peru and Uruguay	8	...	23	11	...	...	34	...	...	...	...	7,073	7,149
Chile	132	1,060	225	11	...	174	1,295	...	20	...	33	2,235	5,185
Brazil	394	2,183	553	405	75	57	2,301	517	572	...	5,304	20,230	32,591
Argentina	2,596	4,750	574	641	509	131	12,689	477	1,283	176	1,041	2,576	27,443
Colombia and Bolivia...	23	18	1	14	48	...	565	...	...	...	66	...	735
Egypt, Tunis and Morocco	142	271	95	44	28	120	1,231	4	14	22	6	69	2,146
British West Africa and Ascension... ...	175	194	68	...	...	188	575	...	53	...	357	369	1,979
Rhodesia, O.R.C. and Transvaal	1,888	3,358	146	497	37	229	2,011	307	885	...	8,558	951	18,867
Cape of Good Hope	1,178	2,460	389	748	32	343	5,070	...	741	3,697	2,664	2,898	20,220
Natal	691	4,635	73	199	...	63	2,291	...	581	...	58	9	8,600
Zanzibar, Brit. E. Africa, Mauritius and Aden	6	53	47	142	18	...	114	...	24	...	45	13,483	13,932
Azores, Madeira and Portuguese Africa ...	54	279	18	...	...	9	360	210	9	...	131	197	1,273
French African and Indian Colonies ...	...	65	22	...	...	...	...	...	...	...	...	65	152
China and Siam	392	207	118	...	...	731	724	395	238	...	48	12,338	15,191
Japan and Korea	1,765	27,020	392	...	...	1,900	9,867	3,858	363	29	61	1,390	46,645
India	2,233	5,248	2,229	2,734	330	1,168	7,218	3,873	826	145	1,023	1,618	28,645
Ceylon	225	38	195	147	...	60	1,190	76	21	...	24	137	2,113
Straits Settlements and Fed. Malay States	303	165	556	47	20	53	470	828	...	39	17	256	2,760
Hong Kong	199	169	173	71	...	562	508	4	24	...	49	33	1,792
West Australia	375	1,388	...	466	254	242	560	3,835	128	...	1,474	168	8,890
South Australia	379	760	26	...	37	...	434	109	8	...	1,621	21	3,395
Victoria	705	4,479	507	1,730	144	107	1,967	210	59	6	114	4	10,038
New South Wales	2,061	3,235	1,033	1,680	28	1,907	17,189	532	254	...	3,037	945	31,901
Queensland and Tasmania	333	1,291	118	194	...	30	2,378	...	37	...	80	...	4,461
New Zealand	1,130	423	365	52	...	...	6,343	...	527	8	...	1,926	10,774
Total, £	23,264	84,251	10,598	10,818	3,377	11,300	114,921	23,298	7,079	4,426	28,938	139,507	461,777

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Norway, Sweden and Denmark	64	...	...	71	5	8	2,350	75	231	213	7,283		10,300
Germany	3,299	3,694	16	11,189	3,643	1,431	60,152	89	3,289	2,501	12,705		102,008
Holland	47	158	...	558	115	...	3	...	...	15	71		967
Belgium	265	493	30	5	32	38	1,095	14	64	170	8,300		10,506
France	221	429	1,539	...	513	264	379	...	1,622	3,522	4,695		13,175
Switzerland	97	838	...	...	...	8	1,827	...	...	4	1,408		4,182
Spain and Italy	48	2,508	...	...	...	...	372	...	...	243	2,372		5,543
Austria-Hungary	...	895	...	342	...	...	256	...	29	189	391		2,102
United States	2,305	4,126	...	445	2,022	57	6,098	6,671	58	17	140		21,939
Total, £	6,346	13,132	1,585	12,610	6,330	1,806	72,532	6,849	5,293	6,874	37,365		170,722

Additional imports: Spain, carbons £310.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above ...	16,265	747	...	533	442	...	790	...	8	176	75		19,036

Total Exports: £461,777. **Total Re-Exports: £19,036.** **Total Imports: £171,032.**

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

MAINS DEPARTMENT RECORDS.

By "RECORDER."

It is so difficult to make profits, and our friends, the L.G.B. inspectors, are so down on much expenditure that would really make for efficiency in the station, that there is a tendency to scamp records. At times one is apt to envy the days when the chief was a personage in the clouds, who might be approached—even by consumers—only when it suited his will. It is related of one man in those far-off times that, as he reclined peacefully smoking one summer's day among the trees, on the far bank of the river which flowed past the works, a clerk came out of the office and shouted that a prospective consumer wanted to see him. "Tell him I'm busy," was the reply, and soon the chief was lying on cushions in the stern of a boat pulled by an obliging friend. Nowadays the likely consumer is angled for as eagerly as if he were a big trout in summer time when the water runs clear.

Perhaps those days were not so good after all. Certainly the big (?) set used to break down at intervals on peak load, sometimes leaving the town for days without juice, and everybody spoke with admiration of the new dynamo, whose sparking was so subdued that it would actually carry three-quarter load without blowing its brushes to pieces, and without diffusing the smell of burnt insulation throughout the engine-room. Certainly, the important task of keeping records of the mains as they were laid was too often neglected. For a time the wonderful memory of Bill the jointer sufficed, but when Bill disappeared, and the mains superintendent got another job, it became a serious matter to find out just where the mains were and where they were not. Do we not all remember the case of one station which kept current pouring into an unknown leaky cable until the arc nearly cut through a railway bridge girder? No doubt a draughtsman should be kept continually entering up elaborate drawings of all mains on large-scale maps, but too often this is prevented by lack of cash. Since the pleasing fiction has been created by L.G.B. Inspectors (for reasons best known to themselves) that cables fade away in a few years after being laid, so that they must be paid off by abnormal sinking funds, and meters are supposed to have lives of only two or three years, and therefore must be paid for out of revenue, while the yearly income must also pay for all permanent labour required for capital extensions (unless inefficient casual labour be employed, in which case it may be charged to capital), there is little or nothing left wherewith to provide a draughtsman. At any rate this is so in small struggling stations, in which the recording work must be done at odd times by a poorly paid assistant who may not be enamoured of his job.

Even when a capable man has been retained it is difficult to enter up the cables in an efficient manner without undue expenditure. A common plan is to try to indicate different kinds of mains on the maps by the use of differently coloured inks, or by lines broken in various ways, but this method has its defects. Take, for instance, a footpath in which are laid two or three lighting feeders, a pair of tramway feeders, a lighting distributor with services, and an arc lighting cable, laid over a long period of years, and on varying systems, solid, drawn-in, armoured, bitumen-covered, &c., with a multitude of sectional areas, some cables being single conductors, and some of other types. To represent such a conglomeration adequately by any of the above methods is impossible. Books or cards of some kind must be kept in addition to the maps, in which must be entered all the essential details for which there is not room on the map.

In the following system of records, which has been in use for many years in a station, will be found a compromise between undue elaboration and scantiness, although the amount of detail required will obviously vary with circumstances. Each length of cable is drawn on the map as soon as possible after it is laid, one set of maps being used for feeders, and another for distributors; if desired, a third set may with advantage be set apart for street-lighting records. (A rough plan of small scale may be hung on the office wall, giving the position of distributors without detail. This is useful for general purposes.) On the map may be entered some notes, but these must be brief, as the space available is scanty. Full details are written up in the Mains Book, in which is written a description of the cable, maker's name, drum numbers, date of laying, depths and distances from the walls or kerbs, and tests. Accurate measurements of joints from fixed points must also be written up, so that any one may be found with the least possible delay, and along with this should be given an account of the joint-box used, filling-in compound and jointer's name. This forms a check on the jointers, as blame may be located should a fault occur through careless laying, even if the trouble happen years afterwards. This fact makes the men careful, and is, indeed, a valuable safeguard. At the ends of each length of cable laid is entered the number of the page in the mains book in which the account is written, so that the map acts as an index. Even if the mains be laid in small sections at long intervals, one is able instantly to turn up the entries relating to them, which is a great convenience in emergency. In the mains book may be drawn enlarged details of special circumstances, such as deviations to avoid cellars and pipes belonging to other people, or, where necessary, drawings may be made on loose sheets, which may be filed and indexed in the mains book. A fault may be marked with the letter "F," and the number of the page in which an account of it is written up. The diagram above, fig. 1, will show how the scheme is carried out.

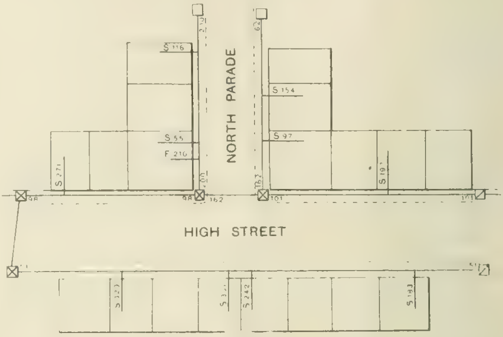


Fig. 1.

Services are indicated by the letter "S" with the page number on which details are entered. They may be drawn in red, and should be entered up in a separate book, called the Service Book, in which details similar to those mentioned in the case of distributors are written up. Services should also be written up on cards, which enables balancing to be followed easily.

Drum books are kept, in which is written an account of every drum of cable which enters the stores. Maker's name, drum number, date of arrival, length, sectional areas, style of cable and insulation, tests, &c., all are entered. Each length cut off is noted, and all lengths are added up when the drum is empty, so that the whole of the cable is accounted for and any leakage is traced. The date on which the drum is returned to the makers forms the final entry. Drum books are particularly useful for stocktaking, and also enable one to judge when further supplies of cable are required.

Meters.—The recording and indexing of meters have been debated frequently, and men in control of large test rooms have expressed varying opinions. Some prefer card systems throughout, but it is noticeable that many people still prefer that books should be made use of to some extent, and, for my part, I agree with them. Ease of changing them about is the chief reason for the use of cards, which have otherwise many disadvantages, but for the primary index there are advantages in the certainty of reference possessed by the bound book. A card may easily be lost in a small meter department, where everything, including testing and clerical work, is done by one or two men, and once lost it is by no means certain that track of that meter will be recovered. The following system for recording meters may seem rather elaborate, but it has proved satisfactory in actual working. The primary index is composed of a set of books, which should be made up of good paper, thoroughly well bound. The strength of binding is important, as badly made books fall to pieces before they are obsolete. Three hundred pages makes a handy size, the page being of sufficient dimensions to enable the details to be entered without cramping. The ruling may be in accordance with the diagram, fig. 2, modifications being made to suit requirements. The pages of the meter book are numbered, and each meter, when it arrives, is given the number of the first vacant page. Clock meters, indicators, and, in fact, every kind of meter, may be entered in the same book in rotation. The maker's name, capacity and type of meter, and other permanent items, are entered at the top of the page, while details relating to services on which it is put are entered below. The full history of a meter may thus be promptly traced. If more details are required of meter tests than are shown in the test column, these may be entered in a separate test book, and indexed in the test book column.

Maker's Name.	Maker's No.	Received.	Type.	Amps.	Volts.	[illegible] K.	
Hookham.	93,274	7-2-10	Amp.-hour.	10	200	3.7	Meter No. 1,000

Consumer's Name and Address.	Service No.	Test. Full	Test. ½	Test. ¼	Tested by.	Test Book.	Sent Out.	[illegible]	
Jones & Co., 50, High Street	1,983	+ 5	0	− 2	G. D. M.	829	10-7-10	15-[illegible]-12	Damaged.

FIG. 2

Consumers' Cards.—Cards are made out for each consumer, giving details of the meters on his premises. From the meter book, therefore, we may find out where any particular meter is, or from the consumers' cards we may learn what meters are on any service.

Meter Ledger.—A ledger is required to keep a check on the stock. This should be a substantial book with not too many leaves, as it may become ragged if its life be unduly prolonged. On one side is entered the stock at the beginning of the year, with columns for the principal sizes used. Separate columns may be added for indicators, clock meters, &c. Each meter coming in, whether from makers or from consumers' premises, is entered up in the ledger on the inwards side, the maker's name, meter number and type being stated to enable it to be recognised, while the figure "1" is entered in the proper column. Similar entries are made on the outwards side when the meter is sent out. At the end of the year, stock-in-hand is entered on the outwards side, and balances are taken. Any shortage can instantly be traced to its proper columns, for, as the meter numbers on the outwards side are identical with those on the inwards, a comparison of numbers on the two sides will disclose the identity of the missing meters, which may then be looked up in the meter book, when their fate will probably be discovered.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

ON June 29th Canada lost one of her most prominent and brilliant engineers, Cecil Brunswick Smith. Much has been accomplished in his short life of 47 years. The chief interest in his career to electrical engineers lies in his work in connection with the large power station of the Canadian Niagara Power Co., which contains generating plant aggregating more than 50,000 H.P. with powers to take up to 110,000 H.P. From June, 1906, to February, 1907, Mr. Smith was a member of the Hydro-Electric Power Commission, of Ontario, and afterwards was the chief partner in the well-known firm of consulting engineers, Messrs. Smith, Kerry & Chace, of Toronto, &c., who have won a wide reputation in the design and equipment of large hydro-electric power schemes at Winnipeg, Calgary, in Eastern Ontario and other parts of Canada, not to mention similar schemes in the U.S.A.

One of the buildings in the Western city of Regina, Saskatchewan, which on June 30th was visited by a terrific hurricane, leaving death and destruction in its path, was the Provincial Government telephone exchange—the whole place being, it is reported, completely wrecked.

$60,000 is the expenditure voted by the city of Brandon, Manitoba, for the construction of 10 miles of street car lines.

French and Canadian capital is invested in a new concern called the Stadacona Hydraulic Co., which proposes to develop 10,000 H.P., as a commencement, at Seven Falls, a short distance from St. Anne de Beaupré, which is a town on the St. Anne River, a tributary of the St. Lawrence, which joins the latter river on its northern shore, at a point about 25 miles north-east of Quebec.

From a well-known electrical engineer here comes a warning, which may well be heeded by British firms represented here, with reference to the choice of a representative. Engineers here are sometimes chary of placing an order with even a first-class home firm if they feel that, in the event of anything going wrong, the local representative is not the man to see the job through satisfactorily. On the other hand, firms of repute with capable men at this end appear to be giving satisfaction.

The choice of a good man is a matter of moment and not always easy of attainment, for a Britisher new to this country cannot do his best till he is accustomed to Canadians and their ways, and a Canadian, although perfectly *au fait* with everything which concerns this end, is probably sadly lacking in a knowledge of home practice. The best man, undoubtedly, other things being equal, would be he who has had two or three years' experience here, but who has received his training at home.

Long-distance overhead transmission is all very well in its way, but in Toronto early this month (July), if the statements of the company concerned be correct, it has had its drawbacks. Owing to numerous thunderstorms no fewer than four serious interruptions have occurred in the service from Niagara to Toronto, each of which has, for a more or less extended period, amounting in one case to about four hours, stopped all the tramcars and paralysed innumerable works and factories, large and small.

A special Providence seems to have watched over the Hydro-Electric Power Commission's supply, as there has been no interruption at all—result, much kudos for the Commission and great confusion of face for the company. How much of this situation is due, on the one hand, to pure good luck or to excellent foresight and design, and, on the other hand, to ill-luck or utter mismanagement, it would be hard to say. In the meantime, the public draws its own conclusion, while the company holds out bright, if somewhat remote, hopes for the future—viz., next summer.

The Board of Railway Commissioners has just approved the plans of the Canadian Northern Railway Co. for a tunnel which it is proposed to cut under the Mount Royal in Montreal. The railway company is thus creating a new outlet for Montrealers, and to increase the usefulness of the tunnel it is building a garden suburb on the other side of the mountain. Now that the plans have been approved, it is to be expected that the work will be pushed ahead as rapidly as possible; the interesting point to electrical men respecting the tunnel is that it is, the writer believes, intended to employ electric locomotives through it. The tunnel will probably be completed in about two years' time.

The Shawinigan Falls Power Co., which supplies Montreal with current, has just ordered a 15,000-KW. 60-cycle generator, this being the largest in Canada.

News from Montreal states that an electric railway scheme is being promoted, to connect Ottawa and Kingston; the two towns are about 90 miles apart, the latter being almost due south of the former on the shore of Lake Ontario.

Kingston has also been brought into prominence recently by its decision, on the advice of an expert, to refuse offers for the supply of electric current from both the Hydro Electric Power Commission, of Ontario, and the Seymour Power Co. The town has decided to extend its own steam plant, the expert having reported that in this way the town could, for several years to come, generate its own electricity at lower cost than that at which it could obtain a supply from either of the competing parties referred to.

The engineers of the Quebec Commission on Running Waters and of the Ontario Hydro-Electric Power Commission are to be instructed to prepare reports on the subject of the development of Chats Falls, on the Ottawa River. According to the Commission of Conservation, these falls are capable of furnishing 58,000 H.P. under present conditions, or 150,000 H.P. "with regulated water and canalised river"; the falls are situated about 30 miles east of Ottawa.

TRADE STATISTICS OF NEWFOUNDLAND.

The following statement of the imports of electrical and similar materials into Newfoundland is taken from the recently issued annual trade statistics for the year ended June 30th, 1911; figures for 1909-10 are added for purposes of comparison, and notes of any increases or decreases are given:—

Dollar = 4s. 2d.

	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
Belting—			
From United Kingdom ...	1,000	3,000	+ 2,000
" Canada	6,000	5,000	− 1,000
" United States ...	12,000	18,000	+ 6,000
Total ...	19,000	26,000	+ 7,000
Gutta-percha manufactures.—			
From United Kingdom ...	7,000	9,000	+ 2,000
" Canada	31,000	35,000	+ 4,000
" United States ...	35,000	50,000	+ 15,000
" Other countries ...	—	1,000	+ 1,000
Total ...	73,000	95,000	+ 22,000
Iron and steel railway bars and fittings.—			
From United Kingdom ...	1,000	—	− 1,000
" Canada	2,000	2,000	—
" United States ...	30,000	7,000	− 23,000
Total ...	33,000	9,000	− 24,000
Locomotives and automobiles.—			
From United Kingdom ...	17,000	32,000	+ 15,000
" Canada	44,000	5,000	− 39,000
" United States ...	35,000	21,000	− 14,000
Total ...	96,000	58,000	− 38,000
Radiators, electric light material, &c.—			
From United Kingdom ...	3,000	10,000	+ 7,000
" Canada	14,000	9,000	− 5,000
" United States ...	24,000	46,000	+ 22,000
" Germany	1,000	1,000	—
Total ...	42,000	66,000	+ 24,000
Machinery for mining purposes.—			
From United Kingdom ...	46,000	51,000	+ 5,000
" Canada	93,000	142,000	+ 49,000
" United States ...	38,000	39,000	+ 1,000
Total ...	177,000	232,000	+ 55,000
Machinery for local industries.—			
From United Kingdom ...	7,000	10,000	+ 3,000
" Canada	11,000	1,000	− 10,000
" United States ...	9,000	7,000	− 2,000
Total ...	27,000	18,000	− 9,000
Motor engines.—			
From United Kingdom ...	1,000	1,000	—
" Canada	1,000	3,000	+ 2,000
" United States ...	6,000	17,000	+ 11,000
" Denmark	7,000	4,000	− 3,000
Total ...	15,000	25,000	+ 10,000
Scientific instruments.—			
From United Kingdom ...	1,000	1,000	—
" Canada	1,000	—	− 1,000
Total ...	2,000	1,000	− 1,000
Goods for Anglo-American Telegraph Co.—			
From United Kingdom ...	2,000	—	− 2,000
" Canada	1,000	—	− 1,000
" United States ...	3,000	—	− 3,000
Total ...	6,000	—	− 6,000
Materials for wireless telegraphy.—			
From United Kingdom ...	—	6,000	+ 6,000
" United States ...	—	1,000	+ 1,000
Total ...	—	7,000	+ 7,000
Materials for Western Telegraph Co.—			
From United Kingdom ...	—	15,000	+ 15,000
" United States ...	—	1,000	+ 1,000
Total ...	—	16,000	+ 16,000
Material for Direct Cable Co.—			
From United Kingdom ...	—	18,000	+ 18,000
" Other countries ...	—	1,000	+ 1,000
Total ...	—	19,000	+ 19,000

PROCEEDINGS OF INSTITUTIONS.

The Faraday Society.

PROPERTIES OF ALUMINIUM ANODE FILMS.

At the July meeting of the Faraday Society, MR. G. E. BAUSTO, M.SC., B.ENG., presented a further study of these interesting and remarkable electrolytic formations, following on his paper of last year on the same subject. The present communication deals with the effect of temperature on the conductivity of the films. This can be expressed by the exponential relationship $i = \mathrm{A}\,\mathrm{E}^{a\theta}$ or $\log i = \log \mathrm{A} + a\,\theta$, where i is the leakage current through the film, and θ the temperature. The universal obedience to this logarithmic law suggests that the relationship has some physical significance, although it is not quite clear how it follows from Mr. Bausto's theory of aluminium films, according to which the films consist of an inner portion, probably oxygen in a liquid or highly condensed form, and an outer portion, whose constitution varies with the electrolyte.

The exponential constant "a" is of considerable interest, as it was found to be independent of the time of formation of the films, the voltage of formation, the strength of the electrolyte, the cation present in the electrolyte, and, up to a point, the applied voltage on the cell. It varied, however, with the electrolyte, and it was proved to be a property solely of the anion, being a definite function of the quantity given by the sum of the atomic weights of the elements in the anion divided by the valency; in other words, of the equivalent weight of the anion. This relationship is shown in the accompanying curve, fig. 1, and when once this curve has been obtained it furnishes us with a method for the determination of the equivalent weight of the anion in an electrolyte.

A NEW ELECTROCAPILLARY EFFECT.

A paper by MR. A. P. ROSHDESTWENSKY and DR. W. C. MCC. LEWIS described some curious pulsations of a mercury meniscus confined in a capillary tube dipping into a solution of a mercury salt, which were first observed accidentally during the progress of some experiments with a capillary electrometer. The movements of large mercury surfaces in contact with various substances have been observed many times, but such effects have usually been traced to the formation in the mercury of films of insoluble salts, whose presence alters the surface tension of the mercury, and which break mechanically, setting up vibrations, as they grow thick. These effects take place without the application of any electromotive force, but the present observations are truly electro-capillary. The apparatus employed is shown in the accompanying diagram, fig. 2.

The E.M.F. up to 1·5 volts was applied between the capillary B and D, the former being the negative and the latter the positive pole. The solution to be examined was placed in the tube B. The difference between the levels of mercury in A and A^1, read by a telescope, gave the increase or decrease in pressure required to bring the meniscus in B to the zero point.

As an example of the kind of pulsation which took place, the care of a decinormal solution of $Hg(CN)_2$ may be considered. This solution supported a mercury column 550 mm. in height. No pulsation was observed until the applied E.M.F. reached 1 volt. Then on closing the circuit, the mercury meniscus was seen to rise slowly for about 6 minutes, and it then commenced to pulsate over amplitudes of about $\frac{1}{50}$ mm., the time of oscillation being 12 seconds.

The occurrence of pulsation is determined by three factors:—(1) The value of the applied E.M.F.; (2) the diameter of the capillary; (3) the nature of the solution. With regard to (1), as the E.M.F. increased, the amplitude of the pulsation increased, but there did not appear to be any corresponding change in the periodic time. As to the capillary, when it was so fine that it would support a column of mercury 700 mm. in height (*i.e.*, a diameter less than 0·02 mm.), no pulsation occurred under any E.M.F. applied. With larger capillaries, the lower limit was found to vary with the strength of the solutions. The question of an upper limit has not been investigated. With regard to the solution, pulsations have been observed with saturated and decinormal solutions of $Hg(CN)_2$, but none have appeared with the more dilute solutions N/100 and N/1,000 $Hg(CN)_2$, and none have been observed when the mercury cyanide solutions have contained free potassium cyanide. These limitations suggest that for the pulsations to take place, the mercury ion concentration must not be too low.

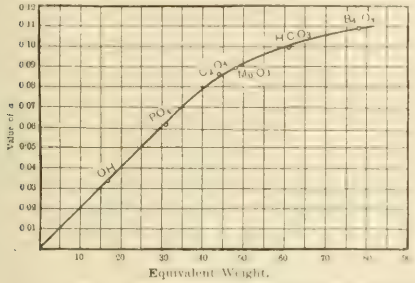


FIG. 1. VARIATION OF *a* WITH EQUIVALENT WEIGHT OF ANION.

The pulsations only appear with an E.M.F. sufficiently high to annul the natural P.D. between the mercury and the solution; in other words, the natural charge on the mercury surface has to be removed before visible pulsation sets in. Further, a small amount of electrolysis must be continuously going on, $Hg^{\cdot\cdot}$ or $Hg_2^{\cdot\cdot}$, or some complex cation being carried towards the capillary mercury surface. The approach of these cations will induce a charge of opposite sign, that is, cause the mercury to become more negatively charged with respect to the solution than it already is, and this would decrease the surface tension. This may explain the second stage of the pulsation, the fall of the mercury column. The initial stage, the slow upward movement of the mercury column, or a slow increase in the surface tension, is more difficult to account for. It may be caused by a reduction of the mercuric solution to the mercurous state, although this does not seem likely. Experiments with mercurous solutions would have to be made before this point could be settled. The pulsations, as a whole, are quite analogous to the case of a leaky condenser which is being gradually charged up until the insulation finally breaks down. The accumulation of cations, whether due to capillary or to electrolytic movement of the ions, would go on, depending on the rate at which the ions approach the surface and forming a double layer the ions induce a greater and greater negative charge on the mercury, thereby lowering the tension until the potential across the double layer becomes too great for the medium and deposition of metal occurs. This would momentarily cause a sudden fall in the P.D., whereby the mercury would rapidly return to its original position, with consequent stirring of the solution in the neighbourhood. The conditions would thus be once more those of the first stage.

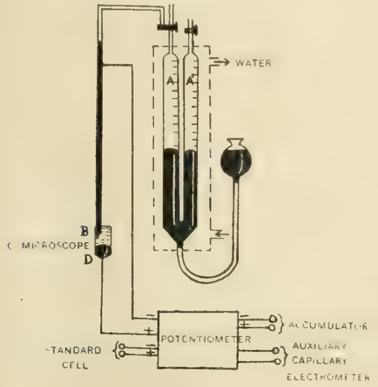


FIG. 2.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Meta" Flat Switches.

The manufacture of flat switches has long been a speciality of the METALLIC SEAMLESS TUBE CO., LTD., of Wiggin Street, Birmingham, and they have now sent us particulars of their most recent patterns. The complete range is illustrated in leaflets A7/14 to A7/22, which cover switches for 5 and 10 amperes, single or double-pole, and fitted with either brass or china covers. The switches are divided into two classes—the "Standard" and the "Colonial" patterns—which differ only in that the former has a brass link movement, while the latter is fitted with a steatite link, and is particularly suitable for use in damp positions. The interior of the standard pattern is shown in fig. 1; two of these mounted together on a wooden block, with coupled dollies, form the D.P. switch. The standard and colonial patterns are also to be had on the "export" base, fig. 2, which has small feet, keeping the switch about $\frac{1}{16}$ in. from the wall. A two-way switch is made, as well as a pattern with an earthing terminal; and lastly, in fig. 3, we show a switch mounted on a grooved base for surface wiring—a pattern of which large quantities have been exported to Continental countries. The dolly can be provided with an insulated knob, and the bases, which are of English porcelain, are white or black as required.

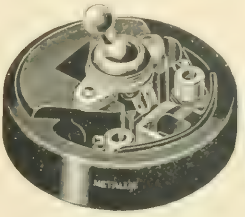


FIG. 1.—"META" STANDARD SWITCH INTERIOR.

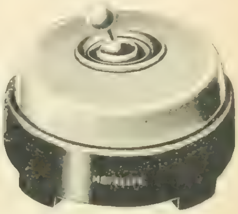


FIG. 2.—"META" FLAT SWITCH ON EXPORT BASE.

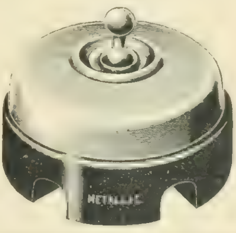


FIG. 3.—"META" SWITCH WITH GROOVED BASE.

A Thermo-Regulator for Electric Resistance Furnaces.

The electric resistance furnaces used in the laboratory are not ordinarily fitted with special means for regulating the temperature, and therefore give more or less fluctuating temperatures, according to the constancy of the supply current and the temperature of the room. This is not a serious matter in the majority of investigations; but when the process under study is very sensitive to temperature, it is desirable to exclude the variations if possible. The principle used by MAX BODENSTEIN and FRANZ KRANENDIECK in their thermo-regulator, described in the *Zeit. für Elektrochemie*, is that an enclosed volume of nitrogen forces a thread of mercury into a glass capillary when temperature variations occur, and this mercury opens and closes a relay and alters the current heating the furnace. This principle is very simple and well known, but the difficulty has been to put it into practice. When the regulator was placed in the usual type of furnace, very large temperature fluctuations were observed, which were undoubtedly due to temperature lag. This can be got over by winding the heating spiral inside the regulator vessel: and, as a matter of fact, Dr. Horak along with one of the writers, was enabled to secure a satisfactory constancy of temperature in this manner. However, only one specimen of the device was made, since too much work would be involved in making others, in view of the life of the nickel-wire furnaces being very limited. The writers have proceeded in the following manner:—

The temperature variations of a furnace arise from variations in the supply voltage, variations in the room temperature, and the heating effect of the reactions taking place. The last-named factor may be ignored. The first two changes, however, will influence in the same manner two furnaces worked in parallel, assuming that the exchange of heat with the surroundings is similar in both. Thus, if a second furnace is set up alongside the working furnace, and if instead of having the usual wound tube the second furnace contains a porcelain or metal bulb, in which the heating coil lies, the change of pressure of the gas contained by this bulb can be used to keep the temperature constant, after the fashion of an ordinary thermo-regulator. The practical realisation of this idea is shown in the illustration, fig. 4, where A is the regulator vessel, a weldless steel tube, 45 mm. in diameter, and 180 mm. long. Into the cover of this steel tube are inserted insulated current leads. Inside the vessel two short pins project through the cover, and, in conjunction with three similar ones let into the bottom of the vessel, they support a thin-walled porcelain tube, on which the nickelin resistance is wound.

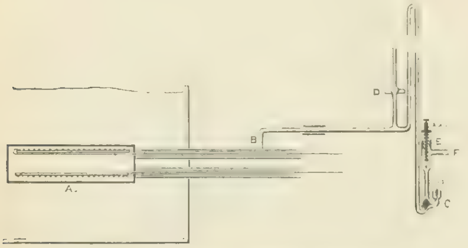


Fig. 4. Section of Thermo-Regulator.

Like the working furnace, this vessel lies in an asbestos box filled with burned magnesia. At B a steel capillary leads from the vessel to the mercury contact C. The stopcock D serves for introducing the nitrogen and for coarsely adjusting the volume to be used. Fine regulation is secured by the contact screw E. In order to prevent the mercury from working back into the regulator vessel when the heating current is intentionally cut off, a loop, ½ mm. in diameter and nearly 760 mm. long, is inserted between the steel capillary and the contact, and underneath the loop is an extension. This regulator must not, of course, work against the outside atmospheric pressure, otherwise barometric variations will cause errors. A closed air-volume is therefore introduced at F in a Dewar vessel, kept constantly in ice. It is protected against the outside air at the contact screw by a mercury seal, and can be filled or relieved by a cock attached laterally.

The writers state that this regulator does more than those which keep the voltage at the furnace constant, since it compensates for the variations in room temperature. It has been possible with the regulator to keep temperatures of 800° to 900° C. constant to within 1° over periods of several weeks.

Electrically-Driven Frequency Recorder.

To meet the necessity for a permanent record of the frequency of supply in A.C. stations, a device was brought out by Messrs. Jens Orten-Böving & Co., of 9½, Union Court, Old Broad Street, E.C., and supplied to the Newcastle-on-Tyne Electric Supply Co., in which a combined tachometer and tachograph, operating upon the centrifugal pendulum principle, was driven by a horizontal synchronous motor mounted on the same base plate, and connected to the tachograph spindle through bronze bevel gearing. Slight troubles were, however, experienced from vibration due to the horizontal arrangement, and although after several alterations and repairs this instrument is now running very satisfactorily, the makers felt that something more suitable might be devised by the employment of a vertical motor. They have therefore, after many careful tests, put on the market an instrument in which practically the same tachometer and tachograph have been employed, but a special base has been added to it to take a neatly enclosed self-starting synchronous motor, which is mounted vertically very close to the tachograph spindle, to which it is directly connected by a flexible coupling. Ball bearings take up the weight of rotor and tachometer pendulum, with the result that the whole apparatus runs without vibration, and takes very little power to drive it. The tachometer pendulum, which acts on the principle of the centrifugal governor, has been designed so that the centrifugal force of the weights is directly opposed by the springs without the intervention of cranks or levers, and the outward motion of the weights is a rotating one, so that all friction is taken up by a small steel spindle. The ratio of the internal friction to the centrifugal and centripetal forces (which constitutes the insensitiveness) is extremely small, and any change in speed, however small, is therefore instantly and exactly recorded. In addition, four weights are employed, which, being in exactly opposed positions, keep the whole pendulum balanced, and the instrument is therefore unaffected by vibration or position. Efficient dampers are fitted to secure a smooth and easily read curve without destroying its accuracy.

The recording mechanism consists of a paper chart 19 in. long by 4½ in. wide, which is fixed to an aluminium drum driven by an eight-day clock, and so arranged that, by means of a little switch, it can be made to revolve once every 12 or 24 hours as desired. A small steel fountain pen, capable of very nice adjustment, is screwed to a little roller carriage, which moves up and down between two guide rods, and is connected directly to the indicator mechanism by a straight rod.

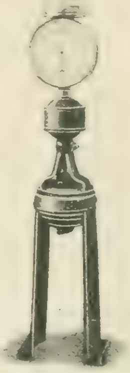


Fig. 5.—Orten-Boving Frequency Recorder.

The dial is about 13 in. in diameter, and both dial and chart are calibrated in cycles per second and corresponding revolutions per minute to suit the generating station for which the instrument is made. The whole instrument, as shown in fig. 5, stands nearly six feet high, and is finished in black, with silver plated edges, rims and lubricators.

Especial care is taken in the testing of each instrument, which is completely calibrated by hand, so that absolute exactitude is assured at all speeds, and the makers guarantee each instrument for twelve months.

The Glasgow Corporation and the British Thomson-Houston Co. are amongst the users of these instruments, and express perfect satisfaction.

An Electric Riveter.

An account is given in the *Génie Civil* of an electric riveter made by Messrs. Karl Flohr, which is illustrated herewith in part section, fig. 6. The armature *a* of the motor, which is pivoted at *b*, can be coupled to the shaft *c*, which is screwed to fit the swivelled nut *i*; the armature runs continuously in one direction, and the coupling is effected by a magnetic clutch in the fly-wheel, which is controlled either by the lever *e* or automatically by the contacts *g h*, which actuate the circuit-breaker *f*, and are adjusted so that the armature is unclutched before the die touches the rivet. The closing of the rivet is therefore effected by the momentum of the fly-wheel on the screw-shaft *c*; at the same time a spring on the end of the shaft *c* is compressed, and serves to bring the nut *i* back to place after the operation. The die-head is pivoted to the lever which carries the nut and to a rod *k*, which

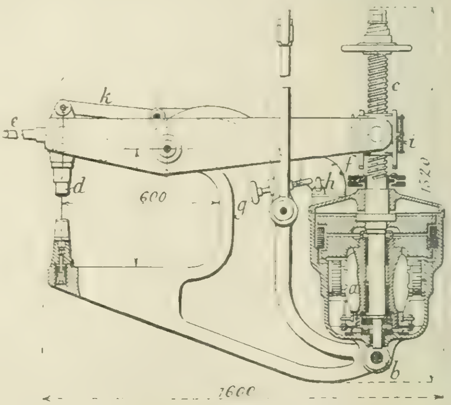


Fig. 6.—Karl Flohr Electric Riveter.

maintains the die always in alignment with its fellow. The machine weighs about 1,200 kg., and is suspended at its centre of gravity from a crane by a swivel, so that it can easily be manipulated by one man with the handle *e*.

DAVIS ELECTRICAL CO., LTD.

Enhanced Debenture Security.

An inquiry was held on Tuesday, before Mr. Registrar Hood, at the London Bankruptcy Court, into the affairs of Davis Electrical Co., Ltd., 17, Moor Street, Cambridge Circus, W.C., against which a compulsory winding-up order was made last January upon the petition of a creditor. The accounts filed under the liquidation showed assets valued at £2,923 and entirely absorbed in the debenture claims of £3,313; unsecured debts, £3,358; and with regard to contributories a deficiency of £4,786.

Mr. H. Brougham, Senior Official Receiver, attended for the Board of Trade to conduct the inquiry; Mr. Rook represented the Sloan Electrical Co.; and Mr. Whateley was briefed on behalf of Mr. Harry Emanuel Davis, the only witness called to give evidence.

Replying to Mr. Brougham, the witness stated that he was the managing director of the company which was formed in October, 1908, as a private company, to acquire and carry on his business of manufacturer of and dealer in electric and other lamps and electrical accessories at 17, Moor Street. Witness had started the business in 1903. The accounts of the trading for the three years preceding the formation of the company showed a gradually diminishing profit. In 1905 it was £559; in 1906 it was only £484; and in 1907 it had fallen to £377.

What was your object in forming the company?—It was to obtain further capital, and his father-in-law (Mr. Charles Levy) was willing to provide it on the security of the debentures. The additional capital was required in order to increase the turnover, and, consequently, the net profits.

Was it not only required for the payment of current liabilities?—The witness agreed that a portion of the money so obtained was used in that manner, although he could not state the amount. The directors were Mr. Chas. Levy, Mr. Harry Norman Howlett and himself. Mr. Howlett had been a trade competitor for 12 years. The directors' qualifications of £10 shares each were all provided by witness, who was appointed managing director for life at a salary of £500 per annum.

How was that salary arrived at, having regard to the profits previous made?—The average of the three previous years was £400 a year, and it was thought that with an increased capital there would be increased turnovers and profits. Mr. Howlett was to receive £3 10s. per week and a commission of 20 per cent. on the net profits, his duties being to supervise the shipping department, and to act as buyer and general representative of the company. He remained on the board of directors until the company was wound up, when he went abroad. Mr. Levy retired from the directorship in March, 1910. The purchase agreement was executed on October 12th, 1908, and by its terms the company agreed to purchase the goodwill and assets of the business as at January 1st, 1908, subject to the liabilities at that date. The company were to make up any deficit or retain any surplus; they were to purchase the fixtures and fittings, stock in trade, and the equity in the lease of 17, Moor Street; that lease was valued at £370, and was held by the bank as security for an advance of between £400 and £500. The purchase consideration came out at £1,998, and was satisfied by the issue of 998 fully-paid ordinary shares of £1 each, and £1,000 debenture bonds, carrying 5 per cent. interest, and covering the whole of the company's assets. As the business was to be acquired from January 1st, 1908, witness was to receive £200 for his services between that date and the date of completion.

Asked why the business was taken over as from January 1st, 1908, the witness explained that the reason was to avoid the expense of stock-taking and accountants' fees. The goodwill was taken at £1,129, and the purchase price was fixed after consultation with his solicitor and accountant. At the first board meeting held on October 12th, 1908, witness was allotted 998 shares, and the directors authorised the issue of debentures for a sum not exceeding £2,000 at 5 per cent. interest, and to be secured on the company's assets. The purchase was completed on November 12th, 1908, when 10 debentures of £100 each were issued to him. On the same day five debentures for a like amount were issued to Mr. Levy for cash advanced. The trading accounts for the year 1908 showed a trading profit of £155, but after charging witness's remuneration of £268, and the debenture interest of £10, that profit was converted into a loss of £123.

Therefore, the company was insolvent from the start?—I understood from the accountant that there were more assets.

The assets, apart from the goodwill, amounted only to £800 or £900?—Yes.

Mr. Whateley advised the witness not to answer a question in the affirmative if he did not thoroughly understand it.

Was the balance of assets over liabilities sufficient to cover the debentures that were issued?—I cannot say; I do not quite understand it.

Further examined, the Witness agreed that the result of the company's trading had been a continuous loss. In 1908 it was £50; in 1909 it was £834; in 1910 it was £63; and for the nine months in 1911 until the appointment of a Receiver for the debenture-holders, it was £1,718. In consequence of those losses, it was deemed necessary to obtain further funds with which to carry on the business, and they were provided, from time to time, by Mr. Levy, on the security of debentures. The first issue was exhausted by the allotment on November 12th, 1908, of £1,000 to witness as part of the purchase consideration; of £500 on the same date to Mr. Levy for cash advanced; and in September, 1909, of £500 to Mr. Levy, also for cash advanced. Then on May 16th, 1910, an issue of £2,000 second debentures was authorised, of which Mr. Levy received £600 for cash, one-half being advanced at the time, and the other half having been advanced one month previously, and witness received £500, being £200 for cash, £200 in respect of a liability of the old business, which liability was taken over by the company, but from which his creditor would not release him, and £100 for salary due. In March, 1910, on the occasion of his marriage, witness transferred to the trustees of the marriage settlement his £1,000 first debentures and £960 shares, whilst Mr. Levy transferred £500 first debentures.

So that at the present time £1,500 first debentures are held by the trustees of your marriage settlement?—Yes.

And Mr. Levy holds £500 first debentures and £600 second debentures?—Yes.

And you hold £500 second debentures?—Yes.

The company was pressed for money throughout its existence?—I don't think so.

But did you not continually have to get advances from Mr. Levy for the purposes of the trading?—All the advances made by Mr. Levy were for the purposes of the trading.

They amounted to £1,600?—Yes.

Examination continued: In August or September, 1911, one of the company's customers informed them that he was unable to pay his account, and asked for further time in which to do so; witness thereupon approached his father-in-law, with a view to obtaining a further advance of £1,000. He was led to believe that the loan would be forthcoming, but in the early part of October Mr. Levy told him that "it was no good enough to put any more money into the concern." On September 25th witness had consulted his solicitor regarding the position of the company, and was advised that if the desired advance was not forthcoming, "the best thing to do would be to close the concern up." A notice of voluntary liquidation was sent out to the shareholders on September 28th; a meeting of the shareholders was held on October 6th, when a resolution for voluntary liquidation was passed, and Mr. G. E. Corfield, chartered accountant, was appointed as Receiver on behalf of the debenture-holders, and took possession of the company's property and assets.

Did you propose Mr. Corfield for the post of Receiver?—Yes.

The Senior Official Receiver: Then he was practically your nominee.

In further examination, the witness stated that, between September 1st and October 6th, inclusive, goods to the amount of £1,613 were delivered to the company, and he admitted that he had never ordered goods to that extent within a corresponding period in former years. In addition to the goods which were delivered, orders were given to two firms for stock to the value of £160, which were not delivered, but witness only knew of one, at least, of those two orders having been given, until after the winding-up order was made against the company. It was probably the fact that, out of the £1,613 worth of goods delivered in the last six weeks of the company's existence, nearly one-half was delivered after September 25th—the date on which witness consulted his solicitor upon the company's position.

And goods to the extent of £236 were actually ordered after September 25th?—Those goods were ordered by Mr. Howlett, as a rule.

Did you order any of them yourself?—I cannot say. I must have ordered a few, but I cannot remember what they were.

Did you tell Mr. Howlett to stop the orders after you consulted with your solicitor?—No.

Did you tell him you had seen your solicitor and what his advice was?—I did.

Did he say anything about that?—I cannot remember what he said, but he was under the same impression as myself—that the money would be forthcoming.

From September 1st to October 6th, 1911, goods to the extent of £665 were sold?—Yes.

The result of those transactions was a considerable addition to the stock during that period?—Not a considerable addition.

Well, an addition of over £1,000?—Yes.

So that the security available for the debenture-holders was greatly enhanced at the expense of the unsecured creditors?—Yes.

Was the principal reason for making these considerable additions to the stock to enhance the value of the debentures?—No, sir.

You received your salary as managing director in full?—I thought I did not, but it appears that I did.

Witness further agreed that the business was still being carried on at Moor Street, and the proceeds of the sales were being received by the Receiver for the debenture-holders. He was now acting as manager for the Receiver at a salary of £4 per week. No attempt had been made to dispose of the goodwill, but in October or November, 1911, an attempt, in a private and confidential manner, was made to sell the business as a going concern.

And the proceeds of the sale of these goods are devoted to paying off the debentures?—I suppose you are right.

Mr. Rook asked the witness: Seeing that goods to the value of £1,613 were delivered between September 1st and October 6th, 1911, what was the value of goods ordered between those dates but not delivered?—Witness replied that he had not the slightest idea.

But surely everyone you gave orders to did not send them in ?—I should think they did.

Mr. Rook : Well, if so they are "one of us."

Further replying to Mr. Rook, witness said the orders given would have been signed by Mr. Howlett, or Mr. Williams, the accountant, or ——

Mr. Rook : The office boy, did he sign orders ?—That is a silly question.

Referring to goods supplied by a certain firm, Mr. Rook remarked, "You always told me their goods were too dear for you ; they were cheap to you then, I suppose."

Asked regarding a duplicated order, witness explained that it had been duplicated by mistake. He would not admit that he was very pleased to get delivery of both sets of goods.

Mr. Rook : Where is Mr. Howlett ?—He has gone to Canada.

Did he pay his own passage money?—No.

Very well, I won't ask you who did. Now, you had certain goods on consignment ?—The company did.

But you are the company. You were vendor, shareholder, debenture-holder and managing director. Why have you not set out the lease as an asset in the statement of affairs ?—Because the dilapidations would cost more than the lease is worth.

Mr. Rook : When you sold the business to the company it was valued at £370, and you are still occupying the premises, although the lease is of no value.

Mr. Whateley : He is not occupying the premises.

Mr. Rook : If he is not, his ghost is in the shape of the Receiver.

The Witness reminded Mr. Rook that before leaving this country for Canada, Mr. Howlett saw the members of the Committee of Inspection, and informed them that he had been offered an appointment in Canada.

Mr. Rook : Who had, or will have, the advantage from the orders given in September, either by you or Mr. Howlett, or the others ?—Eventually the debenture-holders will.

It was your intention for them to have it ?—Certainly not.

The Registrar : We need not go into the witness's intentions.

Re-examined by Mr. Whateley, Witness agreed that the goodwill which had been taken at £1,128, was partly represented by book debts owing to the business at the date of the company's formation. Although he had told the Senior Official Receiver that the company was pressed for money, no writ had ever been issued against them. All the departments, except the shipping department, showed a profit on the trading, and witness only discovered at the latter end of last October that that department was not making a profit. Mr. Corfield, the Receiver for the debenture-holders, had never previously been employed either by witness or the company, but he had acted for certain of the creditors. Mr. Levy had advanced money to the company from time to time, and right up to October 6th, 1911, witness felt certain that he would make them a further advance.

Mr. Whateley : Is there any ground for the suggestion that you ordered goods because you wanted to cheat the unsecured creditors for the benefit of the debenture-holders ?—Certainly not. The witness added that having in the usual way ordered goods heavily in May, 1911, the orders dropped down in June, July and August, with the result that it was necessary to replenish the stock in September. When he gave the orders in the latter month he had no idea that they would have to close down. The value of the duplicated order referred to by Mr. Rook was £8.

The inquiry was closed.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,878. "Galvanic batteries." H. E. Fry. July 8th.

15,905. "Electric lift or hoist starting-rod or rope-locking apparatus." M. T. Medway. July 8th.

15,915. "Method of enabling microphones to be worked when connected in parallel." R. Goldschmidt. July 8th. (Complete.)

15,920. "Electric aerial rail or rope-ways." Elektromotoren-Werke Hermann Gradenwitz. (Addition to and divided application on 12,833, 1912. Convention date, July 8th, 1911, Germany.) July 8th. (Complete.)

15,927. "Electric arc lamps." M. A. Herwig. July 8th. (Complete.)

15,930. "Tensioning device for the contact wires of electric trains." Bergmann-Elektricitats-Werke, Akt.-Ges. (Convention date, August 23rd, 1911, Germany.) July 8th. (Complete.)

15,937. "Metal-vapour rectifiers and similar apparatus." E. Hartmann. (Convention date, March 12th, 1912, Germany.) July 8th. (Complete.)

15,952. "Telephone-machine switching-system." Western Electric Co., Ltd. (Western Electric Co., United States.) July 8th.

15,957. "Electric heaters." Ferranti, Ltd., and J. Roothaan. July 8th.

15,958. "Electrically-heated devices." E. C. R. Marks. (Landers, Frary and Clark, United States.) July 8th. (Complete.)

15,959. "Systems of electric lighting." E. C. R. Marks. (Jehangir Sorabjee Banajee, India.) July 8th.

15,960. "High-efficiency electric incandescent lamp and holder. E. C. R. Marks. (J. S. Banajee, India.) July 8th.

15,961. "Electric toasters and the like devices." E. C. R. Marks. (Landers, Frary & Clark, United States.) July 8th. (Complete.)

16,002. "Electric switches, bell pushes, gas controllers, and analogous articles." M. Ahronsberg. July 9th.

16,024. "Means for electrically lighting road vehicles or other rolling stock." L. Krebs. July 9th.

16,040. "Induction electric furnaces." J. Bally. (Convention date, July 11th, 1911, France.) July 9th. (Complete.)

16,041. "Electric retort furnaces." J. Bally. (Convention date, July 11th, 1911, France.) July 9th. (Complete).

16,042. "Electric boilers," J. Bally. (Convention date, July 11th, 1911, France.) July 9th. (Complete.)

16,043. "Electric transformer boilers." J. Bally. (Convention date, July 20th, 1911, France.) July 9th. (Complete.)

16,044. "Process for manufacturing fire-proof electrically conducting moulded bodies." Gebruder Siemens & Co. (Convention date, July 20th, 1911, Germany.) July 9th. (Complete.)

16,048. "Apparatus for automatic electric heating." H. Leitner. July 9th.

16,065. "Switches for electric wiring systems." L. Milne. July 9th.

16,082. "Signalling apparatus, particularly for use in mines." Sterling Telephone and Electric Co., Ltd., and F. G. Bell. July 9th.

16,084. "Secret intercommunication telephone systems." Telephonfabrik Akt.-Ges. vorm J. Berliner. (Convention date, December 22nd, 1911, Germany.) July 9th. (Complete.)

16,096. "Electrically-controlled rove stops." J. R. K. Sharp. July 9th. (Complete.)

16,104. "Means for connecting electrical conduits to their fittings." Electrical Conduits, Ltd., and J. R. A. Hemming. July 10th.

16,119. "Brackets or pendants for gas, electric and other lighting purposes." H. Perry. July 10th.

16,126. "Electric battery lamps." H. Hunte. July 10th.

16,134. "Prepayment meter for electricity, gas, or the like." Allgemeine Elektricitats-Ges. (Convention date, July 10th, 1911, Germany.) July 10th. (Complete.)

16,142. "Time switch." S. Chiger. July 10th. (Complete.)

16,144. "Electrical contact plugs for switchboards or the like and method of producing same" M. B. Richter. (Convention date, July 10th, 1911, Sweden.) (Complete.)

16,147. "Protection of electric mains and the like." W. B. Woodhouse. July 10th.

16,150. "Electric heating or cooking apparatus." Siemens Bros. Dynamo Works, Ltd., and H. A. Bate. July 10th.

16,151. "Selector switching device for automatic telephone systems and the like." Telephon Apparat Fabrik E. Zwietusch & Co., G.m.b.H. (Convention date, January 18th, 1912, Austria.) July 10th. (Complete.)

16,152. "Method of moisture-proofing cord conductors." Western Electric Co., Ltd. (Western Electric Co., United States.) July 10th. (Complete.)

16,153. "Electric cable sheath." Western Electric Co., Ltd. (Western Electric Co., United States.) July 10th. (Complete.)

16,163. "Wave detectors for radio-telegraphy and telephony." L. J. L. D. Thibault. (Convention date, May 24th, 1912, France.) July 10th. (Complete.)

16,164. "Electric discharge apparatus." R. Moretti. (Convention date, July 15th, 1911, Italy.) July 10th. (Complete.)

16,174. "Automatic electric supply system." H. Leitner. July 10th.

16,207. "Accumulator case and the like." J. A. Walshaw. July 11th.

16,219. "Treating iron scrap by electrolysis." H. C. Woltereck and J. Moeller. July 11th.

16,229. "Electrical switches." A. H. Kling and B. D. Horton. (Convention date, July 11th, 1911, United States.) July 11th. (Complete.)

16,231. "Electromagnetic hammer." W. Richards and W. W. Richards. July 11th.

16,241. "Telephones." E. Ramdohr. July 11th. (Complete.)

16,269. "Automatic cut-outs and ammeters for car-lighting and other dynamos." Optalyte, Ltd., and J. Hewett. July 11th.

16,270. "Electrical connections for motor-car lamps and the like." Optalyte, Ltd., and J. Hewett. July 11th.

16,287. "Electric-current governors." J. F. W. Searle and S. H. Lacey. July 12th.

16,296. "Method of carrying out chemical gas reactions by means of an electrical discharge." H. Andriessens and J. Scheidemandel. July 12th. (Complete.)

16,307. "Appliances or means for mounting incandescence electric lamps and the manufacture thereof." A. W. Beuttell. July 12th.

16,317. "Thermostats for controlling electric circuits." A. W. Prim and F. W. Roper. July 12th.

16,318. "Electric conduits." E. A. Edwards. July 12th.

16,343. "Electric controllers, starting switches and the like." Siemens Bros. Dynamo Works, Ltd., and B. G. Payne. July 12th.

16,358. "Maximum time meter." Allgemeine Elektricitats Ges. (Convention date, July 14th, 1911, Germany.) July 12th. (Complete.)

16,360. "Telephones and hooters for motor-cars." Sterling Telephone and Electric Co., Ltd., and F. G. Bell. July 12th.

16,374. "Subscribers' stations in automatic telephone systems." Zivnostenska Banka v Praze. (Convention date, July 12th, 1911, Austria.) July 12th. (Complete.)

16,384. "Apparatus for measuring the electric conductivity of liquids." M. Coplans. July 13th.

16,406. "Revolving electric furnace intended chiefly for the manufacture of aluminium nitride." Societe Generale des Nitrures. (Addition to 29,299/10. Convention date, August 4th, 1911, France.) July 13th. (Complete.)

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Electrical Potential Regulators. M. Fuss. 7,220. March 22nd. (March 22nd, 1910.)

Electro-Deposition and Refining of Zinc. V. C. Tainton and J. N. Pring. 7,235. March 23rd.

Synchronising or like Devices or Apparatus. J. Chansay and L. F. Rampal. 12,732. May 26th.

Thermo-Electric Generators. C. V. Albrecht. 14,234. June 15th. (December 16th, 1911.)

Combined Boiler and Thermo-Electric Generator. W. P. Perry. 15,087. June 28th.

Selective-Calling Apparatus. E. B. Craft and G. Brown. 15,920. June 30th. (June 30th, 1910.)

Manufacture of Articles of Tungsten. British Thomson-Houston Co. (General Electric Co.) 15,586. July 4th.

Manufacture of Electrical Condensers and Similar Apparatus. J. A. L. Dearlove and S. G. Brown. 16,554. July 18th.

Electric Arc Lamps. Engineering and Arc Lamps, Ltd., and A. T. Dowdell. 16,679. July 20th. (Cognate application, 989 of 1912.)

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THE RATING OF MACHINERY.

OWING to the rapid increase in local rates during recent years, it is of the utmost importance to engineers and manufacturers to see that they are not called upon to pay an undue proportion of the burden. The rating authorities are naturally anxious to draw water from the deepest well. A large and flourishing concern which is known to be making considerable profits is supposed to be able to pay rates without any serious difficulty; and what is more, in its corporate capacity, it has no vote or say in the appointment of the body which levies the rate. If rates are unduly raised in residential suburbs, the ratepayers can make their voices heard at the next elections. But a concern which has a rateable value far exceeding that of a thousand small dwellings can secure no relief by such means.

In what way, then, can relief be obtained?

By an unfortunate development of judge-made law, it has come about that although theoretically it is only land and buildings that are brought into rating, loose machinery is taken into account for the purpose of enhancing value. Take, for instance, a mill which is electrically driven. The numerous motors which are available for the distribution of power must all be treated as part of the premises of which the hypothetical tenant is supposed to be the leaseholder. This was decided in the Tyne boiler case. That decision is so well known that we need not refer to it except to say that it is the leading authority for the proposition that loose machinery is to be taken into account as enhancing the rateable value of the property where it is found: but it does not lay down any principle upon which the enhancing value of machinery is to be estimated. Nor is there any other case which does this. It appears to be settled now that each Court of Quarter Sessions must work out this difficult point for itself; and provided the bench of magistrates—or the recorder of a borough, as the case may be—gives no reason for a decision, that decision is final. This is an exceedingly unsatisfactory state of the law. To take an illustration: What is there to prevent the Court taking the value or the profit-earning capacity of the machinery into consideration in order to arrive at the rateable value of a mill?

Having regard to the decision in the Tyne boiler case, it appears to us that the Recorder of Leeds and the Court of Appeal came to a correct conclusion as the law now stands; but it is quite within the power of the House of Lords to reverse the principle of the Tyne boiler case if the Hunslet case is brought before them. Whether they will do so is another matter; but the case is of such importance that a statement of the facts is well worthy of perusal. The appellant was the occupier of certain buildings, known as the Standard Works in Hunslet, where he carried on the business of a general jobbing engineer. The gross estimated rental of the property was £67, and the rateable value of buildings, &c., £45.

Before the above rating the appellant was assessed at £29 gross and £22 rateable. He appealed from the decision of the Assessment Committee to the Recorder of Leeds. It is necessary at this point to state that the appellant's property consisted of an office, a model room, a fitting shop, a machine shop, a store, an engine room, a shed, and a yard, all of which except the office, model room, and store, contained machinery. Some of the machinery, such as a horizontal steam engine, certain shafting and pulleys, admittedly formed part of the freehold, and was, therefore, properly brought into rating, but there were a number of machines which did not come in this category, and which had been placed there by the tenant or his predecessor in the title for the purpose of making, and which did make, the property fit for the particular purpose for which it was used. On December 31st, 1891, the appellant agreed with Benjamin Greaves, the owner of the property, to take it complete as it stood on lease for five years at a rent of £26. After 1896, he continued to remain as a tenant from year to year. He disputed the new rate on the following grounds:—"(1) That in valuing premises the value or the user of the machinery, other than that which forms part of the freehold, ought not to be considered; (2) that the said machinery ought only to be taken into account in so far as its presence (*a*) afforded proof that the premises were fit for the purpose of the business carried on therein, and (*b*) would be likely to induce a tenant to give a higher rent for the premises than he would give if the said machinery were not upon the premises." He also contended that "machinery of the class to which the said machines belonged, if it were not upon the premises when a letting took place, would be brought and put upon the premises by the tenant to whom the premises were let and not by the landlord who let the premises, and that, therefore, it was wrong to include the value of the machinery in the annual rent which such tenant would pay to such landlord." The Hunslet Union contended, in effect, that the proper criterion was the rent at which the property would let, assuming the tenant had the right to use the machines. The Recorder of Leeds held that this contention was right. He also held that the value to the user of the machinery was not necessarily to be arrived at by taking the cost or value of the machinery and putting a percentage upon such value, as had been done by the respondent's valuers. In fact, he refrained from disclosing the way in which he arrived at his figures. He viewed the works himself, and reduced the assessment to £46 as the gross estimated rental, and £31 as the rateable value. He also pronounced that if the appellant's argument should be sustained, the gross value was £39, and the rateable value £26. The Divisional Court and the Court of Appeal upheld the Recorder's decision, the Master of the Rolls, in the latter Court, saying that the case was governed by the Tyne boiler case, which was decided in the Court of Appeal in 1886.

Finally, in order to try, if possible, to have the Tyne boiler decision overruled, the Hunslet case was taken to the House of Lords, where the attempt proved to be in vain. Lord Halsbury, in giving judgment, said:—"I decline myself to enter into what I may call the original equities which might have guided this matter. It is enough for me that a long series of decisions for certainly half a century have established the bald proposition which is all I am insisting upon, namely, that although the machinery may not be part of the freehold, it yet has to be taken into account; and in saying that I do not want to muffle it in a phrase, but what I mean is that to increase the amount of the rate which is exacted from the tenant you may enter into that question and form a judgment upon it, although, as a matter of fact, the machinery may not be attached to the freehold."

That is the last word on the subject. Nothing short of an Act of Parliament can now take machinery out of rating.

One observation of a practical nature remains to be made. In a recent rating case at Leeds, the Recorder declared that in order to ascertain the rateable value, the Court should have regard to the evidence of practical men. Let the practical man see the premises, and say how far their value has been enhanced by the presence of machinery. In other words, the question is, What rent would he give for the premises fully equipped as they stand? This question answered, the rateable value can be ascertained by a simple sum in arithmetic.

Provision against Antiquation.

For many years past in these pages we have consistently urged the importance of providing for the antiquation or obsolescence of electricity supply plant. In some cases our arguments fell upon deaf ears, in others they were reluctantly set aside by those who, having to show a loss on their undertakings, did not desire to report a larger deficit on account of an uncertain factor. We were at times charged with hostility to municipal control because we urged for sound finance in this respect, but, as so often happens, practical experience has, with a ruthless disregard for losses or profits, convinced the unbeliever who was disinclined to pay heed to warnings until necessity was knocking at the door. Companies and municipalities to-day are being brought face to face with the problem of scrapping machinery of which perhaps only a half of the cost has been paid or written off. Plant, which was the best of its kind obtainable when installed, cannot stand in the presence of modern plant if the maximum efficiency and economy are desired, and unless engineers and their authorities are content with high production costs, the old plant must be got rid of in favour of turbines or Diesel engines, and loans for displaced equipment must hang round the neck of the undertaking if the contingency has not been provided for. The economies made possible with up-to-date machinery are often more than enough to meet the financial charges on the old plant while still giving the benefit of a reduced cost per unit; but how much better it would be for the cause of cheap electricity if these loans could be wiped out when the plant dies. Mr. Frank Ayton, in his annual report to the Ipswich Corporation, enters very fully into the question of reserves for antiquation, expressing his approval of the action of his Committee in starting, two years ago, to build up such a fund. He does so because he feels that it is not always understood how necessary such provision is in connection with the business of electric supply. Emphasis is laid upon the industrial importance of cheap electricity, and upon the fact that the latter cannot be obtained unless inefficient plant is scrapped in favour of turbines for large sets and Diesel engines for small, a kind of supersession which is continually observed in electrical engineering developments, while "the rate of progress and improvement in the future bids fair to eclipse, if anything, the record of the present and the past." "Who knows," he asks, "what changes the next few years may bring forth?" Mr. Ayton has something to say about the disinclination of the Local Government Board to grant loans for new plant in place of old, when the original loans are only partly paid off, its authority being given to reborrow only such portion of the loan as has already been paid off. In such an event, the result is that the undertaking must either call upon the rates for the remainder of the cost, or continue with the old plant and keep up the price charged for electric supply. He proceeds to urge his own Council to aim at making its reserve fund equal to 10 per cent. of the capital expenditure and maintaining it at that figure.

We feel that, speaking generally, engineers whose business it is to keep themselves informed regarding electrical engineering developments agree to-day with the soundness of these views, but unfortunately it does not always follow that they can convince their Councillors. We hope therefore that advantage will be increasingly taken by them of opportunities for dealing with the subject in plain language.

Many reports issued during the last few years have emphatically shown how great has been the benefit obtained from the installation of up-to-date plant in replacement of old ; but to do this reserves are necessary, and it is nothing short of iniquitous that money should be put to rate relief which should properly be applied to reserves, and so improve the stability and efficiency of the undertaking.

A Lift Fatality.

The regrettable lift accident whereby the Duc de Lorge lost his life last week serves to remind us that it is always the unexpected that happens, and even when we have taken, as we believe, every conceivable precaution against mechanical or electrical breakdowns, and mistakes on the part of the users of such apparatus, there is still sure to be some contingency that has not been taken into account. Human foresight, in fact, has its limitations, and it is only by long years of experience that its deficiencies can be remedied.

The lift in question was of the automatic push-button type, and every care had been taken with the express object of ensuring safety. The mechanism was in good order, but it happened that the unfortunate gentleman, perhaps impatient, apparently pulled the door before the cage had descended to the proper level ; this caused the cage to stop and released the door, and the Duc hastily walked through it and fell down the shaft.

The stopping of the cage was normally effected by a trip at the top of the cage, engaging with a corresponding device on each floor, and it was suggested that had this arrangement been at the bottom instead of the top of the cage, the accident would not have happened. Not having the actual details before us, we cannot express an opinion on this point, but it is clear that even the many ingenious safeguards already provided are not sufficient to render accident impossible. It would be easy to add a mechanical lock which would prevent the door from being opened unless the cage was in the correct position, and this would be a wise precaution. The use of glass panels in the door, as suggested by the jury, might also be advantageous, but clearly no reliance at all can be placed upon the vigilance of the users of the lift. If a man cannot see that the cage is not there when he opens the door, he is not likely to pay attention to what he sees through the panels.

Electricity in Ipswich Sanatorium.—The recently opened sanatorium at Ipswich is provided with an elaborate steam heating, cooking, electric lighting, laundry, and sewage disposal plant. The machinery is installed in a separate block of buildings standing in a corner of the site. Steam is provided by two Cornish boilers (each 18 ft. × 6 ft. dia.), natural draught being secured by a handsome 60 ft. brick chimney. Two high-speed, enclosed Reavell engines, in a room adjoining the boiler house, are direct coupled to Crompton dynamos and can also drive overhead shafting which is carried through into adjacent laundry rooms. Abutting on that end of the engine room containing the four-panel switchboard is an accumulator room. A compressed air ejector plant (on the "Shone" system) delivers sewage into the Corporation sewers, the necessary air supply being obtained from two Reavell compressors in the engine room. Electric irons are used in the laundry and large quantities of steam are required for heating, cooking, &c. The latter consideration determined the use of steam plant instead of internal combuston engines. Boby water softeners are installed in the boiler house and, after treatment, water is delivered by an automatically-controlled, electrically-driven pump to an overhead service tank whence distribution is by gravity. The softened water leaves no appreciable deposit in the various calorifiers and hot-water radiators, which, therefore, maintain a high thermal efficiency. Steam is taken from the boiler house through underground mains to the administration block and to the patients' blocks and the whole of the steam condensed in pipes, calorifiers, steam jacketed vessels, &c., is returned through steam traps to the boiler feed tank. The whole of the electrical plant, including an extensive lighting installation, has been supplied and erected by Messrs. Mann, Egerton & Co., who have recently installed a number of other important lighting schemes in the neighbourhood.

PROFIT-SHARING AND CO-PARTNERSHIP.

In the autumn will be published a full report by the Labour Department of the Board of Trade upon the inquiry which is now being made into profit-sharing and co-partnership. The investigation into certain of the schemes in operation has been completed, and from the preliminary report thereon, which is full of interest, much valuable information may be acquired.

With regard to the legality or obligatory nature of the constitution of some of the profit-sharing arrangements, that is to say whether they are purely voluntary or legally binding, it is expressly stated in some cases that participants possess no legal rights, whilst in a few others it is stated that the sharing in profits is conferred as a matter of strict legal right.

The amount of profit to be appropriated to the profit-sharing fund is in the majority of cases ascertained on the basis of a fixed proportion of the profits. In some instances a maximum is imposed at which the claims of the workers cease. In a small number of cases the amount available for the payment of bonus is not a proportion of the profits, but a sum contingent upon a certain rate of profit being earned by the business, this sum being, in some of these cases, a fixed percentage on wages, and in others an amount ascending with the rate of profit earned.

With profit-sharing gas companies the bonus depends upon the price of gas. These companies are by law allowed to increase their dividends beyond a certain point only in proportion to a reduction in the price charged by them for gas. In gas companies, accordingly, the bonus, instead of varying directly with profits, varies with the same factor which governs profits, and rises as the price of gas falls.

The profits taken into account for the purpose of ascertaining the amount available for distribution as bonus are almost invariably the profits earned in the year, or in a certain number of cases the half-year, preceding the distribution ; but in a few cases a part of the profits of each year is carried forward in order to enable a bonus to be paid in an occasional bad year. The divisible profits for the purposes of the profit-sharing scheme are usually declared to be the clear or net profits—that is to say, the gross profits after deduction of rent, taxes, rates, wages, salaries, and other working expenses. In joint stock companies the salaries include those of managing and other directors, and an analogous practice obtains with a few private firms, though, as a rule, in such firms the remuneration of the management is included in the proportion of the profits not allotted to employés but retained by the partners. As to the minimum remuneration of capital, interest at fixed rates is usually included, whether in the case of joint stock companies or of private firms, among the deductions to be made before net profits are arrived at, this rate being generally 5, sometimes 6, per cent., and only exceptionally a lower or a higher percentage. In some cases special mention is made of sums to be set aside for depreciation and for reserve funds.

The reserved limit—*i.e.*, the point at which the participation of the employés begins—is in a few cases known to be based not on the actual profits earned in the years immediately preceding the introduction of the profit-sharing scheme, but on an amount below those profits.

The principle upon which the reserve limit is calculated is generally communicated to the employés, and the results of the calculation determining the total amount available for participation are, in a certain number of cases, certified by professional auditors, whose figures can be seen by the employés. In a few instances the employés are allowed to inspect the books of the firm.

The proportion of the profits allotted for division between the employés varies considerably in different schemes. In cases in which no mention is made of any part of the total net profits being retained for the employers as reserved limit, there are a few cases of 10 per cent. of the profits being allotted as the share of the employés, a case of 5 per cent. is mentioned, and another in which the share of the employés is 2½ per cent. on the divisible profits up to a certain sum, and 5 per cent. of the profits in excess of such sum. In a very small number of cases capital and wages share concurrently, the bonus being at the same rate on wages as the rate of interest received on the capital. Where a reserved limit is mentioned, the proportion of the surplus profits above this limit, which, so far as is known, is appropriated to the payment of bonus, varies from 5 to 50 per cent., well over one-third of the schemes in question allotting the latter percentage, and nearly one other third giving from 20 to 25 per cent. In a certain number of cases the surplus is shared between capital and wages *pro rata*.

With regard to the division of the total bonus fund among the different employés, by far the most common method adopted is to divide this fund between the participants in proportion to the amount which each has earned in the period to which the distribution relates, no deduction being in many cases made for time lost by illness up to a certain limit, but in making the calculation overtime is excluded in a few cases, and overtime and piecework in a considerable number of schemes. In a few cases other elements, such as length of service, or the nature of the duties performed by the employé, are taken into account, and in a very small number of schemes the share to be assigned to each employé is fixed by the employers at their discretion.

There are some cases in which the form of profit-sharing adopted either exclusively or in conjunction with the more common type, consists in paying to employés who leave money in the hands of their employers in the first place, a fixed rate of interest, usually 4 per cent., and then a further return on these deposits varying with the rate of profits of the business; this extra return is, in a few cases, of such amount as, together with the fixed interest, will bring the total return up to the dividend paid by the company, with a maximum limit of 10 per cent., while in a very small number of cases the extra return is to be one-half of the difference between the minimum interest and the dividend paid by the company, with a maximum limit of 7 or 10 per cent. Where employés hold shares which they have bought in the market, they are not considered to be employed under the method of profit-sharing. But where shares are issued to employés either without exacting any payment, or on special favourable terms as to purchase price or method of paying up instalments, &c., this is a form of profit-sharing: but cases of this nature are not frequent.

In some cases all the employés without distinction are allowed to share in the bonus fund; but in many instances participation is confined to persons who possess certain qualifications, the most frequent of which is a certain length of service with the firm, varying from six months up to seven years, the most frequent period being one year. In a few cases, persons below a certain age are excluded. In a small number of schemes, participation in profits is confined to employés selected by the management. In a few instances certain classes of employés, such as persons receiving commission, piece-workers, or casual labourers, are excluded from participation.

Sometimes conditions are attached to participation, by far the most frequent of which is the signing of a contract of service for a stated period—generally 12 months—as is the case with nearly all profit-sharing gas companies, this contract providing that wages shall not be reduced during the term specified. In a few cases profit-sharing employés are required to be members of a fund for provident purposes.

In about one-half of the schemes the bonus is paid in cash; in a considerable number part of the bonus is paid in cash, the remainder being credited to a thrift fund available to provide provident benefits for the employés, as a rule, individually, but in some cases collectively, this fund being usually deposited at interest with the employers. In a very small number of schemes the whole of the bonus is devoted to provident purposes.

In many schemes one-half of the bonus is retained for investment in the capital of the undertaking; in others the whole is so retained until the employé holds a certain amount of stock; subject to this retention, the other half is either paid out in cash or retained on deposit with the employers, unless permitted to be applied for purposes of a provident character. In a few schemes, the whole of the bonus is in the shares or stock of the employing company. In others, shares obtained by the investment of bonus cannot be disposed of except with the permission of the employers, and many schemes provide for the loss of his right to share in profits by any employé selling without permission.

As a rule, to which there are, however, important exceptions, the shares owned by the employés give them the ordinary voting powers, and as time goes on and their holdings increase their voting strength should, in due course, be augmented. At present the proportion of employés' votes to the total number of votes that might be given at a general meeting of shareholders, hardly ever reaches 5 per cent., and in nearly all cases it is a quite insignificant percentage. In only six out of the 100 cases dealt with are the employés represented on the board of directors. There exist, however, under a very large number of profit-sharing schemes, joint committees composed of employers and employed, whose functions, although of a consultative nature only, cannot be considered as other than important.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Railway Cab-Signalling.

Surely Mr. Dammond's letter in your issue of July 19th entirely corroborates my contention that (other things being equal) a rubbing contract is superior to a rotating one.

If, as he states in his letter, he is liable to pick up false indications with the wheel clamped by the brushes, his apparatus is too sensitive under perfect conditions of contact, and his sole factor of safety is the imperfect contact of his rotating wheel, which is too uncertain a factor to allow of confidence in its reliability.

As regards the concluding paragraph, I enclose my pamphlet on the final form of the Brown-Mackenzie system, and would ask your correspondent, in face of that, to substantiate his statement that the system is not "absolutely reliable."

Henry A. Dupré.

Sutton, *July 27th*, 1912.

Australian Labour Conditions.—We have from time to time drawn the attention of our readers to the case of the Australian tramway employés and the progress which is being made with the action they have brought against their employers for higher wages and improved service conditions. It was hardly to be expected that this particular class of workers would be the only one to take action in the Federal Court, and we now find that others have commenced arbitration proceedings. Among them we may specially name:—

Gas Employés.—These are already working under a Wages Board award which granted very considerable increases on previous rates. Amongst the new claims are:—stokers and firemen, 12s. per day of eight hours, 16 days' annual leave on full pay, coal trimmers 11s. per day, skilled labourers 10s. 6d. per day, blacksmiths 12s. per day.

Fruit Growers.—Pickers and general workers over 17 years of age 8s. per day. The existing rate was 7s. per day. Practically the whole of this work is done by women. It was claimed by the secretary of the Union that a full day's pay should be given for a broken day's work.

Postal Electricians.—This class of employés have sent in a long claim. All payments are put in as annual salaries. They ask for:—Mechanicians, £450 per annum; senior foremen, £400 per annum; first grade foremen, £350 per annum; second grade foremen, £300 per annum; third grade foremen, £250 per annum; instrument fitters, £192 per annum; junior instrument fitters, 16 years old, £72 per annum; 17 years, £84 per annum; 18 years, £96 per annum; 19 years, £108 per annum; 20 years, £120 per annum; 21 years, £140 per annum; 22 years, £160 per annum; 23 years, £180 per annum. In the electric light and power department the sums claimed are:—Engineer, £325 per annum; assistant engineer, £235 per annum; shift engineer, £222 per annum; assistant shift engineer, £192 per annum; hours of duty 44 per week; various allowances if meal times interfered with; three weeks' annual leave with full pay, all gazetted holidays, sick leave, and right of furlough; leave of absence for trade union's annual picnic; preference to be given in all matters of promotion, transfers, or leave of absence to trade union members; four years' fees at a technical college to be paid in addition to wages for all juniors, and when no claims are accessible books to an equivalent value to be placed at their disposal.

It will be noticed that many of these claims far exceed those made as yet in this country, and the result of these various applications will be of interest.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The city of Kingston, Ontario, to which reference was recently made in these notes has now decided to spend £10,000 on extending the civic steam-driven electric plant instead of utilising power supplied by either the Hydro-Electric Power Commission or the Seymour Power Co.

The E.B. Eddy Co., of Hull, near Ottawa, who are large manufacturers of matches, paper and other articles, intend to erect a hydro-electric plant of their own, which, it is said, will be one of the largest privately-owned plants in the world. Work has already been begun on excavations.

A few weeks ago the electric lighting plant in a small town in Ontario was completely destroyed by fire, and this week comes news from Quebec of an exactly similar occurrence to a 2,000-H.P. plant owned by the Quebec and Jacques Cartier Electric Co., which lighted part of the city of Quebec itself.

A large American concern, the Standard Underground Cable Co., has recently commenced active manufacturing operations in Hamilton, Ontario. This company has for years supplied large quantities of all kinds of cable, wires, &c., to Canada, and has evidently decided that the time is now ripe to enter the field as an actual Canadian manufacturer.

Indications point to the probable establishment of many other U.S.A. industrial enterprises over here in the next few years.

Mr. P. W. Sothman, the chief engineer of the Hydro-Electric Power Commission of Ontario, has resigned in order to take up private practice as a consulting engineer ; as yet no successor has been appointed. Last week reference was made by the writer to the deplorable way in which the equipment of the line of the power company which supplies the trams and the local lighting company with electric current, failed in the performance of its duties, owing to thunderstorms.

This week has been even worse, while the Hydro-Electric Power Commission's line has maintained throughout an uninterrupted service. This latter fact will undoubtedly enhance Mr. Sothman's already wide reputation here, seeing that he has been responsible for the construction and equipment of the Commission's lines.

The interruptions to the company's service have been so serious that the city authorities of Toronto have taken the matter up as, also, has the local Board of Trade. It has been stated that the company will probably plead an act of God, seeing that they have no direct control over the pranks which lightning may play, but, if this be allowed, it would seem only reasonable to argue that a specially appointed angel has been carefully watching over the interests of public ownership as represented by the Power Commission. The company, though, appears to have had a run of specially hard luck this time.

PARLIAMENTARY.

L.C.C. Tramways and Improvements Bill.

On July 22nd, the Marquis of Bath's Select Committee of the House of Lords commenced the consideration of this Bill. Mr. Ernest Pollock, K.C., and Mr. Lynden Macassey represented the Council. The Bill had already passed the House of Commons Committee, but as the result of the decisions of that Committee and of the withdrawal of certain proposals, it was considerably modified. The proposals for tramways in the Hampstead and Euston Roads, Essex Road and Stamford Road, and Farringdon Road and Farringdon Street were struck out for non-compliance with standing orders ; whilst in consequence of a resolution passed in the House with reference to the use of overhead wires, the tramway from Wood Lane to Harrow Road was dropped. The House of Commons Committee passed the remainder of the proposals, *i.e.*, an extension of the Tooley Street tramway towards London Bridge, an extension of the tramway at Rushey Green along Bromley Road to Southend, the doubling of the tramways in South Lambeth Road, and the reconstruction of the tramways in High Street, Woolwich. They also assented to clauses regarding the making of by-laws for establishing the queue system for passengers, and an important clause enabling the Council to run trailer and coupled tramcars, subject to certain conditions. The Committee decided to consider the Tooley Street scheme first, which was opposed by the owners and occupiers of various wharves, who were represented by Mr. G. J. Talbot, K.C., and Mr. R. W. Harper.

Mr. Pollock, K.C., said the total cost of the works proposed to be constructed under the Bill was £238,565. The County Council were running 1,725 electric cars, and employing 11‘000 men. With regard to the Tooley Street tramway, it was proposed to extend this by 316 yards, 32 yards of which, in the narrowest part of the thoroughfare, would be single line. Tooley Street had been widened at a total cost of £376,000, but further widening was impossible. Three and a half million passengers were carried along the street on the tramcars last year, and the traffic was increasing.

Sir M. Fitzmaurice, engineer to the Council, gave evidence in support of the proposal, which he said would cost £6,900. Throughout the extension there would be a width of 9½ ft. between the rail and the footway.

Mr. J. C. Spensley, assistant statistical officer of the L.C.C., Mr. Bryson, Town Clerk of Woolwich and Mr. A. L. C. Fell, general manager of the L.C.C. Tramways, gave evidence in support of the Bill. In cross-examination, the last witness said he had every confidence in the tramways, and was not nervous about the competition of the 'buses.

On the 23rd ult., considerable evidence was given by occupiers in Tooley Street with reference to the congested state of that thoroughfare, and Mr. Talbot addressed the Committee, and urged that the scheme should be rejected.

The Committee decided to allow the tramway, on condition that a clause was inserted to the effect that the cars should not go further than the present terminus during certain hours of the day.

The matter was left in this state for the promoters to consider the position, and the Committee adjourned.

On July 24th, Mr. Pollock, on behalf of the County Council, intimated that that authority would accept the decision of the Committee relative to the conditions on which the extension of the Tooley Street tramway should be sanctioned, viz., that the extension should only be used before 9.30 in the morning and after 5.30 in the evening.

Mr. A. L. C. Fell, the tramway manager, then gave evidence in support of the clause in the Bill to enable the Council to run coupled tramcars and trailers. He considered that such a system afforded the best means of dealing with the large and increasing traffic at certain periods of the day.

The proposal was opposed by the Metropolitan Police, and evidence was given by Mr. F. S. Bullock, Assistant-Commissioner, and Supt. Basson, to the effect that, in their opinion, the running of such cars would tend to increase the congestion and the number of accidents in the streets.

Having conferred in private, the Chairman said the Committee were prepared to allow the clause with limitations. They would confine the use of trailers to the South of the Thames, but including the cars which passed over Westminster and Blackfriars Bridges and along the Thames Embankment, so as not to interfere with the circular routes. They would also allow their use on the lines crossing Vauxhall Bridge to Victoria and Battersea Bridge to Chelsea, but not on the line crossing Putney Bridge. The Chairman added that by allowing the limited use it would give an opportunity to both the County Council and the police to see how the system worked, and hence they would be in a better position to judge in the future whether it would be applicable to the more crowded termini on the North of the Thames.

The Committee afterwards considered the proposal to double the tramline in South Lambeth Road, and approved of it, subject to the removal of the public convenience there.

Loch Ericht Water and Electric Power Bill.—This Bill has been passed by the Unopposed Bill Committee of the House of Commons, and reported for third reading.

National Electric Construction Co.'s Bill.—In the House of Lords on Tuesday this Bill, as amended, passed its third reading.

LEGAL.

An Unearthed Switchbox.

At the Gateshead County Police Court on July 25th, Henry Marshall Imrie, manager of Chopwell Colliery, Co. Durham, was summoned on a charge of having failed to comply with certain special rules and regulations of the Coal Mines Act, 1887, relating to the installation and use of electricity in mines, inasmuch as a certain switchbox was not earthed in accordance with Rule 8. Mr. Sheriton Holmes prosecuted on behalf of the Home Office, and Mr. Cooper, of Newcastle-on-Tyne, defended.

Mr. Sheriton Holmes stated that the defendant was manager of the colliery, and on May 2nd and 3rd the switchbox of a conveyor —which carried the coal from the "face" to the tubs—was out of order. From the evidence given at the inquest subsequently, a miner named Hudson found the switchbox was out of order, and on May 3rd Hudson said he could put it right. After the current had been cut off, Hudson took the cover off the switch. Inside the switchbox were three fingers, and the cover should not have been in contact with these at all, but in putting back the cover, apparently, he must have shifted one of them so as to bring it in contact with the cover. Hudson then asked that the current should be put on, and the result was that he received a shock that proved fatal. In fairness to Mr. Imrie. Mr. Holmes said it must be mentioned that it was a purely voluntary act on the part of Hudson. but the defendant, as manager, was responsible for seeing that the switchbox was right. The prosecution asked the Bench to uphold the rules that were framed for the safety of all concerned, and, although it might have been a rash act on the part of Hudson, it was just the sort of case for which the rules and regulations were required. The real offence was that the switchbox was not earthed.

Mr. J. B. Atkinson, Mines Inspector. gave evidence that the switchbox was not earthed.

Mr. Cooper, for the defence. said that there was an exemption clause which covered the case. Under Clause 20 it was expressly stated that the rules relating to constructional work would not apply to apparatus in use before June. 1911, until 1920. He contended that earthing was part of the constructional work, and, as such, was therefore covered by the exemption.

After some argument as to the interpretation of the rules, the magistrates asked for some expert evidence bearing out the contention of the defence.

Mr. W. C. Mountain, consulting electrical engineer. of Newcastle-on-Tyne, said that earthing would clearly require constructional work. As the apparatus was in use before June, 1911, when special rules came into force, and before which there was no need to have it earthed, if an earthing system were to be carried out, it would mean new constructional work ; therefore it would come. in his opinion, under the special clause. He was in a position to say that the opinion among the majority of the owners in Northumberland and Durham was that the exemption clause referred to all apparatus in use at the time the order came into operation. The new rules, they took it, applied to apparatus since constructed.

Mr. Robert Winship, chairman of the Bench, observed that it was really a test case, and Mr. Holmes said that if it were so regarded, he would wish to call further evidence.

Mr. Robert Nelson, Home Office expert. who acted as secretary to the Committee which drew up the special rules, said the question of earthing was entirely apart from the construction of apparatus. It did not involve the scrapping of, or the interference with, the construction of any existing apparatus. It would be an efficient earthing to connect a piece of cable to the switch and to the armoured cable. This had nothing to do with the construction of the switch, and. therefore, did not come within the exemption.

The bench, after a short retirement, said they came to the conclusion that the case came under the exemption clause, and it would be dismissed.

Mr. Holmes asked the Bench to state a case.

Rose Bros. v. Albany Engineering Co. and Another.

In the City of London Court, on July 25th, before Judge Rentoul, K.C , plaintiffs, electricians, of 38, Beech Street, E.C., sued the defendant company, electrical engineers, Ossary Road, Old Kent Road, and Captain Gavan Inrig, 154. Bishopsgate, E.C., for £2 12s. 3d. for electrical goods supplied. Mr. H. Strouts appeared for the plaintiffs, and Mr. W. Webb for the company. Captain Inrig defended in person. It was said that the orders were given by Captain Inrig on behalf of the Albany Engineering Co. The goods were delivered in part to the company and part to the Captain. Mr. Webb said that the company repudiated their liability, and said that the goods were ordered by Captain Inrig. Captain Inrig said that if anything was due from him or the company he would pay, but he had had no invoice. Mr. W. A. Rose, one of the plaintiffs, said that they looked to the Albany Co. for payment, and that was why no invoice was sent to the Captain. The Court found for the plaintiffs for £1 5s. 9d. against Captain Inrig only, without costs. The Albany Co.'s costs were awarded them against the plaintiffs.

The Telephone Arbitration.

(*Continued from page* 12[illegible].)

Mr. J. F. C. Snell proceeded to deal with the life of the plant, and said that he had calculated the life of the cast-iron pipes as 15 years. He gave the earthenware pipes known as the "Post Office type" a life of 50 years, and other classes of earthenware pipes 20 years.

In regard to the scrap value, Sir J. Simon pointed out that, of course, such value did not amount to much in the case of the iron pipes, but when they came to the cables it was a very different matter. The scrap value under the head of cables was estimated at half a million.

Witness then proceeded to deal with the life, &c., of the cables. In answer to the Solicitor-General, he said there were various kinds of cable, the biggest class of which was the lead-covered dry-core cable ; then there was the rubber-covered dry core and the gutta-percha insulated ; also armoured cables and the composite types. The lead-covered cable was built up of copper conductors, insulated by means of dry paper, and when made up into the cable it was covered by a continuous sheet of lead-tin alloy which hermetically sealed the whole of the conductors and their insulation. If these lead-covered cables were not exposed to any electrolytic or chemical action, their physical life would be about 50 years.

Sir J. Simon : Have you had experience of the life of these cables ?—Witness said that he could speak of 25 years' experience.

Telephone cables may not in all respects stand on the same footing as power cables ?—I quite agree ; it is only fair to say that the power cables. upon which I am basing my experience to some extent, are subject, of course, to certain effects—such as over-electrical pressure and over-heating to which telephone cables are not subject. For that reason I should give for cables made practically of the same specified materials, and used for telephone purposes, a longer life than those used for power purposes.

That is contrast ; now let us deal with resemblance. Take, for instance, electrolytic action ?—Of course, electrolytic action is common to both. A telephone cable is just as liable to suffer from it as a power cable.

When you talk of electrolytic action you mean action due to outside electric currents. apart altogether from the current the cable is carrying ?—Oh, yes ; of course. I mean external electric currents.

Have you made any investigation or test of this action on the telephone lead-covered cables ?—Yes, I visited Plymouth and made a test of telephone cable of this description which was laid there. I found electric current was actually traversing the lead-sheeting of the cable and it was coming from the adjacent tramway system.

Mr. Danckwerts : Was your examination *ad hoc* ?—Oh ; certainly.

Sir J. Simon : And you found that the cable was in fact suffering from electrolytic action ?—Yes.

Is that a risk which these lead-covered cables run ?—It is. I also examined similar cables in Belfast, where one was actually withdrawn from its duct. In that case the cable-sheathing showed distinct marks of pitting and corrosion due to the passage of external electric currents.

In answer to his Lordship, witness said, that at Plymouth he tested the cable with an ammeter ; in Belfast, which was an investigation and not merely a test, he examined every inch of the cable as it was withdrawn from the duct.

Sir J. Simon : At the time this cable was withdrawn was there any reason to suppose that it would show signs of electrolytic action ? Witness explained that in Belfast there had been cases of electrical decomposition of the telephone cables. It was a matter of history and so he decided to go there and make an investigation. Of course, he did not know before he examined it whether this particular cable would show effects of electrolytic action or not. As it happened, however, there were distinct marks of electrical decomposition upon it. Witness was not quite certain but he thought in the case of Plymouth the cable was laid in a cast-iron conduit, and at Belfast it was laid in cement.

Sir J. Simon : Were the signs of electrolytic action which you observed on the Belfast cable signs which made a difference to the practical life of the cable ?—Yes, certainly, some of the fittings in the thin lead sheathing were one-sixteenth of an inch deep, that means that a considerable amount of the lead covering had disappeared. If that state of things continued the cable would soon become useless, because the very life of the cable depended on the unperishability of its lead sheathing, and when that perished the whole cable was gone. Of course, if the trouble was only a small local fault, the cable might be repaired. but if the depreciation of the lead sheathing was general, the cable would soon become useless. Continuing, Witness said whilst the physical life of the lead-covered cable was, in his opinion, 50 years, deductions had to be made which reduced the practical life to 20 years. These deductions had to be made in respect of electrolysis and its action, the depreciating effect of chemical action and the actual melting of the lead sheathing by stray currents—by which he meant currents sustained by the cable owing to its coming into actual contact with power cables. It did not often occur, but did so occasionally.

Sir J. Simon : When you withdraw a 20-lb. conductor you have the scrap value of the wire ?—Oh, certainly.

His Lordship : What is the object of putting in a 20-lb. conductor in the first place ?—Witness replied that it was not done so much now ; the 20-lb. conductor was used originally for the purpose of better transference of speech. but owing to improvement in the telephonic art in recent years, 10-lb. conductors were able to take the place of the 20-lb. conductors and give the same facilities for speech.

By improvements in other parts of the telephone system you are able to use smaller conductors ?—Witness : Quite so.

How does all this affect the life of the plant ?—That is the point we have to consider.

Sir J. Simon said there were two considerations to be borne in mind. In the first place, they must remember that they were here considering the life of the plant *in situ*. It was not a question whether this particular piece of wire, or that, was going to live in the sense of existing on the surface of the earth without decay for a particular time. The question was how long was it going to live as an installation. Secondly, they had to remember that what they were trying to do was to arrive at value. If they took the value of the plant *in situ* and its value as scrap, then, he submitted, they would arrive at the true value.

His Lordship said it seemed to him that what they had been discussing was not so much the life of the plant as the development of the business. He thought that if the Solicitor-General dealt with that he would be drawing a two-edged sword.

Sir J. Simon argued that the evidence witness was giving was very germane to the question of the life of the plant and accordingly germane to the value of the plant.

Continuing, witness said that it was the experience of the G.P.O. that a certain annual replacement of cable was necessary each year owing to the inadequacy of its size ; that was to say the insufficiency of the pairs of wires the cable contained. He was of opinion that 2½ per cent. allowance for this inadequacy was a fair amount to take, and if that were so the practical life of the cable was reduced to 20 years, having taken in conjunction with this inadequacy the depreciation of the cable from other causes which he had mentioned.

His Lordship. Do you get your 2½ per cent. from estimate or from any actual calculation ?—Witness said the figures was an estimate based on the actual experience of the G.P.O. From 1906 to 1911 the cables of the G.P.O. service of that calibre were replaced to the amount of ½ to 1 per cent. on the ground of inadequacy. If they applied that to the smaller-sized cables the percentage would be higher. Then, having regard to the fact that the Post Office plant was more up-to-date than that of the N.T. Co., there would be a greater percentage of replacement necessary in respect of the latter's system. Taking all these things into consideration, he had arrived at the figure of 2½ per cent.

Mr. Danckwerts: It comes to this. You have adopted 2½ per cent. for the company because the G.P.O. percentage is one?—Oh, no, there is more in it than that.

Proceeding, Mr. Snell then dealt with the vulcanised india-rubber cables. He estimated the life of these cables at 15 years. They were especially liable to deterioriation. He said this from his experience of power cables of the same materal.

Sir J. Simon: What is the cause of the deterioration?—Moisture chiefly, and sometimes the effect of coal and other gases in the ducts.

Do these cables suffer from electrolytic action?—Yes, they do in power work.

Is 15 years the life of these cables when they are used for power work?—Oh, no, it is very much less than that; when they are used for power work their life is 10 years at the most. In fact, so much do they deteriorate, that these cables are seldom used for power work now. Witness added that he noticed Mr. Gill had estimated the life of this cable for telephone purposes at 20 years.

Now, take underground armoured cable. What is the total life you estimate for that?—Armoured cable, witness replied, laid directly in the ground should only be assessed at a short life. He was quite aware that there had been cases where such cable under certain conditions had been known to last a longer time than he estimated, but that was only in cases where the cable had been laid in particularly suitable and very dry soil. But speaking generally, only a short life could be given to this kind of cable. Witness further said that steel-armoured cable was also very liable to decay. He should not give that cable more than 15 years' life; but it was really a small matter, because there was very little of it in use in the telephone system. The potheads, which were the weakest portion of the underground telephone system, he had estimated at 12 years' life. Mr. Gill had given them 15 years. Taking all these cables and accessories together, witness said he had arrived at a general figure of 20 years for the life of the whole underground system. Later witness said he had had a conversation with Sir Alexander Kennedy with respect to the life of the cables, and Sir Alexander had told him that he had advised the L.C.C. to adopt the period of 30 years for the repayment of the loans made to the municipal authorities for power purposes. He did not necessarily mean that 30 years was the life of the cables assessed by him. Questioned with regard to the life of iron poles, witness said he allowed the same life to them as he had allowed to creosoted poles, viz., 20·5 years, although, in fact, investigation showed that the effective life of iron poles was only 13½ years. The effective life of bare wire in position, he calculated at 8½ years, although in his estimates he had actually allowed nine years of effective life, an addition of 5 per cent. After explaining, at some length, how he arrived at this conclusion, witness was taken to the subject of aerial cables of all kinds, and he stated that he had arrived at the equated life of these in the same way as he had arrived at the equated life of conduits. He gave 15 years as the average effective life of the aerial cables. In the case of the exchange equipments, witness said there was an average effective life of 15 years allowed in the case of central battery exchanges. In the case of magneto exchanges of more than 300 lines, the effective life allowed was 10 years, and for magneto exchanges of under 300 lines also 10 years, but with a residual value. The witness observed that succeeding witnesses might be able to make this table, and that dealing with subscribers' apparatus, plainer than he could do. By following the process of equation previously pursued, he adopted an age of 6·6 years for these exchanges. In the case of subscribers' instruments and apparatus, witness said the conclusion he arrived at was that the effective life was 9·5 years, and the age 4·3 years, instead of 6·6 years as suggested by the company, a conclusion which was in the company's favour. The total estimated cost of construction being £11,617,166, which reduced by £92,000 odd, the value of plant not within the contract of purchase, reduced the cost of the purchaseable plant to £11,524,539. Witness estimated the actual value of the plant at £7,005,851. He had found as the result of experience that the existing scrap value of a plant bore a ratio of from 60 to 63 per cent. to the price of construction. In the case of conduits, Witness said there was no scrap or residual value, the cost of recovery being greater than the gain. In the case of cables, he made an allowance of 32·4 per cent. of salvage value, and that was actually arrived at by Mr. Callender, the cable manufacturer. The Witness went into many others of the subjects, contrasting the residual values allowed by the Post Office with those estimated by the company, but

Mr. Forbes Lankester pointed out that there could be no real comparison, the company taking residual values at the end of the physical life of the plant, and the Post Office basing its estimate on the "effective" life.

Sir A. Cripps asked Witness whether he estimated that a system like that of the National Telephone Co. could be laid down and brought up to its present condition in two years?—Witness replied that if a catastrophe destroyed the whole system to-day, he thought it would be quite possible to recreate the system, and connect up the subscribers in two years. He agreed, however, with Mr. Gill's figures that 12 years would not be an unreasonable time for substituting the system and starting it with its existing subscribers. The problem he had to deal with, was the replacement cost of something which already existed.

I will not argue that now, but in the event of an earthquake destroying the system, if you had all the labour in this country sufficiently skilled to deal with matters of this kind, you could not as an actual possibility put up a system under a period much longer than two years?—I am advised that it could be done. From investigations we have made, we believe that in two, or at the most in three years, we should replace the system.

His Lordship: Would the two years involve working night and day?—Witness replied that that was a question which could be better answered by another witness.

Further questioned by Sir A. Cripps, Witness admitted that he had not ascribed any particular time required by the consulting engineer in preparing plans, &c., for the 98 centres in different parts of the United Kingdom. He did not think the preliminary work would take more than two years.

Sir A. Cripps: Supposing the consulting engineer had no knowledge of who the subscribers were likely to be, how long would he take then?—I cannot answer.

A scheme like the company's system, said Counsel, could only be built up over a long period of years, and it was utterly impossible to suggest that a contractor could build it up in two or three years, or any definite period of time.

The Attorney-General suggested, when the Court resumed on Monday, July 29th, that at the conclusion of the day's proceedings the Court should adjourn until after the Long Vacation. There was a good deal of matter, he said, for inquiry, and many figures had to be calculated. The adjournment would be a great convenience to the parties.

Sir A. Cripps agreed, and said it would be impossible to conclude the cross-examination of Mr. Snell before the Long Vacation.

Mr. Justice Lawrence said the Court would consent to the proposal.

Sir A. Cripps asked that proceedings should be resumed on October 15th.

Mr. Justice Lawrence: We will fix the date for resuming on the promise that the parties, in the meantime, put their heads together and try to shorten matters.

Sir A. Cripps: I hope that, after the holidays, the spirit of conciliation will develop.

Mr. Snell, further cross-examined, gave greatly detailed evidence with regard to a number of contracts for trenching, piping, &c., and the prices for the work in its different branches.

The Court adjourned as stated.

Marconi's Wireless Telegraph Co., Ltd. v. United Wireless Telegraphy Co.

Mr. Colefax before Mr. Justice Parker in the Chancery Division mentioned this action, the parties having come to terms.

The action he said was brought for an injunction in respect of alleged infringement of patent, but the parties had agreed and there should be judgment for the plaintiffs upon certain terms.

Mr. Gray appeared on the other side, and his Lordship made an order as arranged.

A Broken Car Axle.—The rolling stock superintendent of an electric tramway frequently has cases brought under his notice which call for a certain amount of ingenuity in coping with them, and very often the incidents which give the most trouble arise from very simple causes. An instance of this sort of thing occurred in connection with the axle of a single-truck car which broke about 6 in. from the wheel boss. The cause of this was very simple. A-⅝ in. hole had been drilled in it in order to secure a pinion to the axle for driving the compressor for the air brake, and this hole had made a weak spot in the axle, and subsequently a fracture occurred across the point of weakest cross-section where the hole was situated. The failure of the car in this way caused traffic on the line to be held up, and it was necessary to remove the car as quickly as possible. In doing so the following method was adopted:—First of all, the inspection traps inside the car were taken up and a heavy plank was laid along the car floor. A small ratchet screw jack which was kept for the purpose was then placed under the motor on the broken axle and the motor was lifted to a distance of about 2 in. When this had been accomplished the motor was then fastened to the plank with a chain sling, so that the plank took the weight of the motor off the axle, and this allowed the wheel to run freely on the rail. The short end of the axle was then secured by jacking up the truck frame and inserting a block of wood between the axle box and the horn stay. When this had been done, the car was returned to the depôt. When towing a car in this way, should the car have a broken axle, great care should be taken when approaching points and crossings in order to see that the loose wheels take the right track. It is also extremely probable that the wheels may jam on a sharp curve, and in order to overcome this difficulty, it is necessary to apply a little grease to the wheel flanges. The incident narrated above shows how necessary it is to exercise due circumspection when it is proposed to make any addition to the structure of a tramcar, inasmuch as the whole trouble would have been prevented if the axle had not been deliberately weakened by the insertion of a hole which it was never intended to receive

PROCEEDINGS OF INSTITUTIONS.

Recent Advances in the Measurement of Light and Illumination.

By J. S. Dow and V. H. Mackinney.

(*Abstract of paper read before the* Optical Convention, *June*, 1912.)

Perhaps the most interesting feature of the progress of the past 10 years has been, not so much the actual advance in the construction of apparatus, as the change in the view-point from which measurements of light have been regarded. There has been a growing recognition that the measurement of light and illumination is not only of considerable industrial consequence, but a fairly simple and feasible process in the hands of others besides the expert. For practical purposes the actual illumination in a room, on a table, desk, or paper is often of much greater importance for the layman than a knowledge of the amount of light given by the lamps employed. Determinations of the illumination on a table or desk, for example, enable us to judge whether the light is sufficient for reading, in a school or library, or for some industrial process in the factory. They also afford a ready means of comparing the concentrating power of different kinds of shades and reflectors, and have many other subsidiary uses. In practice the chief requirements in an instrument for the measurement of illumination are that it should be compact and portable, easy and quick to manipulate, sufficiently accurate for practical purposes, and readily set right should the reading, for any reason, vary in course of time. For the great majority of practical purposes an accuracy of 5 or 10 per cent. is ample.

In 1909 the authors had the pleasure of describing a compact and portable instrument for measuring illumination before the Optical Society. This has since been improved and remodelled, and is now known as the "Holophane Lumeter." The most novel feature is that it can be used not only to measure illumination, but also surface brightness. The general appearance of the instrument (which is only $5\frac{3}{4}$ in. × $4\frac{1}{2}$ in. × $1\frac{3}{4}$ in.) is shown in fig. 1, and the details in fig. 2.

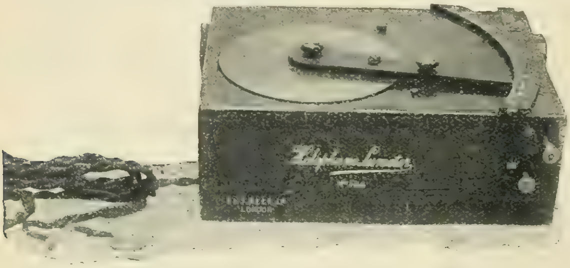


Fig. 1.—The Holophane Lumeter.

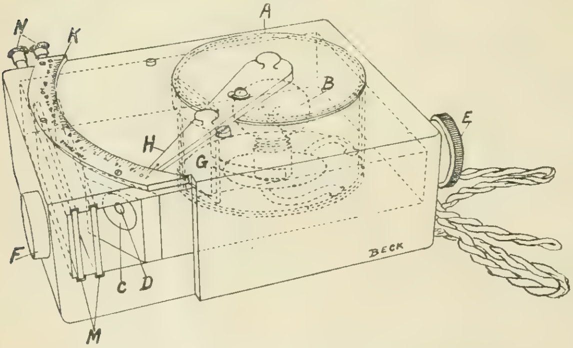


Fig. 2.—Diagram showing Construction of Lumeter.

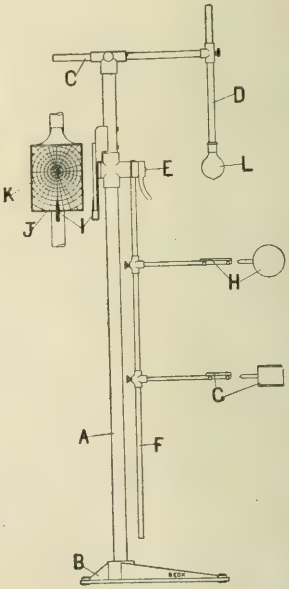


Fig. 3.—Polar Curve Apparatus.

The small glow-lamp B is enclosed in a cylindrical chamber, whitened inside and uniformly illuminating the rectangular aperture G, which is covered by a ground opal glass plate. This plate in turn acts as a source of light and illuminates the photometric screen C. The lid A is attached to a cylinder fitting concentrically round the chamber, and having cut in it an aperture of special shape. As the pointer H is revolved this adjustable shutter covers the source G to a greater or less extent, and varies the illumination of the photometric screen C accordingly. By moving the pointer across the scale the illumination is reduced uniformly from 2 foot-candles (with the aperture fully open) to 0·2 and then to zero.

In using the instrument the observer points the instrument at the surface whose brightness he wishes to study, and places his eye at E, at the same time pressing the contact at the base of the instrument and lighting the lamp. He then sees through the central aperture D in the illuminated surface C the surface to be tested, and adjusts the pointer until photometric balance is secured. The reading can then be observed on the scale in foot-candles. The screen C is made by covering a glass surface with a very fine white emulsion, scraping away the centre, and then protecting it by a covering glass. In this way a screen which cannot be soiled or scratched by contact with the fingers is obtained, and, the emulsion being very thin, an exceedingly fine line of photometric division can be obtained. The makers, Messrs. R. & J. Beck, Ltd., have now succeeded in preparing very sensitive screens of this kind.

In order to increase the range of the instrument, recourse is had to two dark glasses (shown at M) reducing the light to $\frac{1}{10}$ and $\frac{1}{100}$ respectively. These can be placed in the path of the rays from the object studied by pulling out the knobs N. By this means the reading can be multiplied by 10, 100 or 1,000, so that values up to 2,000 foot-candles can be measured.

The small lamp used in the instrument is fed from a four-volt accumulator packed in the case of the instrument, and the whole can be carried about as easily as a small hand camera. The instrument can be be set to read correctly, by reference to a given illumination, by simply adjusting the position of the lamp slightly. When measurements of illumination, as distinct from surface brightness, are to be made, all that is necessary is to observe the brightness of a standard mat celluloid screen supplied with the instrument, and this is also used in calibration. An interesting point which almost invariably occurs to people unfamiliar with the instrument, is the effect of the distance from which the illuminated object is observed. Within practical limits this is immaterial, since the amount of light entering the eye and the area of the retinal image both diminish inversely with the square of the distance. No appreciable difference due to this effect will be observed in measurements of illumination in a room. It should, however, be borne in mind that the area of surface included within the aperture in the field of view of the instrument, is greater with increasing distance; consequently, if the surface examined is not uniformly bright, one would expect this to be recorded on the instrument.

A useful addition for daylight measurements is a small cap provided with a special yellow Wratten gelatine screen, which makes the transmitted light identical to the eye with daylight, and so removes the difficulty experienced by many observers in comparing sources of light which differ in colour. For relative measurements (such as mostly occur in daylight work), the amount of light absorbed by this screen may be ignored. It is, however, quite easy to determine the approximate absorption and allow for it when absolute measurements are desired.

Measurements of illumination in practice enable the lighting engineer to verify his calculations, and to demonstrate to consumers the effect of a certain change in their installation. It is not uncommon to meet consumers whose personal impression leads them quite astray in judging an alteration of this kind, their views being based on examination of the apparent brightness of the lighting units rather than the actual working illumination provided. By the aid of a simple measuring instrument, the engineer has little difficulty in showing that the recommended form of shade and reflector leads to an increase in the illumination in desirable directions. In cases in which the present installation clearly gives too low an illumination, a measurement tells him how much it must be increased, and what types of lamps and fixtures ought, therefore, to be introduced.

Some authorities assert that illuminants should be so screened and shaded that their brightness should not exceed 2—3 C.P. per square in. of radiating area, while others would place the limit even lower. A surface brightness of 2,000 ft.-candles is equivalent to about 4½ C.P. per sq. in., and a brilliancy not exceeding this figure could, therefore, be measured by our instrument.

In connection with industrial processes, again, it is a great advantage to be able to measure illumination in any plane, and even in places which are only accessible with difficulty. In many cases this can be done easily with an apparatus utilising a separate test-plate. The standard screen can be readily placed at any point where it is desired to take a measurement and observed from a distance. When it is only desired to obtain relative values and to determine surface brightness, it is not necessary to do even this, since one has only to point the instrument at the object to be examined.

The facility to measure illumination and surface brightness carries with it the possibility of determining the relative reflecting power of a surface. All that is necessary is to measure the surface brightness at a given spot, and then to place the white celluloid test card in position and measure the illumination. A simple calculation shows the relative reflecting power of the surface, as compared with the test card. This method can be readily applied to the wall papers in any room lighted by natural or artificial light, and the following table, showing the results obtained in four typical rooms, may, perhaps, be of interest :—

Reflecting Power of Wall Papers.

(*From actual Results obtained in Rooms lighted by Tungsten Lamps.*)

Nature of room.	Paper.	Surface brightness (foot candles).	Illumination (foot-candles).	Reflecting power.
Drawing room	Light blue	0·3	0·72	40 %
Hall	Dark red	0·15	0·6	25 %
Library ...	Deep green	0·15	1·0	15 %
Dining room	Very deep blue	0·015	0·35	4·5 %

It may be mentioned, in passing, that, as a result of experiments in many different schools, libraries and private houses, a surface brightness of 0·3 foot-candles seems to be about what is usually needed to give a room a cheerful appearance. In some cases, however (*e.g.*, in a library), a more subdued effect is preferred, and walls with a surface brightness of only 0·1 foot-candles may be found.

It may be observed that the reflecting power of coloured materials depends to some extent on the quality of light by which they are illuminated, and the same results will not be secured by natural and artificial light. This fact has been recently utilised by Mr. T. E. Ritchie, of the Union Electric Co., as a means of testing the resemblance of various artificial illuminants to daylight. A series of ribbons of delicate shades of colour was prepared, and the reflecting power of the series tested with the holophane lumeter by good average daylight. The tests were subsequently repeated with a series of artificial illuminants, and it was found that the closest approximation to the daylight values occurred in the case of indirect arc lighting.

The same appliances which serve for the measurement of reflecting power can also be used to measure the absorption of glasses, gelatines and solutions. An interesting case has come to our notice in which the reflecting power of the powder, as measured by the holophane lumeter, was utilised as an index to the quality of a certain class of coal.

During the last few years it has come to be generally recognised that it is not sufficient merely to state the intensity of a source in a certain direction, or even to give its mean spherical candle-power. It is also most important to show how the light is distributed, especially as the natural polar curve of light distribution from an illuminant can now be modified very greatly by the use of suitable globes and reflectors. The tendency is illustrated by the great variety of holophane prismatic globes and reflectors which enable the distribution of light from a lamp to be entirely altered—either a "spreading" or a "concentrated" effect being obtained, as local conditions demand.

The authors have recently devised an apparatus to facilitate the determination of such polar curves.

The apparatus is shown diagrammatically in fig. 3. It is mounted on a substantial base B; the lamp to be tested L is attached to an adjustable rod D, which can be moved up and down or to and fro. When more powerful lamps are to be tested, it may be desirable to remove this arm (which can be done by means of the sliding piece C), and to hang the lamp from the ceiling. In any case the lamp is brought central with the point E (corresponding with the centre of the polar curve paper shown at K). The rod F rotates about E, and carries the standard celluloid surface G, the distance of which from the lamp tested can be adjudged. As F rotates, therefore, the face of G is always presented vertically towards the lamp L, and its brightness will be proportional to the candle-power of the lamp in that direction. There is also a pointer I rigidly connected with F, which rotates with it and indicates on the sheet of polar curve paper the angle with the vertical which F takes up. This paper is arranged to be a convenient height (about 5 ft.) from the ground.

The operation of testing the lamp is as follows: A lamp of known candle-power is first placed in position. The standard surface G is observed through the holophane lumeter, and its distance on the rod is adjusted until the reading of the instrument is some convenient submultiple of the known candle-power in that direction. (For example, if the candle-power were known to be 16, the reading on the instrument might conveniently be 1·6 foot-candles.) G is then clamped in position, and the lamp to be tested is substituted for the standard lamp.

The arm F is then rotated, the brightness of G being noted in each case, and the corresponding candle-power marked on the polar curve paper opposite the pointer. The curve is thus traced out at once, while the experiment is in progress, and there is no need for subsequent calculations.

When great accuracy is not necessary it might even be possible to use this apparatus in rooms which have not black walls, and in which there is a certain amount of stray light. Under these conditions we make use of H, which is an adjustable black screen, and which can be inserted in any convenient position between the lamp and G. If, therefore, there is any question of the readings being affected by stray light, a reading is taken first without H in position. The brightness of G is then proportional to the illumination due to the lamp tested plus the stray light (if any). The screen H is then inserted, blocking out the direct light from the lamp tested. The brightness of G is now due to stray light only. Hence, by subtracting the latter reading from the former, we get the true value, *i.e.*, reading without dark screen—reading with dark screen = true candle-power.

Experience has shown that in the case of a simple source of light it is possible to repeat the curves obtained by an ordinary bench method with extreme accuracy. In the case of focusing forms of reflectors, however, one precaution is necessary, *i.e.*, to arrange for the distance between the illuminated photometrical surface and the source of light to be the same in both cases, as results depend to some extent on the distance at which the tests are made.

It is, therefore, desirable to adopt some standard of distance of testing such as 10 or 12 ft., this being the nearest equivalent to the distance at which the light would be required as a rule in practice.

In the case of apparatus of the type shown in fig. 3, it is difficult to make the rotating rod long enough to secure a distance of 10 ft. This difficulty can, however, be readily obviated by replacing the celluloid sheet by an inclined mirror and directing the beam on to the test screen at any required distance.

The peculiar advantages of the combination of this form of polar curve apparatus with the holophane lumeter have been described above. The saving in time is often remarkable, owing to the facts that a reading with the holophane lumeter is obtained more quickly than one on a photometrical bench, and that the results are expressed direct in candle-power, without any complicated calculations. Not infrequently a complete curve has been obtained in from 5 to 10 minutes.

Some experiments have also been made on a new form of portable standard of light. It consists essentially in a low-voltage tungsten lamp which is fed by a portable accumulator. A mounted celluloid screen attached to a graduated metal tape is also provided in the case, and the screen can thus be set up any desired distance from the small tungsten lamp, which acts as a secondary standard, and any desired illumination produced.

The most novel part of the apparatus is the means employed of maintaining the voltage across the standard tungsten lamp constant. This is accomplished as follows. A small carbon-filament lamp is run in parallel with the tungsten lamp, and in series with both is placed a suitable adjustable rheostat. Between the two lamps is placed a specially designed form of photometric screen by the aid of which their intensities can be compared.

The action of this part of the apparatus depends on the fact that any change in the P.D. supplied by the cell affects the two lamps unequally, and therefore puts the screen out of balance.

When using the apparatus the operator first regulates the resistance in such a way that the metallic-filament lamp gives some convenient light, say, 1 C.P., by comparison with a suitable standard in the laboratory. He then alters the position of the comparison carbon-filament lamp until the photometric screen appears to be in balance, and clamps the lamp in this position. The standard is now ready for use, and the position of the comparison lamp should not be altered until it eventually becomes necessary to set the standard once more. Should the voltage of the cell fall at any time, this will affect the lamps unequally, and the changed conditions are made evident. By readjusting the resistance he can secure photometric balance once more and bring the standard back to its original candle-power. A similar adjustment can be made should the voltage of the cell be abnormally high owing to its having been recently charged. The standard will, therefore, always give the same light, provided the lamps themselves do not alter. As, however, it is intended that this should be used as a "reference standard" only, so that it should be unnecessary to run the lamps for more than a minute or two at a time, such a change should only take place very gradually.

With the three appliances—the lumeter, the polar curve apparatus and the portable standard of light—one should be able to carry out practically all the operations undertaken in the ordinary laboratory, with the additional advantages that the work can be done quicker, that the apparatus is portable and can readily be removed from one room to another, and that illumination measurements can be made outside the laboratory.

Ogmore Valley Electricity Supply.—The Electric Light and Power Supply Co., Ltd., has applied to the B. of T. for permission to erect overhead lines for the transmission of current at a minimum pressure of 2,500 volts for the purposes of supply under the Electric Lighting Order of 1900.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Bastian Portable Meter.

Station engineers and contractors often experience a difficulty in effecting the purchase or hire of the many electrical appliances on the market for cooking, heating, &c., owing to the consumer being unable to obtain energy at power rates unless he goes to the expense of separate wiring. This difficulty may be overcome by using the new Bastian portable sub-meter (Mounsdon patent), which is constructed so that it can be carried about from one room to another, and connected in series with whatever appliance is to be used, by the usual plug and socket. The units recorded on the portable meter are deducted from the total consumption as shown by the fixed master meter, and charged for at the reduced rates. This meter should prove to be invaluable to salesmen of small electrical appliances, as it removes the consumer's chief objection. It is suitable for direct current only, as is the case with all Bastian meters, and is supplied by the Bastian Meter Co., Ltd., Bartholomew Works, Kentish Town, N.W.

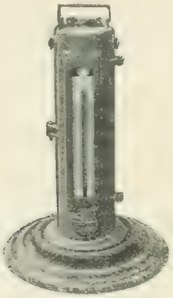


Fig. 1.—Bastian Portable Meter.

An Eye Magnet.

A Swiss oculist, Dr. O. Haab, professor at Zurich University, has entrusted the Oerlikon Machine Works with the construction of a special magnet for extracting magnetic particles from the eye, which is illustrated herewith. An undoubted advantage of this electromagnet is the use of a pedal for completing the circuit, thus leaving both hands of the oculist free to handle the patient. This also dispenses with the necessity of removing the magnet from the eye when discontinuing its action, as even with the best suspension imaginable the heavy mass formed by the magnet and its windings cannot possibly be removed quickly. Another important feature is the form of the pole-piece used for extraction. The magnetic strength of this pole is the higher the more completely it is enclosed by the windings. As, however, the field of operation should not be hidden by the pole-piece, a suitable compromise must be found between the two opposing desiderata.

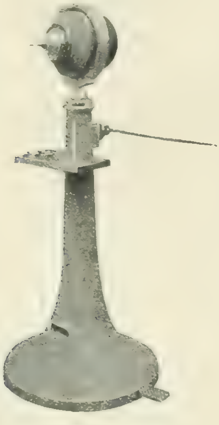


Fig. 2.—Eye Magnet.

Dr. Haab's eye magnet is a bell magnet, only one pole of which is destined for the extraction of fragments. This pole has the shape of a rectangular cone, and the adjoining part of the winding also has this conical shape, thus leaving on all sides a free field of vision as far as the point of the magnet. The shape of the points screwed on the working pole can be adapted to the necessities of each case (fig 3).

The other pole is bell-shaped, the iron surrounding the greater part of the windings, so as to protect them against mechanical damage. This form also has the advantage of greatly increasing strength of the magnet, and, generally speaking, of reducing the region traversed by the flux outside the apparatus.

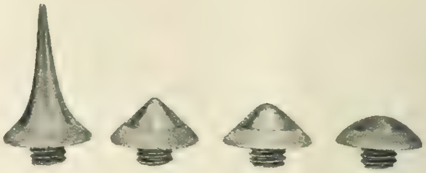


Fig. 3.—Set of Points.

The electromagnet is free to rotate round a hollow cast-iron pillar fitted with castors. A shelf arranged slightly above the middle of this pillar allows the patient to rest his arm, so as to keep the head in a position as steady as possible.

By pressing the pedal, the circuit is closed through a two-pole switch, and as soon as the foot is removed, this switch is brought back by a spring into its initial position. Thanks to the relatively low current density in the copper, the windings are not heated to any material degree. The attraction exerted by this electromagnet is much stronger than that given by most other devices of a similar kind. The magnet obviously lends itself also to the removal from other parts of the body of iron filings and other magnetic fragments, and therefore will be used to advantage in the sick-rooms of large metallurgical works.

Indirect Lighting in Industrial Premises.

The British Thomson-Houston Co., Ltd., Rugby, have recently developed a line of indirect lighting fittings, which, while giving the same efficient lighting results as their well-known "Eye-rest" system, are less elaborate and expensive, and consequently are more suitable to industrial conditions. These fittings consist of a plain metal bowl with an internal reflecting surface of high efficiency, suspended by chains from a ceiling plate (fig. 4). The lamp is placed vertically inside the bowl, and the light is thrown on to the ceiling, whence it is reflected downwards. The fittings are supplied in both extensive and concentrating types, and in three sizes, to take a 60-watt, 100-watt or 300-watt Mazda lamp.

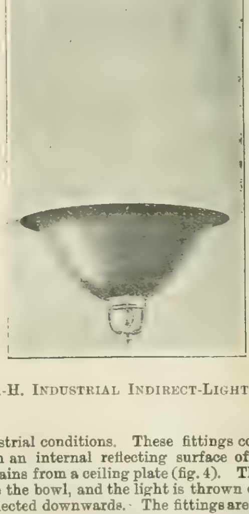


Fig. 4.—B.T.-H. Industrial Indirect-Lighting Fitting.

BUSINESS NOTES.

Book Notices.—*Réception des Signaux Radiotélégraphiques transmis par la Tour Eiffel.* Paris: Gauthier Villars. Price 1 fr. 75 c. This small book is issued by the Bureau des Longitudes, which originated the idea of transmitting time signals from the military wireless station of the Eiffel Tower, and in view of the proved utility and wide appreciation of these signals, has felt it desirable to facilitate their reception. The first two chapters of the book are therefore devoted to a detailed explanation of the various receiving systems suitable for the purpose, the apparatus employed, and the mode of transmitting and receiving the time signals, which will shortly be brought up to an accuracy of ½-second. Improvements are being made in the Eiffel Tower installation, and a "musical spark" will shortly be substituted for the present type of signal, which will facilitate reception in spite of external disturbances. The remaining chapter deals with the methods which have been evolved for the comparison of time at different places, by means of the system of coincidences, to an accuracy of $\frac{1}{100}$ second, for astronomical purposes, &c. The book is written in lucid language, with good illustrations.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Speciales." June, 1912. Liége: The Association. Price 75 cents.

"The Physical Review." Vol. XXXV, No. 1. July, 1912. Lancaster, Pa.: The *Review* Offices. Price 60 cents.

"Universal Directory of Railway Officials, 1912." London: The Directory Publishing Co., Ltd. Price 10s.

Stoker Contracts.—Among the orders recently received by the Underfeed Stoker Co., Ltd., for stokers are the following:—

		Class.
City of Birmingham, Summer Lane Electric Station	7	E.
Central Argentine Railway	26	E.
Battersea Borough Council	1	E.
Borough of West Bromwich Electricity Department	2	E.
Eastbourne Corporation	1	E.
Adelphi Hotel Extension, Liverpool	1	E.
Steel Co., of Scotland	1	E.
Calcutta Electric Supply Co.	4	E.
Leidon Electricity Station	2	A.

Ball Bearings.—We understand that the demand for "Hoffmann" ball bearings, which are made at Chelmsford, has now reached very large dimensions, and in addition to those employed in motor-cars, machine tools, woodworking, textile and electrical machinery, large quantities of these bearings and steel balls are regularly exported, their good qualities enabling them to overcome the extremely high tariffs which now prevail in many countries.

The B.T.-H. Fire Brigade.—We learn that at the National Fire Brigades Union, Midland District, Annual Competitions which were held at Dudley on July 20th, the B.T.-H. Fire Brigade were successful in gaining a prize in every competition. They were second and third in the two Hose Cart Competitions respectively, and won the steamer drill out-right, after tieing with Cape Hill F.B. for first place. By their successes in these competitions, the B.T.-H. Fire Brigade have now won at one time or another every trophy presented for fire brigade drills in the Midland District Competitions, except the Mitchell Challenge Shield for manual drills, for which they do not enter. Over 20 Midland fire brigades were represented in the competitions.

Bankruptcy Proceedings.—Thomas Hugh Parker, consulting engineer, 18, Regent Street, London, S.W.—The first meeting of the creditors of the above was held on the 19th inst. at the offices of the Official Receiver, 132, York Road, Westminster Bridge, S.E. Mr. E. W. J. Savill presided, and reported that no statement of affairs had been filed, owing to the indisposition of the debtor. The latter wished to submit an offer of 7s. 6d. in the £, and the meeting was, therefore, adjourned to enable the scheme to be brought forward. It appeared that, in 1897, the debtor was one of a syndicate which was formed to promote the manufacture of motor-cars. He was appointed managing director, but the business was eventually sold, and he received £600 for his share of the concern. Subsequently he was in employment, but in June, 1905, took offices for himself, first in Piccadilly and then in Holborn. He designed and patented an electrically-wound clock, and obtained orders for them at £75 each. Several of the customers complained, and he returned to each about £15 per clock. The manufacturers of the clocks obtained judgment against him in the Clerkenwell County Court, but on an appeal to the Divisional Court that finding was reversed. The manufacturers took the matter to the House of Lords, where the finding of the Court in his favour was upheld. Although he won the action, he estimated that his law costs amounted to about £1,000. He had also patented other inventions, including a carburettor and a method for steering vehicles. A company, with a capital of £12,000, was formed to exploit these patents, but later went into voluntary liquidation. The debtor alleged that the other directors of the company tried to oust him from the position he held, and as they were unsuccessful, they let the company go to ruin. Last June the debtor entered into partnership to carry on a business as a manufacturing chemist and engineer at East Sheen. When he entered into the partnership, he assigned his interest in the venture to his wife in consideration of moneys he owed her.

Cecil Wray, electrical and mechanical engineer, 16, Chevin View, Eccleshill, Bradford, late 24, Simes Street, Bradford.—An application was made to his Honour Judge Graham, K.C., on July 23rd, sitting at the County Court, Manor Row, Bradford, for the discharge from bankruptcy of the above debtor. Mr. W. Durrance (the Official Receiver) said that the debtor's statement showed ranking liabilities, £1,508, but the proofs and probable claims not yet admitted amounted to £1,609, while the assets, which were estimated to produce £147, had only produced £6 10s., the difference being accounted for by the fact that the household furniture was covered by a bill of sale, that the stock-in-trade, which had been valued at £50, had only realised £5, and that book debts of the estimated value of £49, had only realised £1 10s. No dividend whatever had been or could be paid to the creditors. The debtor had commenced business as an electrical engineer, but neither that nor a subsequent business had been successful. He was now in receipt of about £160 a year as manager of a business. The Judge consented to give judgment for £100, of which £25 was to be paid down, and the balance by weekly instalments of 15s. spread over a period of two years.

Harry Ernest Scarborough, electrical and mechanical engineer, 33, Hampden Place, Halifax, Yorkshire (late trading in partnership with Frederick Leopold Woilliard-Rigg as Woilliard Scarborough & Co.), late Wade Street, Halifax, Yorkshire. An application was made at the Court House, Prescott Street, Halifax, on July 29th, for the discharge from bankruptcy of Harry Ernest Scarborough. His Honour granted the application subject to a payment to the creditors including costs, of £36, to be paid within a year.

Fred Shaw, electrical contractor, Hessle Road, Hull.—Supplemental dividend of 12s. 6d. in the £ payable August 8th at Official Receiver's Office, York City Bank Chambers, Lowgate, Hull.

Dissolutions and Liquidations.—Durham Collieries Electric Power Co., Ltd.—A meeting of creditors is called for August 2nd, at Basildon House, E.C.

The Black Sea Telegraph Co., Ltd.—This company is winding up voluntarily, with Messrs. A. R. Hardie and W. Hibberdine, Electra House, E.C., as liquidators. The cable between Constantinople and Odessa, belonging to the company, is transferred, under an approved assignment, to the Eastern Telegraph Co., Ltd., and the Indo-European Telegraph Co., Ltd., in equal moieties.

Halpin's Patent Thermal Storage, Ltd.—This company is winding up voluntarily, with Mr. S. V. Tiddy, 5, Coleman Street, E.C., as liquidator. A meeting of creditors is called for August 2nd at 5, Coleman Street, E.C.

May-Oatway Fire Appliances, Ltd.—A meeting is called for August 29th at 22, Paul Street, Finsbury, E.C., to hear an account of the winding up from the liquidator, Mr. E. W. Elliott.

J. G. Childs & Co., Ltd., Willesden Green.—Date of release of liquidator (Mr. H. de Vaux Brougham) July 22nd.

National Lighting Corporation, Ltd.—Date of release of liquidator (Mr. H. de Vaux Brougham) July 22nd.

Trade Announcements.—Mr. H. Bevan Swift has removed to larger premises at 15, Great Sutton Street, Clerkenwell. The business of the Dallett Electric Clock Co. is also transferred to the same address.

Owing to increased business the Brilliant Arc Lamp and Engineering Co., Ltd., have removed to larger premises at Actinorae Works, Oaklands Road, Cricklewood, where in addition to their ordinary manufactures, they also do electrical and repetition work of any class, including small aeroplane bolts and screws.

The address of Mr. Chas. Pullan is now 21, Union Street, Bradford. Telephone, No. 4,768; telegraph address, "Switch; Bradford."

Annual Holidays.—The "Omega" Electric Lamp Co., Ltd., Palace Works, Crab Tree Lane, Hammersmith, W., state that their factory will be closed from Monday, August 5th to Saturday, August 10th, both days inclusive, for the annual holiday.

The works of the Langdon-Davies Motor Co. will be closed from to-day, Friday, until Monday, August 12th. A small staff will be at the offices, 110, Cannon Street, E.C., to deal with correspondence.

The works of the London Brass and Aluminium Die Casting Foundry, 90-92, Banner Street, E.C., will be closed from to-night till Monday morning, August 12th.

Messrs. Chamberlain & Hookham, Ltd., Solar Works, Birmingham, announce that their works, test rooms and offices will be closed from to-morrow, August 3rd to August 10th inclusive. A small staff will deal with urgent correspondence only.

The works of the London Electric Firm, Croydon, will be closed from to-morrow, August 3rd until August 12th, inclusive. A small staff will deal with urgent business.

The Cable Accessories Co., Ltd., of Tipton, are closing down from to-morrow, August 3rd, until Monday morning, August 12th, for the "national holiday week."

Messrs. Ramsden, Camm & Co., Ltd., of Brighouse, announce that their works will be entirely closed from the evening of Friday, August 9th, until the morning of Monday, August 19th for the local holidays. The offices will be closed on August 12th and 13th only.

Patent Restoration.—An order has been made restoring Patent No. 1,146, of 1902, granted to Chas. Vincent Potter, for an improved solution to be used in and process for the separation of metals from the sulphide ores.

Meter Approved.—The B. of T. has approved of the B.T.-H. single-phase two-wire A.C. prepayment meter, type R.P. deposited in March last by the British Thomson-Houston Co., Ltd., of Rugby.

Wiso Water-Softening Apparatus.—Messrs. Wiso, Ltd., of 66, Victoria Street, S.W., are makers of water-softening apparatus from the little plant of 5 gallons per hour capacity to the big plants for hotels and industrial purposes. In the small sizes of the Wiso apparatus the supply comes in under the control of a ball valve and enters a float chamber, so arranged that as the float rises it lifts a valve, and a quantity of water is allowed to run out of the float vessel through a siphon overflow. The escaping water has a double outlet, of which one is small and adjustable. This portion of the supply is sent to the base of a lime vessel, where it is saturated with lime, and the clear supernatant lime water at the top of the lime vessel overflows and passes down into the mixer vessel with the larger division of the water.

Thus each discharge of water from the measuring tank is separately and equally limed. The float movement serves to work an agitator at the foot of the lime vessel and keeps it in a state of agitation sufficient to ensure the taking up of lime by the freshly supplied water. The mixed stream descends a pipe to the bottom of the mixer vessel, where the softening action is perfected, and deposit of the removed lime carbonate takes place. This deposit is very perfectly sedimented. The overflow of this vessel then flows to the filter tank to remove any remaining crystals, and the water is ready for use. The filtering material may be wood wool or sharp sand, or other approved material. The apparatus seen by us at work did its work well and was simple in construction. It works on the Clark process, which may be generally formulated as $Ca\,CO_3 + CO_2 + Ca\,O = 2\,(Ca\,CO_3)$. The caustic lime, which is the soluble chemical employed, takes up the carbonic acid from the calcium bicarbonate which is dissolved in the water, reducing this to insoluble monocarbonate and itself becoming an insoluble monocarbonate, or $Ca\,CO_3$.

The process is one of those exchanges of bases which are so usual in commercial chemistry, and the results are excellent and productive of great economy in industrial works, saving soda and soap, and in the art of dyeing producing colours of richer and fuller intensity.

Japan.—The Korean Government contemplate in their Budget for 1912-13 the acquisition of new passenger and goods wagons, engines, and the electric lighting of the principal express trains.

A New Scheme for Buenos Ayres.—The Compana Italo-Argentina de Electricidad is the title of a new company which is to be formed at Buenos Ayres, principally with Italian capital, for the purpose of supplying electricity in Buenos Ayres and suburbs. Similar schemes have previously been brought forward at different times, but they never seem to reach the stage of realisation, as it is unlikely that a competitive undertaking could prosper in Buenos Ayres in rivalry with the gigantic enterprise of the German Transmarine Electricity Co. in the city. Apart from the exceptionally large lighting load, both for public and private services, the latter also supplies the extensive network of tramways with power on the basis of contracts which are operative for many years, and the cost of production on the whole business has been reduced to a level which is said to be impossible of attainment by any possible competitive undertaking.

"Exide" Battery Plates.—We recently gave some particulars of the large battery, stated to be the largest in the world, installed by the Electric Storage Battery Co. for the Consolidated Gas, Electric Light and Power Co., of Baltimore, U.S.A. This battery is fitted with "Exide" plates, which are manufactured in this country by the Chloride Electrical Storage Co., Ltd., of Pendlebury. The "Exide" plate has shown itself to be well suited to "stand-by" battery work, a class of service which is extending, and likely to increase in favour in the future.

Catalogues and Lists.—The Pyro Boiler Cleaning Co., 37-39, Essex Street, London, W.C.—Pocket pamphlet relating to their apparatus for the removal of boiler scale.

Messrs. Schoen Bros., 29/30, Cock Lane, Snow Hill, London, E.C.—40-page catalogue containing illustrated particulars and prices of a variety of electric bells and bell material, lighting brackets, pocket and hand lamps and other novelties and accessories.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—32-page price list (D5) containing illustrations, &c., of a variety of shades and reflectors in glass, metal and silk. In addition to the ordinary types of glass shades, a selection of bead and lustre shades is shown, the latter being specially effective when used in conjunction with massive fittings. High quality cut-glass globes and pines are listed in a number of patterns, together with lantern globes and well glasses for outside fittings. Silvered glass and mirror reflectors for shop window lighting are illustrated, and in the section dealing with silk and linen shades there are exclusive artistic designs for many classes of fittings. There is no advance of prices.

The Brilliant Arc Lamp and Engineering Co., Ltd., Oaklands Road, Cricklewood, London, N.W.—Ten-page pamphlet, containing illustrated descriptions and prices of the Brilliant enclosed, Brilliflamme long flame, and the "Actinoræ" photographic arc lamps; also a 12-page pamphlet, entitled "Artificial Light in the Studio," giving particulars of the firm's lamps, stands, reflectors and screens, and hints on arranging the studio and using the lamps.

LIGHTING and POWER NOTES.

Ascot.—Owing to the increasing demand for current, the Ascot District Gas and Electricity Co. are laying feeder and pilot cables from their Sunninghill works to a point near Ascot grand stand, the distance being upwards of a mile.

Belfast.—At a special meeting of the Tramways and Electrical Committee on Monday last, held for the purpose of considering the reports of Mr. S. L. Pearce, of Manchester, the following points in his report were discussed and recommended to the City Council for approval:—(*a*) That it is inexpedient to attempt at the present time to supplement the total power at the East Bridge Street station by replacing any of the older high-speed engine sets with steam turbines, or by installing new steam plant on the vacant land. (*b*) That such portions of the vacant land as are available at the existing power station be held for further developments. (*c*) That negotiations be immediately opened for the purchase of a site on which to erect a second power station, which should be available for service by the autumn of 1914. (*d*) That the ultimate capacity of the new power house should not be less than 24,000 H.P., generating three-phase alternating current at 6,500 volts for transmission to sub-stations, there to be transformed and distributed either in the form of A.C. or D.C., as the exigencies of the localities may require. (*e*) That in view of the present knowledge and experience with the Diesel engine, the first instalment of the plant at the new power station should be of the steam turbine order.

Bradford.—The T.C. has been recommended to install additional converting plant at the Valley Road Electricity Works, at an estimated cost of £6,235.

Brighton.—The T.C. has decided to reduce the price of energy supplied to large business premises using not less than 15,000 units per annum to 3d. per unit, the same price to be applicable to high candle-power metallic-filament lamps for outside lighting.

The Council has also decided to supply electricity to the new cold storage to be erected in Russell Street at a standing charge of £80 per annum, plus ·61d. per unit metered, the demand to be 40 KW. There is provision for an increased charge if coal exceeds 17s. per ton, and it is estimated that the revenue to the Council will be about £400 a year, exclusive of the income from lighting, for which energy will be supplied at current rates.

Bushey.—The U.D.C. has consented to Watford U.D.C. supplying current to the premises of Messrs. Blyth & Platt, Ltd. Greatham Road.

Chester-le-Street.—The B.G. has decided to engage an electrical engineer to prepare specifications, quantities, and estimates for lighting by electricity the workhouse, infirmary, and other buildings. At present gas is used.

Chile.—The Ministry of the Interior has granted to Don Pablo Fabre a 10 years' concession for the installation of electric generating plant and the distribution of electrical energy in Curacautin.—*Board of Trade Journal.*

Chingford.—The Works Committee of the Metropolitan Water Board reports having had under consideration the question of the motive power to be provided for the temporary purpose of pumping from foundations, and for the permanent purposes of operating the coal elevator and air compressor and lighting the pumping station and the road leading thereto from Enfield Lock, and has come to the conclusion that, subject to satisfactory arrangements being made, electrical energy would be the most suitable power to adopt. The works are within the area of supply of the North Metropolitan Electric Power Supply Co., and that company is prepared to provide and erect the requisite cables, plant and apparatus, at a cost of £840. With respect to the supply of electrical energy, the terms upon which this can be supplied depend to some extent upon the granting of concessions which the company seeks from the Board for the laying of an electric main through the Board's land. After considerable negotiations, the Committee has decided to grant an easement on certain terms, and that electrical energy should be supplied to the Board on the following conditions:—(1) The contract to be for 21 years, determinable by the Board at the end of 7 or 14 years. (2) The maximum supply the Board may demand not to exceed 50 KW.; the company to be notified six hours beforehand if the Board require to use extra power between the hours of 3 p.m. and 11 p.m., during the months from October to March. (3) The charge to be one penny per unit, subject to a minimum payment of £10 per quarter whether energy to this value is consumed or not.

Clayton-le-Moors.—The U.D.C. has entered into an arrangement with the Accrington Electricity Committee, relative to the lighting of Whalley Road, under which the latter agrees to install and maintain 18 100-C.P. lamps, at £3 15s. per lamp per annum.

Continental Notes.—Germany.—The Prussian Waterway Administration proposes to obtain water from the rivers Lippe and Weser for meeting the requirements of the Rhine-Hanover canal. In order to prevent interference with shipping on the Weser in periods of low water, two reservoirs are being built to furnish the compensation water, one on the Eder, near Hemfurt, and the other on the Diemel, near Helminghausen. The construction of the dams will render available considerable power as a result of the delivery of the compensation water to the Weser, and the Waterway Administration has come to the conclusion that the power should be utilised for the production of electricity in State works and the energy furnished to a number of neighbouring towns for industrial purposes. Water-power belonging to the State is also accessible on the Werra and Fulda and a third power station is, therefore, held in prospect at Munden. It is estimated that the three stations would be able to yield 41,000,000 KW.-hours per annum. The scheme contemplates the erection of six turbine sets of a total of 15,000 H.P. on the Eder, three of 2,400 H.P. on the Diemel and six of 4,000 H.P. at Munden. The total expenditure is computed at £365,000, of which £85,000 would be required for high pressure mains in the chief districts to be supplied.

An unusually large electrically-operated crane—it having a lifting capacity of 250 tons—is at present being constructed by the Deutsche Maschinenfabrik Gesellschaft, of Duisburg, for the shipbuilding yard of Messrs. Blohm & Voss, of Hamburg.

It is announced that an English syndicate has secured a concession from the Government of the Grand Duchy of Luxembourg to utilise the water power of the Haute-Sûre. It is proposed to construct a "barrage" about 150 ft. high near Insenborn, which would create an artificial lake 11 miles long and render about 6,000 H.P. available, which will be utilised in the generation of electrical energy for lighting and power purposes.

Coventry.—The E.L. Committee has decided to apply to the L.G.B. for sanction to a loan of £20,000 for the extension of mains. Guarantees having been received from residents at Longford, an outlying district, the extension of mains to that district is to be proceeded with; mains will also be laid to supply the Centaur Road and Spon Street Council Schools. The Committee is also asking the Council to confirm recommendations for the extension of the office accommodation at the works and for two additional sub-stations, the cost of these to be paid out of revenue. The Committee has been approached by the Tramways Committee regarding an additional power supply for the tramways, which have just been taken over by the city authorities. It has been decided to submit a proposal to supply direct current at 500 volts to the tramways at the lowest price for the time being charged to any consumer, the necessary converters to be provided at a cost of £3,800 out of the profits of the electric light undertaking.

Deal.—The T.C. has been informed that a prov. order for electric lighting is to be applied for by a private company. Powers have already been obtained by a syndicate, but have not yet been put into force.

Derby.—The E.L. Committee of the T.C. has reduced the charge for cooking and heating purposes from 1½d. to 1d. per unit, and has decided to supply apparatus on hire at an annual rental of 10 per cent. of the cost. The charge for energy for electric signs has been reduced to 2½d. per unit.

The mains are to be extended to the premises of Messrs. John Smith & Co., Ltd., and to the Baseball Hotel, Shaftesbury Crescent.

Dublin.—Mr. Patrick Moore, clerk of works to the South Dublin Union, has estimated that the introduction of electric light into the workhouse will, at the end of 12 months, have saved about £900. The premises were first lighted electrically on January 8th last, and the cost of the intervening half-year works out at a figure which is less by £433 than the gas bill (for lighting purposes only) paid by the Board of Guardians for the corresponding six months of 1911. The installation was carried out by a German firm of electricians, who allege that they lost £1,400 on the contract, owing to a mistake in their original estimate.

Ealing.—The borough electrical engineer has been instructed to go into the question of the existing machine switchboard with a view to its replacement by a new switchboard capable of dealing with the output of the station for some years to come.

Epsom.—A L.G.B. inquiry was held last week to consider a loan of £3,721 for purchasing a Diesel engine, and £500 for extending mains to Ewell. The Epsom and Ewell Gas Co. opposed the application.

Gillingham (Kent).—The Kent Education Committee has accepted the offer of the T.C. for electricity for lighting the County School for Girls.

Greenock.—The Port Glasgow and Greenock authorities recently came to an agreement under which the latter were permitted to provide electricity to power users in Port Glasgow for a period of 30 years. It is now stated that the Board of Trade, when approached for power to carry out the agreement, replied that their sanction would be given on condition that should application be made within a reasonable time on behalf of a public company to supply Port Glasgow with electricity, Greenock must give way, and allow their service plant to be taken over at a valuation, all disputes being settled by the Board's arbiter. A deputation from the Greenock Electricity Committee will ask the Board of Trade for a modification of the conditions.

Halifax.—The accounts of the electricity department for the year ended March 31st, show a total income of £42,783, and working costs £21,528; after deducting capital charges there remained a net surplus of £2,199. The units sold amounted to 6,256,583, and the maximum demand was 3,034 KW. The renewals fund stood at £3,802, and the reserve fund at £1,241.

Heckmondwike.—The U.D.C. has received a communication from the L.G.B., stating that the Board proposes to defer consideration of the Council's application for borrowing powers in respect of its electricity undertaking until the audit of the Council's accounts has been held.

Hereford.—A L.G.B. inquiry was held on July 24th into the application of the T.C. for a loan of £1,000 for public services for two years. There was no opposition.

Ipswich.—The report of the engineer and manager, Mr. F. Ayton, on the working of the electricity supply department for the year ended March 31st, shows a total revenue of £21,485, working expenses £12,951, interest and sinking fund £6,187, and special charges £1,281, leaving a net surplus of £1,066, which has been placed to reserve. The charge for energy supplied to the tramway department having been reduced, the revenue from this source was £348 less than it would otherwise have been. The special charges included the purchase of meters, conversion of 50 street lamps from gas to electric lighting, and the wages of permanent staff engaged upon work chargeable to capital account. Mr. Ayton deals at length with the reserve fund, emphasising the immense importance of such a fund to an electricity supply undertaking, in view of the rapid developments in electrical practice, and points out that some of the original generating plant will have to be scrapped within a few years to make way for larger and more efficient sets. The reserve fund, in his opinion, ought not to be allowed to fall below 10 per cent. of the capital expenditure. The revenue from electric supply has increased by over 28 per cent., compared with the previous year, and the working expenses by 15¾ per cent.; the revenue from power supply alone (excluding traction) has increased by 88½ per cent. The installation department has received a total income of £3,728, showing a net profit of £66. The capital expended on rental wiring now amounts to £2,608. The units sold for all purposes were over two millions.

Kingston-on-Thames.—The T.C. Lighting Committee will shortly advertise for tenders for the following items sanctioned by the L.G.B.: Generating plant, fuel pipe, fuel tanks, extensions to sub-stations, &c., £10,327; engine-room extension, £1,459; new switchboard, £864. The L.G.B. condemn the existing high-pressure board as out of date and dangerous, and state that a stand-by switchboard is unnecessary.

At the T.C. meeting last week, lengthy correspondence was read regarding alleged preferential rates granted to Mr. Frank Bentall, a local draper, who has a contract for lighting at 3·1d. per unit till April, 1913, and afterwards at 2·8d. until April, 1916, Mr. Bentall agreeing to pay a minimum sum of £2,300 during the period of the contract. For a substantial day load for his basement, Mr. Bentall has the use of 20 meters free. A rival trader avers that, if he had the same terms, he would pay £82 a year instead of £150, and that the preference accorded Mr. Bentall is equivalent to a ½d. rate. After discussion in camera, a resolution of confidence in the Lighting Committee was confirmed in full Council, though it was admitted that the motion originated with the Committee itself. The town clerk justified the special terms by reference to Sections 19 and 20 of the Act of 1882, and cited Clause 46 of the Kingston Lighting Order, 1891, which permits meter rents to be charged by agreement. In view of eventualities, Mr. Bentall is contemplating the possibility of installing his own generating plant.

Lancaster.—The T.C. has decided to extend the mains from High Street to Dallas Road Council School, which is just approaching completion.

On being informed that the coal contracts were £500 up, Councillor Bland suggested that they should harness the Lune and get water power.

Leicester.—The Tramways and Electricity Committee of the T.C. recommends that a prov. order be applied for respecting the rural parishes of New Parks, Oadby, Evington Humberstone and Birstall.

Leigh.—The annual report of Mr. A. T. Smith, engineer and manager, to the Electricity Committee for the year ended March 31st, shows a revenue of £8,637, working costs £5,137, and gross profit £3,500, compared with £3,641 last year. After paying capital charges there was a net surplus of £507. The units sold increased by 13 per cent. to 1,028,430, and new plant recently installed is showing much more economical results. The load factor was 22·4 per cent., the highest yet recorded, the power output being three times that for lighting.

London.—BETHNAL GREEN.—In order to meet the requirements of persons residing in portions of Bethnal Green contiguous to the Borough of Stepney, it is proposed that the Stepney Borough Council should take advantage of Sec. 3 of the London Electric Supply Act (1908) by laying cables and spare ducts along Cambridge Road from the boundary to Patriot Square, and along Green Street to Poplar boundary, and also in any other street within these limits. Cables suitable for D.C., 3-wire 480-240-v. supply and for three-phase, 4-wire A.C. supply are to be laid, and under the proposed agreement the Stepney Council is to proceed in all respects as if it were the undertaker under the Bethnal Green order. The Bethnal Green Borough Council is to have the right at any time to terminate the agreement upon its being in a position to give the necessary supply and upon paying the cost of mains, services, meters, &c., laid down under the proposed scheme.

The question as to what arrangements should be made for the supply of electricity to the borough was once more before the Council on July 25th, when, after a protracted discussion, the whole matter was again referred back. In 1899 the B.C. obtained a prov. order (which precludes private companies from undertaking the work of supplying the borough with electricity), it being the intention of the borough to make some arrangement for a municipal supply. Time went on, and nothing was done, until the B. of T. intimated to the Council their desire to meet a deputation from that body. To that deputation the B. of T. insisted upon the importance of the Council giving immediate effect to the prov. order. Thereupon the Council engaged the services of Mr. J. F. C. Snell, to prepare a scheme for the supply of electricity to the borough, and as a result of his report (which appeared in these columns on July 5th), the Electricity Committee recommended the acceptance of a proposal of the Stepney B.C. to supply electricity in bulk to Bethnal Green. After a discussion which covered a very wide ground, Councillor Brooks moved that the whole matter be referred back, in order that information as to details of the arrangement with Stepney might be obtained. Personally, he would like Stepney to come in and take over the whole work, and, if there were any profits, take those profits. The Town Clerk, in answer to a question, said the Board of Trade had told the deputation in effect that they must insist on the importance of Bethnal Green giving immediate effect to their provisional order. There was also an application from Shoreditch under the Electric Light Act of 1908, and the Board intimated that the Act was to enable a neighbouring authority to deal in a provisional way with the supply of electricity on the border of a neighbouring area when application was made, but it was clear that the Board would not sanction any Council making a general use of the provisions of the Act for the purpose of supplying in a general way anyone in the neighbouring borough irrespective of locale. It was necessary, the Town Clerk added, that the Council should come to some conclusion. A vote was taken, when the amendment was defeated, but a division being claimed, the amendment was carried by one vote, the chairman exercising his vote.

HACKNEY.—A loan of £16,400 is to be taken up from the L.C.C. for a period of 50 years. Mains are to be extended in various parts of the district at an estimated cost of £426. The Electricity Committee reports having been in negotiation with the National Electric Construction Co. as to the terms upon which the Council's opposition to the company's Bill should be withdrawn. The object of the company in promoting the Bill was to legalise the agreement entered into in 1901 by the Council, which enabled the company to provide and fix wires and fittings on premises of the Council's consumers, receiving, as rental, 5½d. per lamp per quarter. The agreement did not prove satisfactory in working, and it was terminated by the company on September 26th, 1903, except as to work already done. Before and after the last-mentioned date disputes had arisen between the company and the Council as to the interpretation of the agreement, and as to the liability of original consumers who were parties to the agreement, and of new consumers who were not. The Council had always contended that the rental was only payable so long as the installation was in actual use; but the company had, on the other hand, contended that the original consumer at least was bound to pay the rental whether the installation was in use or not. As a result of negotiations the Committee has been able to come to terms, which it thinks will place the Council and the consumers under more satisfactory conditions. The company are now prepared, in consideration of their agreement being confirmed, to adopt the Council's view as to the interpretation of the clause relating to the method of charging, and it is suggested that a supplementary agreement be entered into providing for the confirmation of the original agreement as regards work already done on September 26th, 1903, in consideration of the company agreeing that the sum payable to them under the original agreement shall be payable only while the installation is in actual use, and upon such number of lamps as shall from time to time be agreed to be used, either by the consumer signing the agreement, or successive consumers who were not parties thereto. On the execution of the agreement the company will delete from their Bill all reference to the Council or to the principal agreement. An agreement on these lines has accordingly been prepared by the town clerk.

WOOLWICH.—The Electricity Committee has received a letter from the L.C.C. informing it that in view of the London Electric Supply Acts, 1908 and 1910, under which the County Council is constituted the purchasing authority of the undertakings of the companies supplying electricity in London, the Council has appointed a Special Committee to consider and report to it on the question of the supply of electricity in London, in the light of the present situation. In the course of the inquiry, the letter continues, the Committee will necessarily have under consideration the possibilities, from the point of view of bulk supply, of each of the existing undertakings, and it thinks that, before arriving at any conclusion under this head of the inquiry, it would be of advantage both to the Council and to the several supply authorities in London, if an opportunity were afforded the separate supply authorities to discuss the possibilities of their individual undertakings with the Committee. With this object in view, the letter concludes by asking the Local Committee to appoint a representative to meet the Supply Committee on a date to be mutually arranged. The Electricity Committee is in agreement with this proposal, and has appointed Mr. W. H. Dawson and the borough electrical engineer. The electricity mains are to be extended at an estimated cost of £190, subject to protective conditions.

L.C.C.—Consequent upon the decision of March last to discontinue the running of Blackwall Tunnel generating station, taking supply from the Poplar Council and the South Metropolitan Electric Light and Power Co., by which a saving of £1,900 per annum will be effected in the maintenance of the tunnel, steps are now being taken with regard to the staff of the station. Employment for all but three of the 15 men whose services must be dispensed with has been found. These three have been offered work at rates of pay closely approximating to their present wages, but, for various reasons, it has been declined, and their cases are still receiving consideration. Messrs. H. H. Evans, engineer, and F. J. Butler, foreman, have been appointed electrical wiremen and fitters. Two switchboard attendants will be wanted at the tunnel, but this matter is to be reported upon later.

Newport.—The accounts of the electricity undertaking for the year ending March 31st show a loss of about £2,000.

New Zealand.—According to an Australian contemporary, a scheme for electricity supply and dust-destructor plant has been prepared for the Oamaru Council, and in consequence a scheme for gasworks extensions stands over for a time.

Nottingham.—After considering the reports of two independent experts, Messrs. B. M. Jenkin and W. H. Patchell, on the best means of improving the plant at the electric generating stations and obtaining more economical and efficient working, the Electricity Committee has come to the conclusion that it is desirable to install at St. Ann's power station an exhaust steam turbo-generator with condensing plant, at an estimated total cost of £17,140, which it is proposed to take from the reserve fund of the electricity undertaking.

Paisley.—The accounts of the Electricity Department again show a deficit (£143). The department has done better than last year, and but for the coal strike would have closed the year with a surplus. The estimates for coal this year are £1,277 higher than those of last year, and unless there is a fresh demand for energy there will be a debit balance of about £700 for the current year. During the year 2,930,775 units were sold, an increase of fully 19 per cent. Energy supplied to the tramways was fully 3 per cent. over that of the previous year. There is an increase of 50 per cent. under private lighting, power and heating, while the quantity used for public lighting is about 2 per cent. less. Although a fifth more electricity had been produced, the costs (apart from coal) were lower by £886 than in the previous year.

Plymouth.—The revenue account of the electricity undertaking for the year ended March 31st showed an income of £28,028, compared with £27,025 in the preceding year. The working expenditure amounted to £14,664, leaving a gross profit of £13,364, as against an expenditure of £14,208 and gross profit of £12,817 the previous year. The gross profit was applied as follows:—Dividends and interest, £4,644; stocks and mortgages redemption, £3,942; and repayment of loans, £1,320, leaving a net profit of £3,458, of which £2,071 was spent on mains, &c., £1,251 transferred to district fund in aid of rates, and £135 placed to reserve fund. In the previous year the net profit amounted to £2,969, of which £1,797 was spent on mains and £1,170 applied in relief of rates.

Runcorn.—The work of carrying the high-pressure overhead electric cable from the Mersey Power Co.'s Works at Weston Point across Frodsham Marsh to Helsby has been completed, and the current has now been switched on at the Helsby works of the British Insulated and Helsby Cables, Ltd.

A circular has been issued to ratepayers by the Clerk to the R.D.C. in which it is stated that "recognising the advantages of a public supply of electricity in the district, the R.D.C. (through the Stockton Heath Parochial Committee) had approached the Mersey Power Co., Ltd., who have Parliamentary powers, authorising them to supply current in the rural districts of Runcorn, and to extend their mains into the neighbourhood at an early date. The extension was under consideration, and should a sufficient demand for power and light be received, the mains would be laid."

Shipston-on-Stour.—The ratepayers having decided in favour of an E.L. scheme, the R.D.C. has given permission for Messrs. Brown & Parsons, of Leamington, to erect standards to carry the wires.

Shrewsbury.—The total income of the Corporation's electric light undertaking for the past year was £7,858, as against £8,262 in the previous year, a reduction accounted for by the reduced price of energy during the twelve months. £2,200 was spent on the undertaking on capital account, and the sinking-fund contribution was increased from £2,445 to £2,575.

South Africa.—In the course of his speech at the meeting of Messrs. A. Goerz & Co. held at the end of June at Johannesburg, the chairman, Mr. M. G. Elkan, as reported in the *South African Mining Journal*, said: "The electrification of a large number of plants on the mines, in anticipation of the power to be supplied by the Victoria Falls and Transvaal Power Co, was completed early last year; unfortunately, however, the Power Co. was delayed for various reasons, the chief among which was the foundering of a steamer carrying considerable quantities of machinery, which it took many months to duplicate. The supply now obtained from the completed stations is giving general satisfaction, and an additional power station is in course of erection at Vereeniging, which is expected to be in full working order towards the end of this year, while the station at the Simmer Pan is going to be further increased—such increase will, however, only be completed during 1913. From the experience gained so far, I think I am right in saying that no doubt exists in anybody's mind as to the great savings to be obtained from the use of purchased electric power, as against steam power raised by the mines themselves, either when it is a question of equipping a new mine or any existing mine with a long life before it.

South Shields.—Mr. H. S. Ellis, borough electrical engineer, in his report on the fifteenth year's working of the Corporation's electricity undertaking, states that after meeting all statutory charges. the surplus amounted to £2,195, an increase on the previous 12 months of £780. Revenue from private lighting had increased from £12,412 to £13,110 during the past three years, and owing to the high efficiency and long life of the latest types of metal-filament lamps they could look forward to a continued increase of revenue. Revenue from power supply was £5,936, as against £4,662 in the previous year. while the total sales for traction were £5,918. The revenue for the year was £27,834, and the expenditure £13,666, leaving a gross profit of £14,168. For interest and sinking fund £11,973 was required, leaving the net balance above mentioned, which Mr. Ellis recommended should be added to the reserve fund, bringing that up to £10,078, equivalent to 6·1 per cent. of the capital spent on plant of a depreciative character. Mr. Ellis refers to the desirability of establishing a show-room for the latest electrical accessories for various domestic purposes, and he states that a sub-committee has this matter under consideration.

Southampton.—The Electricity Committee has decided to put *bonâ fide* clubs on the same basis for the supply of energy for lighting as private consumers, *i.e.*, the charge after the first 50 units being reduced to 2½d. per unit.

Stoke-on-Trent.—The T.C. has offered to provide a three-phase stand-by supply of current to the Shelton Iron, Steel and Coal Co., Ltd., when the new plant and mains are ready, on an agreement for payment of standing charges at the rate of £300 per annum, and for energy consumed upon the consumption rate in force.

U.S.A.—According to a Press report the town board of Miller, Ill., ordered the electric light to be turned off recently because of the visit of millions of fireflies. They decided that the flies furnished enough light.

Wakefield.—The report of the city electrical engineer, Mr. H. A. Nevill, for the year ending March 31st, states that the great change in the methods of charging adopted during the year has proved satisfactory; the income per unit sold has fallen from 2·279d. to 1·757d., but the total costs have also dropped, from 2·334d. to 1·666d., showing now a profit of 0·091d., compared with a loss last year of 0·055d. New plant has been installed, which will further reduce the cost of production. The gross income was £13,604, working expenses £7,767, and net profit, after deducting capital charges, £695; last year there was a loss of £213. The capital expenditure amounts to £95,499, and the reserve fund to £303. The number of units sold was 1,857,186, an increase of 22·4 per cent.; the power connections amounted to 2,100 H.P. The price of lighting supply was raised in 1910-11, but the diminished consumption resulting has almost neutralised the gain, and Mr. Smith is of opinion that the former price (4d. per unit) should be restored.

Wellingborough.—The U.D.C. has decided to ask the Electric Supply Co. if they are prepared to sell their undertaking to the Council, and if so at what price.

Weston-super-Mare.—The Electric Supply Co., Ltd., has reduced the price of energy supplied to the U.D.C. for lighting to 4¼d. per unit, less ¼d. per unit discount. For energy for the Milton sewage pumping station the price has been lowered to 1½d. per unit.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramway accounts show a total revenue of £77,180, the highest figure ever obtained, and an an increase of £3,710 over the preceding year. The surplus of £11,158, the largest ever recorded, is an increase of £3,554 over last year. £6,262 has been placed to the renewal account, and the remaining £4,396 carried to reserve account.

Algeria.—Plans are being prepared in respect of a projected electric tramway in the town of Bone.

Australia.—Reuter states that, with the assistance of the Federal Arbitration Court, and as the result of a conference between the parties, the dispute between the Melbourne Tramway Co. and its employés has been amicably settled.

The preliminary steps to the purchase of the Perth tramways has been taken by the Western Australian Government. The purchase price is £475,000, and the agreement is only waiting for the ratification of the shareholders.—*Australian Mining Standard.*

Birkenhead.—The manager of the Corporation Tramways (Mr. W. Wyld) in his report shows a net profit of £2,478 on the year's working, compared with a loss of £115 last year. Traffic receipts were £59,282, an increase of £2,565, and the total income from all sources reached £60,151, an increase of £2,489. Working expenses increased by £707 to £36,314, which left a gross profit of £23,836, an increase of £1,782. Interest on capital accounted for £11,856 and instalment to sinking fund, &c., £9,500. The net gain has been placed to renewals account, which now amounts to over £15,000, equivalent to 4 per cent. of the total capital outlay. The increase in passengers numbered 633,600. The average consumption per car-mile for traffic purposes was 1·96 units. The percentage of working expenses to receipts was 60·37 (1911—61·75); average working expenses per car-mile, including power cost, 7·11d. (1911 [illegible])

A conference between the Mayor of Wallasey and other members of his Council and representatives of the Birkenhead civic authorities was held on July 24th relative to the provision of improved communication between two boroughs by means of tramways. The reports of the respective engineers were considered, and after some discussion it was decided not to proceed further in the matter at the present time. It was considered that the least costly scheme proposed at the meeting would involve an expenditure of something like £200,000, and the time was not thought opportune for such a commitment.

Blackpool.—At a meeting of the Tramways Committee, on July 25th, Mr. Furness (manager) presented the following figures:—From April 1st to July 18th the total receipts were £23,561, an increase of £3,656—remarkable in view of the threatened boycott of the cars. The greatest increase, one of no less than £2,561, was on the circular route, the receipts being £2,787, against only £226 last year. The receipts per car-mile on the circular route amounted to 2s. 7⅜d., and the passengers were 212,883. The passengers carried on all routes during this period totalled 3,431,968.

Bradford.—A report presented to the City Tramways Committee by the manager, Mr. C. J. Spencer, on the effect of the institution in the city of ½d. fares in the early mornings during May and June, shows that the actual decrease in receipts is £7,606, with an increase in mileage of 124,574, the cost of which was computed at £3,620, making a total increased cost to the department of £11,226. Mr. Spencer feared that the cost would probably be still more, as, according to the traffic chart, the early morning traffic was not being catered for as it might be. Comparisons with last year show that the decrease in receipts before 9 a.m. has been almost exactly balanced by the natural increase of traffic after 9 a.m. In connection with transfer tickets and return tickets, Mr. Spencer drew attention to the possibilities of fraud in that system.

Continental Notes.—Russia.—The grounds of the Polytechnic Institute, in St. Petersburg, are now being utilised for the purpose of making experiments on a large scale with currents at very high pressure, and the trials are to be continued in the winter. The tests, which are said to have already resulted in the attainment of a pressure of 250,000 volts, are being conducted at the order and expense of the Minister for Communications, who has under consideration the question of converting to electric traction the railways centring in St. Petersburg. The capital lies within reach of four supplies of water power. The Narvas waterfall is situated 92 miles distant from the Baltic Railway; and the Imatra in Finland, the Kiwatch near Petrosavodsk, and the Volchoff waterfalls are located 155 miles from the capital. The use of the last mentioned is held in prospect in the first place, whilst the others would be drawn upon as occasion might arise.

France.—A scheme is at present under consideration for the construction of an electric mountain railway between Chamonix. Mer de Glace and Le Convercle (Haute Savoie).

Coventry.—The Tramways Committee of the T.C. has decided to apply for a loan of £20,475 for the purchase of 10 tramcars, the construction of additional passing places and overhead electric signals, extensions of sheds and stores, cables, &c. The B. of T. has sanctioned a loan of £220.538 for the completion of the purchase of the tramway undertaking.

Dutch East Indies.—A project is on foot for the construction of an electric tramway in Sourabaya, designed to connect the town with the harbour.—*Board of Trade Journal.*

Edinburgh.—A report has been submitted by the burgh engineer as to the self-propelled cars running between Morecambe and Heysham. The Edinburgh Town Council desires to develop tramway transit in and about the city, but considers the laying of additional cable lines too costly. Electric trolley tramways and railless cars are under consideration. The Edinburgh burgh engineer is impressed with the feasibility of the self-propelling system. The track is an ordinary tramway; the gradient is fairly steep, and the cars are of the single-decker, closed-in type, capable of seating about 34 persons. The motive power is derived from a petrol engine, and is transmitted directly from the engines to the axles. The burgh engineer has conferred with the designer of the petrol-electric mechanism as applied to the newest type of motor-'bus in London, and the designer is sanguine that the application of the petrol-electric system would result not only in the same economy of working cost, but in greatly reduced vibration and increased comfort of travelling by a car propelled on this system. It is stated that the cost of a car would amount to about £1,100, as compared with an electric car of about £650; but against the difference is the saving in the fitting up of overhead electric equipment, viz., £1,500 per mile of track, and, further, there would be no central generating station. As regards the Morecambe car, the cost of actual running is about 1d. per car-mile for power. The report has been continued for further consideration.

Holywell.—An inquiry has been held here by the Light Railway Commissioners into the application of the Mid-Flintshire Light Railway Co., Ltd., for an order for the construction of a line of light railway, about 11 miles long, at an estimated cost of £100,000.

Ipswich.—The report of the engineer and manager of the tramways, Mr. Frank Ayton, for the year ended March 31st, shows a total revenue of £22,939 and working expenses £16,861; after deducting capital charges, there remained a profit of £294, of which £117 was appropriated for the cost of fitting meters on the cars. With the aid of a contribution of £2,100 from the rates, the deficit of £1,222 from the previous year was liquidated, and the sum of £1,054 was carried forward. The use of meters on the cars has reduced the energy consumption 10½ per cent., and an appreciable reduction of wear on motors, brakes, &c., has also been observed. The passengers carried numbered 5½ millions: car-miles run, 662,792; units used per car-mile, 1·007.

Leeds.—The Corporation has under consideration a scheme for a 2-mile extension of the Pudsey section of the tramways.

London.—L.C.C.—The recent tramway report shows a serious decrease in traffic receipts, which is largely attributable to the great increase in the competition of other means of locomotion during the past 18 months. The heaviest tramway traffic is carried during the early morning, late afternoon and early evening. Much of this traffic is carried at very unremunerative workmen's fares (in some instances averaging 1d. for 9 miles journey). At present tramways are not allowed in the most profitable traffic areas, but motor omnibuses and tube railways for the most part operate on routes where there is a large amount of all-day traffic.

With a view to removing these obstacles to the more profitable operation of the tramways and to increasing the value to the public of the system as a whole, the Highways Committee proposes the following tramway schemes to be introduced in the next Parliamentary session:—

Marble Arch to Cricklewood (7 m. 5 f., conduit and overhead, £125,294).

Chalk Farm to Child's Hill (5 m. 4 f., conduit, £114,880).

Gray's Inn Road to Farringdon Road (5 f. 6 ch., conduit, £20,300).

Charles Street to Ludgate Circus (5 f. 6 ch., conduit, £19,055).

Seven Sisters Road to Crouch Hill (1 m. 2 f., conduit, £26,300).

Seven Sisters Road to Stamford Hill (1 m. 2 f., overhead, £22,130).

The subjoined railless trolley schemes are also put forward:—

Mare Street, Hackney to Wick Lane Bridge (1 m. 4 f., £6,270).

Stanstead Road, Catford to Sydenham Station (2 m. 0 f., £11,510).

Sydenham Station to Forest Hill (1 m. 0 f., £2,640).

Sydenham Road to county boundary (1 f. 8 ch., £620).

These estimated costs cover construction and equipment of lines, but not street widenings. The total outlay involved by the proposed 17¼ miles of tramways and 4⅞ miles of railless route, including street widenings, approximates £770,600, the most expensive scheme being that for the tramway from the Marble Arch to Cricklewood. This involves an outlay of nearly half a million, and has already been rejected three times by Parliament, but the route offers a large volume of traffic all day long, and would, therefore, be especially valuable to the Council. No street widenings will be necessitated by the railless schemes, and experience in Bradford and Leeds has shown that trolley 'buses are very suitable for the class of work here concerned.

It is further proposed to secure powers for running tramways across the new St. Paul's Bridge, and constructing a tunnel from the City end of the bridge to Cheapside. This tunnel would cost £86,000, and the Council is willing to give a contribution of £350,000 to the St. Paul's scheme. It has been suggested that the tramway which will cross St. Paul's Bridge should be extended through the City to connect with the northern tramways. A scheme to link up with the tramways in Aldersgate Street would cost £1,631,000, while one for connecting with Goswell Road would cost £1,281,000. These proposals would involve the construction of tunnels large enough to admit double-deck cars, and, for the present, they are to be laid aside on account of their great cost, which would bring up the outlay on the St. Paul's scheme to over £2,000,000. Under the scheme which it is proposed to adopt for getting tramways to Cheapside, a total outlay of £447,000 will be involved; of this £350,000 will be contributed by the L.C.C., only £20,000 of this amount being charged to the tramways account.

The Highways Committee has further considered the question of the working of the tramways from West India Docks to Crossland Road, Hackney, at present worked at a loss by horse-car services. As the Committee cannot obtain the consent of the Stepney B.C. for the reconstruction of the lines on the overhead trolley system, and owing to the extra cost involved by the use of the conduit system, it has been recommended that three horse cars be equipped with petrol-electric propelling machinery at a cost of £2,400. The equipments are to be manufactured by Messrs. W. A. Stevens, Ltd. The work is to be put in hand at once, and the cars will be tried on one of the existing routes, so that the B. of T. may inspect the working of the cars, and indicate whether it is prepared to approve of the adoption of the system for the Burdett Road lines.

Port of London Authority.—The Authority, which has for some time been considering the question of adopting motor ambulances, owing to the fact that the docks controlled by it cover an extended area, has finally decided on electrical vehicles, and has acquired four such ambulances from the Cedes Electric Traction Co., Ltd. The machines are fitted with electric motors built up on the hubs of the rear road wheels, current being supplied by a battery of 44 Tudor accumulators, which give a radius of action of 25 miles at a speed of 16 miles per hour and of 35 miles at 12 M.P.H. Each ambulance is designed to carry two stretchers, and in addition seating accommodation is provided in the interior for three persons. The vehicles, which have been built under the supervision of Messrs. Markham & Prance, who acted as consulting motor engineers to the Port of London Authority, will be stationed at the London, Surrey, Commercial, West India and Royal Victoria Docks, where special garages and battery-charging stations have been established.

Metropolitan Railway.—On July 24th, Lord Aberconway, chairman of the company, laid the centre stone of the new Baker Street station, which will be the chief station of the Metropolitan Railway. Mr. R. H. Selbie, general manager, said that they intended putting in an underground junction which would enable trains from the City to Harrow to cross the up circle line without fouling the track.

East London Railway.—Speaking at the half-yearly meeting the other day, Lord Claud Hamilton said that the electrification of the line was progressing satisfactorily, but he was unable to say when it would be finished. At the three stations—Shoreditch, Whitechapel and Shadwell—the platform was being raised to 3 ft. above the rail level. When the electrification was completed the speed of the trains would be greatly increased.

Middlesex.—The Light Railways Committee of the County Council reports that the lessee company (the Metropolitan Electric Tramways, Ltd.), have intimated that owing to the condition of their rolling stock, and the increase of the car service north of Wood Green, further car-shed accommodation is required in or near that district.

Newport.—The accounts of the Corporation tramways for the year ending March 31st last show a profit of £1,300.

Plymouth.—The assessment of the Corporation tramway undertaking has been increased from £3,254 gross to £10,299, and from £1,789 net to £5,208.

South Shields.—The Corporation Tramways Committee has recommended that the tramways be extended to Harton, giving a 20 minutes' service, at a cost of £8,098. The profit on the last year's working of the tramways amounted to £5,663.

Southport.—The Tramways and Electricity Committee has had under consideration the question of the appointment of an expert to inquire into the Corporation tramways undertaking, and has decided to defer the inquiry pending the receipt of the report of Mr. Watson, electrical engineer to the Bury Corporation, on the electricity undertaking.

Stalybridge.—It has been decided by the Stalybridge, &c., Tramways and Electricity Board to alter and increase the fares of workpeople on the Board's cars. Alderman Clark, in explaining the increases, said the tramways had had to be subsidised out of the rates of the four boroughs of Stalybridge, Hyde, Mossley and Dukinfield to the extent of £70,000. Last year the loss was £6,500.

Walthamstow.—A special committee has been appointed to consider the question of providing additional tramway cars.

West Ham.—The report of the manager, Mr. H. E. Blain, for the year ended March 31st, shows that the total revenue was £144,147; working expenses, £104,574; net surplus, £4,509, compared with £8,513 last year, of which £4,082 was transferred to the reserve fund. The car-miles run were 3,287,917, and the passengers carried 41 millions. The energy used per car-mile was 1·69 units. The reserve fund now stands at £41,944. During the year £8,800 has been spent on track maintenance and renewals. The cost of energy purchased from the electricity department, at 0·95d. per unit, was £22,055; on the basis of charge recommended by the Joint Committee of the Municipal Tramways and Municipal Electrical Associations, the price has now been reduced to 0·75d. per unit. The department carries its own risks, and has paid £2,840 in compensation for injuries during the year.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Tests at the Pennant Hills wireless station (N.S.W.) have proved satisfactory. With 70 H.P., the station has succeeded in establishing communication up to a distance of 2,920 miles. It is considered probable that communication may be established at night time between Sydney and San Francisco—a distance of about 6,000 miles.—*Australian Mining Standard.*

City of London.—According to the report of the city engineer, Mr. F. Sumner, to the Corporation, during the year 1911, four miles of disused overhead wires were removed. Private owners of overhead wires in use numbered 135, and the telephone service possessed about 735,824 spans crossing public thoroughfares. Notifications of defective materials, broken wires &c., were issued to owners in 9,030 cases. The Post Office gave notice of intention to open telephone manholes on 4,052 occasions, and laid 464 new services; the City of London E.L. Co. laid 206 new services and constructed 39 new street boxes, and the Charing Cross Co. laid 288 services. The County of London E.S. Co. laid mains from Deptford to City Road, along a total of 1,400 yards in the City; they found the footways so crowded with other pipes and mains that they were compelled to lay their mains under the carriageway. Only 35 out of 100 private clocks fixed above the public ways of the City are synchronised from Greenwich.

Canada.—Arrangements are being made for Mr. Lucas, of the Ontario Cabinet, to study the question of publicly-owned telephones in Great Britain this summer.

China.—It is proposed to establish wireless communication between Pekin and Lhassa, with two intermediate stations, one at Tachienlu and the other at Batang. The establishment of a chain of 12 wireless stations along the entire length of the Chinese coast, from the island of Hainan to the Gulf of Pechili, is also under consideration.

East Indies.—Of the four wireless stations in Dutch India, whose erection was entrusted to the Telefunken Co., of Berlin, those of Sabang (Wé Island) and Sitoebondo (Java) are finished. The installation at Koepang (Timor) was recently begun, while Ambon will shortly be taken in hand. The first named serves shipping alone, on which account it is favourably placed in the traffic-frequented Straits of Malacca; with plant of 2·5 KW. power, a range of 750 km. is attained by day and 3,600 at night. The stations' operations have produced disturbances on the Lodge-Muirhead station at Victoria Point, Burmah, giving rise to protests, with the result that the Dutch Government has ordered that Sabang shall in future work only with 36 per cent. of its power. For the remaining three stations a power equal to 5 KW. is planned; those on Timor and at Amboyna will effect connection with the German-Dutch system. The distances covered will be: Sitoebondo-Koepang, about 1,100 km.: Koepang-Ambon, about 900 km.; and Sitoebondo-Ambon, about 1,600 km. *Zeit. fur Schwachstromtechnik.*

Express Telegrams.—The favourable consideration given by the Postmaster-General to the proposal that express telegrams should be accepted at a special tariff has evoked a protest in the Press from Sir J. C. Lamb, a former secretary of the Post Office, on the score that all telegrams are urgent, and no priority should be recognised save that of receipt. In reply, Mr. F. A. B. Lord writes to the *Times* pointing out that there is an urgent demand, backed by the London Chamber of Commerce, for express telegrams, which already are common practice on the Continent, and have given great satisfaction there; he questions whether ordinary telegrams suffer any appreciable delay through the transmission of express messages, and urges the necessity of greater expedition in many instances.

Germany.—The Telefunken Co., of Berlin, has taken over the high-frequency machine invented by Count Arco, and has erected one at the company's station at Nauen. Although this station is at present equipped with a mast only 250 ft. high, it has been possible to obtain a range of over 620 miles with the use of the high-frequency generator. The erection of a new tower in place of that which was overthrown in March has been begun; it will extend to 670 ft. in height.

Imperial Wireless Stations.—Having received notice of opposition to the agreement between the Postmaster-General and the Marconi Co., the Government has deferred the discussion of the matter till next week.

It appears that the station originally set down for Aden will be erected in British East Africa.

Italy.—The Bill for the improvement of the telegraph service in Italy, introduced last month, contemplates the expenditure of 1,850,000 lire on a variety of objects. Seven new copper and five new iron inland lines are to be established, and two submarine cables laid. The projected new lines include two between Genoa and Spezzia, for the traffic between central and southern Italy, or Piedmont and Lombardy; two others from Genoa to Ventimiglia and Porto Maurizio respectively, to serve the traffic in Liguria; one from Palermo to Messina, and another from Messina to Catania, and a third between Catanzaro and Reggio. A cable will be laid between Naples and Palermo to improve the connection between the Continent and Sicily and Tripoli, and another between Sicily and Calabria.—*Zeit. fur Schwachstromtechnik.*

Wireless Control.—A demonstration was given by Mr. Raymond Phillips at the Coliseum last week, of his system of control from a distance, as applied to an airship, and to musical instruments. It is understood that a new system of selection of signals with the aid of synchronised revolving drums is employed.

Wireless Telephony.—Mr. H. Grindell Matthews recently demonstrated his wireless telephone system before members of the Government, and it is reported that the invention will be tested at the forthcoming Army Manœuvres.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" July 26th.

September 11th.—Telegraph, telephone and electric material for a year, for the P.M.G.'s Department. See "Official Notices" to-day.

September 25th.—Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

October 2nd.—N.S.W. Government Railways. Six 1,000-KW. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Australian Mining Standard.*

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

August 6th.—9,200 yd. of ·2 sq. in. concentric cable, and 2,200 yd. of ·1 sq. in. concentric cable for the Melbourne City Council. See "Official Notices" July 19th.

Batley.—August 23rd. High-tension cables, for the Corporation. See "Official Notices" to-day.

China.—August 13th. High and low-tension sub-station switchgear, for the Shanghai Municipal Council. See "Official Notices" July 26th.

Costa Rica.—December 9th. Tenders will be received for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars of the Secretaria de Fomento, San José.

Dublin.—August 7th. High-tension switchgear and accessories for the Corporation. See "Official Notices" July 26th.

August 7th.—Oerlikon and Westinghouse motors and pumps, for the Corporation. See "Official Notices" July 26th.

Eccles.—Subject to the usual section, tenders are to be invited for four mechanical stokers at the electricity works.

Gateshead.—August 10th. Installation of electrical plant at the new lunatic asylum at Stannington, for the Visiting Committee. See "Official Notices" to-day.

Halifax.—August 5th. Portable X-ray switchboard, &c., for the Guardians. See "Official Notices" July 26th.

London.—L.C.C.—The Fire Brigade Committee is obtaining tenders for a portable set of electric charging apparatus for use in the event of the failure of the public electric supply at any station or in any other emergency. This action is consequent upon the increasing number of electrically-driven motor appliances in use in the Fire Brigade.

It has been decided to provide electrical dischargers at various tramway substations to act as safety valves should the pressure on the high-tension cables rise above a safe limit. Tenders are to be invited forthwith for the necessary spark gaps at the whole of the existing sub-stations, and the most suitable will be accepted during the recess. The cost is to be about £2,200.

Three narrow-gauge electrically-propelled shop trucks and battery charging apparatus are to be purchased (about £570), also wheel-turning lathes, for the central car repair depôt; tenders are to be obtained from selected firms, and one will be accepted during the recess.

Newcastle-on-Tyne.—August 9th. Electric light installation at the workhouse hospital, for the B. of G. G. Walker, clerk, 127, Pilgrim Street.

New Zealand.—August 16th. Electric motor and induced-draught fan for Christchurch City Council. Tenders to City Surveyor. Deposit £5. Copy of specification can be seen at Board of Trade Commercial Intelligence Department, London, E.C.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Roumania.—Giurgevo.—Electric lighting installation for the city. Estimated cost 350,061 fr. Particulars, Conseil Superior Technique, Bucharest.

Shipley.—August 14th. (*a*) One 300-KW. rotary converter with E.H.T. and L.T. switchgear and (*b*) supply and laying of E.H.T. cables, ducts, telephone cables, &c., for the U.D.C. Mr. S. D. Schofield, electrical engineer, Dockfield, Shipley. (Returnable deposit for each contract of £1 1s.)

The U.D.C. has decided to invite tenders for 5,000 tons of engine coal for the Dockfield Works, and also for alternating-current plant.

South Africa.—September 11th. Durban Corporation. One-ton electric storage battery vehicle. A statement on the matter can be seen at the Board of Trade C.I. Department, London, E.C.

Spain.—August 10th. Tenders are being invited by the municipal authorities of Maguilla (province of Badajoz) for the concession for the electric lighting of the town during a period of 15 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Maguilla (Badajoz).

Madrid.—October 22nd. Concession for installation and working of an electric light service for 15 years. Deposit, 5 per cent. of the offer, eventually 20 per cent. Particulars from Hotel de Ville Madrid.

Stockport.—Steel lattice tramway poles and trolley wire, for the Corporation Tramways Committee. Mr. R. Lomax, borough electrical engineer, Electricity Works, Millgate.

Turkey.—CRETE.—October 21st. Tenders will be received at the "Bureau de la Mairie," Canea, for a 50 years' concession to construct and work an overhead system of electric tramways in Canea and the neighbourhood. Copies of the *Cretan Official Gazette*, containing the conditions and further particulars regarding these concessions, may be seen at the C.I. Branch of the Board of Trade, London, E.C.

Warrington.—August 9th. Electric lighting and electric bell installation in the boys' department, Bolton Council School, Latchford. Mr. J. Moore Murray, Education Office, Warrington.

CLOSED.

Australia.—According to the *Australian Mining Standard*, the Newcastle (N.S.W.) City Council has adopted a report by its consulting engineer (Mr. J. E. Donoghue) in regard to the tenders received for condensers :—

Haes & Eggers (a)	£4,150	Fyvie & Stewart (a)	£2,813
,, (b)	5,246	,, (b)	2,263
,, (c)	3,450	Simpson Bros.	2,036
Goodall & Co.	3,836	Belliss & Morcom	1,779
Morrison & Bearby	3,520		

The lowest complete tender as per specification was that of Messrs. Fyvie & Stewart, at £2,263, and this was accepted.

The same exchange reports the placing of the following orders by the P.M.G.'s departments :—

SYDNEY.

1¼ miles cable, paper-insulated, lead-covered, 7 pairs, 12½-lb. conductors, at £60 per mile; 6¼ miles cable, paper-insulated, lead-covered, 26 pairs, 12½-lb. conductors, at £155 per mile; 89 miles cable, paper-insulated, lead-covered, 104 pairs, 12½-lb. conductors, at £352 per mile.—B.I. and Helsby Cables, Ltd.

4¾ miles cable, paper-insulated, lead-covered, 13 pairs, 12½-lb. conductors, at £95 per mile; 2⅝ miles cable, paper-insulated, lead-covered, 39 pairs, 12½-lb. conductors, at £190 per mile.—Western Electric Co. (Australia), Ltd.

23⅝ miles cable, paper-insulated, lead-covered, 52 pairs, 12½-lb. conductors, at £283 per mile; 7⅝ miles cable, paper-insulated, lead-covered, 78 pairs, 12½-lb. conductors, at £294 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

2⅝ miles cable, paper-insulated, lead-covered, 208 pairs, 12½-lb. conductors, at £527 per mile; 7⅛ miles cable, paper-insulated, lead-covered, 260 pairs, 12½-lb. conductors, at £623 per mile; 4¾ miles cable, paper-insulated, lead-covered, 312 pairs, 12½-lb. conductors, at £709 per mile.—Siemens Bros. Dynamo Works, Ltd.

ADELAIDE.

8¾ miles cable, paper-insulated, lead covered, 416 pair, 12½-lb. conductors, at £851 per mile; 440 yds. cable, switchboard, silk and cotton-insulated, 21 pairs of conductors, at £79 per mile; 150,000 paper jointing sleeves, at 2s. per 1,000.—Western Electric Co. (Australia), Ltd.

4⅛ miles cable, paper-insulated, lead-covered, 208 pair, 12½-lb. conductors, at £512 per mile; ¼ mile cable, paper-insulated, lead-covered, 156 pair, 12½-lb. conductors, at £450 per mile; ¼ mile cable, paper-insulated, lead-covered, 156 pair, 20-lb. conductors, at £610 per mile; 3 miles cable, paper-insulated, lead-covered, 104 pair, 12½-lb. conductors, at £307 10s. per mile; 3⅝ miles cable, paper-insulated, lead-covered, 52 pair, 12½-lb. conductors, at £192 10s. per mile; ½ mile cable, paper-insulated, lead-covered, 26 pair, 12½-lb. conductors, at £131 5s. per mile.—W. T. Henley's Telegraph Works Co., Ltd.

600 yd. telephone switchboard cable, silk and cotton-insulated, and light lead-covered, 104 pair, 12½-lb. conductors, for a sum of £142.—B.I. and Helsby Cables, Ltd.

BRISBANE.—

4 nauts cable, submarine telegraph, india-rubber-insulated, at £177 10s. per naut.—W. T. Henley's Telegraph Works Co., Ltd.

The Victoria Government Railways Department has accepted the offers of Messrs. B.I. and Helsby Cables, Ltd., for trolley wire, ears, insulators and other overhead material for the duplication of the St. Kilda-Brighton electric street railway.

Barnsley.—The B. of G. has accepted the tender of Mr. J. Taylor, May Day Green, at £422, for the fitting up of the workhouse premises and infirmary with electric light.

Barrow.—The T.C. on Monday approved the acceptance of a tender of Messrs. Wm. Gradwell & Co., Ltd., amounting to £983, for extensions to the electricity works buildings. The electrical engineer was also authorised to purchase a second-hand two-seater motor-car, for about £75, for the use of his department.

Belgium.—The Belgian Post and Telegraph authorities last week opened tenders for the supply of 25 telephone cables. Eleven concerns, seven German, three Belgian and one British, the latter being the British Insulated and Helsby Cables, Ltd., of Prescot, competed for the contract, the lowest offer being that of the A.E.G. Union Electrique, of Brussels.

Bexhill-on-Sea.—The T.C. has accepted the tender of Messrs. Dinham, Fawcus & Co. for 1,000 tons of Tibshelf peas or Shipley peas for the electricity works, at 18s. 9d. per ton.

Bradford.—The Tramways Committee has accepted the following tenders for the supply of equipment and materials required for 24 new cars :—

Siemens Bros. Dynamo Works, Ltd.—Motors, resistances and circuit breakers, £5,389.
Dick, Kerr & Co., Ltd.—Controllers, £1,152.
J. Rushforth & Sons.—Teak and oak, £576.
Beecroft & Wightman, Ltd.—Ash and birch, £113.
Gabriel & Co., Ltd.—Car fittings, £67.

The tender of Messrs. Taylor Bros. & Co., Ltd., for the supply of 62 chrome nickel steel axles, for £167, has been accepted by the Committee, as also has the tender of Messrs. Cammell, Laird & Co., Ltd., for 200 steel tires, for £307.

The order for the electric lighting of the works of Messrs. Cresswells, Ltd., asbestos manufacturers, Wellington Mills, Bradford, has been placed with Mr. H. Moss.

Carnarvon.—The B. of G. has accepted the tender of Mr. D. O. Evans, of the National Electric Construction Co. for the electric lighting installation at the Workhouse and new Infirmary.

Croydon.—The tender of Mr. Sydney Hunt, at £50, has been accepted by the Croydon Education Committee for the installation of electric light at the South Norwood School.

Derby.—The Tramways Committee of the T.C. has accepted the tender of Messrs. Edgar Allen & Co., of Sheffield, for points and crossings, at £96.

Dewsbury.—The Joint Hospital Board has accepted the tender of Mr. J. T. Foggo, of Dewsbury, for installing electric light at the new diphtheria block, at £39.

Hull.—The Electricity Committee has accepted the tender of Messrs. Siemens, for mains.

Johannesburg.—The Municipality has accepted the tender of the Brush Electrical Engineering Co. for 10 double-deck car bodies and covers.

Kingston-on-Thames.—The following tenders have been accepted :—

Coal (four kinds) till June 30th, 1913.—Wm. Cory & Sons, Ltd., 14s. 9d. to 15s. 11d. per ton.
Building extension foundations at Corporation works to accommodate Diesel engines.—S. Kavanagh, £1,987, accepted after the tender of Powley Bros., at £1,476, had been withdrawn.
Cable, ½-mile ·1 sq. in. low-tension concentric.—Craigpark Electric Cable Co.

London.—HACKNEY.—With reference to the list of tenders given in our last issue, the Electricity Committee recommended at the Council meeting of July 25th, the acceptance of the following tenders where alternatives were mentioned by the engineer :—

Feed pumps.—J. P. Hall & Co., £499.
Coaling plant and bunkers.—W. J. Jenkins & Co., £7,518.
Pipework and valves.—Brightside Foundry and Engineering Co., £3,958.
Travelling crane.—Chatteris Engineering Co., £816.
Turbo-alternator, exciting and condensing plant.—Willans & Robinson, Ltd., (£7,950 plus extras) £8,280.

Messrs. Pooley & Austin have just secured the contract for the supply and erection of plant comprising automatic reversible booster, switchboard, milking booster, automatic battery regulating switch and cables from the Baltic Mercantile and Shipping Exchange, Ltd., St. Mary Axe, E.C.

The Central London Railway Co. has accepted the tender of the Brush Electrical Engineering Co., for the supply of 24 motor cars, 26 motor trucks and 26 trailer trucks.

L.C.C.—The Fire Brigade Committee received the following tenders for electric lighting installation at the Hampstead fire station :—

Barlow Bros. & Co.	(recommended)	£179
E. Lawrance & Sons, Ltd.		180
Lund Bros. & Co.		190
Waring & Withers		196
G. E. Taylor & Co.		197
Foote & Milne, Ltd.		217

Chief engineer's estimate, £175

WOOLWICH.—The B.C. has received the following tenders for the supply of two 500-KW. converters :—

Name.	Efficiency per cent. at load of.					Delivery.	Total amt.	Extra if crane is not available.
	¼	½	¾	Full.	1¼			
Brit. Thomson-Houston, Co.	81·7	88·5	90·75	92·0	92·0	4¾ to 5¼ months	£ 2,967	£ 10
Brit. Westinghouse Co.	81	89·25	92·25	93·25	93·5	24 weeks	3,316	10
Bruce Peebles and Co.	81	88·5	90·5	91	91	18 weeks	3,186	20
Dick, Kerr & Co.*	69·6	79·6	85·5	87·4	87·5	5½ months	3,168	20
Siemens Bros. At R.P.M. 750	79·4	87·0	90·5	91·75	92·3	26 weeks	2,996	20
,, 500	74·1	84·4	88·3	90·25	91·0	26 weeks	3,741	20

* This tender was for motor-generators, and the figures relate to the over-all efficiency.

The tender of Bruce Peebles & Co. has been accepted, at £3,186.

HAMMERSMITH.—The B.C. has accepted the tenders of Messrs. Spagnoletti, Ltd., and the Edison & Swan United Electric Light Co., Ltd., for the supply and delivery of low-tension switches (400 and 1,000 ampere), and high-tension switch panels, respectively, during the coming year.

The Electricity Committee has agreed to furnish New Olympia, Co., Ltd., with an additional supply of continuous current, including the use of a motor-generator, in consideration of the company paying the Council £175 in respect of such supply, plus the agreed rate for the supply of current consumed. With regard to the generator mentioned above, one at the White City, but now not required, is to be taken and altered to give 220 volts, and to carry out this alteration the Committee has accepted the tender of the Westminster Engineering Co., at £87 10s. This price includes the supply of a new commutator. In connection with the question of the purchase of the apparatus provisionally agreed to be hired to Messrs. Gwynnes.

the Electricity Committee has decided to accept the following tenders:—

Chatteris Engineering Co.—(1) The electrical equipment of one 10-ton crane, consisting of three motors, one 12 H.P., one 3 H.P., and one 10 H.P., complete with controllers, switchgear, &c., £99; and (2) the electrical equipment for three 5-ton cranes, consisting of one 10 H.P., one 6 H.P. and one 1½ H.P. motors for each crane, complete with controllers, switchgear, &c., £80 10s. per set.

The Submersible and J. L. Motors, Ltd.—(1) Two motors, at £23 each, and (2) two regulators and starters, for £5 8s.

For the supply of one each 50, 30, and 20-H.P. A.C. motors also required, tenders are to be invited.

The Metropolitan Asylums Board has accepted the tender of Messrs. J. W. Gray & Son, at £110, for the supply and fixing of, and repairs to, lightning conductors at five of their institutions. The following tenders have also been accepted:—

Pump and Power Co., Ltd.—Provision of small electrically driven centrifugal pump, £72.

Brush Electrical Engineering Co., Ltd.—One generator, regulator, and generator panel for electric light plant at Surbiton, £172.

General Electric Co., Ltd.—Electrical fittings, including cut-out boards, switches, lampholders, &c., for electric light plant at Surbiton, £69.

Portsmouth.—The Tramways Committee has accepted the following tenders for materials and fittings for Twyford Avenue tramway extensions:—

Welded joints.—Thermit, Ltd., at £1 8s. each.
Rails.—Scholey & Co., Ltd., at £7 4s. 6d. per ton.
Tiebars.—Bayliss, Jones & Bayliss.
Junction and special work.—Hadfield's Steel Foundry Co., Ltd., for junctions, points and crossings.
Poles and fittings.—Watlington & Co., Imeson & Finch, J. Shervell, Ltd., Siemens Bros. & Co. and Johnson & Phillips.
Section insulators and mechanical ears and safety bridle ears.—Imeson and Finch.
1/16 telephone and pilot wire.—Watlington & Co.
Feeder cables and connections.—B.I. and Helsby Cables, Ltd.
Copper bonds.—Watlington & Co.
Fibre conduit.—Watlington & Co.
Frames and covers.—J. Sherwell, Ltd., £1 10s. 8½d. each.
Feed and section pillars.—W. Boydell & Sons, Ltd.

Reigate.—The T.C. has accepted the tender of Messrs. Rickett, Smith & Co. for 800 tons of coal for the electricity works, at 25s. per ton.

Stockton-on-Tees.—Messrs. T. B. Watson & Son have secured the contract for lighting and power at the new model factory of Messrs. Cerebos, Ltd., Greatham, Stockton-on-Tees; also the lighting contract for the Parish Church and Hall, Meddowfield Co. Durham.

Weaving Shed Equipment.—We recently mentioned that it was proposed to equip the new weaving shed of Messrs. David Whitehead & Sons, Rawtenstall, with electric power. We now learn that the complete electrical equipment, comprising generating plant and 268 loom motors, has been placed with the A.E.G. Electric Co., Ltd., to the specification and requirements of Mr. E. M. Lacey. The same company has just secured the order from Messrs. Nelson & Greenhalgh for the new weaving shed at Whitefield, including the equipment of 300 looms for individual drive, also to the specification of Mr. E. M. Lacey.

Wednesbury.—The Lighting Committee has accepted the tender of the General Electric Co., Ltd., for a 250-KW. dynamo, with compound wiring. The Committee will also purchase a 400-H.P. gas engine from Messrs. Fraser & Chalmers, of Erith.

West Bromwich.—The Corporation has accepted the tender of Messrs. Clough, Smith & Co., Ltd., for the removal of 217 existing tramway centre poles, and for the replacing of the same with side-pole span-wire construction.

NOTES.

Fatalities.—On July 25th, an inquest was held on the body of Robert Henry Riches (32), assistant linesman employed by Messrs. Blackwell & Co. The evidence showed that the man was working with a gang on the overhead electric wires between Tulse Hill and Peckham Rye. The switchman at the former station earthed the end of his wires and at the same time notified the Peckham switchman of what he had done. The Peckham man replied by telephone "all right; current is off." At 3.50 a.m. the current was switched on and the deceased received a shock at 6,600 volts and was immediately killed. Thos. Tothill, foreman of the linesmen, under whom deceased worked, said he assumed that the current had been earthed at Peckham as well as at Tulse Hill. He had every right to think that the Peckham switchman would earth his line when he knew that there were men working on the line; when the deceased received the shock sparks flew from his hand and a finger fell off. He fell from the girder on which he was sitting. Cecil Draeger, of Coniston Road, Croydon, the switch-cabin attendant at Peckham Junction, said he inadvertently turned on the switches at Peckham Junction forgetting that he had been asked to discharge the current at Tulse Hill; but he ought, under the company's rules, to have been told that the work was of an exceptionally dangerous character, so that he could have taken extra precautions. A verdict of accidental death was returned.

Mr. E. A. Gibson, Manchester City Coroner, held an inquest on Wednesday last week on the body of Albert Thornton, aged 22 years, an assistant electrician in the employ of Messrs. Johnson and Nephew, Forge Lane, Bradford, Manchester. He had been employed by the firm for about four years. Mr. A. F. J. Pickford represented the Electricity Department, and Mr. S. L. Pearce, the city electrical engineer, was also present at the proceedings. The foreman electrician of the firm said that Thornton was employed on Sunday morning cleaning motors at the works, a task he was well acquainted with. Rubber mats, gloves and shoes were provided for electrical work attended with danger, but the work of cleaning motors while stopped did not require these precautions. In the course of his work it appeared that Thornton found that the motor would not run when he made a test. He could not locate the fault, and went to the house of the foreman, who gave him instructions not to interfere with it till his arrival. Apparently Thornton disregarded the warning, for when the foreman arrived at 1 o'clock deceased was found lying on the floor dead, with his feet towards the motor. One of the wires, which was disconnected from the motor, and led directly to the Corporation's main, was in Thornton's hand, and in the other hand he held a pair of test lamps. The switch was in the "on" position, so that the current was going through the wire and his body and burning his hand. A man who took the wire away received a shock himself. The foreman added that the deceased had no right to be testing the wires, and in any case proper precautions for insulation should have been taken before the wires were touched. The Coroner said it was perfectly clear that Thornton died from an electric shock while doing what he had no right to do. He had not taken the ordinary precautions that he should have done when meddling with the high pressure. The jury returned a verdict of "Accidental death."

The general manager of the firm expressed sympathy with Thornton's family. The firm, he said, had lost a very useful young fellow, and it was the first accident they had ever had with electricity in the works

The Coroner remarked that, as far as he could see, there could be no possible suspicion of blame on the part of the firm.

Is the Trade Union a Failure?—Events of the last few years have shown that, although the influence of the Trade Union in modifying the relationship of employers and employed is proclaimed on every platform, very few genuine or lasting reforms have been carried out through the agency of these bodies. During the past few years they have persuaded the Government to intervene on various occasions, but their intervention has done but little good. The Labour Party are now imploring the Ministry to come to their assistance again; but, as the *Times* pointed out on July 26th, it behoves the Government to be very wary in this matter. "They have attempted a good deal of legislation already, and the experience offers more warning than encouragement. Apart from the Trade Disputes Act, which might be named an Act for promoting strikes, they have tried their hand at conciliation. Only in 1908 Mr. Churchill set up an Arbitration Court, which was to perform wonders. It has performed so little that last year it was superseded by the Industrial Council, which was also received with a flourish of trumpets. Now that is pronounced a failure. Then there was the Minimum Wage Act of this spring. The miners are finding out what it means by degrees, and are more and more disappointed. The other day we had Mr. Wilson's gloomy pronouncement, and now the secretary of the Cleveland miners is still more outspoken on the ill-effects of the Act. Whatever is done or not done, let us have no more legislation in a hurry on these social questions."

Coal-Dust Explosions.—The first report of the Committee engaged in investigating the subject of explosions in coal mines was issued last Friday. It states that the fact has now been established beyond all doubt that coal dust suspended in air, without the presence of any inflammable gas, is capable of being ignited and of propagating an explosion through dusty galleries. The use of stone dust to prevent such explosions is now being investigated.

Belfast Disturbances.—One of the consequences of the disturbances in the shipyards at Belfast was to render idle about 3,000 men at the works of Harland & Wolff, owing to the molestation and intimidation of skilled employés in the power station. The effect of shutting down a considerable part of the power plant naturally was to stop operations in other departments.

English Engineers' Claim.—The Belgian Court of Appeal has dismissed the claim of two English electrical engineers against the Antwerp Bell Telephone Co. for £8,000 damages. Last summer, says Reuter, the two engineers were prosecuted by the company for the alleged betrayal of trade secrets and were acquitted. They subsequently brought the present action against the company on account of the moral prejudice they had suffered from the unfounded action against them.

Osram and Robertson Cricket Club.—The annual fixture between the General Electric Co. "Witton" and the Osram and Robertson C.C. was played on Saturday last on the latter's ground at Shepherd's Bush. The Witton team arrived from Birmingham in the morning, and occupied themselves with sight-seeing, &c. In the corresponding match last year in London, the Lamps were easy winners. This year the visitors won the toss and opened the batting. J. Jessop and L. Ralph commenced the bowling for the home team, and half the side were out for 24 runs; then C. Heywood and A. Metcalf stopped the rot, and before they were parted 98 runs appeared on the board, and the side were eventually out for 118. After tea the Lamps commenced batting, and it was evident they had a very difficult task before them; it was thought that the homesters were a beaten team when three wickets fell very cheaply, but 35 runs were added for the fourth wicket, J. Jessop and E. Furnell playing the fast bowling of Heywood with ease, which caused great anxiety in the Witton camp. The home team were eventually dismissed for 88 runs, the last wicket falling as time was called, leaving the Witton team winners by 30 runs. After the match both teams were entertained in the recreation room at the Robertson Works. The Witton party left Euston at midnight, after having spent an enjoyable day.

Institution Notes.—Institute of Metals.—The annual Autumn meeting of the Institute will be held in London on September 25th and 26th, at the Institution of Electrical Engineers. Anyone desirous of taking part in the meeting should communicate with the Secretary, Mr. G. Shaw Scott, Caxton House, Westminster, S.W.

Institution of Mechanical Engineers.—On July 30th the summer conference of the Institution was opened in Belfast, with a welcome from the Lord Mayor. The very extensive electric power equipment of the works of Messrs. Harland & Wolff was inspected during a visit to the company's shipyard. The annual dinner was held on Tuesday evening. The programme included an official visit to the Picture House, Royal Avenue, yesterday, August 1st, at the invitation of the Provincial Cinematograph Theatres, Ltd., who arranged for a special private reception, and a programme of technical interest, including films of the following subjects:—The Raising of the Maine: The Birth of a Big Gun; The Steel Town of Elberfeld; The Greatest Engineers' Feat in the World; Constructing a Dam, &c.

Unemployment Insurance Contributions.—We are officially informed that as some misapprehension appears to exist on the matter, the Board of Trade wish to make it known that no stamps can be used for payment of contributions in respect of Unemployment Insurance, other than the special Unemployment Insurance stamps, which are obtainable at any post office. Health Insurance stamps and ordinary postage stamps cannot be used for the purpose, and, if affixed, do not count as contributions in respect of Unemployment Insurance. Where such other stamps have been affixed, it will still be necessary for the proper Unemployment Insurance stamps to be affixed, and the liability for affixing them rests upon the employer. For the present, however, as a temporary arrangement and with a view to facilitating the correction of mistakes, the Board of Trade will themselves be prepared, without charge, to affix Unemployment Insurance stamps in lieu of the Health Insurance stamps wrongly affixed, obtaining the employer's acknowledgment. For this purpose all unemployment books to which a Health Insurance stamp or stamps have been wrongly affixed should, as soon as possible, be sent to a divisional office, with a request for the affixing of Unemployment Insurance stamps of value corresponding to the Health Insurance stamps upon them. The addresses of the divisional offices are as follows:—

London and South-Eastern, Caxton House, Westminster, S.W.
South-Western, Canada House, Baldwin Street, Bristol.
West Midlands, 164, Corporation Street, Birmingham.
Yorkshire and East Midlands, 14, Frenchgate, Doncaster.
North-Western, Lancashire and Cheshire, Cairo Street, Warrington.
Wales, Law Courts, Cathays Park, Cardiff.
Scotland and Northern, Bath Street, Glasgow.
Ireland, 21, Parliament Street, Dublin.

An Electrical Method of Measuring Small Intervals of Time.—In the *Physical Review* of June, 1912, Mr. F. C. Brown states that the time between two mechanical operations can be measured quite accurately by the use of resistances, battery, ballistic galvanometer, condenser, and contact keys. The advantages of the method are simplicity and ease of manipulation. The interval of time to be measured may be diminished to the limits of dependable electrical contact, no doubt less than 0·001 second. How large the interval may be varies from 0·4 second to several seconds depending on the period of the galvanometer. The galvanometer is connected to a Wheatstone bridge in the usual way, except that there are two contacts in its circuit, one closed the other open. The time interval to be measured is that which elapses between the closing of the latter and the opening of the former, which operations are effected by the mechanical processes under investigation. The bridge is thrown out of balance by a known amount, and the throws of the galvanometer, under suitable conditions, are then closely proportional to the time interval. The conditions necessary, and the theory of the method—which enables time to be measured in terms of length and resistance, or ultimately in terms of length and mass—are detailed in the article. In a particular case the resistances in the four arms of the bridge were each 9,000 ohms, a battery of 38 volts was employed, the galvanometer resistance was 950 ohms, and its period was 26·7 seconds. One of the arms was increased to 9,100 ohms, and proportionality of throw to time was proved from 0·002 to 0·32 second by comparison with a standard pendulum. With an out-of-balance resistance of 500 ohms and a galvanometer period of 91 sec., the linear relation was extended to 2·7 sec., and by increasing the resistances of the proportional arms (to the middle of which the galvanometer was connected) to 100,000 ohms each, proportionality was further extended to 3·6 sec.

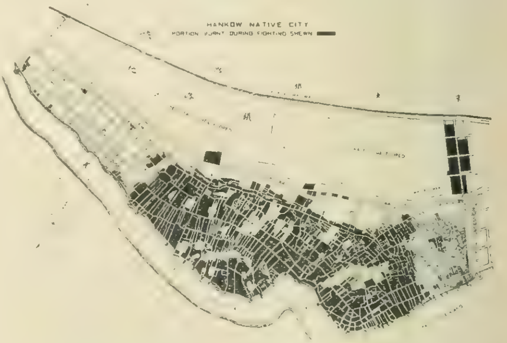
We believe the late Robert Sabine published an electrical method of measuring small intervals of time some 25 to 30 years ago.

Lighting of the House of Commons.—Last week Mr. Benn stated that two bays out of the four in the ceiling light of the debating chamber of the House of Commons had been converted to electricity, and the First Commissioner proposed during the recess to complete the change.

Legacy to the Institution of Civil Engineers.—Under the will of the late Sir James Inglis, a former President of the Institution of Civil Engineers, the Institution has just received a legacy of £5,000, to be applied to its new building which is now in course of erection in Great George Street, Westminster. This legacy testifies to the marked interest which Sir James Inglis took in the scheme for the rebuilding of the Institution, towards the cost of which he had also during his lifetime contributed liberally, regarding the occasion as an opportunity to promote the centralisation, and thereby the strength, of civil engineering interests throughout the British Empire.

British Enterprise in Luxemburg.—It is stated that a British syndicate has decided to proceed with a hydro-electric scheme in the Grand Duchy of Luxemburg. Several years ago a number of manufacturers in German Lorraine and in the Grand Duchy prepared a project for constructing a dam in the Haute-Sûre, so as to provide storage for hydro-electric works, but ultimately, and after reports had been made by French and Belgian engineers, the conclusion was reached that the available power would not be sufficient to justify the execution of the scheme. It is now reported that the Government of the Grand Duchy has granted a concession to the Transport-Development and Power Syndicate, Ltd., to proceed with the works. The dam, which is to be built in the vicinity of Insenborn, is to have a height of 150 ft., and the reservoir thereby erected will have a length of slightly over 11 miles. The power available is declared, on the one hand, to be 6,000 H.P., while, on the other, some engineers submit that it will not exceed 2,500 H.P. A conduit leading from the dam will convey the water to the power station, which will be situated above Esch-sur-Sûre, and steam plant of 3,000 H.P. will have to be installed as reserve. The concession has been granted for 60 years, and the station has to be completed within three years from the date of the approval of the plans. It is provided that the supply, which is to be rendered for transport and other purposes, shall not be at a higher rate than 2½d. per KW.-hour for power and 4d. for lighting, whilst lower rates have been fixed in case of the working of railways or tramways. The holders of the concession reserve the right of transferring their powers to a company to be formed according to Luxemburg laws, and no deposit is provided for, or has been asked of the British syndicate, to guarantee the interests of third parties.

Electricity Supply in Hankow.—In the course of a letter we recently received from the engineer of the Hankow Waterworks and Electric Light Co., Ltd., the following interesting remarks occur:—"I think you will be interested in a plan which I am sending showing the parts of Hankow destroyed by fire during the fighting which took place between the Imperialists and Revolutionists during November last. The company's distributing system was entirely overhead, and realising that the Chinese streets are narrow, you will be able to judge, from the position of the generating station (locally styled 'Ta Wong Miao'), the sort of mess the fires made of things. The station is run entirely by Chinese, and they kept things going until practically everything was burnt away, and the station, with the exception of that part facing the River Han, was entirely surrounded by fire. They then escaped across the river to Hanyang, and were kept prisoners by the Revolutionists until we were able to satisfy the authorities as to how it came about that they were in Hanyang. During the last few days before the supply failed, owing to all the feeders having been burnt down, the station was made a target by the gunners on the hills at Hanyang on the opposite side of the river, and the place was very much knocked about. The pontoon on which we had two 50-H.P. motor centrifugals, for supplying circulating water, was sunk, a shell damaged one of our chain-grate stokers, another struck the water drums of No. 3 boiler, leaving an ugly indentation, some pieces of shrapnel tore some holes in the lagging of No. 2 engine, without damaging the cylinders, and our chimney shaft and roof were badly riddled, the roof so much so that we have had to re-roof the whole of the engine and boiler rooms. The station was shut down on November 1st with a load of 1,300 KW., and was started up again at the end of January with a load of 90 KW. The load is now going up rapidly, although progress is slower than it should be owing to building being delayed pending a decision as to



the form which the new city is to take. With the exception of two days a constant supply of water has been given, although heavy fighting took place at the waterworks, which were held first by the Revolutionists, and after by the Imperialists. Three of the company's men were killed, and several injured, and I must say that a more plucky lot of men it would be difficult to find."

Educational Notes.—University of Leeds.—The report for the year 1910-11 states that the number of regular Electrical Engineering Students has increased, and a course in that subject has been instituted for students in Mechanical Engineering and Mining.

City and Guilds (Engineering) College.—The Council of the City and Guilds of London Institute has awarded the diploma of "Associate" to the following students of the College in Electrical Engineering: Otter, F. L.; Rosen, J.; Lion, B. S.; Smith, C. P. (Siemens Memorial Medal); Beavis, E. A.; Pittman, C. F.; Solomon, T. H.; Hutchison, E.; Dannhorn, A. J.; Patel, A. C.; Varadachari, P.; Clark, G. C.; McDougald, L. A.; Hews, C. J.; Mitchell, M. H. J.; Burrowes, H. C.; McHatton, G. T.; Mathias, E. L. A.; Milner, D.; Panayotopoulos, C. G.; Mann, R. R. G.; Searle, A. M.

University of London, University College.—Notice is given in our advertisement pages to-day of the courses in electrical engineering, electrical design, mechanical and civil engineering, &c., for the session 1912-13, which commences on Sept. 30th.

University of London.—The University has decided to hold a summer school of town planning at Hampstead Garden Suburb, and the Marquis of Crewe will give the inaugural address to-morrow, August 3rd. Particulars of the course of lectures can be obtained from the hon. secretary, Mr. J. S. Rathbone, The Institute, Hampstead Garden Suburb, N.W.

The Bray Explosion.—While full particulars regarding the accident are not yet available, it is interesting to note that the circumstances have been very carefully investigated by Mr. E. G. Hiller, chief engineer of the National Boiler and General Insurance Co., who presented his report to the Council on Tuesday. Mr. Hiller finds that the accident was not in any way due to defective design or construction of the engine or of the air receivers, but was owing solely to the use of oxygen for raising the pressure in the latter. In his opinion, the accident is unique, and blame attaches to no one.

We shall deal with the matter fully in our next issue.

Liquid Fuel.—A Royal Commission has been appointed to report on the supply of oil fuel for the Navy. As the terms of reference cover "the means of supply and storage of liquid fuel," presumably including the reliability of the various sources, the question is of interest to electrical engineers also.

Appointments Vacant.—Mains assistant, for the Sunderland Corporation electricity works (50s.); working foreman, to inspect wiring, &c., for the Salford Corporation; junior assistant engineers for the Newcastle-upon-Tyne Electric Supply Co., Ltd. (10s.); Constructional engineer for the City Electric Supply Department, Birmingham (£400). See our advertisement pages to-day.

Electric Miner's Lamp.—An improved electric miner's lamp made in accordance with the Hailwood patents has lately been brought out by Messrs. Ackroyd & Best, Ltd., of Morley, near Leeds. The lamp primarily comprises two main portions of cylindrical form. The bottom portion contains a circular accumulator, having flat plates, the paste of which is inserted under great pressure. The upper part of the lamp is provided with an incandescent bulb enclosed in a glass dome, the top part of which is no less than ½-in. thick, in order to render it proof against accident owing to falling pieces of coal or stone.

Kelvin Memorial.—A General Committee, representing the engineering societies of the British Empire and the United States, has been formed, to carry into effect a proposal for the erection of a memorial window to Lord Kelvin in Westminster Abbey.

The Sherardising Process.—We are informed that this process is making rapid progress in the United States, where there are some 34 plants at work; it is being extensively used by the General Electric Co. for line material. A Committee of the Franklin Institute has recently reported on the process, and awarded Mr. Cowper-Coles the John Scott Legacy Medal and Premium.

Sheffield Corporation Wiring Department.—As we anticipated would be the case, a Select Committee of the House of Lords, considering the Bill promoted by the Sheffield Corporation to legalise the operations of its wiring department, has decided that the Corporation may let apparatus on hire, but must not sell electrical fittings and the like goods. This decision puts a stop to the wiring business, and supports the decision of Mr. Justice Eve that the Corporation, in carrying on that business, was acting illegally. We reviewed the circumstances in our issue of June 28th, when we also indicated our belief that, although the House of Commons had passed the wiring clauses, they would never get through the House of Lords.

Annual Holidays.—The Adams Manufacturing Co., Ltd., of Bedford, announce that their works will be closed from to-morrow, Saturday, until the morning of Monday, August 12th.

Electrical Exhibition at York.—At the Health Exhibition held in connection with the Royal Sanitary Institute's Congress at York this week, the electricity department of the York Corporation (Mr. J. W. Hame, city electrical engineer) gave a display of electrical appliances, and each day gave demonstrations of cooking by electricity. The department was awarded two silver medals for its exhibit.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The staff of the Harrogate Corporation Electricity Department, desiring to show their appreciation of the honour paid to their chief, Mr. Geo. Wilkinson, in being elected president of the I.M.E.A., met on the evening of July 23rd at the offices, 33, Swan Road, and made a presentation of a gold medallion as a memento of his year of office. Mr. McLean, chief assistant, in asking Mr. Wilkinson to accept this tangible expression of the goodwill of his staff, also referred to the success which had attended the Convention under his presidency. Mr. R. McCourt, mains superintendent, and Mr. J. Ridsdale, chief clerk, also voiced the feelings of respect and esteem in which Mr. Wilkinson is held by all. In replying, Mr. Wilkinson thanked his co-workers not only for the medallion, but for the spirit of comradeship of which it was the expression, and said he would greatly value the present, which would remind him of a year of strenuous work, and also of many instances of valuable assistance from his staff in discharging the duties of president of the I.M.E.A.

The *Standard* states that the Marylebone Borough Council has decided, by a large majority, "to negative a proposal by the Electricity Supply Committee that a bonus should be paid to certain officials in connection with the sale of electric current."

Mr. W. Phethean, assistant electrical engineer at Farnworth U.D.C. electricity works, was the recipient, on 26th inst., of an electric clock from the engineer and staff in commemoration of his marriage, which was to take place on 29th inst.

We are pleased to learn that Mr. W. J. U. Sowter, of Bray, is making a most remarkable recovery, and it is expected that he will be able to return home from hospital in a few days. Mr. R. E. McDonnell, deputy electrical engineer, is already back at work, and he reports himself none the worse for his nasty experience. A report on the explosion is to come under discussion at next Tuesday's Council meeting at Bray.

General.—In the Faculty of Engineering at University College, London, Mr. E. Kilburn Scott has been re-appointed lecturer in electrical design for the session 1912-13, and Mr. A. H. Barker has been re-appointed lecturer in heating and ventilating engineering. Mr. B. J. Lloyd-Evans has been appointed demonstrator in the department of mechanical engineering.

Mr. John Hesketh, chief electrical engineer, Postmaster-General's Department, Melbourne, is at present on a visit to this country. Last week he revisited Blackpool, where, it will be remembered, he was city electrical engineer many years ago.

Mr. Greenwood Dunn, of Burnley, who went to Australia two years ago, has received an appointment as electrician to the Sydney Steel Co.

Consequent upon Mr. R. J. Elmhirst's resignation from the Batti-Wallahs' Society, the committee has appointed Mr. E. R. Carter to succeed him as assistant hon. secretary.

NEW COMPANIES REGISTERED.

Ilkeston Motor and Electrical Engineering Co., Ltd. (123,033).—This company has just been registered with a capital of £5,000 in £1 shares, to carry on the business of motor-car proprietors and agents, garage proprietors, electrical and general engineers, &c. The subscribers are:—Dr. G. R. Northwood, Kimberley, Notts, 500 shares; T. W. Fletcher, Oak Lodge, Kimberley, Notts, manufacturer, 500 shares; E. Hickman, 4, Charlotte Street, Ilkeston, motor engineer, 500 shares; T. W. Fletcher, jun., Oak Lodge, Kimberley, clerk, 500 shares; W. Fletcher, Wood Street, Ilkeston, mechanic, 1 share; J. Northwood, 152, Oxford Street, Bilston, Staffs., engineer, 1 share; F. E. Fletcher, Oak Lodge, Kimberley, Notts, clerk, 500 shares. Private company. The number of directors is not to be less than two or more than four; the first are Dr. G. R. Northwood, chairman and managing director, and T. W. Fletcher; qualification, £100. Registered office, Northern Garage, Heanor Road, Ilkeston.

Alkaline Accumulators Paul Gouin, Ltd. (122,968).—This company was registered on July 3rd, with a capital of £2,000 in £1 shares (272 preference), to acquire and turn to account any patents, options, concessions, licences or other interests relating to electric accumulators, or any process or device connected therewith. The subscribers (with one preference share each) are:—R. B. Canning, 36, Lausanne Road, Peckham, S.E., clerk; G. W. Lomax, 25, Moore Street, W., clerk; P. Rowson, 17, Chapel Street, N.W., clerk; H. M. Cordrey, 6, Dundalk Road, Brockley, S.E., clerk; W. H. Brown, 5, Shouldham Street, W., clerk; A. W. Read, 11, Ironmonger Lane, E.C., solicitor; J. R. Pakeman, 11, Ironmonger Lane, E.C., solicitor. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification (except first directors), 200 shares; remuneration, £4 each per board meeting attended. Registered by Pakeman, Son & Read, 11, Ironmonger Lane, E.C.

Arc Syndicate, Ltd. (123,121).—This company was registered on July 10th, with a capital of £4,000 in 1s. shares, to acquire, deal with and turn to account patents for any part of the world in certain inventions for transmitting photographs and printed and typewritten telegraph messages by wireless telegraphy, and over cables and landlines, and for receiving them directly printed at the receiving station or stations, and for receiving telegraph messages automatically transmitted over cables and landlines, &c. The subscribers (with one share each) are:—J. A. Parker, Friars House, New Broad Street, E.C., solicitor; F. Gerhold, 65, Boundary Road, Wood Green, N., clerk; C. E. Gray, 51, Thorne Road, South Lambeth, clerk; F. W. G. Mills, 10, Novarre Road, East Ham, accountant; P. F. Carlton Jones, 7, Boothby Road, St. John's Road, Highgate, N., gentleman; J. C. Leigh, 101, Iverson Road, West Hampstead, clerk; F. W. Lee, 8, King's Road, Willesden Green, N.W., gentleman. Minimum cash subscription £100. The number of directors is not to be less than 2 nor more than 10; the first are J. A. Parker, F. Gerhold, C. E. Gray, F. W. G. Mills, P. F. Carlton Jones, J. C. Leigh, and F. W. Lee (provisional directors); qualification, 10 shares. Registered office, Friars House, New Broad Street, E.C.

Wedmore Electric Light and Power Co., Ltd. (123,118).—This company was registered on July 9th, with a capital of £3,500 in £1 shares, to take over the business of an electric supply company, carried on by the Wedmore Electric Light and Power Co., at Wedmore, Wedmore, Somerset, and to adopt an agreement with W. G. Burrough. The subscribers are:—Mrs. E. M. Smith, The Manor House, Wedmore, 100 shares; W. G. Burrough, Hill House, Wedmore, solicitor, 100 shares; W. E. Bracey, The Uplands, Wedmore, surgeon, 100 shares; W. Owen, Mains Corner, Wedmore, draper, &c., 100 shares; W. A. Duckett, The Myrtles, Wedmore, yeoman, 100 shares; A. Tucker, The Laurels, Wedmore, yeoman, 100 shares; E. Bond, Wedmore, engineer, 20 shares. Minimum cash subscription whole of the share capital. The number of directors is not to be less than four or more than six: the first are Mrs. E. M. Smith, W. G. Burrough, W. E. Bracey, W. Owen, W. A. Duckett and A. Tucker; qualification, £100. Registered by Jordan & Sons, Ltd, 116-117, Chancery Lane, W.C.

Hellyar & Sons, Ltd. (123,330).—This company was registered on July 22nd, with a capital of £2,000 in £1 shares, to carry on the business of designers, manufacturers, exporters and importers of, contractors and factors for, and dealers in electric light apparatus, conduits, dynamo machines, lamps, fittings and accessories, electric accumulators, &c., to acquire the business carred on at Barnes by T. H. Hellyar, of 169, Church Road, Barnes, as Hellyar and Sons. The subscribers (with one share each) are:—C. Hawkins, 46, Angus Road, Acton Vale, W., clerk; A. B. Dean, 10, Buckingham Road, Forest Gate, E., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, (except a director appointed by T. L. Hellyar, or other holder of the £800 first mortgage debenture to be issued), 50 shares. Registered by Wingfield, Blew & Kenward, 74, Cheapside, E.C.

Triplex Arc Lamp Co., Ltd. (123,347).—This company was registered on July 22nd, with a capital of £2,500 in £1 shares, to take over from H. Weiss the benefit of a certain invention relating to improvements in arc lamps, &c. The subscribers (with one share each) are:—H. Weiss, 67, Drummond Street, N.W., electrical engineer; T. English, 136, Oxford Road, Reading, corn merchant. Private company. Table "A" mainly applies. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Beauly Electric Supply Co., Ltd. (8,331).—This company was registered in Edinburgh on July 17th, with a capital of £1,000 in £1 shares, to carry on business of electrical engineers, electricians, suppliers of electric light, &c. The subscribers (with five shares each) are: J. McBean, Waterloo Place, Inverness, cashier; D. F. McKenzie, 42, Union Street, Inverness, solicitor; A. Fraser, 63, Church Street, Inverness, solicitor. Private company. The first directors are D. McGrath, E. J. Williams and J. Menzies.

Walker, McEwen & Co., Ltd. (123,296).—This company was registered on July 19th, with a capital of £100 in £1 shares, to carry on the business of electricians, electrical engineers and contractors, suppliers of electricity, manufacturers of electric and other apparatus, &c., and to adopt an agreement with D. Walker and G. McEwen. The subscribers (with one share each) are:—G. L. MacEwen, 7, Princes Street, Westminster, barrister; Capt. J. D. Walker, Royal Automobile Club, Pall Mall, S.W. Private company. The number of directors is not to be less than two or more than seven: the first are Capt. D. Walker, G. L. MacEwen, H. Leitner, R. W. Liddell, and F. J. B. Collis; remuneration as fixed by the company. Registered by Cox & Lafone, 17, Tower Royal, Cannon Street, E.C.

Aldershot and District Traction Co., Ltd. (123,372).—This company was registered on July 24th, with a capital of £15,000 in £1 shares, to carry on the business of motor-car, omnibus, van, and cab proprietors, carriers of passengers, goods, &c., in the districts and towns of Aldershot, Farnborough, Fleet, Ewshot, Guildford, Ash, Farnham, Frimley, Camberley, and elsewhere, to acquire the undertaking of the Aldershot and Farnborough Motor-Omnibus Co., Ltd., and to adopt an agreement with the said company and the British Automobile Traction Co., Ltd. The subscribers (with one share each) are:—M. E. Sheerboom, 64, Sutton Road, Southend-on-Sea, clerk; W. J. Harris, 4, Warrendon Road, Tufnell Park, N., clerk; A. W. James, 233, Melford Road, Thornton Heath, clerk; E. E. Arnold, Haileybury House, Durham Road, Stepney, clerk; W. E. Bennett, 29, Falkland Road, Hornsey, N., secretary; S. Emile Garcke, 1, Kingsway, W.C., engineeer; W. S. Wreathall, 1, Kingsway, W.C., director. Minimum cash subscription, 20 per cent. of the share capital offered to the public. The number of directors is not to be less than three or more than five; the first are W. E. Foster, T. M. Foster, W. S. Wreathall, and S. E. Garcke; qualification, £200; remuneration, £100 per annum, divisible. Registered offices, Halimote Garage, Halimote Road, Aldershot, Hants.

South American and General Syndicate, Ltd. (123,398).—Registered July 24th, by Budd, Johnson & Jecks, 24, Austin Friars, E.C. Capital £50,000 in £1 shares. Objects: To acquire the benefit of any concessions, grants, decrees, rights, powers and privileges for the construction and working of electric tramway lines, power stations, railway lines or other public works, to carry on business as tramway, railway and omnibus proprietors and carriers, to supply electric light and power, to act as engineers, electricians, manufacturers of and dealers in electrical and water supply apparatus, &c. The subscribers (with one share each) are:—W. H. Jackson, 35, Park Hall Road, East Finchley, N., accountant; H. A. Griffin, Devonport House, New Malden, clerk. Private company. The first directors (to number not less than two or more than five) are to be appointed by the signatories. Remuneration as fixed by the company.

Yorkshire Incandescent Electric Lamp Co., Ltd. (123,421).—This company was registered on July 25th, with a capital of £2,000 in £1 shares, to take over the business carried on as the Metalline Electric Incandescent Lamp Co., at 83, Kirkstall Road, Leeds, and to adopt an agreement with H. F. McDowell, W. Plews and E. M. Bailey. The subscribers (with one share each) are:—W. Plews, The Woodlands, Cardigan Lane, Burley, Leeds, manufacturer; H. F. McDowell, Rosslyn, Knaresbro' Road, Harrogate, engineer; E. M. Bailey, Swinnow Road, Bromley, Leeds, engineer; T. Middleton, 96, Vicar Lane, Leeds, diamond merchant. Private company. The number of directors is not to be less than three or more than seven; the first are W. Plews, H. F. McDowell and T. Middleton; qualification, £100. Registered by Jordan & Son, Ltd. 116-117, Chancery Lane, W.C.

CITY NOTES.

Mersey Railway Co.

The half-yearly meeting was held on Tuesday at Worcester House, Walbrook, E.C., Mr. J. Falconer, M.P., presiding.

The Chairman, in proposing the adoption of the report, said that the progress of the company continued to be maintained. Notwithstanding the coal strike, which paralysed the trade of the country for about six weeks, the number of passengers carried during the half-year constituted a record, and the same was the case with the revenue. As compared with the last half-year during which the railway was worked by steam, the number of passengers, exclusive of season ticket-holders, had increased from 2,844,000 to 6,123,000, an increase of 3,278,000, or 115 per cent. During the same period the season ticket-holders, estimated by journeys, had increased from 512,980 to 1,584,870, an increase of 1,071,890, or 209 per cent. The receipts had increased during the same period from £29,470 to £56,275, an increase of £26,805, or 91 per cent. The result of the past half-year was undoubtedly striking, having regard to the coal strike, and he thought the continued progress of the railway could only be accounted for by the situation in which it was placed, with a large body of people in Liverpool who must get out to the country to reside, and by the very suitable and attractive service given by the company. The excellence of the service was now universally recognised for its frequency, its rapidity, its comfort, and he was thankful to say its continued safety, and it was upon those considerations that their hopes for the continued development of the line must mainly depend. The fact that they were able to continue their service during the coal strike was due to the energy and foresight of the general manager and the whole of the staff. They had been prudent enough to lay by a store of coal which was adequate not only for the demand which was made, but which would have kept the line running during the period of any imaginable strike. He thought it was right to say that, despite the continued progress made last half-year, they had still got a considerable distance to go before they would be in a position to commence any payment to the shareholders.

Mr. Robert Cooper seconded the motion, and the report was adopted.

Dublin United Tramways Co. (1896), Ltd.

Mr. W. M. Murphy presided on 26th ult. at the meeting held at Dublin, and in moving the adoption of the report for the half-year ended at June, he first referred to the death of Mr. P. Bernard, who had been a director for 10 years, and then alluded to the provision of workmen's cottages. The passenger traffic receipts were £149,291, an increase of £7,290 over the corresponding half of 1911. The increase in expenditure was only £864, leaving £6,532 to the good. The electrical department accounted for an increase of £2,129, of which £1,821 was due to increased cost of coal to provide against failure during the colliery strike. The result justified the expenditure, for they did not miss a single journey. There was a fall of £2,159 in permanent way maintenance expenditure. Last year a number of joint plates were inserted which had helped to prolong the life of the rails. The cost was charged to revenue, and the operation did not require to be continued this half-year. Traffic expenses were up by £864, due to improvement in wages and hours of work. There was a reduction in interest paid on mortgage bonds, because of the redemption of the latter. The balance was £57,829, or £6,670 more than last year. It was proposed to pay the usual dividends of 6 per cent. on the ordinary and preference shares, adding £10,000 to permanent way renewal fund, and £1,000 to accident insurance reserve. The time was coming when they might find it necessary to incur a larger expenditure on renewal of permanent way than they had hitherto had to make, and it would be wise to have a substantial sum in hand earmarked for this purpose. They were carrying forward £1,670 more than last year. In future the company will probably meet once a year, and pay interim dividends, in accordance with the Railway Act of Parliament, which comes into force next year. The National Insurance Act would cost the company £1,000 per annum.

The report was adopted, and the dividend resolution passed.

City of Buenos Ayres Tramways Co. (1904). Ltd.—The directors have declared a dividend of 1s. 3d. per share, being at the rate of 5 per cent. per annum, less income-tax, for the three months to June 30th.

Chelsea Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate 4 per cent. per annum (2s. per share) on the ordinary shares for the half-year ended June.

National Gas Engine Co., Ltd.—The directors announce an interim dividend at the rate of 5 per cent. per annum, less income-tax, on the preference shares, and 9d. per share, less income-tax, on the ordinary shares for the six months ended June.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on Thursday, July 25th, at Salisbury House, E.C., under the chairmanship of Mr. A. A. Campbell Swinton.

The Chairman, in moving the adoption of the report (see Electrical Review, page 164), apologised for the absence of Mr. P. D. Tuckett, who had been called away to America on private business. Turning to the accounts, he said the gross trading profit had increased by £309, dividends and interest by £2,555, while the loss on working local authorities' undertakings had decreased by £1,080. The Urban Co.'s guarantee this year disappeared, while the increase of £1,385 in administration expenses, principally due to the rearrangement consequent upon the expiry of the Urban guarantee, was more than covered by the £2,000 Urban Co. management fee. This year there appeared in the accounts for the first time a provision for the redemption of debenture stock under the supplemental trust deed of 1908. After making this provision, which amounted to £4,720, the balance of net profit was £16,114, as compared with £16,138 a year ago when no such provision was made. The results of the year were therefore better by £4,696 as against last year. They recommended carrying the balance of £16,144 to reserve. The loss of £94,728 on the company's holding of ordinary shares in the Urban Co. consequent on the reduction of that company's ordinary capital by £2 per share, had been charged against reserve, and the balance of the reserves, including the net profit for the past year, would be absorbed in the scheme of capital reduction unanimously adopted by the shareholders at the recent meetings of the company held for that purpose. It was the intention of the directors. as soon as the scheme had received the approval of the Court, to pay a 3 per cent. interim dividend for the current year on the new 6 per cent. cumulative preference shares arranged for under the scheme. The redemption of the prior lien debenture stock had been effected at an average premium of 1·54 per cent., some of the stock having been previously redeemed at a discount. The issue realised approximately £94,000 net in 1908, and shareholders might, therefore, congratulate themselves on the very moderate cost at which the company had been extricated from an extremely critical position. By the redemption of the prior lien debenture stock they escaped payment of the additional ½ per cent. interest, which would otherwise have become payable on the 4½ per cent. first mortgage debenture stock under the conditions of the supplemental trust deed executed when the prior lien debentures were issued. Turning to the affairs of the sub-companies, new equivalent lamp connections showed an increase of 126,522, as compared with an increase of 107,209 in the previous year, and 88,935 two years ago. The increase was largely for power supply. The profits in subsidiary companies had increased by £8,721, as against an increase of £7,642 a year ago, the only substantial decrease being in Guernsey due to a serious breakdown of gas-engine plant, one of the contingencies to which electric supply undertakings were liable. The repairs necessitated by this breakdown were now practically complete. The Lancashire Power Co., in which they were largely interested, continued to make substantial progress, the profit realised amounting to £10,695, as against £6,485 for the previous year, and as against losses of over £4,000 per annum in 1907 and 1908. The Cornish Power Co., in which they were interested through the Urban Co., was also developing most satisfactorily. Indeed, the demand for power in the area it served had altogether exceeded their anticipations, with the result that their difficulty was to keep pace with it. During the year the sale of the Winchester undertaking to the Corporation of Winchester had been completed, releasing an investment of £25,815 at a net profit on realisation of £5,607, the total amount received being £31,422. This sum had been applied towards redeeming the prior lien debenture stock, and had proved very opportune in this connection. In company with most tramway undertakings, and in consequence of the phenomenally fine summer, the Scarborough tramways had done better last year, showing a profit of £804, as against a loss of £39 for the previous year. The general position of these tramways, however, remained the same. With regard to their prospects for the current year, the metal-lamp economy still exerted a marked influence on revenue in many cases, and he regretted to say that the results for the first quarter were somewhat poor, due to the coal strike and dearer coal and the tendency for all materials and wages to increase in price. They more than held their own, but the increase in profits would have been more rapid but for the influence of these factors. In future, until the Urban Co. resumed payment of ordinary dividends, the increased profits on the Urban Co.'s £1,250,000 capital would not be reflected in their accounts as it had been hitherto during the guarantee period, when the whole of the increase had come to them in reduction of their guarantee. For the next few years, therefore, the increase in their gross profits would necessarily be affected by this feature. It was well that this fact should be understood so as to avoid disappointment; but apart from this point, they continued to look forward with confidence to the steady improvement of their business.

Mr. S. Beeton seconded the motion, and the report was adopted without discussion.

Mr. A. A. Campbell Swinton was re-elected a director.

Lanarkshire Tramways Co.—The twenty-second ordinary general meeting was held on Tuesday at the offices, 83, Cannon Street, E.C., under the presidency of Mr. A. R. Monks. On the motion of the chairman, seconded by Mr. H. C. Levis, the report was unanimously adopted.

Great Northern and City Railway Co.

The half-yearly general meeting was held on Tuesday at the Westminster Palace Hotel, the Earl of Lauderdale presiding.

The chairman in moving the adoption of the report, said the accounts showed a considerable improvement on those for the corresponding period of last year, in that they were able to carry forward a small balance after paying debenture interest and all other fixed charges, and this in face of difficulties due to the recent strikes. Of all the railway companies which had had to struggle against these difficulties, that company had almost the unique misfortune of having to contend not only with the coal strike itself with all its attendant expenses and inconvenience, but also with the disastrous consequences of the dock strike in London. Owing to the energetic methods adopted by the general manager and to his forethought in taking timely advantage of opportunities to lay in sufficient supplies in anticipation, an uninterrupted and effective train service was maintained throughout the critical period of the strike, but not without an additional cost of £1,247 for power-house fuel. When the coal strike ended they thought their troubles were over, but the dock strike had proved in its effects almost as severe as the coal strike. Whilst coal was now abundant, though dear, and the contractors were ready to deliver, the dock strike had prevented its delivery to their power house through the Thames up the Regents Canal. For weeks they had been deprived of their usual supply. The passenger traffic had increased by over half a million, and had yielded additional revenue amounting to £2,613. The expenditure, on the other hand, had on the whole been £1,140 in excess of last year. Fuel for the power house cost £1,247 more, of which £898 was for locomotive generating. The ratio for working expenses came out at 47·82, as against 48·17 for the corresponding period of last year, a most satisfactory result, being the lowest figure yet attained. They carried to net revenue £21,687, as against £20,158 last year, or an increase of £1,555, whilst in the net revenue account there was a credit balance of £184 to carry forward against a deficiency of £1,110 last year. The average fare per passenger was 1·48d. compared with 1·51d. last year, which was due to the larger use of strip and workmen's tickets. The passengers per car-mile had risen to 7·7, representing an average of 26·3 passengers in every coach on both up and down journeys, and was the highest figure reached since the railway was opened. The subway connecting their platform at Moorgate with that of the Metropolitan Railway at the same station was on the verge of being opened for the interchange of passengers, and they had entered into arrangements with the Metropolitan and District Railways for through bookings on a revised scale. Referring to the tramway competition, he said, as they would remember, the electrification of the L.C.C. trams turned that company's business which was fast approaching a profitable basis, into a heavy loss. The cheaper construction, the cheapness with which capital was raised, and the fact that the trams were a surface service, whilst their fares competed with those of the railway, were disastrous to the immediate prospects of the company. From this calamity the company was slowly recovering. But something like dramatic justice seemed to be overtaking the trams. They, in their turn, in spite of their London County Council backing, were being made to suffer by the competition of the motor 'bus. The motor 'bus, cheaper in installation, cheaper in running, cheaper in upkeep, more flexible in use, and speedier in transit, was severely cutting into the business of the trams. It seemed as though the future of London City traffic, owing to the great congestion in the centre, might possibly find itself solved by the recent union of motor-'buses with tubes, by which the motor-'bus, acting as feeders or collectors for the underground service, might enable the transport of masses of people so collected with speed underground to their central destination, thus relieving greatly the congestion of the streets. The electric tram was, by reason of its clumsy size, its occupation of a definite position in narrow and crowded thoroughfares, becoming obviously a nuisance, and it might well be that the day of the electric tram, as a surface carrier in crowded districts, was drawing to a close.

Mr. Charles Steel seconded the motion, and the report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of £68,000 4 per cent. consolidated first mortgage debenture stock.

The committee have appointed a special settling day as under and ordered the securities mentioned to be officially quoted:—

Tuesday, August 13th.—Babcock & Wilcox, Ltd.—Further issue [illegible] ordinary shares of £1 each, fully paid, Nos. 830,001 to 1,000,000.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended June 28th, 1912, amounted to 1,012,739, compared with 835,288 units in the corresponding four weeks of 1911.

Westminster Electric Supply Corporation, Ltd.—The directors have declared an interim dividend at the rate of 9 per cent. per annum, less income-tax, owing to the high price paid for fuel due to the strike, but they express the hope that during the remainder of the year the results will enable the full dividend of 10 per cent. for the year to be paid.

Central London Railway Co.

The directors' report for the June half-year shows that the financial results were as follows :—

	1912.	1911.	
Traffic receipts	£121,072	£137,846	£16,774 dec.
Miscellaneous receipts ...	13,561	12,263	1,298 inc.
Gross receipts	£134,633	£150,109	£15,476 dec.
Less working expenses	71,969	84 208	12,239 dec.
Balance to net revenue account	£62,664	£65,901	£3,237 dec.

After providing for interest on the debenture stock, and other payments, there is an available balance, including the amount brought forward, of £76,670, as compared with £76 878, in the corresponding period. After deducting £7,894 for interest on the 4½ per cent. preference stock there remains a balance of £68,776, out of which the directors recommend the declaration of a dividend on the undivided ordinary stock at the rate of 3 per cent. per annum, and on the preferred ordinary stock at the rate of 4 per cent. per annum, for the half-year, requiring £38,538, leaving a balance of £30,238. The number of passengers carried is as follows :—

	Half-year ending June.	Half-year ending December.	Total.
1909	18,989,109	19,394,285	38,383,394
1910	20,664,896	19,995,960	40,660,856
1911	20,006,287	18,076,996	38,083,283
1912	17,249,169	—	17,249,169

The continued decrease in receipts from passenger traffic is mainly attributable to the severe motor-'bus competition and to the coal strike in the early part of the year, during which period there were fewer passengers travelling generally. On the other hand, there is a further considerable reduction in working expenses. The extension of the railway to Liverpool Street (Great Eastern Railway) is practically completed, and was opened for public traffic on Sunday last. The Bill promoted by the Metropolitan Railway Co. for running powers over the Ealing and Shepherd's Bush Railway was successfully opposed by the joint efforts of this company and the G.W. Co. Arrangements for the construction of the short extension from Wood Lane to connect with the G.W. Railway are being actively proceeded with, so as to have this portion ready when the line under construction by the G.W. Railway is completed. The directors refer to the death, on February 8th, of Sir Henry Oakley, who was chairman of the company from March, 1898, to April, 1911. The dividends will be paid on and after August 8th next. The meeting was held yesterday, August 1st.

United River Plate Telephone Co., Ltd.

Sir Irving Courtenay (chairman and managing director) presided on 23rd ult. at Winchester House, E.C., over the meeting of this company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 103), said that the company continued to make steady progress, in spite of the fact that the year which had just closed had, in some respects, not been an ideal one. The wheat harvest in Argentina had not been up to expectations, and, while the maize was apparently to be a record crop, the comparative failure of some of the other cereals had been severely felt. Then the country got something of a set-back through strikes, and that in turn was followed by a certain amount of stagnation, resulting, both directly and indirectly, from the national coal strike in this country. He believed these troubles had now been, happily, surmounted, but the effect had not been to help their development. Last year he reported the prevalence of widespread storms and floods, and was sorry to say that this year these had been worse than ever before. It had cost them thousands of pounds to repair the damage to their property, to say nothing of the loss of traffic, for on several occasions when a provincial line had been blown down they had been unable to get near it for a week to put matters right, whole tracts of country being first converted into a lake, and then into a swamp. In the towns overhead lines had been blown down, and manholes had been flooded time and again; several times men who had been in the manholes jointing cables had had to escape for their lives, the water entering the uncompleted joint and doing a great amount of damage. There had been great congestion in the Port of Buenos Ayres. The port authorities had now reorganised the department, and these deplorable delays were disappearing; and there seemed to be good reason for hoping that, given freedom from labour troubles, affairs in the port would soon become normal. In spite of these various drawbacks, they had had a good year. A larger number of subscribers had been connected than in any previous year. A number of outside towns had been joined to the Capital. Exchanges had been opened in several places where they were not previously established. They had rebuilt some trunk routes and strengthened others, and generally had maintained the service and the plant in what he might call an increasing state of efficiency. In Buenos Ayres extensions had been made to several of the common-battery exchanges, and as some of these were beginning to approach their limits of expansion, they were already considering what had better be done when additional accommodation had to be provided, as it must be shortly. A new toll exchange had been opened, which had greatly improved their trunking, and had made possible the expansion in the trunk-line receipts. They had made many minor improvements, such as increasing the number of junction lines between the various Buenos Ayres exchanges, thus cutting down the time required for communication between various districts; opening several sub-exchanges in the Capital and suburbs; installing new workshops, &c.; and the necessity for constant watchfulness and foresight in order to see where improvements could be introduced, would be apparent when he told them that in 1911 they established over 50 million telephonic communications for their subscribers in the Capital alone, and that the number of these communications at the present time was increasing at the rate of something like 12 millions per annum. In face of such facts they had some reason to congratulate themselves in that the service kept on improving and complaints decreasing. The new deposit in Calle Valentin Gomez had been finished, and the bulk of their stores removed there, and so much had the business grown, that, although at the time the site was purchased, during his visit to Buenos Ayres in 1906, the accommodation seemed ample, already they were finding it none too large for their requirements. The private branch exchange business continued to make satisfactory progress, and was of mutual benefit to themselves and to the subscribers. They received something like 100,000 calls a month through these private branch exchanges. They were busy with the undergrounding of La Plata. Most of the ducts had been laid, and the cables to put into them were now awaiting shipment. As soon as arrangements had been made for the necessary building accommodation they must put in a new and modern board there to take care of the constantly increasing traffic. The new trunk line to that city, mentioned last year, had not yet been completed, owing to a variety of causes, but the work was being pushed on as fast as the weather and state of the labour market would permit. Considerable development had been made in the Cordoba district during the year, in the way of undergrounding the plant, metallic-circuiting the lines, and connecting up surrounding towns. A new board for Cordoba was on order, and they expected soon to have that city equipped on the most modern and progressive lines. In Rosario progress had been made, and they hoped to make much greater strides there when the plant had been remodelled. They had been trying to come to some kind of arrangement with the municipality before doing this, but he was sorry to say that up to the present they had not succeeded. They were making arrangements to provide for the immediate future in a temporary way, and if once they could come to an understanding with the municipality, they were prepared to put in entirely new switchboards in that important centre. They had been prepared, and indeed anxious, this year to do even more than they had done in the way of development, but the necessary permits from the authorities were not always obtainable as quickly as they could desire, and frequently long delays occurred before they could obtain the necessary concession to connect up a new town or to run some new trunk lines. On the whole they could not complain of the treatment they received. The subways were extending rapidly. In large towns these were absolutely a necessity. Overhead wires alone would soon get so thick as to be at once an eyesore and a menace, and besides, these always constituted the vulnerable point of a telephone company. Hitherto subway work had been mostly confined to the larger cities, but they were now finding that in all directions local authorities, in their endeavours to beautify the towns, were objecting to poles in the streets, and they had in consequence had to put a certain amount of cable underground, even in comparatively small towns. This was a condition of things which made it necessary for them to acquire their own exchanges, and pursuing their usual policy in this respect, they had purchased land and buildings in several provincial towns to house their exchanges. The various developments had necessitated further capital, and it was proposed to make a fresh issue of 40,000 ordinary shares. These, as on previous occasions, would be offered to the ordinary shareholders at par. After careful consideration they had decided to alter the date for terminating the company's financial year from March 31st to December 31st. This would enable them in future to present the accounts in April, which they thought would be an improvement. At the last meeting he showed the liability of telephone plant to obsolescence and deterioration of one kind and another, and the necessity for a very strong fund to meet any possible contingency in this connection. They proposed to continue the policy then inaugurated and appropriate a further £40,000. They were satisfied that this was not by any means too much in view of their great and continuous expansion. They had expended during the year £213,594 on extensions of plant and about £20,000 on real estate, buildings, &c. The securities were up by about £18,000, representing investments made during the year, and the stock of materials by about £35,000. They had also on March 31st a sum of £80,000 on loan against securities, but this sum had since been withdrawn and practically all used for the necessities of the business. Their receipts and expenses in Argentina showed increases of £67,685 and £60,245 respectively. The latter sum included the year's appropriation for renewal of plant, and it was this item, which was *not* cash expenditure but provision for the future, which accounted for the largest part of this apparent increase in expenses. The other items were all normal, the net result showing a profit for the year of £136,511, as against £129,854 last year. They proposed an appropriation of £2,000 to the staff provident fund. The fund was a contributory one, and was doing excellent work among the employés in Argentina. As the company got most loyal and often devoted service from the staff at any hour of the day or night, and sometimes under very trying conditions, he was sure the shareholders would be absolutely in sympathy with this grant. The directors recommended a final dividend of 5 per cent. on the ordinary share capital, making, with the interim dividend paid on December 30th last, a return of 8 per cent. for the year free of income-tax.

SIR F. GREEN seconded the motion

MR. MARTIN HERZHEIM called attention to the automatic system of telephony, which, he believed, would do great things for telephony in future years, and trusted that the board would give it a trial. He also asked whether the reserve of £40,000 alluded to was not less than were the sums put by for a similar purpose in past years, in proportion to their capital and engagements. Perhaps, however, the board had provided for this in the large sum put aside for maintenance.

MR. STAMMERS asked if the board thought they could continue to pay the same dividend when the capital was increased.

The CHAIRMAN said he hoped the new capital would make no difference to the dividend. The board watched every development in telephony, and they had placed an experimental order for an automatic board, The answer as to the sufficiency of the reserve was, as Mr. Herzheim himself suggested, in the amount set aside for maintenance.

The directors were re-elected, and on the motion of the Chairman, seconded by Mr. Geo. Keith, it was agreed to increase the capital of the company to £2,000,000 by the creation of 100,000 new shares of £5 each.

The CHAIRMAN moved a vote of thanks to the consultative Committee, the general manager and staff in Argentina, and the secretary and staff in London.

SIR J. GAVEY, in seconding the motion, referred to his recent visit to Argentina, where he had come into close touch with the committee and the staff, and had been much impressed with the zeal and energy with which they carried out their work, and the discretion and tact with which they carried on the negotiations with the authorities. He had inspected the plant in the large cities and some of the trunk lines, and was pleased with the work carried on and the developments which had taken place. He experienced some of the storms the chairman had referred to, and, as a result, had a conference with the technical staff of the company, which, he trusted, would tend to minimise the damage from that cause in the future. He had also discussed with the staff the steps which must be taken in the next four or five years to deal with the growth of the business, and this also, he trusted, would lead to an efficient and economical lay-out.

The motion was carried. and the meeting concluded with a vote of thanks to the board.

City of London Electric Lighting Co., Ltd.

THE half-yearly interim report gives a comparison of the position of the company at various periods, from which we extract the following :—

	Dec., 1910.	Dec., 1911.	June. 1912.
No. of customers ..	13,876	14,246	14,277
KW. connected	37,1[illegible]7	39,122	39,962

On June 26th, 1912, in addition to the above connections, there were orders in hand for a further 1,097 KW. awaiting connection on completion of the consumers' wiring, delivery of motors, &c., as compared with 928 KW. on June 28th, 1911.

	First six months, 1910.	First six months, 1911.	First six months, 1912.
Approx. gross revenue from all sources	£140,569	£146,768	£149,432
Increase on previous year	1,432 dec.	6,199	2,664

	First six months, 1910.	First six months, 1911.	First six months, 1912.
Approximate net revenue for half-year..	£76,499	£81,676	£80,753
Add amount brought forward from previous year	25,668	27,656	25,943
Total	£102,167	£109,332	£106,696

The number of units sold was 13,622,385, as compared with 13,388,242 during the corresponding period of 1911, an increase of 234,143 units, which occurred entirely in the demand for power purposes, the units supplied for lighting and heating being somewhat less than in 1911. In the first six months of 1912 there has been a net increase of 840 in "kilowatts connected," as compared with an increase of 972 in the corresponding period of 1911. The approximate net revenue for the half-year was £80,753, of which £18,000 is required for payment of interest on loans and debenture stocks, &c., leaving £62,753, plus £25,943 brought forward, making £88,696 available for reserve and other appropriations, dividends, and carry forward. On July 17th the directors declared dividends at the rate of 6 per cent. per annum for the half-year ended June 30th, 1912, on both classes of shares, absorbing £31,243, leaving an unappropriated balance of £57,453. Warrants for these dividends, less income-tax, will be posted on September 16th. The stock of coal referred to in the last annual report has proved of the greatest value in the maintenance of a full and uninterrupted service throughout the period of the coal strike and the subsequent strike of London Dock labourers and lightermen which is still proceeding. During the current year additional rates, imposed by the quinquennial valuation of 1910, will be payable. Working expenses will also tend to be increased in future by the enhanced cost of coal and other materials, and by contributions payable by the company under the National Insurance Act, both on account of sickness insurance and unemployment insurance. Since the ordinary general meeting of the company held in March last there have been active dealings in the company's shares. So far as the directors could ascertain these were due to persistent rumours that the City Corporation was considering the advisability of exercising its option to purchase the company's undertaking in 1914. As no negotiations of any kind between the Corporation and the company had taken place, the directors considered it their duty to announce publicly that such was the case, and that they had no knowledge of the intentions of the Corporation as regards a proposed purchase. Ultimately, the Court of Common Council resolved that "it would be inexpedient to take any steps in the matter at the present time, and recommending that such rights of purchase be not exercised in 1914 or 1915."

Metropolitan District Railway Co.

THE expenditure on capital account during the June half-year was £30,775. The gross receipts on revenue account were £344,255, being an increase of £9,876. The working expenses were £140,952, a decrease of £13,590, but in previous half-years the charge for electric current included interest on the cost of the power house, &c., whereas from January 1st last, when the power house undertaking was leased to the company and the London Electric Railway Co. jointly, the interest, by way of rent payable under the lease, appears in the net revenue account. After providing for interest and other charges and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £83,491, out of which the directors recommend dividends, payable on August 8th, at the rate of £4 per cent. per annum on the 4 per cent. guaranteed stock, at the rate of £4 10s. per cent. per annum on the 4½ per cent. first preference stock, and an interim dividend at the rate of £2 per cent. per annum on the 5 per cent. second preference stock.

The comparative figures for the first halves of the years 1912 and 1911 are as under

	June half-year, 1912.	June half-year, 1911.	Inc. or dec.	Or per cent
Gross revenue	£344,255	£334,379	£9,876	2·95
Working expenditure	£140,952	£154,542	— £13,590	
No. of passengers, including workmen and season ticket-holders' journeys	42,910,560	41,503,831	+ 1,406,729	3·39
No. of passengers carried at workmen's fares	7,5[illegible],591	7,0[illegible],4[illegible]	510,[illegible]0	[illegible]
Passenger receipts	£325,434	£313,572	£11,862	3·78
Average receipt per passenger	1·82d.	1·81d.	0·01d.	[illegible]
Train mileage on District Ry.	2,037,264	1,808,620	228,644	12·64
Car mileage on District Ry.	8,084,[illegible]	7,44[illegible]	640,[illegible]67	8·61

* See above reference to power house lease.

The traffic receipts and working expenses have been adversely affected by the national strike of coal miners and of the transport workers on the Thames. In the corresponding half-year there was an abnormal increase in the traffic owing to the Coronation festivities. The company have sold during the past half-year £150,000 of prior lien debenture stock to pay for the 65 new carriages which have now been placed in service, and for other capital purposes. The Metropolitan District Railway Bill has been passed by Parliament and awaits Royal assent. The London Electric Railway Bill and the G.E. Railway Bill have been passed by Parliament and await Royal assent. An approved society under the National Health Insurance Act, 1911, is being formed for the benefit of the employés. Members of this society will receive extra benefits in addition to the minimum benefits payable under the Act.

Year.	Passengers.	Receipts.
1910	72,732,612	£560,534
Half-year ended		
June, 1911	41,503,831	£313,572
Dec., 1911	39,897,061	£300,625
June, 1912	42,910,560	£325,434

The meeting was held yesterday.

Metropolitan Railway Co.

THE directors report that the total receipts for the June half-year amount to £391,441, and the expenses to £191,462, leaving a profit of £199,979. Compared with the corresponding half-year of 1911 the receipts show a decrease of £9.295 and the expenses a decrease of £4,205. The net revenue account, after providing for the interest upon the debenture stocks and other fixed charges and placing £7,500 to the electrical renewal and depreciation fund, shows a balance of £158,815 which will permit of the payment of dividends upon the preference stocks, and leave £53,074 available for dividend upon the ordinary stock. The directors recommend a dividend upon the ordinary stock, for the past half-year, at the rate of £1 10s. per cent. per annum, carrying forward £4,611. The dividend on the surplus lands stock, for the half-year, will be at the rate of £2 15s. per cent. per annum. The receipts from passenger, goods and mineral traffic experienced a set-back. The prolonged coal miners' strike not only stopped the transit of coal, but caused a considerable decline in the goods and mineral traffic over the railway, and necessitated a restriction in the passenger train service. The passenger traffic continued to feel the keen competition of the growing motor omnibus and tramway services, while the fact that the receipts during the last month of the half-year compared with the exceptionally heavy business arising from the Coronation festivities in 1911, has also to be taken into account. On the other hand, the season ticket traffic maintained the satisfactory development which has been a marked feature for some years. The Bill promoted by the company authorising the construction of a branch line to Watford and the widening of the existing line between Finchley Road and Wembley, has been passed by both Houses, and is now awaiting the Royal Assent. Parliamentary sanction has also been given to the Bill deposited by the G.E. Railway Co., which included powers for the electrification of the East London Railway. The substitution of improved machines for the existing electrical plant at Neasden continues to progress satisfactorily, and the economy resulting from the change is already appreciable. The projected alterations at Baker Street station are in a forward state, and further contracts have been let during the half-year. The new road-bridge across the station at King's Cross was opened to the public on July 1st, and the remaining works in connection with the reconstruction of that station are rapidly approaching completion. The arcade over the Liverpool Street station was opened in January last, and most of the shops have been already let at satisfactory rents. The subways at Moorgate Street to connect this Co.'s. station with those of the City and South London and Great Northern and City Railways are nearly completed, and will be opened at an early date. The work of electrifying the East London Railway by the lessee companies is well in hand, and when this is completed the through running of Metropolitan trains over that line will be resumed. The widening of the line between Finchley Road and Wembley Park has been commenced, and considerable progress will be made during the present half-year.

Year.	Passengers.	Gross receipts for passengers, goods, minerals. and tolls.
1909	99,961,997	£696,881
1910	102,844,478	718,089
1911	101,620,653	720,745
1912 to June 30th	50,338,009	351,812

The dividends will be payable on August 14th. The meeting was held on July 31st.

Metropolitan Electric Tramways, Ltd.

MR. E. GARCKE (chairman) presided on Friday last week at the Electrical Federation Offices, 1, Kingsway, W.C., over a largely attended meeting of the shareholders, to consider resolutions reducing the capital from £1,500,000 to £1,074,504, as briefly explained on page 149 of our last issue.

The CHAIRMAN, in proposing the adoption of the resolutions, said the main reasons for the proposals was explained at the meeting held on April 3rd, when he stated that if they waited until the dividends paid increased to such an amount that the deferred shareholders would be in immediate expectation of a dividend, then considerable pressure would be brought to bear on the directors to pay higher dividends on the ordinary shares, and then there would be considerable risk of the directors not being able to place to the reserve fund as much as they deemed to be necessary in the interests of the company. Those of them who had been in companies which possessed founders' shares were aware of the great difficulties which arose from possible conflict of interests due to the existence of such shares. In their case the deferred shares were very much in the position of founders' shares, and anticipating difficulty in the future the directors deemed it to be their duty to advise the shareholders to deal with the difficulty before it arose, rather than wait until it became acute. The essence of the matter could be stated in a few words, but first he would like to make it clear that the interests of the preference shareholders were in no way affected by the proposal. At present the deferred shares were not entitled to any dividend until the ordinary shares had received 8 per cent. in any one year, and with regard to capital rights the deferred shareholders had no interest until the whole of the capital represented by the ordinary shares had been returned. After that the deferred shareholders were entitled to one-half of the surplus assets. The effect of the proposed conversion was to give to the deferred shareholders an interest very nearly equal to one-sixth of the ordinary capital so far as profits were concerned, and they would have one-sixth participation in the assets. The company had only to earn £7,900 more than they were at present earning, which would represent 2 per cent. on the ordinary shares, before the deferred shares ranked for dividend, and when that stage was reached the antagonism would become acute. It had been suggested that they might wait until the position was changed, but if they did so it would be much more difficult to deal with the subject on the terms which could be arranged now, and the directors might find themselves reproached for not dealing with the problem when it was more easy of solution. It was the duty of the directors to do the right thing for the shareholders collectively, and not to argue in the interests of either class. The directors had taken a good deal of time in weighing the respective claims, and the conclusions they had arrived at were embodied in the resolution. They felt that the giving of 5s. for every deferred share in ordinary shares, expressed a fair and equitable arrangement between the two classes of shareholders. The cost of doing this was not a very serious one for the ordinary shareholders. The converted shares would not rank for dividend till 1913, and if the company paid the same dividend as last year, viz., 6 per cent., the amount required to pay the dividend on the converted shares would be £4,900. It would not, however, necessarily cost the ordinary shareholders that amount, because the conversion would enable them to reduce the capital by £235,000. That capital was not represented by what were called tangible assets, and, indeed, it was difficult to say what it was represented by. Perhaps an accurate definition would be to say it represented goodwill. They would recollect the circumstances under which the deferred shares were created—they were given to the shareholders of the old North Metropolitan Tramways Co. by way of making up the nominal value of their shares which at the time was not represented by market value, and therefore it was strictly in the nature of a payment of goodwill. Part of the reduction of capital would be applied to writing off the preliminary expenses which stood in the balance-sheet at £92,000. At present they were writing off the item out of profit and loss at the rate of £3,000 a year, and this £3,000 would go a long way towards making up the £4 900. The net result of the scheme was that whilst they were paying small dividends the terms of the conversion were in favour of the deferred shareholders, whilst if they were able to pay large dividends then the terms would be in favour of the ordinary shareholders. He quite recognised there was a little element of speculation in the transaction. The future of the company was full of possibilities, and they had only to earn 2¼ per cent. more on their ordinary shares in the North Metropolitan Power Co. to bring the ordinary dividend in the Metropolitan Electric Tramways Co. up to 8 per cent., assuming, of course, that the tramway situation remain the same. But, as they were aware, their tramway receipts were being cut into by the competition of the motor omnibuses, and in order to preserve their property, and, if possible, earn further profits they were going to run 'buses also. They might improve their position by meeting competition by competition, or they might be able to do better by co-operation. Obviously, he thought, both sides would prefer friendly co-operation if that were possible, and more than that it would be inadvisable for him to say at the moment. He could only leave it in the hands of the shareholders, but he might say the proxies they had received were overwhelmingly in favour of the scheme.

SIR E. SPENCER seconded the motion.

MR. SKEEL, as one who had paid £1 for shares in the company recently expressed the opinion that the board ought to resist any pressure that deferred shareholders might bring upon them with regard to the placing of adequate sums to reserve and leave the capital as at present.

MR. SPILSBURY severely criticised the action of the board of the old North Metropolitan Tramways Co. in advising their shareholders to accept the deferred shares.

The CHAIRMAN asked Mr. Spilsbury if he attributed anything of an unscrupulous character to the directors of the Metropolitan Electric Tramways Co.

MR. SPILSBURY said he did not. It seemed to him that the deferred shares were now blocking the progress of the company, and hence he considered the ordinary shareholders ought to make some sacrifice.

MR. SHARP also thought it an unreasonable thing that the deferred shareholders should be asked to sacrifice 75 per cent. of their holdings.

The CHAIRMAN said he had tried to put the whole matter clearly before them, and it was apparent from the remarks made that each class of shareholders thought they were making sacrifices.

The resolutions were then put and carried.

Subsequently separate meetings of the ordinary shareholders and of the deferred shareholders were held, and the necessary resolutions for the carrying out of the scheme adopted.

London Electric Railway Co.

THE directors report that during the June half-year the capital expenditure was £76,627. The gross receipts on revenue account have amounted to £389,011, being a decrease of £3,806, as compared with the corresponding half of last year. The working expenses were £156,161, a decrease of £18,758, but in previous half-years the charge for electric current included interest on the cost of the power house, &c., whereas from January 1st last, when the power house undertaking was leased to this company and the Metropolitan District Railway Co. jointly, the interest by way of rent payable under the lease appears in the net revenue account. After providing for interest and rents, and reserving £7,500 for contingencies and renewals, there remains a balance of £121,654 available for dividends, and the directors recommend that a dividend at the rate of 4 per cent. per annum be declared on the 4 per cent. preference stock, and that a dividend at the rate of 1 per cent. per annum be declared on the ordinary shares, leaving £12,014 to be carried forward. The dividends will be payable on August 8th. The comparative figures for the corresponding half years of 1912 and 1911 are as under :—

	Half-year ending June 30th, 1912.	Half-year ending June 30th, 1911.	Decrease.	Per cent
Gross revenue	£389,011	£392,817	£3,806	— ·969
Working expenditure	*£156,161	£174,919	£18,758	—
Passenger receipts	£363,325	£369,326	£6,001	—1·625
Train mileage	2,688,949	2,728,961	40,012	—1·466
Car mileage	9,100,307	9,284,870	184,563	—1·988

* See above reference to power-house leases.

The passengers carried has been as under :—

Half-year ending	Passengers including season ticket holders' journeys.	Receipts.
December, 1910	46,665,279	£332,563
June, 1911	52,548,384	369,326
December, 1911	48,666,842	342,451
June, 1912	51,691,661	363,325

The traffic receipts and working expenses have been adversely affected by the National strike of coal-miners and of the transport workers on the Thames. In the corresponding half-year there was an abnormal increase in the traffic, owing to the Coronation festivities. The London Electric Railway Bill has been passed and now awaits Royal Assent. Some amendments were made during the Committee stage, the most important being the deletion of the provision for an additional passenger exit to Argyll Place at the Oxford Circus station. The Metropolitan District Railway Bill and the Edgware and Hampstead Railway Bill have been passed and await Royal Assent. An approved society under the National Health Insurance Act, 1911, is being formed for the benefit of the employés. Members of this society will receive extra benefits in addition to the minimum benefits payable under the Act.

The meeting was held yesterday.

South American Light and Power Co., Ltd.

The directors' report for the year ended March 31st, 1912, states that the net profit was £6,787 plus £580 brought forward, making available £7,367, which is to be dealt with as follows:—Dividend of 4 per cent. on the £150,000 capital issued, £6,000, interest at the rate of 4 per cent. per annum on £36,409 capital expenditure incurred during the year by the railway company, £602, to reserve £305, carrying forward £459. The directors further recommend that the premium on the redemption of the £50,000 old debentures (viz., £2,500) should be charged against the reserve account. By the agreement of July 25th, 1910, the company is saved from large capital expenditure for the purchase of generating plant, and the railway company is relieved from keeping in repair the old generating gas plant.

The steady increase in the business has been as under :—

	March, 1910.	March, 1911.	March, 1912.
Arc lamps, connected	511	587	639
8-c.p. incan. lamps connected .	39,084	44,511	46,530
Fans, connected	200	219	271
Motors	52	75	81
Customers ..	960	1,166	1,381

The Right Hon. Frederick Huth Jackson retired from the board on November 13th last, and Mr. A. H. Bartlett was elected in his place.

The nineth annual general meeting was held on July 25th at Dashwood House, E.C., Mr. T. Penn Gaskell presiding.

The CHAIRMAN, in proposing the adoption of the above report, said that the past had been the least progressive year that the company had had for some time, but he was glad to say that the prospects now were very much better. As they were aware, Bahia Blanca had suffered very greatly for some years, owing to the deficient harvests. The harvest of the past year had been comparatively good, and he believed they were going to see the effects of it as regarded the company in the current year. The net receipts during the past year were between 9 and 10 per cent. better than those of the previous 12 months, but the receipts for April of the current year had created a record, and showed an increase of about 25 per cent. over those of the corresponding month last year. If that went on, they might certainly hope to resume the 5 per cent. dividend they had paid in the past, and he would not be surprised if they did not exceed it.

MR. EDMUND CHARRINGTON seconded the motion.

MR. A. C. GRIFFITHS said he would like to know whether they were coming to an end as regarded capital expenditure. During the past few years it had been necessary to raise a large amount of fresh capital which had been put in front of the ordinary shareholders, and their prospects had not improved quite in the same ratio.

The CHAIRMAN replied that undoubtedly the capital expenditure in the future would be less than it had been during the past few years. They had been obliged to lay underground cables instead of overhead, the cost of which fell upon the company. He believed the capital expenditure had now been brought into a comparatively narrow compass. Of course, if the business increased, naturally they must put cables down in streets where new houses were being erected. He had told them that the returns for April this year showed an increase of 25 per cent. over those of the previous April, and they might take that as a fair index of what the results were likely to be over the whole year, April being about an average month as regarded demand. He did not think the shareholders need be alarmed about the debenture issue, because it was a 5 per cent. stock, and he hoped it would not be long before the dividend on the shares would greatly exceed that figure, and it would be an advantage to the shareholders that half of the share capital was at a fixed 5 per cent., as the ordinary shareholders would reap the benefit.

The report was adopted.

Official Announcements re Companies.—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved :—

British Power, Traction and Lighting Co., Ltd.
Chipping Norton and District Electric Light and Power Co., Ltd.
Electrical Corporation, Ltd.
Mono-Rail Construction Co., Ltd.
E. M. H. Tramway Syndicate, Ltd.

The following companies have been struck off the register, and are accordingly dissolved :—

City and Surrey Electric Railway Co., Ltd.
Cooke's Patent Tramway System, Ltd.
Electrical Manufacturers and Wholesale Traders' Protection Association, Ltd.
Electric Circuit Breaker, Ltd.
Furnace and Boiler Syndicate, Ltd.
Garrett Automatic Sprinkler, Ltd.
Gaseous Steam Generator, Ltd.
Hughes' Metallic Packing Co., Ltd.
Lowden Electric Lamp Co., Ltd.
Mechanical and Electrical Power Co., Ltd.
Mica and Felspar Syndicate of Norway, Ltd.
Munro Fire Detector Co., Ltd.
Phœnix Peat Fuel Syndicate, Ltd.
Soler Aluminium French Works Syndicate, Ltd.
Soler Aluminium Parent Syndicate, Ltd.
Sperling's Nut-Lock (Foreign), Ltd.

Bristol Tramways and Carriage Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 80th.

Mersey Railway Co.

The accounts for the half-year ended June 30th, 1912, show that the train mileage was 284,758 miles, as compared with 326,063 during the corresponding six months of 1911. The number of passengers amounted to 6,123,227 as against 6,027,753, exclusive of season ticket holders. The total receipts from all sources for the half-year were £56,275, as compared with £55,796. The working expenses, exclusive of the charges for pumping, ventilation, and lifts, were £26,312, equal to 46·75 per cent., as against £26,426, equal to 47·36 per cent. These charges for pumping, ventilation, and hydraulic lifts amounted to £3,211, equal to 5·71 per cent., as compared with £2,799, or at the rate of 5·01 per cent. for the corresponding period of 1911. After providing for rent charges, renewal fund, and interest on the new first perpetual debenture stock, there is a balance at the credit of net revenue account of £8,109, which has been carried forward to the next half-yearly account to be applied so far as available therefor, after December 31st towards payment of interest on the debenture stocks, which is contingent on the revenue available therefor in each separate year ending December 31st.

The French Westinghouse Co.—The Société Anonyme Westinghouse, of Paris, whose share capital was reduced in 1910 from £800,000 to £500,000, is unable to pay any dividend for 1911. The gross profits and yield from investments experienced an increase last year, but working expenses and interest charges also advanced and a larger sum has been placed to reserve and depreciation funds than in 1910. The final result is a loss of £12,000 as compared with a deficit of £5,000 in 1910. According to the directors' report, the orders received at the workshops in Havre and Freinville were slightly less than in the preceding year. A considerable turnover at remunerative prices took place in condensers. As far as possible the electrical department was limited to the construction of standard types or of types already built. At present the company has a considerable amount of orders on hand, including large requirements for electric train equipment. The report also refers to the various undertakings in which the company is interested. It is mentioned that in consequence of the war the Italian Westinghouse Co., whose special sphere is the construction of electric locomotives, did not receive any Government orders for this department, although various materials were supplied for the Italian army.

Paris Lighting Companies.—The Secteur de la Place Clichy, which belongs to the Union of Secteurs, which is to be merged into the Compagnie de Distribution d'Electricité in the course of two or three years, earned net profits of £37,000 in 1911, as compared with £24,000 in the preceding year. It is proposed to pay a dividend of £2 12s. per share on the capital of £240,000, as against £1 16s. per share in 1910. The company holds shares of £175,000 in its subsidiary undertaking, the Société Triphasé. The Société Triphasé, which has a share capital of £500,000, reports net profits of £34,000 in 1911, as contrasted with £23,000 in the previous year, and the dividend is at the rate of 16s. per share, as in 1910. A portion of the company's output is being sold to the Secteurs until the Compagnie de Distribution has completed its plant, whilst the former is also further extending the scope of its activity outside Paris.

Victoria Falls and Transvaal Power Co.—According to the *Times* the directors report a profit of £323,094, plus the amount brought forward, making £360,943. After providing for debenture interest and income-tax, £124,736, and for depreciation, £61,264, the balance is £174,943. A dividend at the rate of 6 per cent. per annum, less tax, on the amounts for the time being paid up on the preference shares from October 15th, 1909, to December 31st, 1910, was paid last month, absorbing £129,199, and leaving £45,744 to be carried forward. The profit was secured by sales of power from the Brakpan and Simmer Pan stations, and by profits received in respect of the company's holding in the Rand Mines Power Supply Co. The company has received applications for power supplies amounting to 52,000 H.P. and the Rand Mines Power Supply Co. for supplies of electricity of 67,000 H.P. and of compressed air of 66,000 H.P., making a total notified demand of 185,000 H.P. When all the extensions to the stations for which arrangements have been made are completed, the combined plants of the Victoria Falls and Transvaal Power Co. and the Rand Mines Power Supply Co. will have a capacity of 232,000 H.P.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th, 1912, at the rate of 5 per cent. per annum.

Blackpool and Fleetwood Tramroad Co.—The aggregate revenue for the six months was £13,239, an increase of £740 compared with the corresponding period last year. The directors recommend the usual 4 per cent. dividend after writing off £2,000 for depreciation reserve (£750 more than last year) and £500 for general reserve, leaving £1,074 to be carried forward.

Chatham and District Light Railways Co.—The twenty-third ordinary general meeting of the shareholders was held on Tuesday at the offices 83, Cannon Street, E.C., Mr. A. R. Monks in the chair. The chairman formally proposed the adoption of the report, which was seconded by Mr. W. B. H. Martindale, and agreed to.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 31st.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	„ Nitric	„	22/-	..
a	„ Oxalic	per lb.	2¾d.	..
a	„ Sulphuric	per cwt.	5/6	..
a	Ammoniac Sal	„	42/-	..
a	Ammonia, Muriate (large crystal)	per ton	£29 10	..
a	Bleaching powder	„	£5 10	..
a	Bisulphide of Carbon	„	£18	..
a	Borax	„	£16 10	..
a	Copper Sulphate	„	£24 15	..
a	Lead, Nitrate	„	£26 10	..
a	„ White Sugar	„	£25 10	..
a	„ Peroxide	„	£32	..
e	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3¼d.	..
a	Potash, Caustic (88/90 %)	per ton	£22 10	..
a	„ Chlorate	per lb.	3½d.	..
a	„ Perchlorate	„	4¼d.	..
a	Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7¼d.	..
a	Shellac	per cwt.	70/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	„	£6 10	..
a	„ Recovered	„	£5 10	..
a	„ Lump	„	£5 5	..
a	Soda, Caustic (white 70/72 %)	„	£10 5	..
a	„ Chlorate	per lb.	3⅝d.	..
a	„ Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks	per lb	3d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£80	£5 inc.
b	„ Wire, in ton lots	„	£102	..
b	„ Sheet, in ton lots	„	£120	..
p	Babbitt's metal ingots	„	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	½d. dec.
c	„ Tube (brazed)	„	11½d.	..
c	„ „ (solid drawn)	„	9¾d.	.
c	„ Wire, basis	„	8½d.	½d. dec.
c	Copper Tubes (brazed)	„	10½d.	¼d. dec.
c	„ „ (solid drawn)	„	11¼d.	¼d. dec.
g	„ Bars (best selected)	per ton	£95	£3 inc.
g	„ Sheet	„	£95	£3 inc.
g	„ Rod	„	£95	£3 inc.
d	„ (Electrolytic) Bars	„	£81 10s.	..
d	„ „ Sheets	„	£99 10	..
d	„ „ Rods	„	£[illegible]	..
d	„ „ H.C. Wire	per lb.	10¼d.	..
f	Ebonite Rod	„	5/8	..
f	„ Sheet	„	4/9	..
n	German Silver Wire	„	1/7	..
h	Gutta-percha, fine	„	6/6 to 8/6	..
h	India-rubber, Para fine	„	4/11	¼d. inc.
i	Iron Pig (Cleveland warrants)	per ton	58/8	1/8 inc.
l	„ Wire, galv. No. 8, P.O. qual.	..	£14	..
g	Lead, English Pig	„	£19 2 6	5s. inc.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£8 10	
e	Mica (in original cases) small	per lb.	6d. to 3s.	..
e	„ „ „ medium	„	3/6 to 6/-	..
e	„ „ „ large	„	7/6 to 11/-	..
p	Phosphor Bronze, plain castings	„	11d.	..
p	„ „ rolled bars & rods	„	1/0½	..
p	„ „ rolled strip & sheet	„	1/1	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	11d.	..
r	Steel Magnet, in bars	per ton	£55	.
g	Tin, Block (English)	„	£208 to £209	£5 inc.
n	„ Wire, Nos. 1 to 16	per lb.	2/5	..
p	White Anti-friction Metals	per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.)	„	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

That the precipitate fall in Consols should have been stayed, is in itself a strengthening factor to Stock Exchange markets. It had the effect of arresting the downward movement that had started in Home Railway prior charge issues, and it stopped the crumbling in certain other gilt-edged securities, at the same time restoring a little confidence to the City as a whole. Buyers, however, are still timid about laying in any large quantity of stock; and markets, with August stretching in front of them, go softly as a whole.

The Home Railway market, after being acutely flat, recovered most of the losses, upon the theory that the worst regarding the past half-year is now known, and that the takings in respect of the current six months will run against strike figures for a month or so. Electrical Railway stocks, however, have moved little during the past week. There was a slump in Metropolitans, but the net decline is no more than ½ on the week, while Districts are ½ down. Central Londons, while nominally unchanged, are a better market on the opening of the Liverpool Street extension, which took place last Saturday. From the lay point of view, it would seem that there should be almost instantaneous success for this greatly needed spur of line, but whether the traffics will justify the half-a-million pounds expenditure remains to be seen. The escalator itself is an attraction just at present. City and South London stocks are nearly all *ex* dividend, allowing for which, the Ordinary is a point down. The recent firmness in Great Northern and City Preferred, which has been still further improved upon this week, is explained by the issue of a report showing the Company to have earned its Debenture interest, on the strength of which the shares have moved up to 2. Underground Electric "A" are a little lower at 12s. 6d. middle, having touched 12s., while the Income Bonds at 88 are a point down.

London United Tramways Preference lost 5s. of their last week's sharp advance, while the Debenture stock is unaltered. The only changes in British Electric Tractions are a fall of 1 in the 7 per cent. Preferred and a rise of 2 in the 5 per cent. Debenture stocks. Yorkshire 4½ per cent. Debenture is up a point, the rarity of movements in this stock making the advance the more noticeable.

English electricity supply shares are good. With the exception of City of London Ordinary, what movements have taken place are in the upward direction. Rises of ⅛ have been secured by Brompton Ordinary and Preference, Charing Cross Preference, and County Ordinary. South Metropolitan Preference improved $\frac{1}{32}$. St. James' recovered the dividend of 5s. per share deducted last Friday. City of London Ordinary fell 15s. on the issue of the interim report for the half-year to June, 1912, which shows that the company has made substantial progress, but which again denies that any negotiations have taken place between the Corporation of London and the company. The report points out that during the current year additional taxes imposed by the Quinquennial Valuation of 1910 will be payable, while working expenses will tend to increase by reason of the enhanced cost of coal and materials, and by contributions payable under the National Insurance Act. These are items which, of course, affect all companies in the list, but the declarations of satisfactory interim dividends have been sufficient in their cases to counteract the expectation of increased costs. There is, moreover, the nebulous anticipation of some scheme of welding into a whole the various interests of electrical bodies working in London, which anticipation, as we have pointed out previously, is certainly very premature just yet.

Latin-Canadians are somewhat passive as regards quotations, and the movements, on the whole, are inclined to descend. Rio Trams, Sao Paulo Trams, Mexican Light and Power, Shawinigan Water, Mexico Tramway 6 per cent. Bonds, and one or two others, are a point or so down, though this, considering the previous rises and the season of the year, is natural enough. British Columbia Electric Preferred Ordinary there has been some pressure to sell, and the price went back 2½. Small rises were secured by Toronto Debenture and Electrical Development of Ontario Bonds. In other directions, Calcutta Trams are ⅛ up. Bombay Preference, nominally ¼ lower, are *ex* dividend.

Interest in the Telegraph market is largely absorbed by an increase of speculation in National Telephone Deferred stock. The price fell to 141½, but rallied in the early part of this week, so that on balance the movement is a decline of ½. The Third Preference shares have been moving in sympathy, but they will be extinguished, so far as their par value of £5 is concerned, this week. The arbitration proceedings stand adjourned until the autumn. Incidentally, it may be remarked that those who contend that the payment by the Government for the Telephone undertaking must necessarily constitute a bear point for Consols, rather overlook the fact that the money is pretty certain to come back to the Stock Exchange for re-investment; so that, roughly speaking, the operation is little more than an exchange of investments.

Globe Telegraph and Trust Ordinary are a little better, but the American and the Eastern groups are extremely quiet. United River Plate Telephone Ordinary were quoted *ex* rights the other day, these being valued at about 7s. per old share, and the new shares being quoted 1⅞-2 for renunciation letters. In Marconis there is not much excitement for the time being, and prices show small losses.

The manufacturing division presents few points of interest. Babcock & Wilcox recovered most of their fall of last week. On the drop, a good number of buying orders came in, at limits a shade under the market level, and not a few of these got missed, at all events for the present, because the prospective purchasers tried to get the shares a little too cheaply. Callenders are ¼ down, and Henley's Preference receded a small fraction. Vickers and other armament shares, after hardening a trifle on the ambitious naval programmes of various nations, have gone back to about the same as they were before; while the Rubber market lost most of the vigour it displayed last week, the auction sales on Tuesday being considered somewhat colourless.

Newcastle and District Electric Lighting Co., Ltd.—The directors have declared an interim dividend at the rate of 3 per cent. per annum, for the June half-year.

Metropolitan Electric Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the half-year ended June 30th.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 30th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	9¾— 10¾	.	5 2 4
Do. 4½ % Pref...	10	4½	4½	9 — 10		4 10 0
Do. Second 6 % Pref. ..	10	6	6	10½— 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	10†	8½— 9	+ ⅛	5 11 2
Do. 7 % Cum. Pref.	5	7	7	7¾— 8¼	+ ⅛	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½— 5	..	5 0 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅜— 4⅞	+ ⅛	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾— 4¼	..	5 6 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅜— 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	7	8	17½— 19½	- ½	4 2 1
Do. 6 % Cum. Pref.	10	6	6	14½— 16½	..	3 12 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	5	6	11¼— 11¾	+ ⅛	5 2 2
Do. 6 % Pref.	10	6	6	11½— 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 8 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	7/16— 11/16		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾— 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95 xd	..	4 14 9
Hove	5	[illegible]	9	7½— 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	9	7½— 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93 xd	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1¼— 1½	..	4 0 8
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3½— 4	..	6 1 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼— 4¾	..	4 17 4
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	85½— 87½	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4¾— 4⅞ xd	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	6⅛— 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8¾ xd	..	5 14 8
Do. 7 % Pref.	5	7	7	6¾— 7¼ xd	+ ¼	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	+1	4 1 5
Smithfield Markets, Ord. ..	5	Nil	2	1⅜— 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	.	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1 3/16— 1 5/16	+ 1/16	5 17 8
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord...	£3	5	..	¼— ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½— 3	..	3 6 8
Do. 4½ % First Mort. Deb...	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord.	5	10	10	8½— 8¾	..	5 14 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5¼	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½— 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7½— 8	+ ⅛	5 6 3
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	96— 98	..	5 2 0
Canadian Gen. El. Com. ..	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	13/16— 15/16	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 — 98	+ 1½	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— ¼	..	Nil
Do. 6 % Pref.	1	6	6	13/32— 23/32	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1⅞— 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	93 — 96	—1	4 3 4
Do. 7 % Cum. Pref.	$100	7	7	108 —111	..	6 6 2
Do 5 % 1st Mort. Gold Bds.	..	5	5	99 —101	..	4 19 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90	..	5 11 1
Montreal, Lt., H. and Power ..	$100	7	8	233 —243 xd	.	3 5 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	151 —156	—1	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	+ ½	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½— 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	Nil	11⅞d.	⅞— 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½—107½	..	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7½— 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½— 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	148 —150	..	5 6 8
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph ..	Stock	3¾	3	65½— 67½ xd	+ ¾	5 1 0
Do. 6 % Pref.	Do.	6	6	110¾—111¾ xd	+ ½	5 7 5
Do. Def...	Do.	30/-	30/-	25¾— 26¼	+ ⅛	5 14 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½—104½	..	4 16 2
Chili Telephone	5	7	..	7½— 7¾	..	4 19 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	..	4 15 3
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable ..	10	4½	5	7¼— 7¾ xd	..	6 9 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128 —131	..	5 6 10
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79	— ½	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	98½—100½	..	3 19 7
Eastern Extension	10	7	5†	12¾— 13¼	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust ..	10	5⅞	6†	11 — 11½	+ ¼	5 4 4
Do. 6 % Pref.	10	6	6	12⅝— 13⅛	..	4 11 5
Great Northern Telegraph ..	10	18	18	28 — 29	..	6 4 2
Indo-European Telegraph ..	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common ..	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5 3/16— 5 5/16	— ⅛	3 15 2
Do. 7 % Cum. Partic. Pref.	1	16	17	4½— 4¾	— ⅛	3 11 5
Monte Video Telephone, Ord...	1	6	6	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 3
National Telephone, Pref. ..	Stock	6	6	101½—104½	..	..
Do. Def...	Do.	6	6	142½—144½	— ½	..
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5¾— 6	— 3/16	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99½—100½	..	4 9 7
Oriental Telep. and Elec. ..	1	8	8	21/32— 25/32	+ 1/16	4 10 0
Do. 6 % Cum. Pref.	1	6	6	1 1/16— 1 3/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	11 — 11½	+ ⅛	3 9 5
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 1/16— 7 5/16 xd	..	5 9 7
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 11 0
West Coast of America	2½	2½	2½	1 5/16— 1 9/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	½	2½— 2¾	..	1 16 4
Do. 6 % Cum. 1st Pref. ..	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾— 10¼	..	5 17
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17
Western Telegraph, Ltd. ..	10	7	6†	13 — 13½	..	5 3
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 30th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32 — 11/32	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	41 — 44	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	97 —100	+ 1½	5 0 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	74 — 76	..	3 19 0
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	2	73 — 75	..	2 13 4
Do. 4 % Deb.	100	4	4	99 —101	—1	3 19 3
City & South London, Ord. ..	100	1½	1⅝	33 — 34 xd	—1	4 1 0
Do. 5 % Pref., 1891	100	5	5	106 —108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1901	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1903	100	5	5	101 —103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10⅜ — 11⅜ xd	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅞ — 2⅛	⅛	Nil
Hastings Trams, 6 % Pref. ..	1	Nil	6	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	5 — 5½	— ½	..
Do. 4 % Deb.	100	4	4	73 — 77	..	5 4 0

NAME.	Stock or Share.	Dividends for		Closing Quotations July 30th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅜	1⅞	54 — 54½	— ½	2 19 8
Do. Surplus Lands	100	2¾	2⅞	67 — 69	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	86 — 88	..	3 18 8
Metropolitan District Ord. ..	100	Nil	Nil	38 — 38½	— ½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	98 —100	..	4 0 0
Do. 4½ % First Pref.	100	3¼	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def.	1	Nil	..	3/16 — ¼	..	Nil
Do. 5 % Pref.	1	5	5	27/32 — 31/32	..	5 4 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	..	Nil
Do. "A"	1/-	..	..	13/32 — 21/32	— 1/32	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	87 — 89	— 1	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	+ 1	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5 3/16 — 5 7/16	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 15/16 — 5 1/16	..	5 6 0
Do. 4 % Deb.	100	4	4	94 — 95½	— ½	4 3 9
Do. 4½ % Deb.	100	4½	4½	99½ —101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	8†	135 —140	..	5 14 4
Do. Pref. Ord.	100	6	6	114½ —119½	—2½	5 0 6
Do. 5 % Pref.	100	5	5	114½ —108½	..	4 12 2
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	— ½	4 6 7
Calcutta Trams, Ord.	5	6	7	6⅛ — 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5 5/16 — 5 13/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0

La Plata Elec. Trms, Ord. ..	1	..	..	½ — ¾	..	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	123 —126 xd	..	5 11 1
Do. Gen. Con. 5 % Bonds ..	..	5	5	100 —102	..	4 18 0
Do. 6 % Bonds	100	6	6	102 —104	— 2	5 15 5
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7¼ — 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16 — 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	151 —154	—1	3 5 0
Do. 1st Mort. 5 % Bonds ..	..	5	5	102¾ —103¾	— ½	4 16 5
Do. 5 % Mort. Bonds ..	100	5	5	99¾ —100¾	..	4 19 3
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	257 —262	—4	3 16 4
Do. 5 % 1st Deb.	$500	5	5	106 —108	..	4 12 7
Singapore Trams, 5 % Deb. ..	100	5	5	82½ — 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100	..	5 0 0
Un. Elec. Trams Monte Video ..	5	6	7	5⅜ — 5⅞	..	5 19 2
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104½ —106½	..	4 4 6

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝ — ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3 — 3¼	+ ⅛	4 6 2
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
British Aluminium, Ord. ..	1	..	..	9/16 — 13/16	..	..
Do. 6 % Cum. Pref.	1	..	..	⅝ — ¾	..	..
Do. 5 % Prior Lien Debs. .	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	6 — 6½ xd	..	4 12 4
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	8	Nil	..	7/16 — 11/16	..	Nil
Do. Deb...	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¼ — 11¼	— ¼	6 16 4
Do. Pref.	5	5	5	4¾ — 5	..	5 0 0
Do. Deb...	100	4½	4½	98½ —100½	..	4 9 6
Castner-Kellner	1	17½	20	3⅝ — 3¾	..	5 6 8
Do. Deb...	100	4½	4½	102 —105 xd	..	4 5 9

Crompton & Co.	8	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16 — 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅜ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	¾ — 1 xd	..	7 10 0
Do. Pref.	2	7	7	1⅝ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾	..	5 16 8
Do. Pref.	5	4½	4½	4⅞ — 5⅛	—1/16	4 7 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	8¼ — 9¼	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction.. ..	12	20	10†	32½ — 34½	..	6 16 6
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

REVIEWS.

The Steam Turbine. By Sir C. A. Parsons, K.C.B. Cambridge : University Press. Price 1s. 6d. net.

This useful little volume contains the Rede Lecture of 1911 on the steam turbine, by Sir Charles Parsons. The nature and intention of the Rede Lectures do not permit an exhaustive treatment of any subject within their limits. It is only possible to give the bare outlines, and these, with respect to the turbine, are given with admirable clearness and compression by the one man who is best able to do this. The development of the turbine is not only a romance of invention which has captured the imagination even of the lay public, it is an invaluable example of the value practical manufacture derives from mathematics and abstract speculation. Sir Charles Parsons states that £24,000 were spent in experiments before an order was received. As he puts it, "The practical development of this engine was commenced chiefly on the basis of the data of physicists." And afterwards a further sum of £20,000 sterling was spent in proving the advantage of mechanical gearing of turbines in mercantile and war vessels. Of all modern developments of engineering the turbine has depended least of all upon the chance discoveries of rule of thumb. As it was thought out, so it was worked out. And the results ? To-day the aggregate power of Parsons turbines fitted for marine propulsion is six million shaft horse-power, with an equivalent amount for land use. The total is thus considerably more than double the available power of Niagara Falls. It may be asked why it is necessary to emphasise a fact so well known. Well, it may be well known, but it certainly is not acted upon universally ; and in a hundred different directions the old "not quite good enough" is being produced for lack of a little imaginative daring in spending some money, attacking a problem from its fundamentals, and working out its solution with patience, and with a wise lavishness in expenditure. Engineering is the most continuously progressive movement in the world to-day, but even it is letting slip opportunities such as those seen and seized by Sir Charles Parsons. If, for example, there had been a man of his calibre backed with adequate capital five years ago to take an interest in aviation, we should not see, as we see to-day, the French controlling the entire industry, followed by the Americans, *longo intervallo*, and the British comparatively nowhere. Of the many types of turbines in the market there are four chief types. There is the compound reaction turbine, of which the author is the pioneer. It comprises 90 per cent. of all marine turbines, and half those used on land for driving dynamos. Next comes the de Laval, which is, of course, only used for small powers. Thirdly, there is the Curtis, or multiple impulse compounded, chiefly used on land. The last is a combination of the first, with one or more Curtis elements at the high-pressure end to replace the reaction blading. To the general public, and, perhaps, in some measure to the average engineer, the wonderful progress of the turbine as a marine engine has monopolised attention to the exclusion of some other interesting developments. For instance, Sir Charles draws attention to the growing use of low-pressure turbines to utilise the large quantities of steam that are blown off to waste in colliery and iron districts. This "waste" is now often used to generate electricity or for working blast-furnace blowers and centrifugal pumps and gas forcers. But an even more interesting extension of utility has been made recently in a Scottish iron-plate mill, where an exhaust turbine of 750 H.P. has been applied to drive the mill.

This is the first turbine that has been geared to a rolling mill, and it is the precursor of many others. By a double reduction of helical gear the mill is driven at 70 revolutions, the turbine itself revolving at 2,000 R.P.M. During the short time of each rolling the turbine and fly-wheel collectively exert 4,000 H.P., the maximum fall in speed at the end of each roll being only 7 per cent.

The book is illustrated by a number of interesting plates, showing the arrangement of machinery in various types of naval and mercantile vessels, together with tables showing the development of power of turbo-generators at different dates since 1885.

Depreciation and Wasting Assets. By P. D. Leake. London : H. Good & Son. Price 10s. 6d. net.

This is a clear and well written exposition of the principles, calculation, record and treatment in general of depreciation and wasting assets, a subject of transcending importance, various aspects and branches of which, it may be observed, have received able treatment in the columns of the Electrical Review.

The theme, as treated by Mr. Leake, covers 12 chapters 196 pages in all. The book is well got up ; but the price strikes us as being expensive.

Mr. Leake does not appear to introduce anything that may be characterised as new ; indeed, the ground traversed has been, generally speaking, more or less already so frequently covered in varying forms, that there is but little to add to such a threadbare, but none the less important, subject.

That depreciation is a loss, and therefore a proper and necessary charge in the profit and loss account before arriving in the usual manner at the estimated total profit or total loss for the period (profits are more or less estimated), is an elementary and irrefutable statement ; but, perhaps, two of the principal difficulties encountered in the direction of giving due effect thereto are (1) the inability of the undertaking to afford ample practical recognition of the needs of depreciation from various causes, and (2) the recurrence of making the minimum demands of depreciation subservient to the requirements of dividend on capital.

There are other considerations of different natures, governed by the idiosyncrasies of the particular trade or by special circumstances, which, however, cannot be noticed well in the course of a review ; but those indicated, and others generally, are untenable from the point of view that depreciation is a loss, and that ample reparation thereof should be systematically made and accounted for in the common process of arriving at so-called net profits or net losses.

Economic and legal profits are, however, two different things, as the following dicta will show :—

"There is nothing in the Acts which says that dividends are only to be paid out of profits . . . . but still there is this firmly fixed—that capital assets of the company are not to be applied for any purpose not within the objects of the company, and paying dividend is not the object of the company, but carrying on the business is its object. In considering whether this is to be treated as an honest division of profit, or as a division of capital under the guise of a dividend, the Court will have regard to the directions of the articles, although, of course, if those articles authorise, not a mere division of profit, but a division of capital (using capital in the proper sense of the word, by which I mean permanent assets and assets not to be expended in providing for the profit earned by the company), such a provision will be *ultra vires* and void."

Thus spoke Cotton, L.J., in Lee *v.* Neuchatel Asphalte Co., in dealing with the question of the distribution of dividends in the case of wasting assets or properties.

In the same case, Lindley, L.J., delivered himself of the following, among other expressions :—

"There is nothing at all in the Acts about how dividends are to be paid nor how profits are to be reckoned ; all that is left, and very properly left, to the commercial world. It is not a subject for an Act of Parliament to say how accounts are to be kept ; what is to be put into capital account, what into an income account, is left to business men."

"The Companies' Acts do not require the capital to be made up, if lost. They contain no provision of the kind."

Before leaving this phase of the subject, let us notice the perhaps more important pronouncement of Lindley, L.J., in the case of Verner *v.* General and Commercial Investment Trust :—

"There is no law which prevents a company from sinking its capital in the purchase or production of a money-making property or undertaking and from dividing the money annually yielded by it without preserving the capital sunk, so as to be able to reproduce it intact either before or after the winding-up of the company."

When it is said, and truly said, that dividends are not to be paid out of capital, the word capital means the money subscribed pursuant to the memorandum of the association, or what is represented by that money. Accretions to that capital may be realised and turned into money, which may be divided among the shareholders, as was decided in Lubbuck *v.* British Bank of South America.

The law is more accurately expressed by saying that dividends cannot be paid out of capital, than by saying that they can only be paid out of profits. The last expression leads to the inference that the capital must always be kept up and represented by assets, which, if sold, would produce it, and this is more than is required by law.

Floating or circulating capital must be kept up, and so on.

It would not be wise to rely on these decisions; they reflect at once the transparent difference between true or economic profits and legal profits, whilst they do not appear to encourage the performance of the economic obligation to provide systematically and adequately for exhaustion of capital. From an economic point of view, are not dividends often more or less paid-out capital? Reverting to the first paragraph of Lindley's opinion, we should not have so many wild-cat schemes launched upon the public if there were imposed a salutary obligation on those concerned to return a minimum proportion of the paid capital in any case, either in the shape of capital or of dividend. We often read of large dividends; but what of dividendless companies and of lost capital? It would be interesting to study a statement showing the capital embarked, the dividends paid, and the capital lost in industrial and other undertakings.

The measurement of depreciation is a subject which teems with difficulties; but they are far from being insuperable. Haphazard reservations on account of depreciation are generally inefficient, and it therefore becomes of the greatest importance in all undertakings to inaugurate a proper system for its approximate ascertainment and its record, and what is equally important, its entry in the profit and loss or revenue account, such system or record with its history of the plant and machinery, say, embracing, *inter alia*, its estimated life, renewals, amounts written off at the end of the financial year, obsolescence and probable sale, and forming a valuable detailed adjunct to the usual accounting.

Any proposal of the nature suggested should be, of course, framed by the accountant or the secretary of the company in conjunction with the engineering department for the approval of the directorate. Mr. Leake considers that the word depreciation has too wide a meaning, and suggests the use of the phrase "expired capital outlay" in preference to that term, in its commercial sense. Wasting assets are defined, followed by a chapter upon fixed and floating capital, in which he draws attention to the distinction between the amount of the capital embarked and the state of the capital investment, and interprets capital outlay on wasting assets as only long period revenue outlay. The subject of economic costs is intelligently treated, whilst the chapter upon the interest question is interesting; the interest incidence is often more academic than practical, and may be dismissed with the observation that the simpler the method employed the better. The ascertainment of the depreciation of industrial plant receives just notice, the writer being of opinion that the adoption of his proposed register of plant would secure a great advance on present methods. To the section on the record of the depreciation of industrial plant is naturally devoted a fair share of the author's consideration.

There are some points on which our views do not quite harmonise with those of Mr. Leake; but the book is a meritorious contribution to the literature on the subject.—G. J.

The Principles and Practice of Electric Wiring. By A. Bursill, A.M.I.E.E. London: Longmans, Green and Co. Price 3s. net.

The list of books available for the instruction of the electric light wireman is now a long one; although there is considerable variation in their quality, it may be said that all are useful, and the least of them contains information of value to practical men. Unfortunately the author appears to know much more about wiring than about the men who do it for a living, and it is seldom that the problems which arise in everyday work, the only ones left to the unaided judgment of the workman, are tackled with sympathetic knowledge of the mental limitations and point of view of the workman or youth, whose preparation often consists of a Council schooling, a year or so of holding ladders, and finally initiation into the mysteries of wiring, his rate of progress in that somewhat degraded art varying inversely with the prices at which his employer is able to obtain contracts.

It appears from the preface of this book that it is intended to supplement the usual technical school wiring class, and it contains useful references to much of the ground covered in these courses, although in his endeavour to render the subject extremely simple the author often lapses into expressions and lines of thought usual amongst school-men, but quite foreign to the average wireman.

The notes on wires and cables are good, but some explanation of the trade meaning of "class" and "grade" as applied to insulation resistance might have been given on page 172. An india-rubber test is described without comment, giving 1,250 megohms for cable labelled as "600-megohm grade."

The notes on paper-insulated cable are scanty; this material is apt to give trouble in the hands of men accustomed only to rubber insulation. The author's remarks with regard to the flexibility of cable presumably refer to rubber, and if taken too literally with large sizes would certainly lead to trouble. Describing the leading systems of wiring in use, the author makes a statement with regard to the relative extent to which wood casing and other systems are at present employed. We refrain from quoting it; no doubt those who supply the wiring material illustrated a few pages further on will do all that is necessary.

Concentric wiring is dismissed in a few lines, distinctly a lost opportunity at a time when manufacturers are obliged to train men to the use of their material; attention to cheap and simple methods of wiring, with a review of their practical advantages and disadvantages, should form a prominent feature in every book of this class at the present time.

The photographs of joints are numerous and good, and should help those who care to practise them. Jointing always appears to be a strong feature in wiring classes; students and teachers alike yield to the fascination of the "handicraft" involved in making them, and often fail to realise how comparatively unimportant cable jointing has become on small installation work. Employers feel the need of men who can plan an installation and lay out runs with a view to economy, determine cable sizes, and handle existing decorations with care. Men who are able to do this work with a minimum of supervision often command higher wages than those who have only skill in handling material, and are better employed on large contracts where supervision is continuous.

A fuller explanation of the supply company's apparatus should certainly have been given; it is assumed that the reader knows that one pole of a supply system is usually at earth potential, and the "live" wire is referred to but not fully explained. A few diagrams showing distribution of potential would have been useful, also a description of a three-wire service. Alternating current is entirely neglected, no mention being made of voltage-reducing transformers or of A.C. motors, subjects upon which every wireman needs information of a simple description, accompanied by clear diagrams; when explaining that power is a product of current and pressure, a warning at least should have been given that the statement is not necessarily correct for alternating current.

Heating is dealt with briefly. The formulæ for calculating the cost of heating water may be of use, but a clear statement showing how to translate the ratings marked on a kettle into the number of pints boiled for 1d. would suit the wireman's needs much better; the everyday commercial aspect of electrical work is not sufficiently appreciated by those who handle the material and who often come into close contact with consumers, by whom they are known as "Electricians." It is most essential that these men, who are for the most part keenly interested in their work, should be put in possession of simple and accurate knowledge of the use and cost of electrical apparatus; they will then become valuable canvassers, often securing the attention of a customer who would be inclined to discount the statements of their employers as being too much interested in effecting a sale.

The general heating of rooms remains a somewhat difficult proposition, even where electricity is obtainable at 1d. per unit. Cooking, on the contrary, is by no means a luxury at that rate, but represents the next big field of electrical development.

The notes on lighting neglect the modern development of reflectors and shades, and some explanation of "foot-candle" should have been given; it is also not clearly brought out that as a lamp ages, the consumption increases "per unit of useful light received." No opportunity should be lost of correcting the fallacy that old lamps consume more current than new ones; this statement is made every day by someone who claims to be an electrician.

The author's observations on testing installations are very just. It may be well, however, to point out that watt-hour meters are now connected up in most cases with the shunt joined to the series coil on the supply side, so that the consumer pays for the series coil losses, which vary with his load, and the supplier pays for the shunt losses, which are constant. The author's method would be very helpful, but is not to be recommended.

A Primer on Alternating Currents. By W. G. Rhodes, D.Sc. London: Longmans, Green & Co. Price 2s. 6d. net.

Although ethically unsound, the principle upon which most students and many teachers judge of textbooks is the principle of price. There is nothing really wonderful about this, because it has become more and more difficult of late years to find even an elementary textbook that is quite satisfactory unless it has cost something more than a modest dollar. And this is especially true of the multitude of books on alternating-current work that come to us from America and Germany. It is with this in mind that we find it refreshing to light on a book, written by the head of one of the largest English Technical Institutions, which presents the principles of alternating currents in a sensible and scientific manner, omitting nothing of importance, yet carefully abstaining from academic theorising on the one hand, and technical puzzles on the other, at a price within the reach of any evening technical student.

The book contains all the theory that is necessary for students preparing for the alternating-current part of the ordinary grade of the City and Guilds Electrical Engineering Examination; and while primarily written for students of limited mathematical attainments, it should prove useful to all classes of beginners, whether well equipped mathematically or not.

The chapters on transformers and A.C. motors are specially good, while the whole method and arrangement of the book is distinctly praiseworthy.—P.H.S.K.

A SMALL RURAL HYDRO-ELECTRIC SCHEME IN FRANCE.

The utilisation of small waterfalls in France has long constituted a fascinating problem, and, in view of the great possibilities of similar developments in Ireland, and, to a less extent, in other parts of the British Isles, the following description of a rural hydro-electric distribution scheme utilising the energy of a 15-20 H.P. fall, and transmitting current over a maximum distance of 4 5 miles, should interest the British electrical engineer.

The installation in question is located in Cotentin, on the banks of the River Saire. In the Commune of Valcanville, the stream falls 100 ft. in 4·5 miles; six cataracts total 33 ft. fall, and pass an average flow of 35·5 cb. ft. per second. One of these falls, La Planche, has now been harnessed by the Société Française d'Eclairage des Villes (which has been engaged in acetylene lighting in the neighbourhood since 1905). The maximum distance of transmission is from the fall to the town of Barfleur (population 1,200) about 4·5 miles away; over the intervening country a particularly complete service is rendered, tiny hamlets, isolated houses, and even stables being furnished with metallic-filament lamps. The distance between consumers averages 650 ft., and from the generating station at the fall there are supplied a farm 1,530 yards away, two villages at 1,530 and 1,850 yards respectively, and important grouped loads at 3,300 and 5,500 yards.

Capital outlay on distributing and service lines being a most important consideration, it was decided to use three-phase overhead transmission with transformer stations at convenient central points. Current is generated at 210/120 volts, and is distributed at 120 volts between phases and neutral in the immediate vicinity of the central station; 120-volt current is stepped up to 145 volts for transmission to a farm 1,530 yards from the station, and to 5,000 volts for transmission to Valcanville Gare, Montfarville, and Barfleur. Energy at 210 volts is transmitted from the generating station to Valcanville Eglise, where it is reduced to 110 volts for local distribution. The high-pressure current is reduced to 120 volts at Valcanville and Montfarville, and to 190 and 110 volts at Barfleur. Though only 10 H.P. is at present available, and this is distributed very uniformly over a distance of 4·5 miles, supply is available at 110/220 volts throughout. For the distribution of small amounts of energy over moderate distances 200 volts is a very convenient pressure, but A.C. at this voltage being always dangerous, the Société has given even 90-watt consumers on 200-volt lines a small 200/110-volt transformer, thus making matters quite safe, and giving the customer the advantage of low-voltage lamps.

The generating station is situated on the site of the old La Planche mill. The available fall is 6·5 ft., reduced to 5·5 ft. in times of flood; the flow averages 35·5 cb. ft. per second, rises to 64 cb. ft. in winter, and falls to 17·8, or even 12·4 cb. ft. per second in summer. There is thus no question of the conditions being specially favourable. A Poncelet wheel with curved floats, designed for a fall of 1·5 m. and a flow of 1,000 litres per second, is at present used. This wheel has a maximum efficiency of 60 per cent. and yields a maximum output of 10·7 H.P. Its most efficient speed is 10 R.P.M., and the 100/1 speed ratio required to reach the generator speed of 1,000 R.P.M. is effected by three belt stages in series (40/120 and 270 R.P.M.); to avoid the high mechanical losses occasioned by this arrangement, the Poncelet wheel is to be replaced by a high-speed American turbine at an early date.

The station building occupies 322 sq. ft. of ground area, and is entirely of reinforced concrete construction. The alternator is a star-wound, three-phase, 50-cycle machine running at 1,000 R.P.M. and yielding 12 K.V.A. at 210 volts between phases; its efficiency ranges from 70 to 80 per cent. ($\cos\phi = 1$). As a stand-by in case of drought, an 8-H.P. 600-R.P.M. petrol engine is installed, and, in case of need, the alternator can be belted to a D.C. motor fed from another fall. The arrangement of the station is a model of security, simplicity and cheapness.

During the day the output of the station is utilised in a dairy for the conversion of 1,320 gallons of milk to cream and cheese; at 4 p.m. in the winter, and at 7 p.m. in the summer the dairy shuts down, and supply is switched on to the lighting circuits of the men working at the dairy during the day.

Leading particulars of the chief transformer stations and distributing lines are given in Tables I and II herewith. Aluminium conductors are almost exclusively used, and are carried on creosoted wooden poles. A great part of the transmission route is across fields, but where the high-pressure lines run within 30 ft. of the State telephone lines for 1·25 miles, no induction troubles have yet appeared. For crossing the railway at two points, a particularly safe and simple construction has been evolved, using steel posts and silicon-bronze wires.

The high-pressure lines are of 3·5 mm. diameter aluminium wire weighing 91 lb. per mile and having an ultimate tensile strength of 460 lb. For an average span of 245 ft. a tension of 44 lb. (284 lb. per sq in.) is required. Torsion joints are used, and 2·5 mm. aluminium binding wire where necessary. The chief trouble so far has been winter breakages caused by workmen straining the wire too tightly. No. 171 Parville 5,000-volt insulators are used on the high-voltage lines, and, where copper lines join aluminium, double-groove insulators are employed ; the aluminium line is placed in the lower groove and copper in the upper groove ; an aluminium connecting bridge is used and rubber taped where it is in contact with copper. For low-voltage lines, of wire 5 mm. or more in diameter, aluminium is wholly advantageous ; it is lighter and easier to work than copper, and can be stretched over spans of 260-330 ft., which would be quite impossible were copper used. On branch lines, 3-mm. aluminium proves quite satisfactory, whereas 1·5 or even 2-mm. copper lines give much trouble by breakage. By taking the aluminium lines indoors before connecting to copper, corrosion is entirely avoided ; near the coast the overhead aluminium lines show no corrosion, whereas copper would be badly attacked.

Aluminium lines vibrate so badly that sleep is often impossible in houses to which the lines are connected or near which they pass, and, to avoid this trouble, it is necessary to use heavy "dampers." The best results are obtained by threading the line through a porcelain ball, weighing about ½ lb., and placed between the line and the insulator. Leaden dampers may be used, provided an aluminium sleeve is fitted round the line to take electrolytic corrosion.

The local distribution line from the central station has been extended nearly 2 miles across fields to supply an isolated farm, which started by using only four lamps. When, at length, 25 lamps were in use, the voltage drop reached 25 volts on full load, and, to maintain 110 volts at the consumer's terminals, it became necessary to step the line voltage at the central station up to 145 volts ; this was effected by using a small 110/25-volt metal lamp transformer as an auto-transformer. The latter is mounted on an ammeter panel at the works and is only placed in circuit when the line current exceeds 3 amperes.

The general appearance of the Barfleur transforming station is shown in fig. 1. The cabin is of reinforced concrete, occupies 13 sq. ft., and stands 7 ft. high. High-pressure lines are brought to a light framework on top of the building, and insulated conductors are thence taken through the usual protective devices to the transformer (see Table II). The low-voltage circuit is three-phase, four-wire, with the neutral placed above the phase lines (an arrangement which dispenses with the necessity for lightning protectors and makes it easy to arrange a guard network where passing under telephone wires). Ordinary consumers are connected to two of the phases, and public lighting is supplied, through a meter, from the third. On opening the system, the third phase was, for a time, unloaded, but the supply pressure was never more than 3 volts out of balance.

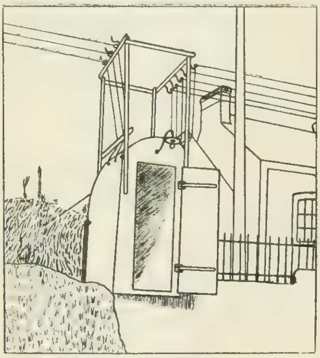


Fig. 1

In such small undertakings as the present one, the choice of a tariff is a most delicate problem. To obtain the best possible returns, while avoiding the cost of installing and superintending meters, energy is sold by contract, from sunset to 11 p.m. all the year, and from 5 a.m. to daylight during the winter. To avoid the restriction of the number of lamps installed, so frequently imposed by a contract tariff, an ampere-year basis of charge is adopted, and current limiters are installed ; a uniform rate of 88s. per ampere-year is levied, with a minimum of 60s. for three lamps simultaneously alight.

Table I.—Transformer Equipment of Various Stations.

Station.	Transformers.	Line served. (Table II.)
Generating station	120/145 v. auto-transformer serving outlying farm	1
	5,000/210 v. ; 10 K.V.A. ; 3-ph. delta 3 × 27·5 a. at 210 v. : 3 × 1·38 amp. at 5,000 v.	3
Valcanville Eglise	220/120 and 110 v. : 1 KW. ; 1-ph.	4 from 2
Montfarville ...	5,000/120 v. ; 1 K.V.A. ; 1-ph.	—
Doncanville Rue (for Valcanville Gare) (Transformer on posts)	5,000/120 v. ; 2·2 K.V.A. ; 3-ph. delta ; 3 × 10·7 a. at 120 v. ; 3 × 0·5 a. at 5,000 v. ; only 2 secondary phases occupied	5 from 3
Barfleur	4,950/190-110 v. ; 5 K.V.A. ; 3-ph.	6 from 3

Consumers may install lamps of any C.P., and can change whenever they choose, but new lamps must be purchased from the Société (at less than current market prices). The standard sizes supplied are 16, 25, 32 and 50-C.P. Osram lamps, and (of 240 installed) 10 per cent. have been renewed during a year of 1,800 hours ; 115-volt lamps are supplied for use on 105-110-volt circuits. The underrunning thus involved does not materially change the colour of the light, but greatly extends the life of the lamps and further guards against carbon lamps being used ; not only would the limiters operate in the latter case but also the light would be intolerably red.

Mercury limiters (by the French G.E.C.) are employed, and their use has been found a great preventative of serious short-circuits and fires. On severe overload, the limiter switch opens (at two points at once) with such violence that the mercury is ejected from the contact cups, and the circuit therefore remains interrupted ; on several occasions this action has occurred without allowing time for the circuit fuses to blow.

By the above supply tariff, a consumer secures unlimited use of a 16-C.P. lamp during the stated hours for 15s. per annum—a low price considering the convenience and safety of the lamp and the definite amount of the bill. From the station standpoint, such a tariff amounts to a guaranteed revenue, and by encouraging free use of the lamps installed, the system practically obliterates the evening peak (which is here very slight and lasts from 6 to 9 p.m.). In installations of one or two 16-C.P. lamps, such as are here common, the use of meters is quite impracticable.

TABLE II.—Particulars of various Transmission Lines.

Line route.	Length. Miles.	Voltage.	Load. KW.	Conductors.	Voltage var'n.†	No.
Local from station ...	0·88	120	0·60	3·5 mm. al.	‡	1
Central station to Valcanville Eglise.	1·06	220	0·66	3·5 mm. al.	5 v.	2
Central station to Valcanville Gare, and	0·95	5,000	5·00	3·0 mm. si-brz.	10 v.	3
thence to Barfleur.	3·45	5,000	3·00	3·5 mm. al.	40 v.	—
Local from Valcanville Eglise.	0·63	110	0·60	3·5 mm. al.	5 v.	4
Local from Doncanville Rue.	0·50	120	1·50	3·5 mm. al.	nil.	5
Local from Barfleur ...	—	190/110	2·50*	5·0 mm. al.	nil.	6

* Several consumers at Barfleur have between 20 and 30 lamps installed. For public lighting, 25 and 50-C.P. lamps are used.

† From no load to full load.

‡ Negligible (see also text).

The popularity of this enterprising scheme is such that several farmers have as many as 20 lamps in their stables alone. The maximum output attainable from La Planche Fall is being rapidly approached, and already the Société is treating for other mill sites in the neighbourhood.—R.E.N.

ELECTRICAL TRANSMISSION OF ELECTRICAL MEASUREMENTS.

The accompanying diagram shows the means whereby the indications of a recording wattmeter were transmitted over a 35-mile private telephone line, and reproduced at the far end thereof. In this particular case (which is cited by Mr. O. J. Bliss in a paper before the Am.I.E.E.), station A contracted to supply a station B at a tariff composed of a KW.-hour charge + a KW.-year charge, the latter being based on the average of the three highest half-hour peaks during the year. The input to the transmission line was recorded by a printing watt-hour meter, but to enable the station B to regulate its load curve, check the records obtained at A, and control its own switchboard attendants, the present equipment was devised. The arrangement is simple and effective; it does not interfere with the telephonic use of the line, and it is applicable to the transmission of measurements or signals between any two places connected by telephone lines.

The graphic recording wattmeter W_R at A has a relay-type movement, and is connected through current and voltage transformers to the power line (12,000 volts, 60 cycles, three-phase). The contactor of a small variable rheostat R near by is coupled to the meter pointer by an insulated brass rod. A suitable source of D.C. is connected across the rheostat (a 36-volt storage battery B passes 150 m.a. in the present case), and one terminal and the moving contact are connected across the telephone line. The voltage applied to the line then varies with the position of the rheostat contact, and hence with the indication of the watt-meter. This indication is reproduced and recorded at station B by indicating and recording voltmeters, V_I, V_R, calibrated in watts.

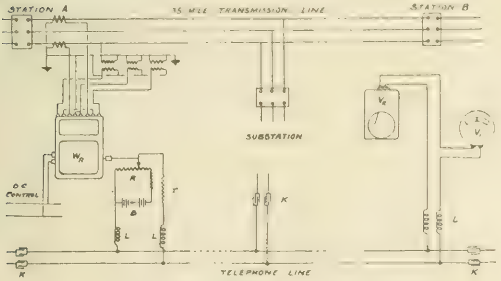


Fig. 1.

Owing to the fact that the rheostat has uniform resistance per unit length, the line E.M.F. does not vary exactly with the distance of travel of the contact, but if the current through R is high as compared with the instrument current, the error due to this cause is negligible. In the present case, the voltmeters at B give full scale deflection with a current of about 7 m.a. (regulable by resistances at A and B). The signalling system forms a shunt across the telephone line, and should be of not less than 1,000 ohms resistance in order not to interfere with speech. The condensers K and reactances L shown, respectively prevent access of the signalling D.C. to the telephone circuits, and of the ringing-up A.C. to the meter circuits.

An Elevated Coal Transport Railway.—An elevated electric railway for the transport of coal is on the point of being opened in Italy. It is 12·4 miles long, and connects the port of Savona to the west of Genoa with the San Guiseppe station on the Savona-Turin Railway. It is intended for the conveyance of seaborne coal to that station, where provision has been made for the accumulation of large stocks, and whence the coal can be sent on to the north-western provinces. The coal is discharged from the ships in Savona into a store, where it is lifted to the roof and is dropped into the trucks of the elevated railway, the track of which is carried on concrete piles. Each truck contains 1 ton of coal, and the capacity of the railway is 180 tons per hour.

CAR MILEAGE: A SUGGESTED ALTERATION IN THE METHOD OF CALCULATION.

By W. WYKES, Sheffield.

In reading a report of Mr. Fell's presidential address delivered before the annual conference, in London, of the Municipal Tramways Association, in 1909, I notice that he alludes to the question of "car-mile units," and suggests that it is open for someone to devise a better system of calculation. On reviewing the matter it occurs to me that something might be done in this direction. I take it that the units consumed are not only taken as a guide by tramway managers as regards the increase or decrease in the cost of working their own systems, but also as a means of comparison with other systems. That being so, the present method of reckoning the mileage is very misleading, because in comparing a comparatively flat town with one that is hilly, as is often the case, equal results cannot be expected. As a means, therefore, of overcoming the question of gradient, I would suggest that the mileage of each town be, as it were, flattened out, and that the cost per car-mile be computed on the increased mileage thus obtained, irrespective of the exact distance in ordinary miles. What I mean by flattening out is to express the distance of each route in level or flat miles, and, to arrive at this result, I would propose that a car with a meter fixed be run, in the first instance, over a level mile and the amount of energy consumed carefully noted. I would then run the same car at the same uniform rate of speed over each section, taking careful note of the amount of energy consumed on each round trip on each section. Then the units used per round trip, divided by the units consumed on the level mile, would represent the total number of level miles on the section. To put the matter in the form of an equation, the result would be as follows:—

Let a represent the amount of energy consumed per level mile.

Let b represent the amount of energy consumed per round trip on the section tested.

Let c represent the number of "flat miles" on each section.

Then $b/a = c =$ number of "flat miles."

If this were done, the difficulty as regards the gradients would be practically overcome, and, given the same cost of production of energy, and all other things being equal, the cost of energy per car-mile should vary very little; but owing to the difference in the equipments, frequency of running, passengers carried, stoppages, &c., this is not so in practice. I take it, however, that each general manager adopts the type of car suitable for the traffic in his district, and that the frequency of running, &c., is also fixed to meet the exigencies of the service and the requirements of the public. That being so, the number of passengers carried per car-mile, based on the new mileage, would, I think, be as good a means as it is possible to devise, in a simple form, for comparing one system with another. Of course, it would be possible to reduce the different equipments, frequency of running, &c., to a common standard, but as all these factors are more or less contingent upon the number of passengers carried, they may, for the purpose of these calculations, be disregarded.

The following formulæ show how the results aimed at might be obtained.

Let a represent the total weekly number of flat miles travelled.

Let b represent the total weekly number of passengers carried.

Let c represent the total weekly number of passengers carried per flat car-mile.

Let d represent the total weekly cost of tramway service.

Let e represent the total weekly cost of tramway service per flat car-mile.

Let f represent the total weekly cost of tramway service per passenger per flat car-mile.

Then $b/a = c =$ total weekly number of passengers per flat car-mile.

$d/a = e =$ total weekly cost per flat car-mile.

$e/c = f =$ total weekly cost per passenger per flat car-mile.

My proposal, therefore, in brief, is to reduce in the first instance all the mileage to flat miles, and then to work out the cost per passenger carried per mile, as shown above, and to use the result thus arrived at as a basis of comparison with other tramways. Each general manager would then be able to see at a glance which tramway undertaking showed the best results, and would be able to make inquiries into the working of such system for the purpose of improving his own and bringing it up to the same standard of efficiency.

I should like to add that, since writing the above, I have read an article by another writer, in which he points out the principal defects to be met in making a satisfactory comparison between the amount of energy consumed per car-mile on different tramway systems, and, *inter alia*, mentions *gradient* as one of the troubles to be contended with. The question of gradient is probably the most pronounced of the disturbing factors referred to, but I think if the suggestions I have made were generally adopted on the various tramway systems, the difficulty in this respect would to a great extent be overcome.

TUMBLER-SWITCH CONTROLS FOR HEATING AND COOKING APPLIANCES.

By W. PERREN MAYCOCK, M.I.E.E.

While it is generally admitted that the tumbler switch is far more convenient and more indicative of its "position" than the turn switch, many makers of heating and cooking apparatus still use the latter. Perhaps one reason for this is that they are unacquainted with the various electrical types of Messrs. A. P. Lundberg and Sons' three-position tumbler switch, and with this firm's recent improvements and developments in switches and circuits for electric heating purposes. These are fully dealt with below.

A disadvantage of certain American makes of turn switch, is that the position of the thumb-key cannot be depended upon to indicate the position of the switch contacts. Because of this, indicating windows have generally to be fitted. These windows permit of the entry of dust and grease; and the lettering in time becomes obliterated. Further, it is evident that switches so arranged are not of much use at the side of a heater (an oven, for instance) which has to be put in a corner with its switches close to a projecting wall. Another and more serious objection to these switches is that their stated current capacity is a very over-rated quantity, particularly for prolonged work.

One or two of the controls described here are already largely used. Most of them, however, are of quite recent design, and it seems that they should fulfil many requirements.

List of Tumbler-Switch Controls.

Control No.	No. of heating sections.	Degrees of heat.	No. of switches.	Remarks.
1	Two	Two (low, full)	One	
2	Two	Two (low, full)	Two	Break at both poles.
3	Two	Two (low, full)	Two (cpld.)	Break at both poles. (Separate poles in separate switches.)
4	Three	Two (very low, full)	Two	Break at both poles.
5	Two	Two (low, full)	One	
6	Two	Two (half, full)	One	
7	Two	Three (low, medium, full)	One	The "Twinob" switch is a combination of two in one.
8	Two	Three (low, medium, full)	Two	Break at both poles.
9	Three	Three (low, medium, full)	Two	
10	Three	Three (very low, medium, full)	Two	Break at both poles.
11	Two	Three (low, medium, full)	Three	Break at both poles.
12	Two	Four (low, 2nd, 3rd, full)	Two	
13	Three	Four (low, 2nd, 3rd, full)	Two	Break at both poles.
14	Two	Four (low, 2nd, 3rd, full)	Two	

All but the last three of the above controls are described and illustrated herein. These last three (Nos. 12, 13 and 14) are interesting in that they provide for four degrees of heat with but two or three heating sections and two switches. Their common drawback is that the manipulation of the switches to give any desired effect is not a sufficiently simple matter for domestic use.

Control No. 1 (fig. 1).—The two heating sections R, R, are controlled by a series-parallel-and-off three-position tumbler switch. The switch is off when its knob is in its central position. When the knob is up the sections are in series, as seen in the complete diagram on the left, and the low heat is given. When the knob is down the sections are in parallel, and full heat is obtained. (Maximum, 10 amperes.)

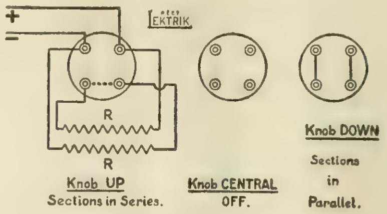


Fig. 1.—Control No. 1.

Control No. 2 (fig. 2).—Here an extra switch is provided for making and breaking the circuit on both poles. Otherwise the control resembles No. 1. The on-and-off switch is a single tumbler D.P. one, and is the left-hand switch in the diagram. There are two forms, one of which resembles fig. 3. The right-hand switch in the diagram is a series-parallel without an off position, and it puts the sections R, R in series for low heat and parallel for full heat. (Maximum, 5 amperes.)

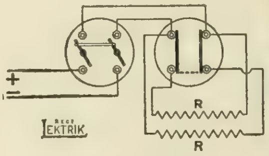


Fig. 2.—Control No. 2.

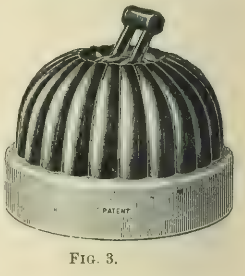


Fig. 3.

The covers of the switches should preferably be of porcelain or plain brass. That of the left-hand one might be marked OFF ON, and that of the right-hand one LOW FULL.

Control No. 3 (fig. 4).—Although the fact that both poles enter both of the switches in the previous control has not proved a serious drawback, it having already been used on many thousands of heaters, it may sometimes be objected to. When this is so, a switch with separated poles may be got by coupling and connecting two two-way-off ("Duplex") switches, as shown in the adjacent diagram; this arrangement has the additional advantage of providing for a maximum of 10 amps.

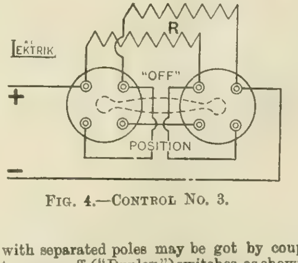


Fig. 4.—Control No. 3.

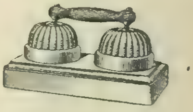


Fig. 5.

As the combination gives an off position, the separate D.P. switch used in the previous control may be dispensed with, the circuit, with the switch off, being as shown in the lower of the two figures.

The aforementioned coupling would resemble the familiar arrangement seen in fig. 5, but the hardwood base-block of course would generally be dispensed with.

CONTROL No. 4 (fig. 6).—Here the two switches are of the single-tumbler D.P. type, like fig. 3.

The left-hand switch puts the current on and off. When the right-hand switch is off, the three heater sections are in series, and give a very low heat. When this switch is on, the sections are in parallel, and give full heat.

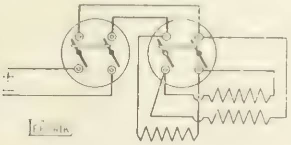


FIG. 6.—CONTROL NO. 4.

It should be noted that as the right-hand switch never breaks circuit, the sparkwear at its contacts is negligible. (Maximum, 10 amperes.)

To render the manipulation of the switches quite clear to the user, the cover of the left-hand one might be marked OFF ON, and that of the right-hand one LOW FULL.

Modification.—If either arm of the right-hand switch be removed, the full heat will be that due to one section on full pressure and the other two in series; the low heat, as before, being given by the three sections in series.

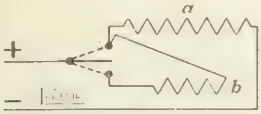


FIG. 7.—CONTROL NO. 5.

CONTROL NO. 5 (fig. 7).—This control is effected by a single two-way-and-off ("Duplex") switch. Section *b* is used only for putting in series with *a*, and the two then give a low heat, the degree of which depends on the resistance of *b*. Full heat is that due to *a* alone. The switch cover might be marked as in fig. 8. (Maximum, 10 amperes.)

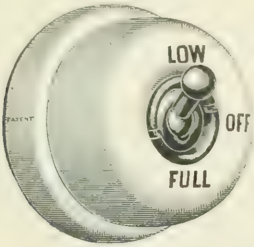


FIG. 8.

CONTROL NO. 6 (fig. 9).—This control is effected by a single "All-or-part-and-off" switch, which has three positions. When the knob is central, the switch is off. When the knob is up, the two lower terminal contacts are interconnected, and one of the sections is in circuit. With the knob down, both sections are in circuit, and full heat is given. (Maximum, 10 amperes.)

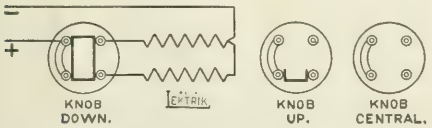


FIG. 9.—CONTROL NO. 6.

If the two sections be equal, half heat will be given with the one in circuit, and the cover might be marked HALF OFF FULL.

CONTROL NO. 7 (fig. 10).—In this control, a "Twinob" switch enables three degrees of heat to be got with two unequal heater sections *a* and *b*. The cover of the switch can be marked as seen in fig. 11. If the heater sections be equal, only two degrees of heat can be got, but the use of the "Twinob" is still advantageous, as it enables either or both of the sections to be put in circuit. If, however, a *one or both* control only is required with the equal sections, control No. 6 is preferable, as there is only one switch knob for the unskilled person to think about. (Maximum, 10 amperes per way.)

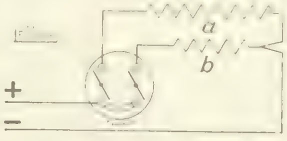


FIG. 10.—CONTROL NO. 7.

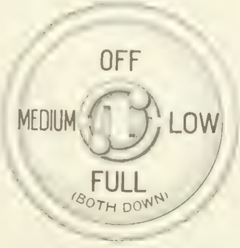


FIG. 11.

CONTROL NO. 8 (fig. 12).—This control is an extension of No. 7, the addition of the single-tumbler D.P. switch on the left (like fig. 3) enabling the circuit to be broken at both poles. (Maximum, 10 amperes.)

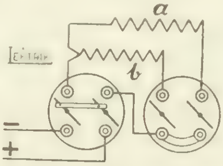


FIG. 12.—CONTROL NO. 8.

CONTROL NO. 9 (fig. 13).—The current is put on and off by the single-tumbler D.P. switch on the left (corresponding with fig. 3); and the connections of the right-hand ("All-or-part-and-off") switch are such that its three positions give three degrees of heat. When its knob is central, there is no inside connection between the switch contacts, and sections *a* and *b* are then in series and give low heat. When the knob is up, *a* is bridged, and *b* alone is in circuit and gives medium heat. When the knob is down, sections *b* and *c* are in parallel and give full heat. (Maximum, 10 amperes.)

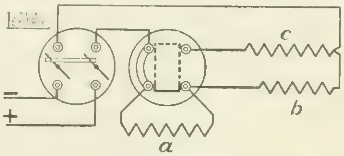


FIG. 13.—CONTROL NO. 9.

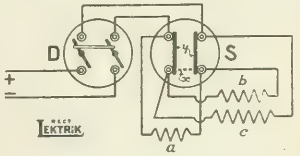


FIG. 14.—CONTROL NO. 10.

CONTROL NO. 10 (fig. 14).—The two switches used here are a single-tumbler double-pole switch D (like fig. 3) and a series-parallel-and-off switch S. D serves to turn the current on and off. S, when off, leaves the three sections *a*, *b* and *c* in series, and a very low heat is given. When the knob of S is up, *b* is bridged across by the switch contact *x*, and *a* and *c* are left in series giving a slightly greater heat. When the knob of S is down, contacts *y* come into action, and the three sections are thrown into parallel—giving full heat.

The "manipulating code" is as follows, the knobs of the switches D and S being referred to :—

Current off.	D up.	S anyhow.	
Low heat.	D down.	S central.	(*a*, *b* and *c* in series.)
Medium heat.	D down.	S up.	(*a* and *c* in series.)
Full heat.	D down.	S down.	(*a*, *b* and *c* in parallel.)

The working of the switches by the user of the heater might be rendered clearer by the switch cover diagram (fig. 15), which could

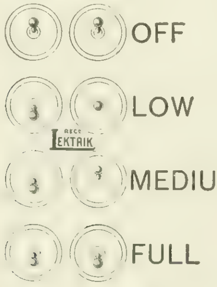


Fig. 15.

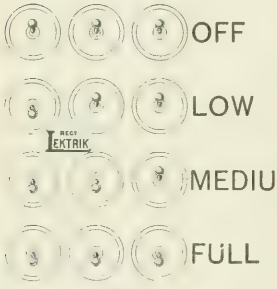


Fig. 16.

be in the form of a "Directions" tablet fixed adjacent to the switches. It may be noted that the sparkwear at S is negligible, since its circuit is never actually broken. (Maximum, 10 amperes.)

Modifications.—(1) It is possible to rearrange the connections to give three sections in series, two in series, and two in parallel. (2) If S be a series-parallel switch without an off position (like that used in Control No. 2), the connections may be arranged to give two sections in series and three in parallel.

Control No. 11 (fig. 17).—This control gives three heats with two sections, *a* and *b*. The two outer switches are single-way, and the middle switch is a series-parallel without off position. The following "manipulating code" and the "Directions" tablet (fig. 16) should make it clear that the working of the switches to get any desired effect is a very simple matter :—

Off (I).	All knobs up.	
Low heat (II).	First knob down.	*a* and *b* in series.
Medium heat (III).	First and second knobs down.	*a* alone.
Full heat (IV).	All knobs down.	*a* and *b* in parallel.

In other words, if—starting from the right—the switches be numbered 1, 2 and 3, 1 will give the first heat, 1 and 2 the second heat, and 1, 2 and 3 the third heat.

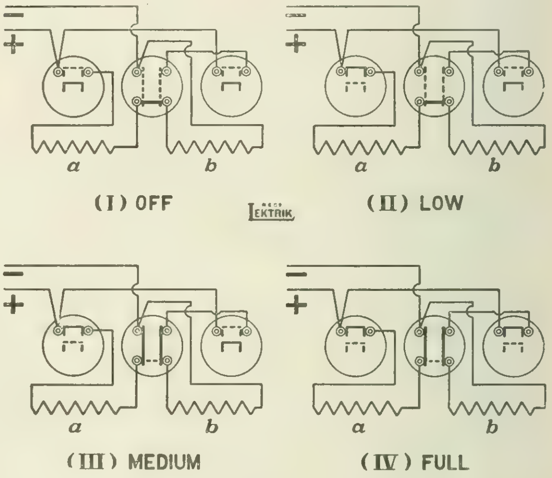
If the operator strays from these simple directions, no harm is done, as there is no possibility of short-circuiting, and nothing more than medium heat could be got. (Maximum, 10 amperes.)

Bailiffs in a Corporation Tramways Office.—At a meeting of the Newcastle Corporation Tramways Committee on July 25th, a question was raised as to the accuracy of a rumour that bailiffs had taken possession of the tramways office. It was admitted that this was correct, and it was explained that it arose out of a recent action at the last Newcastle Assizes, in which the Corporation were the defendants and lost, judgment being given the plaintiff for injuries sustained in a tramway accident. Soon after the judgment was delivered the bailiffs were put in, before the Committee could make arrangements for the payment of the award. The bailiffs, it is understood, were in possession for a day, and the matter will be brought before the City Council at an early meeting.

CENTRAL LONDON RAILWAY EXTENSION.

On Saturday last the formal opening of the Central London Railway Extension to Liverpool Street Station took place; a large party of guests travelled by a special train from the Bank Station to Liverpool Street, and there partook of luncheon at the invitation of the Central London and Great Eastern Railways. Lord Claud Hamilton, M.P., chairman of the latter company, presided, and was supported by Dr. H. F. Parshall, chairman of the former, and the Lord Mayor of London; many distinguished members of Parliament, financiers, railway engineers and heads of metropolitan and provincial boroughs and district councils were also present.

After the toast of "The King," the Lord Mayor proposed "Success to the New Extension," which he said would confer benefits upon two classes—the travelling public, and the shareholders, who also deserved consideration; they had expended a quarter of a million sterling on a length of less than half a mile, and he hoped they would receive their due reward for the great benefits the community would derive from their enterprise.



(I) OFF (II) LOW (III) MEDIUM (IV) FULL

Fig. 17.—Control No. 11.

Lord Claud Hamilton responded, referring to the "missing link," which had so long been needed and had now been provided; he believed it would prove of more value to the public than any other extension that had been carried out on the metropolitan railways, and he attributed the credit for it to the enterprise of Dr. Parshall. No payment or rent was demanded by the Great Eastern Railway for the admission of the Central London Railway to their terminus, for he believed that benefits would accrue to both parties. A great initial mistake had been made in laying out Liverpool Street Station on a low level; had it been otherwise, they could have provided for their vast suburban traffic underneath it. However, by co-operation with the Central London they would do their best to remedy the error.

Dr. Parshall, responding for the Central London Railway, acknowledged the cordial support which that undertaking had received from the City of London in every way since its inception. The extension had been opened five or six months earlier than was anticipated, in spite of the railway and dock strikes, and great credit was due to the engineers, contractors and staff for this result. The extension was of greater importance than appeared at first sight, for while it joined them to their colleagues the Great Eastern Railway, it also affected their extension to Ealing, where they were on equally friendly terms with the Great Western Railway, and would link these two systems together. The extension would be opened for traffic on the following day, with through bookings from stations on the Great Eastern Railway. The permanent way had been vastly improved, and the new type was being extended throughout the whole length of the line, together with automatic electric signalling, giving greatly enhanced speed and comfort. He hoped the work would be complete by the time their junction with the Great Western Railway was effected.

The desirability of a connection with Liverpool Street Station was recognised by the promoters of the Central London Railway in the earliest stages, over 20 years ago, and in our issue of June 28th, 1895, we published a map of the intended line, showing its city terminus at Liverpool Street; power was, however, reserved in placing the contracts to exclude the section beyond the Bank station, and this course was eventually adopted. The consequence has been that all west-bound passengers arriving at Liverpool Street have had to walk the half-mile to the Bank, or make use of the omnibuses which run from Liverpool Street westwards, and with the advent of the motor-omnibus, which could compete seriously with the railway in point of convenience and economy of time, the handicap, no doubt, made itself very severely felt. The decision to extend the line westwards to Ealing, linking up with the Great Western Railway, was also a powerful incentive to the completion of the Eastern section, and the establishment of so efficient a new connection between East and West cannot fail to be productive of great benefit to the railway and to the public.

It should further be borne in mind that the Central London Railway also makes connection with most of the other tube railways, and affords ready communication with the various tramway routes leading to the north or west.

The new City terminus is directly under the Liverpool Street Station, to which access is gained by means of travelling staircases, or "escalators," the vertical distance between the two levels being 70 ft. Communication with Broad Street Station of the North London Railway is also provided. The extension to Ealing will be completed in about 18 months.

The adoption of a new type of permanent way, and the institution of automatic electric signalling, will increase the efficiency and capacity of the line, which already carries on the average 125,000 passengers daily. Trains will run at intervals of about 2 minutes throughout the day, from 6 a.m. to 12.30 a.m., covering the distance of 7 miles (between the present termini) in 25 minutes, with 13 stops.

The construction of the tunnels has been carried out by contractors under the supervision of Mr. H. J. Deane, resident engineer for the consulting engineers, Messrs. Mott and Hay; the installation of the permanent way, electrical equipment, &c., has been done by the railway company's staff, under the direction of Mr. E. P. Grove, chief engineer to the company, who has also supervised the introduction of the automatic signalling system of the Mackenzie, Holland and Westinghouse Power Signal Co.

Conditions at Vancouver.—Mr. C. H. Smith, who was for some years attached to the staff of the Acton Council's electricity department, and who has emigrated to Vancouver, in a letter home, says:—"From a business standpoint, one could write much, but, briefly, the business here is of a first-class character, and real estate has by far the preference. The three large departmental stores which can be said to equal Harrod's, Whiteley's, or Shoolbred's, are the Hudson Bay Co., Spencer's, Ltd., and Woodward's Store. Besides these there are several large wholesale warehouses, which deal with various stocks. The city has one of the finest street-car services in the Dominion, and electricity is in very general use by reason of its generation by means of water power. The American system of town planning has been adopted, with the blocks containing 100 buildings from street to street. Just taking a glimpse at the conditions of labour as they are at present, one is unpleasantly surprised, after the information supplied by the emigration authorities in the old country. Within a few minutes' walk of the Canadian Pacific Railway depôt, is a general centre for employment agencies, and there can be seen from 300 to 500 men who are genuine workers seeking employment, and amongst them are skilled mechanics and tradesmen. Strikes are very prevalent here, the carpenters having just returned to work at $4.25 a day, an increase of 25 cents, when the strike was for 50 cents and a "closed shop." A general strike of all the building and allied trades is spoken of, and this is expected to stagnate the whole business of the city, as the whole of the Union men (8,000) will quit, and this means that the electricity supply, which is the root of the life of the city, will cease. Although two out of every three persons here are English, the feeling against the British is such that in applying for employment, despite his capabilities, a preference is always given to any other man. The method of workmanship is more speedy and less thorough than is the case in the old country."

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NORWAY.—The Norwegian Department of Finance and Customs have decided that double-tube superheaters for steam boilers are to be admitted free of Customs duty on importation into Norway under the law which provides for the special free importation of machinery of a class or kind not made in the country. They have also decided to admit free of duty under this law carbon brushes for electrical machines.

NETHERLANDS.—The Dutch Customs authorities have decided that vacuum cleaning machines suited for household use, even if driven by electricity, are to be dutiable at the rate of 5 per cent. *ad val.*

TURKEY.—The Turkish Customs Department have issued a notice requiring that, in order to facilitate the weighing and checking of goods on importation, shippers should mark on all packages both the gross and net weights, in kilogrammes.

RUSSIA.—A law has been promulgated providing for the amendment of certain sections of the Russian Customs Tariff, by means of which the heading for electric incandescent lamps has been divided according to whether the lamps are carbon or metal-filament. Under the previous tariff heading, both kinds of lamps paid 30 roubles per pood and 60 roubles per pood mounted and not mounted, respectively. The following is the new classification:—

	Roubles per pood.
Electric incandescent lamps:—With carbon filaments even if covered with metal.—Mounted	30
Not mounted	60
With metallic filaments:—Mounted	65
Not mounted	90

Note.—Rouble = 2s. 1⅓d. Pood = 36 lb.

DENMARK.—The Danish Customs authorities have issued the following decisions as to the duty to be levied on certain goods imported into Denmark:—

So-called "waterproof" electric lamp, the principal material being a globe of uncoloured blown hollow glassware in combination with porcelain, which is used neither for mounting nor sealing	28 öre per kg.
So-called "Dictaphone," a kind of phonograph talking machine which, in addition to the cast-iron base, consists of the phonograph instrument itself with wax cylinder and other accessories, also of a wooden box, on the top of which the phonograph is fixed, and containing a small electric motor for working the apparatus—the electric motor not being of sufficient importance to render the whole article liable to duty as an electrical machine	70 öre per kg
Note.—"Shaving machines," or "rubbing-off machines," by means of which the Dictaphone records are peeled or rubbed off, whether with crank handle or with electromotor ...	5 % ad val.
So-called main switch, both the base and the cover consisting of earthenware, probably mixed with asphalt, the two fuse boxes of porcelain and metal and the usual ebonite button being also visible	12½ öre per kg.

Note.—100 öre = 1s. 1⅓d.

FRANCE.—The French Customs Authorities point out that if labels affixed to goods imported for consumption in, or merely passing in transit through, France, contain the name of a French town accompanied by the name of an English town, they must in every case contain a further inscription stating explicitly the actual origin of the goods, such as "importé d'Angleterre." This regulation is made in accordance with the Merchandise Marks laws, and failure to comply with these is liable to heavy penalties.

MEXICO.—In accordance with the Mexican Revenue Law for the financial year, which began on July 1st, 1912, the import duties on all goods entering the country from abroad will be increased by 5 per cent. on and after September 1st next. This increased duty will be charged at the ports of entry on goods arriving by vessels which reach the ports later than midnight on August 31st, and at the frontier Customs Houses on goods crossing the border subsequent to that date and hour.

COSTA RICA.—A Presidential Decree which has recently been promulgated prescribes a duty of 6 centavos per kilog. for nails for railways and tramways, known as spikes. Note.—100 centavos = about 1s. 10½d.; 1 kilog. = 2·204 lb.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,457. "Socket or attachment fittings for rods, tubes, brackets, electric and chandelier fittings and the like." W. D. Taylor. July 15th.

16,460. "Method of and means for electrically cleaning certain articles." G. P. M. Lee and W. A. Brame. July 15th.

16,465. "Luminous electrical and gas switches." G. Mason. July 15th.

16,473. "Telegraphy." H. W. Sullivan. July 15th.

16,475. "Anodes for use in electrolytic apparatus." G. P. M. Lee and W. A. Brame. July 15th.

16,506. "Manufacture of radiators and other incandescent lamps." V. C. J. Nightingall. (Convention date, March 19th, 1912, Australia.) July 15th. (Complete.)

16,517. "Power-machine plant." Allgemeine Elektricitats-Ges. (Convention date, July 13th, 1911, Germany.) July 15th. (Complete.)

16,534. "Electrical pedal combined with a magneto applicable to railway lines." L. Ducellier and H. Guillou. July 15th.

16,538. "Rotary magnets." O. T. Blathy. (Convention date, August 24th, 1911, Hungary.) July 15th. (Complete.)

16,541. "Body for motor-'buses, electric trams, or similar road vehicles." L. Messervy. July 15th.

16,549. "Trolleys or collectors for electricity." L. J. Tetlow. July 15th. (Complete.)

16,568. "Utilisation of alternating currents and the transformation of such currents into single-phase currents." O. Zingg. July 16th.

16,582. "Electrical windings." Ferranti, Ltd., and P. W. Scholefield. July 16th.

16,622. "Cable terminals." T. B. Farmer and C. L. Kohlstead. July 16th. (Complete.)

16,628. "Driving mechanism of lifts." Electromotor Equipment Co., Ltd., and A. J. Barlow. July 16th.

16,633. "Methods of sealing metallic conductors into vitreous material." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 16th.

16,634. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 16th.

16,664. "Electric igniters." J. G. Cook. July 17th. (Complete.)

16,671. "Insulating and tensioning device for electric cables." I. Porak. (Convention date, April 4th, 1912, Austria.) July 17th (Complete.)

16,679. "Electric telegraphy and telephony." A. C. Nash. July 17th.

16,707. "Electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 17th.

16,708. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 17th.

16,730. "Apparatus for testing electrical-measuring instruments." G. North. July 17th.

16,758. "Electro-therapeutic appliances for the soles of boots, shoes, and the like." G. Wilson and C. J. Wilson. July 18th. (Complete.)

16,761. "Electric glow lamps." G. Davis. July 18th.

16,765. "Keyboard-controlled electric illuminated signs for advertising and the like." J. W. Cook. July 18th.

16,767. "Appliances for X-ray photography." C. F. Thatcher and Newton and Wright, Ltd. July 18th.

16,779. "Electrolysis of alkali chlorides and apparatus therefor." J. Y. Johnson. (Badische Anilin and Soda Fabrik, Germany). July 18th.

16,782. "Voltage regulators. A. Pollak. (Convention date, July 31st, 1911, France.) July 18th. (Complete.)

16,790. "Circuit connections for alternating-current commutator motors." Siemens-Schuckertwerke G.m.b.H. (Convention date, July 18th, 1911, Germany.) July 18th. (Complete.)

16,806. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 18th.

16,827. "Method for producing electric oscillations or alternating currents." W. P. Thompson. (Ges. für Drahtlose Telegraphie m.b.H. Germany.) July 19th. (Complete.)

16,830. "Means for and methods of clearing faults on alternating-current systems." A. M. Taylor. July 19th.

16,840. "Storage batteries." W. Dudley. July 19th.

16,842. "Telegraphic transmitters." H. W. Scott. July 19th.

16,857. "Means for the distribution of electrical energy." M. J. Railing and C. E. Gunner. July 19th.

16,865. "Method for the production of filament-holders for metal-filament electric incandescent lamps." M. Baum. July 19th. (Complete.)

16,874. "Instruments for measuring or controlling the frequency or wave length of alternating currents." G. Seibt. July 19th. (Complete.)

16,885. "Process for repairing electric incandescent lamps." E. Cervenka. (Convention date, July 19th, 1911, France.) July 19th. (Complete.)

16,886. "Electric arc lamps." E. A. O. Salmon. (Convention date July 28th, 1911, France.) July 19th. (Complete.)

16,906. "Telephone exchange systems." W. Aitken. July 20th.

16,937. "Arc projectors." Korting & Mathiesen Akt.-Ges. (Convention date, December 27th, 1911, Germany.) July 20th. (Complete.)

16,938. "Regulating switch." F. C. Curtis. July 20th. (Complete.)

16,952. "Apparatus for economising current in electric plants." A. Bischoff, P. Walbert and G. Lecocq. July 20th. (Complete.)

16,954. "Alkaline secondary battery or accumulator." A. B. Shell. July 20th. (Complete.)

16,960. "Ovens and the like." British Electric Transformer Co., Ltd., A. F. Berry and M. A. V. London. July 20th.

16,968. "Electric primers for mines." J. Sou. (Convention date, July 21st, 1911, France.) July 20th. (Complete.)

16,965. "Wolfram or tungsten filaments for incandescent electric lamps," Ehrich & Graetz. (Convention date, July 2nd, 1912, Germany.) July 20th. (Complete.)

Prosecution.—Robert Howard, Park Street, Crosshill, pleaded guilty at the Dunfermline Sheriff Court to having, while employed as an authorised shot firer in Benarty Pit, neglected to couple up an electric cable to a charge about to be fired, and neglected to see that all persons in the vicinity had taken proper precautions. Sheriff Umpherston imposed a fine of 15s., with the alternative of five days' imprisonment.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electro-Magnetic Switches. W. E. Lake. (United States Light and Heating Co.) 10,841. May 4th.

Installations for Wireless Telegraphy. G. Marconi and Marconi's Wireless Telegraph Co. 13,020. May 30th.

Terminals for Electric Storage Batteries. W. E. Lake. (United States Light and Heating Co.) 13,299. June 2nd.

Telephone Systems. W. H. Derriman. (Automatic Electric Co.) 15,133. June 28th.

Dynamo-Electric Machines. J. S. Priestley and H. Aldred. 15,390. July 1st.

Electric Arc Lights. General Composing Co. Ges. 15,474. July 3rd. (July 4th, 1910.)

Bells for Signalling Purposes. Western Electric Co. (Western Electric Co.) 15,568. July 4th.

Subscribers' Sender Mechanism for Automatic Telephone Systems. Telephon Apparat. Fabrik E. Zwietusch & Co. Ges. 15,569. July 4th. (July 5th, 1910.)

Wireless Signalling. J. Erskine-Murray. 15,718. July 6th.

Production of Metals from their Ores. J. Harden and Electric Furnaces and Smelters, Ltd. 15,824. July 7th.

Apparatus for Operating Valves and Electric Switches. A. E. Lambkin and F. Mead 17,809. August 4th.

Magneto-Ignition Apparatus. C. & E. Fein (firm of). 20,019. September 8th. (January 14th, 1911.)

Insulating Compositions. British Thomson-Houston Co. (General Electric Co.) 21,987. October 5th.

Method of Applying and Apparatus for the Production of Intermittent X-Rays for the Treatment of Deep-Seated Parts. K. Schall. 27,227. December 6th.

Electrically-Operated Cranes or Other Raising or Lowering Machinery. B. Thomas, E. Thomas and E. M. Holme. 16,906. July 24th.

Apparatus for Producing a Perforated Paper Slip by Electric Current Impulses. H. Bille. 20,810. September 20th. (April 7th, 1911.)

Burglar-Alarm Devices. A. Bing. 21,262. September 26th.

Systems of Electrical Distribution Employing Rotary Converters. Siemens Bros. Dynamo Works, Ltd., and H. D. Cook. 21,687. October 2nd.

Selecting Devices for Telephone Systems. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 22,804. October 16th. (March 7th, 1912.)

Miners' Electric Safety Lamps. H. F. Atherton. 25,416. November 15th.

Field Magnets for Multipolar Dynamo-Electric Machines having External Stationary Armatures. E. Volkers. 29,161. December 28th. (January 21st, 1911. Addition to 29,160 of 1911.)

1912.

Integrating Electric Meters. S. G. S. Dicker. (Chicago Electric Meter Co.) 1,571. January 23rd.

Generation of Alternating Currents. K. Zickler and P. Czepek. 5,551. March 5th. (March 19th, 1911.)

Electro-pneumatically-Operated Brakes. W. V. Turner. 8,152. April 4th. (July 18th, 1911.)

Volt-Registering Devices. E. Barker. 217. January 3rd.

Interrupter for Electric Ignition of Internal-Combustion Engines. A. G. Bloxam. (Firm of Robert Bosch.) 4,699. February 24th.

Insulators for Telegraph, Telephone and other Electric Wires and Cables. T. Taylor. 5,054. February 29th.

Sparking Plugs. W. A. Harber. 6,162. March 12th.

Electrically-Fired Cartridges. Soc. Peuble et Durif. 6,298. March 13th. (March 25th, 1911.)

Ignition Devices for Internal Combustion Engines with a Symmetrical Arrangement of Cylinders. M. C. Brenot. 6,567. March 16th. (March 21st, 1911.)

Selective Electric Circuit Signalling on Omnibus Circuits. G. H. Crook. 6,639. March 18th. (Addition to 8,283 of 1911.)

Electric Arc Lights. General Composing Co. Ges. 8,907. April 15th. (July 4th, 1910. Divided application on 15,474 of 1911. July 3rd.)

Electrolytic Process. C. J. Reed. 9,612. April 23rd.

Electric Brakes.—Transport appliances used in connection with the movement of material through a factory generally answer their purposes very effectively, and are liable to be regarded as automatic machines which require no skilled attention; this particularly applies to the small winches and hoists which are used for rapid transport or haulage purposes, and which are frequently situated in somewhat inaccessible places, making inspection very difficult. In most of these appliances, in order to stop the motor and therefore the gear promptly after the current has been interrupted, there is usually a small solenoid-operated brake which applies itself to a revolving drum as soon as current is cut off, and hence stops the gear at once. It is advisable to inspect these brakes very frequently, inasmuch as quite apart from ordinary wear, there is a considerable amount of danger of excessive wear being established due to the following cause, if judicious overhaul is not frequently made. It will be noticed in a good many of such winches that the surface of the drum on which the brake shoes press may become very much worn and scored, and any roughness or inequality of this nature not only depreciates the life of the hoist, but makes the smooth working of the brake gear almost impossible. This particularly applies to cases were the brake blocks are of cast-iron. Where such scoring is noticed the brake blocks should be taken down, and it will probably be found that there are some very hard spots in the casting. These are very frequently formed by the chilling effect which occurs during the casting of these blocks, and hence care should be taken to avoid castings which contain these local chills, inasmuch as they act almost like a lathe tool and score the drum surface. A considerable amount of wear could be traced to this cause, which therefore should receive special attention.

THE

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THE BRAY EXPLOSION.

INFORMATION is now available with regard to the recent disastrous explosion of a compressed-air reservoir at Bray, Ireland. In a Diesel engine plant there are starting reservoirs of compressed air which need not contain what we may term the Diesel pressure of 500 lb., and there are fuel injection cylinders of compressed air which may carry a pressure as high as 800 lb., so as to furnish air capable of injecting oil into the compressed air in the engine cylinder at 500 lb. Sometimes it may happen that these air stores become depleted, when, according to the makers' instructions, they may be recharged with carbon dioxide gas *or oxygen*, bottles of which are usually on sale containing the gases at very high pressures. It appears that at Bray on July 7th the starting air was lost, and it was made good from a 40-ft. oxygen cylinder to a pressure of 350 lb., and at the same time the pressure in the blast cylinder was raised from 350 lb. to 700 lb., so that apparently this reservoir had also been depleted.

The information to hand does not make it clear whether the starting reserve was very far run down, for, though it is said that the starting air was lost, only "a little" oxygen was let into one of the starting receivers. It would then contain an air very rich, at least, in oxygen and capable of producing more than usually violent combustion. It seems certain, however, that the blast reservoir pressure was doubled by addition of oxygen, and therefore, in place of atmospheric air with one-fifth its volume of oxygen, there was a mixture containing about six-tenths of its volume of oxygen; this, shooting into an already richly oxygenated air, would produce very rapid combustion of the sprayed fuel, and possibly, but for the Diesel principle of protracted fuel entry, there might have been worse results. Mr. McDonnell's report, which we print elsewhere in this issue, states that the fuel valve on the cylinder of the engine exploded, and the flame "burst along the blast pipe" and reached the blast receiver, which *then* (*sic*) also exploded. But if the receiver had contained nothing but oxygen, it should not have exploded.

Are we to infer that when the fuel valve burst it only burst internally, and that the explosive and flaming blast carried some oil forward to the receiver, where it was exploded by the oxygen? It must have been burning, or how could the oxygen cause explosion?

Messrs. Ross and Lilly speak of the enormous pressure that would be generated in the engine cylinder, the ignition, by the flame, of fuel at the fuel valve, and the transmission of the explosion to the blast air receiver, which exploded—"probably due to a rich mixture of nearly pure oxygen and oil vapour in the cylinder." But again, this is no explanation. How came there oil vapour in the receiver? Its presence seems to be taken for granted, but not a word is said as to how the oil got there. This receiver never should have oil vapour in it, but this report reads almost as though its authors regarded the oil vapour as properly there, and the oxygen as the dangerous interloper. Without excess of oxygen the oil might be exploded; without oil the oxygen would be as inert as nitrogen.

The report of the National Boiler Insurance Co. informs us that "the explosion consisted of the development of explosive energy"—a truly marvellous explanation, but little satisfying—"apparently . . . owing to the combination of the oxygen in the blast receiver with oil in the receiver or its passages." Again the assumption of oil, without any comment on its presence or any hint as to the wrongness of its presence.

Without a personal examination of the wreck, of the details of design, and of the general arrangement, it is not possible for us to say with confidence how the oil did get into the high-pressure air receiver, if it really was there.

It is stated that oil may get into the air receivers from the air compressors, being carried over as vapour by the air which, of course, is hot as it leaves the compressor. But it is not likely that it would remain vaporous in the cool receiver. It would condense again, and certainly in the present case it is unlikely that oil vapour was present, for the receiver was not filled from the compressor, which had been standing with the engine. The fuel used at Bray has been crude Texas oil, but paraffin was used at times of starting up after long stoppages or dismantling.

Had the fuel valve burst into the atmosphere it would have let out the contents of the receiver; the cylinder pressure could not then have blown oil against the 800-lb. pressure. So let it be assumed or admitted that the heavy pressure in the cylinder destroyed the fuel valve internally and left an open pipe between the cylinder and the blast air vessel. This open pipe was fatal. Granting that flame and oil were forced into the receiver, this would be ample to account for the explosion. Even if flame alone reached the receiver, the heat addition would raise the pressure in this, and it might explode.

The root cause of the trouble was undoubtedly the oxygen. If blast-furnace gas, which will hardly burn under a steam boiler, will ignite certainly, regularly and explosively, when under compression in an engine, will not compressed oxygen be also far more energetic than when at atmospheric pressure? Even without pressure beyond the atmospheric, oxygen is far more active than air, which is a 20 per cent. mixture only with nitrogen.

Surely oxygen was a dangerous gas to employ as a starting medium. The engine cylinder, if oxygen was so used, ought to have been allowed to make one exhaust stroke before fuel was admitted. The fuel should only have been admitted into air. Let it be allowed that the cylinder pressure depends upon the amount of oil injected, and that the protracted injection prevents explosion, and that there is only continuous burning; then an excess of oil would consume all the oxygen contained in a cylinderful of air. But, given a cylinderful of oxygen or of an over-rich mixture of oxygen, and combine with this an excess of oil—the pressure that would ensue would be disastrously high and might well burst through the fuel valve and send flame and oil into the high-pressure receiver, there to do further mischief. The oil sprays into a Diesel cylinder are not copious, and therefore a little extra oil might mean much by way of high pressure in a rich atmosphere. Then, again, is there information as to the condition of the cylinder in respect of lubrication? Engineers in charge are very prone to flood a cylinder with lubricant at the time of starting. With a hot oxygen flame and plenty of surplus oxygen, may it not be fairly inferred that such excess of lubricating oil could do the mischief by burning in the presence of hot oxygen?

While the fundamental cause of the trouble was apparently the use of oxygen, it is very probable, as indicated above, that this alone could not have caused excessive pressure in the engine cylinder. A definite charge of oil only contains so many heat units, and the oil only enters the cylinder as the piston moves, and can only cause so much increase of pressure of the charge, whether that be air or oxygen. This seems to be indisputable. There must, therefore, have been an excess of oil forced into the cylinder, and owing to the unfortunate coincidence of an excess of oxygen, more heat units were generated; the pressure became excessive, the fuel valve failed, and, driving a plug of oil in front of it, the flaming blast rushed into the blast vessel, where the plug of oil was violently sprayed and ignited by the following flame, in this vessel containing 60 per cent. oxygen.

The moral is that oxygen, perhaps safe enough under the normal conditions of a small oil injection, contains serious elements of danger when fuel conditions are abnormal, and it should not be used. Carbon dioxide gas does not appear to have any such risks; indeed, an engine might hardly be expected to make a start with it until at least one exhaust stroke had cleared the cylinder and allowed air to enter for compression as the working charge. As engines of the Diesel type become more numerous it may be expected that bottles of compressed air will become available for charging empty receivers. The users of Diesel engines can hardly be blamed, for makers are usually very chary of exposing their wares to improper stresses; but they should now be warned against such uses of oxygen.

In view of the liability of losing the air store of a Diesel plant, it seems desirable that there should be some small independent air compressor for recharging purposes, such compressor to be driven by a small gas or petrol engine, an easily started oil engine, or by an electric motor from a storage battery or other reliable source.

Another point that may be put is that between the engine and the blast air vessel there ought to be placed, in the course of the blast air pipe, a reflux or retaining valve which would prevent the possibility of any blow back into the blast vessel. Had such a valve been present at Bray the air vessel would not have exploded. But even had this air vessel not burst, the destruction of the fuel valve might have permitted an excess of oil to reach the engine cylinder, and there might still be risk of destroying the latter. Thus, no matter how the blast air vessel may be safeguarded by a retaining valve, this will not safeguard the engine, and therefore oxygen ought not to be employed.

Incidentally, engineers in charge of Diesel plant might with advantage satisfy themselves that oil cannot creep by gravity from the fuel valve to the blast air container. If there is a fall to the container, there should be a sump in the course of the blast pipe with a pet-cock for discharging such creep.

In conclusion, we are writing after the event, and we wish to make it clear that our remarks are not intended to cast any reflection whatever upon the management of the Bray electricity works. Mr. Sowter, who has sustained so shocking a misfortune, was acting upon the instructions of the makers of the engine, and cannot be held responsible for the accident. Our aim is rather to prevent a recurrence of such a disaster than to reproach anyone for its occurrence.

Wasteful Controversy: An Appeal to Both Sides.

For several years past the electrical industry in some of its sections has been as a house divided against itself. Rate-aided competition with the private electrical contractor compelled the latter to strengthen his organisation, and scour the country establishing a fighting fund with which to fight supply station engineers and their committees, contest the legality of municipal operations in the Courts, and so on—and with what result? The supply authorities fighting with public money for the maintenance of departments which were calculated to injure the private trader, and for the securing of further powers, have had to eat humble pie. Not only the spirit of the contractor and ironmonger, and all other trading interests dependent upon the initiative of the private business man, has been active in its hostility, but the Courts have decided against undue trespass upon private ground, and in Government quarters there is no sympathy with excessive municipal ambition. As we have said again and again, the ambitions of the supply engineer are easily understood in these days when commercial development is an imperative necessity, and we can quite understand that the failure of a contractor to show enterprise in a district might hamper the electricity supply department, but, these things notwithstanding, we shall deplore the dawning of the day when the mere desire for success of a public department shall be allowed to trample on the fundamental principle of the rights of the private trader. We have no desire to repeat the old arguments with respect to this question. Our readers are not strangers to our policy—we have expressed it plainly in respect of the Leicester case, and on other occasions, and we have urged repeatedly for the putting an end to this disagreement in the interests of the whole industry. Surely there are amongst us, either in the sections concerned, or else acquainted with them, though not actively engaged therein, men who can sit down and dispassionately and judicially define the legitimate sphere of the contractor under a given set of circumstances, and the legitimate sphere of the supply authority. We doubt whether this quarrel will ever be permanently settled by the contractor or by the supply man without the assistance of some other party. Compromise and co-operation there will have to be, but we are inclined to doubt whether, after all that has passed, the two parties will, in conference, be able to draw up a scheme acceptable to both sides, for the good of the industry, and likely to receive the sanction of Government departments. Each side has its own ends to serve, and give and take are inevitable, but a strong and diplomatic presiding genius is needed to hold the balance. The subject has been threshed out till everybody is weary of it. Let there, then, be a renewed effort on the part of both contractors and supply men to "come together" in regard to main points and let them enlist the assistance of some public-spirited independent mind as an arbitrator or as a guide, so that we may have peace in the interests of the entire electrical industry, not constant internecine wasteful strife between sections, which really is good for nobody. The time is ripe for action. The Courts have shown that in cases municipalities have exceeded their powers, a Parliamentary committee has given its decision, as reported on another page to-day, on the side of the contractor, and the I.M.E.A. further powers Bill is not forward at present. We suggest, then, that the conference, which a year or so ago met in London, and from which some of us expected so much, but which ultimately dispersed without any good result, should meet again immediately the holiday vacation is passed, in the hope that a new serious determined effort may be made, so that the wound may be permanently healed and the wasting process may terminate.

Copper.

In commercial circles the views of the producer must still have weight, in spite of the modern doctrine that administration belongs to the consumer—the non-productive consumer for choice. It is, therefore, interesting to note the *résumé* of the copper position given by Major F. Johnson, chairman, at the meeting of the Falcon Mines, Ltd., held on August 1st. This gentleman considered that the world's output of copper had far from kept pace with the ever-increasing demand, and pointed out, in support of this theory, that, whereas 15 years ago the total output of copper was under 400,000 tons, and the price (average for the year) was only £49 10s., yet in 1911, with more than double the output the average price was £55 16s. Again, during the 10 years 1890 to 1900 the average price of copper was £50, while for the 11 years to the end of 1911 the average was over £65, and for the present year the average has been over £70, and this is not remarkably high, comparing it with the £86 10s. averag for the two years 1906-7. The encouraging inference (for the electrical world) was drawn that frequent strikes amongst railway and transport workers will hasten the conversion of railways to electrical working. Increased knowledge of the earth's surface was instanced as rendering the discovery of more high-grade mines less likely.

The conclusion to which the chairman of the Falcon Mines arrived was that the prospect of a permanent reduction in the price of copper is remote, and that all indications are in favour of a maintenance of the present rate. The deduction that railway electrification will be hastened by coal strikes appears perfectly sound, especially in countries where water-power is available. If, however, the price of copper, which would also be affected by transport strikes, should rise to inordinate heights, the question of aluminium conductors would enter into the financial considerations so far as transmission is concerned.

South African Progress.

Engineering changes are proceeding at a considerable pace in the Rand district of South Africa. In the gold-mining industry low working costs and maintenance charges are everything, and during the past year the change from steam to electric winding has practically been completed, the power being obtained either from the power company or the mine generating plant.

According to Mr. F. H. Davis in his valedictory address as President of the South African Institute of Engineers (published in the *South African Mining Journal*), the fears which were entertained by many as to the effect of the change have proved groundless, and the users find that they can get results with the electrical winders which they were unable to secure with the older system of working. The plan of granting certificates after examination for efficiency either as electrical or mechanical engineer is now in full force. As three certificates are compulsory before employment can be given in responsible positions, the result is that a higher standard of competency has been reached with correspondingly improved efficiency. This is seen all round, not alone in electrical developments but also in the intelligent use of compressed air, which is now being distributed from central points to the various mines on a metered basis just like electrical energy. Hot bearings and minute leaks are now sought for, and at once eliminated—a welcome change from old-time methods. Another direction in which progress is being made in the Transvaal is in the establishment of iron and steel works. One such is already in successful operation, turning out 20 tons of finished products per day. Rounds, squares, flats and angles in both iron and steel, as well as rails weighing up to 20 lb. per yard, are now being manufactured locally, so that it may not be long before home exports of these articles are affected.

In view of the Johannesburg municipal gas engine fiasco, and the consequent set-back in local confidence in this method of utilising energy, it is noteworthy that a 400-H.P. producer gas plant has been installed at the Groenfontein Tin Mine. It has been at work for some months, and is giving the very best results, vindicating to a great extent the reputation of the gas engine in that district. This plant uses all classes of local bituminous coal, and is probably only the first of many such installations.

Altogether the past year bears witness to the engineering ability at work in the Rand district of South Africa, and the results justify the optimism as to the future which is apparent on all hands.

Newcastle-under-Lyme Electricity Supply. — In presenting the annual report of the Electricity Committee to the T.C., Alderman Myott stated that a profit of £535 had been made. The Committee had wiped off all capital expenditure other than that sanctioned by the L.G.B., and had also some money in hand towards proposed extensions at the works.

The T.C. has reduced the price of current for power as under:—Up to 2,500 units per annum, 2½d. per unit; 2,500 to 5,000, 2d.; 5,000 to 7,500, 1¾d.; 7,500 to 20,000, 1½d.; with a discount of 5 per cent. for 10,000 units and over.

ELECTRO-HYDRAULIC POWER FOR STEERING VESSELS.

THE application of electric power to steering gear, in order to dispense with steam auxiliaries entirely, has received the attention of many firms interested in ship design. One of the latest achievements in this direction is the equipment of the steamship *Orama* with an electro-hydraulic steering gear made by Messrs. John Hastie & Co., of Greenock, according to the Hele-Shaw-Martineau patents. This gear is the result of experiments which have been carried on for the last seven years, and one of the conditions which the makers lay down as being essential to reliable operation is the use of a continuously-running electric motor, protected from shocks upon the rudder from the sea, which transmits its power by means of a pump and hydraulic cylinders attached to the rudder stop. The pump has to be so arranged that its flow can be instantaneously stopped or directed by the steersman to either of the hydraulic cylinders operating the rudder. It is claimed that gear of this description combines reliability with great economy of running cost over other forms of gear. In steamers where a lighting set is at work all day, the extra steam required for the steering power is imperceptible. The gear gives extreme sensitiveness and quickness of action, enabling a very straight course to be steered, which indirectly saves coal to the ship; there is also great economy of space, combined with simplicity of construction, and the gear is not noisy in working. Fig. 1 shows the general lay-out of the gear; A is the tiller fixed to the rudder stop, and B_1 and B_2 are the hydraulic cylinders and ram operating the tiller by means of the cross head; C is the specially devised Hele-Shaw pump driven continuously by the electric motor D; E is a spindle controlling the operation of the pump, and this is so arranged that in its mid-position no flow of liquid takes place, although the pump is running. If it is pulled out from the pump, liquid is drawn from pipe F_1 and cylinder B_1, and propelled down pipe F_2 to cylinder B_2. If the spindle E is pushed in, a reverse flow of liquid takes place. G is a floating lever coupled at about its middle point to the spindle E while H is connected to the control shaft or telemotor, this connection being fixed at one end to the lever G whose other end is connected at K to the tiller through the medium of lever L. It will therefore be seen that when H is moved it moves G and the spindle E and liquid flows at once to one ram, and the rudder is operated. The tiller in moving displaces the point K of the floating link G owing to the action of lever L, and by doing so, returns the spindle E to its mid-position. When this occurs the rudder stops and is held until H is again moved. At M will be noted a by-pass valve, so arranged that should the rudder be subjected to any severe shock from the sea, the stress will be relieved at a predetermined value and the rudder will give way. In doing this, however, it will move the spindle E and the pump will immediately return the rudder to its previous position. Leakage from any point is taken back to a small tank, and is returned to the system through a non-return valve on each cylinder. The whole system is thus self-contained and is charged with oil, preferably turbine oil, instead of water, and in this way perfect lubrication of all working parts is ensured, and temperature effects are eliminated.

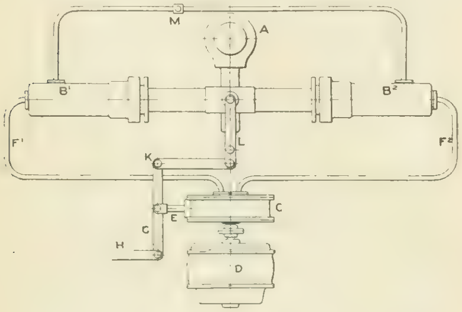


Fig. 1.—Diagram of Hele-Shaw-Martineau System.

The central feature of the above arrangement is, of course, the pump, and this has a high efficiency derived from simple mechanical contrivances, which can best be explained with the aid of the diagram in fig. 2. This represents diagrammatically a sectional view of the pump, in which A is the containing case forming the framework and support for the bearings. Within this is a cylinder body *b b*, revolving centrally with the containing case, and from which radiate a number of working cylinders attached to it. It revolves on a hardened steel circular shaft *c c*, and in this shaft are inlet and discharge ports occupying a little less than half the circumference. The incoming and outgoing oil approaches these ports by means of the passages *p* and *q* in the shaft. Sliding in the working cylinders are a number of plungers with their free ends pointing inwards towards the shaft, and a circular frame or guide ring *d d* acts as a guide for the outer end of the slippers which are attached to the plungers. This guide ring, which is capable of being placed eccentrically to the cylinder body, is supported from this body by the projecting guide *e e*, which is connected to the spindle shown in fig. 1. The cylinder body is supposed to be rotating in the direction shown by the arrows, and the slippers at the end of the plungers are maintained in contact with this guide. It will be seen that if the ports are suitably arranged in the central supports *c c*, oil will enter the cylinders, will then pass below the central line *x y*, and will be discharged again from the cylinders while they are travelling above it. In this case, the circular passage *p* becomes the outlet passage for the oil, while the passage *q* will be the supply passage. Now, supposing that the guide ring *d d* is moved horizontally throughout the stroke, and the projecting guide *e e* is in exactly the opposite position, and the direction of rotation of the cylinder body is unchanged; then by the same process of reasoning, the movement of the oil will be reversed in direction. In this

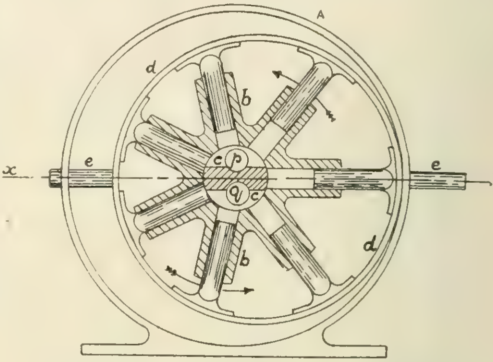


Fig. 2.—Sectional Elevation of Hele-Shaw Pump. Position full stroke; Suction through *q*, Discharge through *p*.

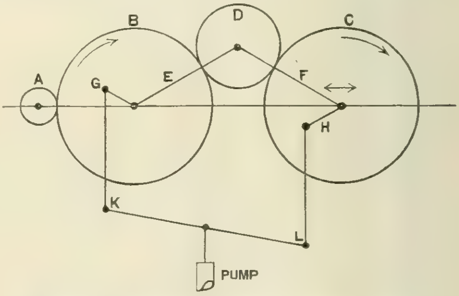


Fig. 3.—Diagram of Brown Hydraulic Gear.

way, the liquid is reversed in direction of flow, and, therefore, the gear driven by it is reversed without any change being made in the rotation of the pump itself, and of the electric motor driving it. This reversal is effected without shock no matter how rapidly the mechanism may be moved, because the guide rings pass gradually from one extreme position to the other, through the central, in which no movement of the plungers takes place. Moreover, it will be seen that as the guide ring is moved a variation takes place in the volume of oil swept out by the pistons or in the rate of delivery to the pump. This is most important because, assuming that the motor operating the pump always exerts the same effort, and that this effort is converted into energy of moving oil by the pump, then evidently as the stroke or capacity of the pump is diminished as it approaches the central position the effect of leverage on the pump is increased, and hence with a diminished volume of oil moved, there is a corresponding increase of pressure upon it. From this it is evident that the pump is remarkably well adapted for steering-gear work, as it generally runs in its central position, and the slightest movement of the helm finds the pump in a position in which it is capable of exerting its maximum effort. Since it is in this position that the inertia of the rams and rudder has to be overcome, and since pressure in the pump rises instantaneously, the effect is that there is almost instantaneous response of the rudder to the slightest movement of the steering wheel. This gear, therefore, as fitted on the *Orama* and other vessels, has been found in practice to give most excellent results.

Turning now to another form of electro-hydraulic gear, which has been experimented upon by Messrs. Brown Bros., Ltd., of Edinburgh, and which promises to give good results, the source of power is again electric. The main idea is that the work which the electric motor has to do will be constant when the steering gear is being moved, as the amount of fluid per second discharged from the pumps operated by the motor multiplied by the pressure of the fluid will be practically constant. The pressure water or oil moves the rudder head by means of two ordinary rams of the usual type. The motor is a constantly running one, so that there is no starting and stopping in connection with it, and no switches or resistances are required, except the usual starting switch. If desired, the motor can have one, two, or more different speeds, the fastest being used when the ship is in narrow waters or docking, and the slowest being resorted to when the vessel is out at sea clear of all land and traffic, and only slow movements of the rudder are required to keep the ship on its course. As the whole of the parts will be seen to be ordinary mechanical details without requiring any special knowledge or tools to manufacture, there is nothing about the gear that is of an experimental or doubtful nature, and as a special oil is used the friction wear and tear is very little indeed.

The mechanism can be best understood by reference to fig. 3, a skeleton diagram showing the arrangement of the hydraulic transmission gear. The pump mechanism supplies fluid variable in amount or pressure to the necessary hydraulic ram, or rams, on the steering apparatus, and varies the pump delivery, while means are provided for maintaining a constant torque resistance in the driving shaft with a varying pressure in the transmission system. The arrangement consists essentially of two crankshafts arranged side by side, the first being fixed in position and operated by the motor, while the second is movable radially with respect to the first, and is driven by gearing from it.

The cranks engage with slotted cross heads, which have on them guide blocks sliding at their upper and lower ends in bosses placed in fixed brackets. These parts are in duplicate. Below them are blocks mounted so as to move with these cross heads, which engage slots in the outer ends of floating levers, which are pivoted at their centres upon the piston rods of two pumps. The fixed crankshaft is driven through a pinion A and gear from a shaft coupled to the motor. On the two crankshafts referred to above, one fixed, and the other movable, are similar pinions B and C which both gear with an intermediate pinion D, the shaft of which, connected by toggle links E, F, with the two crankshafts, must at all times remain in gear with the pinions on the crankshafts. The movable crankshaft is carried in blocks sliding in guides. Hence, if the intermediate pinion be moved downwards, the movable crankshaft will be forced laterally outwards in these guides by the toggle links, and the cranks will be altered in phase one to the other. If they move synchronously and in phase, so moving the floating lever K L bodily up and down, the full stroke of the pumps will be given, but when a certain point is reached in the downward movement of the intermediate pinion, the cranks will move in opposition, and the floating lever will be rocked on the pivot without moving the pump. The stroke of the pump will therefore vary between those limits in accordance with the position of the intermediate pinion.

This pinion may be adjusted in position by hand, but preferably it is automatically adjusted in the system, and with this latter arrangement there is maintained automatically a constant torque resistance in the shaft driven by the motor, in spite of the fact that the pressure in the transmission system varies. In order to effect this the spindle of the pinion is connected by links with a lever pivoted upon fixed brackets, and connected by links with the piston rod of a hydraulic cylinder, which is connected to the pump delivery, and is loaded by a spring whose tension can be adjusted. As the pressure in the pump delivery rises the piston, or ram, in this cylinder rises also, compressing the spring, and thus moving the link work so as to adjust the intermediate pinion described above, so as to shorten the effective stroke of the pumps. It will be seen that this system is very simple and easily applied to steering gear, and although it has not actually at the moment of writing been fitted to any ship, it is being subjected to a few months' running tests in the shops of Messrs. Brown Bros. to make sure of its operation. This experimental gear has fulfilled expectations in every way. When running light—that is to say, when no work is being done—only 7 amperes are taken from a 100-volt circuit. As soon, however, as fluid is being taken, the amperes rise to 30, remaining constant with a variation of 2 above and below until the pressure is reduced to 250 lb., at which the pumps have their full throw. The amperes then begin to come down until the water pressure is *nil* with the current at about 9 amperes. The range of pressures for which the gear is at present made is 1,500 lb. maximum and 250 minimum. The whole arrangement is practically automatic, and immediately the control valve is shut, the pressure rises to 250 lb. per square inch, when the pumps are in their neutral position, and there is, of course, no further increase. Immediately the control valve is opened so that the pressure is reduced, the pumps at once take up their work and the discharge is then the equivalent of the pressure in the main.

It would not be wise, in the present state of development of electric steering, to attempt to enlarge on the subject by reference to all the proposed types which have been suggested. The examples mentioned above, however, represent what may be described as advanced and careful thought upon this interesting subject, and indicate the lines along which electro-hydraulic steering is likely to be developed.

British-owned Vessel Driven by a Diesel Engine.—Last week the preliminary trial trip was carried out of the motor-ship *Earestone*, owned by Messrs. Furness, Withy & Co., Ltd. The engine with which she is fitted has been supplied by Messrs. Richardsons, Westgarth & Co., of Middlesbrough, under joint licence from Messrs. Carels Frères, of Ghent, and the Diesel Engine Co., Ltd., of London. It will be remembered that lately the businesses of Messrs. Carels Frères and the Diesel Engine Co. were amalgamated in the formation of the Consolidated Diesel Engine Manufacturers, Ltd., and that extensive works for the construction of Diesel engines are being built by them at Ipswich. The engine has four separate vertical cylinders, each 20 in. by 36 in., and runs at 115 R.P.M., developing over 850 B.H.P. The engine consumes crude or residual oils, and works upon the two-cycle principle, by which a power stroke occurs at each revolution of the crankshaft, and the design embodies special features developed by Messrs. Carels Frères and the Diesel Engine Co. The *Earestone* is the first large British-owned sea-going vessel to be equipped with a Diesel engine. As compared with a sister ship driven by steam engines, the extra space available for cargo on a 30 days' trip amounts to no less than 400 tons.

"WANTED, AN ASSISTANT——." THE STORY OF A FARCE.

By JUGGINS.

"Wanted, at once, an Assistant." Thus read the advertisement which was the beginning of this "Farce"; and thus, for that matter, commence so many of the farces connected with the filling of vacancies which occur in municipal electrical undertakings.

In the particular instance under consideration, the position was one of responsibility, and the salary attached to the post, although not excessively large, might be termed fair. As a consequence, aspirants to the position were numerous, in fact, well over 100, and in the "first act" we see the chief engineer, with his senior assistant, struggling through the applications, determined to select the most suitable man.

And this is no easy matter. Each applicant has some special qualification which fits him for the post, or, on the other hand, some are without some attribute, which, if possessed, might prove more of a hindrance than otherwise.

The chief and his assistant are, however, both alive to the fact that many men not suited in any way for the position, except in so far that their signatures would look well on the pay sheets, are using all manner of methods to try to cover their deficiencies and to show themselves up to the best advantage.

And the result is that most of the "swankers" (if the term may be allowed) are disqualified by the end of this preliminary act; but not necessarily all. In order, therefore, that the chief may be quite certain, he selects, say, a dozen candidates, and with the aid of his assistant, interviews them, plying them with all manner of questions, which cannot but reveal their weaknesses.

In this way the chief is able to form a definite opinion as to who is not necessarily the best man, but the man most suited for the postion which is vacant. Perhaps a second or even a third interview is necessary before the most suitable man can be finally decided on.

Now, it so happens that in municipal undertakings, the chief, before he can settle any single item, has to appeal to the Lighting Committee, and so in the next act, which undoubtedly is the making of the "farce," and yet which in itself is quite "dramatic," we see about half-a-dozen out of the original hundred served with writs to appear before the Committee.

The Committee, on examination, will be found to consist of anything from about six to 20 men, chiefly tradesmen and schoolmasters, and these, in turn, sometimes all at once, question each of the selected candidates.

But of what do these questions consist? Here is a typical one: "Are you married?" There is a rumour to the effect that a certain Committeeman once had the effrontery to ask a candidate his religious and political persuasions. In number the questions are usually few, and, perhaps, it is as well, since they relate to any topic but electricity.

Surely, then, it is reasonable to assume that under such circumstances the ultimate selection would be left to the chief engineer, on the results of his recent examinations of the candidates. But that is not so. It seems that vacancies are not filled by the possession of electrical knowledge and experience, but rather by the kindness of nature to some individuals in the matter of appearance, or by age, or even by "big boots."

Such was the result of the case here cited. Four candidates appeared before the Committee. The man on whom the chief engineer's choice fell was not given the post, on account of youth. Although he satisfied that electrical expert, the chief engineer, that he was just *the* man for the post, yet he was disqualified by a Committee of, roughly, 20 of all sorts, because he was too young.

It is, of course, consoling to that candidate to think that he is too young and not too old, but is it complimentary to the chief to think that his Committee have not sufficient faith in his abilities or good judgment to allow him to select the best man to fill a vacancy? And there were no "big boots" behind the scenes in this act. Some time ago the world was perhaps startled to hear that a man was "too old at forty." The youthful unsuccessful candidate wonders if the world would be startled to hear that one was too young at twenty-five. To limit the lease of useful life to fifteen years is rather unkind, to say the least, and as we refuse to believe a man to be too old at forty, so we fail to understand why a "man" of twenty-five should be too young.

Should this catch the eyes of Lighting Committees, the writer hopes they will take a lesson from it. As surely as it requires a butcher to dress meat respectably, so surely does it need an electrical engineer to select a capable man to fill a vacancy in the electrical profession. When will Committees understand that they have no right to interfere with their chief engineers in such matters as these?

When will they cease to select men with curly locks, or even grey hair, men with blue eyes or men using some other person's "big boots," and determine to have the most suitable man? that is, the man selected by the chief engineer. May it be soon.

COAL PURCHASE BY CALORIFIC CAPACITY.

By W. H. BOOTH.

There is another side to the much sounded system of buying coal on the basis of calorific capacity. Coal is, in its actual state, a very complex substance. As a fuel it ought to consist solely of carbon and hydrogen, and the hydrogen should not be combined with oxygen. There should be no nitrogen, no silica, no sulphur, or lime or magnesia. In actual coal there are all these impurities, and they are differently combined in every seam and in different areas of the same seam. And these different combinations cause the coals to behave very differently on the grate of a furnace. The impurities may produce merely a dry ash, which can be freely rattled through the openings of the grate, or they may produce a liquid glassy clinker which will melt and hang in strings into the ashpit, or the clinker may spread over the grate surface and effectually choke it. It is these differences that produce coals which possess various characteristics, such as self stoking, quick burning, long flaming, short flaming, dusty, and so on. That coal which has the highest calorific capacity per unit of weight may not be the coal which will put most heat units into the water in the boiler per unit of coal used, or per price, or per hour, all which factors may count in the choice of a coal. For a coal giving a bad clinker in a hot fire cannot, perhaps, be burned in a boiler plant of limited capacity. Then, again, is it desirable by means of certain too arbitrary specifications so to narrow down the choice of coal as to result in permanent waste of fuel, in the deliberate leaving of coal in the mine? Some of the coal specifications one reads are the effusion of the type of man who demands everything of the impossible best variety, and wants to reject every knot in a piece of timber as though it were of the order of a blister in a furnace plate instead of being a natural product. Some coal specifications would demand a coal with an impossibly low percentage of ash. Many coals possess a considerable percentage of ash that does not enter as slate or bass, as a result of a careless hewer. The ash is disseminated throughout the mass of coal and cannot be washed out. Now if all such coals were to be rejected by everyone the price of coal generally would be enormously enhanced and the rejected coal would be left in the pit. As a national asset, every pound of coal left in the pit is represented by a pound of some better coal taken out, and the coal reserves of the country, indeed of the world, are by so much reduced. It is our habit to regard coal as a national asset of great importance. It is so regarded by most of Europe and all North America and Australia, and all the grimy, dirty work which coal enables man to undertake, has gripped men's minds so firmly as a necessity of national prosperity that very few of us regard the scheme of modern industry as a mere passing phase in human life on earth, a phase that in its present hideous development must inevitably cease in a few hundred years at the outside.

True, having set out on the path we have to follow it out to its end, and we cannot say, "Here are we in error! let us back to the conditions of the regretted past." The worst thought we ever have thrust on us is that our coal may give out before that of other nations, and we shall become by comparison even as Holland is to-day, a comparatively non-industrial country with none of our people toiling on hot furnaces or in the dusty dangerous mine. But as we at present desire to push as far off as possible this desirable condition, we ought to regard it as a duty to take care of our coal by refusing to enact such systems of purchase of it as will induce the mining community to exploit it wastefully. A man's life is so short and a mine's life so comparatively long, that the man will shorten the life of the mine if by doing so he can profit a shilling in place of 11d. He himself looks for, say, 20 years at 1s. per unit of output rather than 40 years of the more moderate 11d. rate. All the high grade fanciful ideas of purchasing the best and rejecting what nature has supplied in greater quantity would, if they became universal, bring about the rapid depletion of the coal reserves and a great enhancement of price. Coal, not having been foreseen, became, by oversight, private property, so that the State cannot step in and demand that 97 per cent. or other ratio must be brought to the surface. Much the larger portion of the coal once worked in Staffordshire was left below in waste, and pillars, and even if recoverable, is lost for want of proper records of its locality.

Probably such influence as is wielded by the State is expended rather in the direction of causing coal to be left underground than of conserving every pound of it. It rests, therefore, with the good sense of the community not to formulate such impracticable demands as shall conduce to wasteful exploitation.

There is a tendency among public bodies to set up such impossible standards. Municipalities which put forward specifications for all manner of articles, all to be of the very highest quality, are among the chief offenders, and they pay very much more for goods than their intrinsic value.

The exacting specification for coal, or any other product, invariably means that the ratepayer or the shareholder has bigger rates to pay or less dividends to receive, because, for the very best of coal, there is not enough to fill the demand of the "crank" specification, and inferior stuff is smuggled through at the "crank" price. And, in any case, it is bad national policy to set up, as it were, an aristocracy among the coal heaps, so that the best coals are sold at a price not warranted by their calorific capacity or practical utility, after all.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Railway Cab-Signalling.

The first paragraph of Mr. Dupré's letter, in your current issue, greatly surprised me. My previous letter, far from corroborating, plainly contradicted his contention.

In this connection, it will be well to remember that the question is not whether rubbing or rolling is better for electrical contact. The question at issue is formulated only when we add the restriction of high train speeds together with dirt, rust or ice.

Considering the fact that my wheel pressure on a ramp was certainly greater than 150 lb., and that Mr. Dupré says that my apparatus was "too sensitive under perfect conditions of contact," it is pertinent to ask the meaning of his language (in his previous letter) to the effect that "sliding contact can be kept so light," &c. I consider 150 lb. rather heavy here. I found this weight amply sufficient for rolling contact under the extremely imperfect conditions of contact under which all such members must operate.

My article, which precipitated this discussion, plainly shows that what Mr. Dupré calls an "imperfect contact" is not my "sole factor of safety." I show that if failure of this contact produces an error of indication at all, it can produce only the safe error. Since he brands as "imperfect" the rolling contact, which never failed, why does he not also designate as "imperfect" the rubbing contact, which, under the same practical conditions, repeatedly made safe errors?

It is exceedingly easy to prove that the Brown-Mackenzie system is not "absolutely reliable." If Mr. Dupré will supply me with a copy of the pamphlet to which he refers, I shall be glad to go into detail in this matter. For the present a few facts of a somewhat general character will suffice. From the *Railway Engineer* of last June it is obvious that the Brown-Mackenzie cab signal will indicate "clear" when the correct indication would be "stop" in event "the track wires should for any reason become cross-connected, or if contact should accidentally be made between the angle irons composing a group of ramps." In this respect the Brown-Mackenzie system is certainly far less reliable than the system illustrated by fig. 3 of my article. It is quite true that the Brown-Mackenzie system provides a magnet which in effect "breaks the main circuit," "de-energises all the coils, and exhibits a danger signal;" but this magnet cannot produce this vitally important result if the magnet coil is short-circuited or open-circuited.

The Brown-Mackenzie system requires as many as five ramps at a given point along the track, while the cab system approved by me requires no more than two, and the grounding of these two ramps will not produce a false "clear" signal. The breaking of the ramp-engaging members in the Brown-Mackenzie system (by ramp action or by a foreign body on the track) would result in failure to give the "danger" indication at the next ramp ahead, even if the track immediately in advance is obstructed.

William H. Dammond.

West Bridgford, Notts.,
August 2nd, 1912.

The Standing of the Engineer.

At the time—about six weeks ago—that an article from Mr. Goody appeared in your paper, I was tempted to add my comment, but refrained. However, after reading last week's Review and noting the advertisement *re* the "Constructional Engineer" required by the Birmingham Corporation, I should like to make a few remarks. As can be seen from the advertisement, the man required must be an engineer of first-rate ability, able to prepare specifications, have a knowledge of architectural requirements, able to superintend the erection of practically all types of steam and electric plant, conduct trials, &c., and also take charge of a drawing office. The salary offered is £400-£500 per annum, which is not over much in my humble opinion. However, my main object in writing this is to remark that, side by side with the qualifications of the engineer required, it would be interesting to know the corresponding responsibilities of the "Secretary" that a certain Corporation Electricity Department appointed at a commencing salary of £600 per annum, about 18 months ago. Electricity concerns are made, and exist, by reason of their engineering staffs, and I consider these self-same staffs should not in any way, either financially or socially, be subordinate to the clerical staff. There is too much of the "Manager and Secretary" business already.

Interested.

Indirect Lighting.

It is rather amusing to read in recent issues of the Electrical Review of the value of indirect and semi-indirect lighting. It would appear that some of your contributors have awakened from a Rip van Winkle sleep, and with their eyes dazzled by the brilliancy of metal-filament lamps, have rushed into print with their ideas without considering that for some years now such lighting has been recommended and practised by the General Electric Co., Ltd., who have devoted considerable attention to this charmingly efficient system of lighting.

For some years now the G.E. Co. have produced and supplied in increasing quantities fittings of this nature for use in private, public, and institutional buildings. In direct lighting the bulk of light is wasted by absorption in the decorative scheme and by shadows cast from objects. Where the direct light falls upon high reflecting surfaces, such as books, papers, white tablecloths, &c., the eye cannot easily accommodate itself without undue strain, due to constant contraction in the endeavour to adjust itself, as it changes its view from a light absorbing material to one of high reflective brilliancy.

The natural working light of daylight is a diffused light; hence, if we approximate to daylight conditions in our artificial lighting by illuminating our largest reflecting surface, viz., the white ceiling, we get the light rays reflected over the whole of the working plane, eliminate shadows and get as much light as the eye requires to work with easily and comfortably. A certain amount of filtration of light takes place by reflection from the ceiling, rendering the value of the light of great importance in any decorative scheme, and allowing pictures to retain their true colour value by artificial light.

Of the two methods, under ordinary conditions, we strongly recommend totally reflected light as fulfilling every requirement. So thorough is the diffusion of light that it is possible to hold a sheet of white paper a few inches below the solid reflector without any shadow falling on the paper.

Under certain conditions (other than personal preference) it is necessary to use semi-indirect lighting or to have specially designed fittings which embody a suspended reflector to take the place of the ceiling, where the ceiling is too lofty or too indifferent a reflector. For hospitals and other institutional buildings of a like nature the Willard fitting adequately fulfils its purpose. There is the minimum of tarnishable metal, the reflector being made in vitreous enamel, with a complete clear glass dust cover, and a diffusing bowl of opal glass to soften the direct rays.

Fred. T. Cash.

Sidcup, *July 24th*, 1912.

THE BRAY EXPLOSION.

We are now enabled to publish the reports of the various engineers who inspected the plant at the Bray electricity works, as well as that of the deputy electrical engineer, Mr. D. E. McDonnell, who has now been appointed to carry out the extension scheme, and to act as resident engineer for the present.

Dr. Lilly, of Trinity College, and Mr. William Ross, M.I.M.E., of the firm of Ross & Walpole, engineers, Dublin, were engaged by the Council to investigate the matter, and reported as under:—

"We find that the explosion in the Diesel engine was due to the use of pure oxygen instead of air. The builders of the engine were cognisant of the fact that oxygen was being used for starting the engine, as stated in your engineer's letter to them of February 15th, 1912. It appears that the use of oxygen for such a purpose in engines of this kind is dangerous. This explosion resulted from its use.

"A careful examination of the Diesel engine and of the wreckage of the air-injection cylinder, &c., shows that the explosion was not only one of great violence, but also of extreme rapidity, from which we infer that something abnormal must have taken place. The explosion occurred during the starting of the engine, after a period of idleness for a few days. We have ascertained the following facts:—

"1. Before starting the engine the blast cylinder and one starting receiver were partially charged with oxygen under pressure, ordered from, and supplied by, Messrs. Mason, of Dame Street, Dublin.

"2. On starting, the engine cylinder was connected with the starting receiver in the usual manner. The effect of this was to fill the engine cylinder and connections with air highly charged with oxygen

"3. On changing over the engine to run on fuel supply and blast, the explosion, or explosions, took place.

"4. The condition of the engine and wreckage points to the conclusion that the explosion was caused by the presence of the oxygen with fuel, somewhat in the following manner:—

"Near the completion of the compression stroke of the engine, the compressed air being charged with oxygen and fuel, exploded in the engine cylinder, with a rise of pressure far above that obtained under the usual working conditions with air. This pressure exceeded that in the air injection cylinder and pipe connected to the fuel valve; the flame from the engine cylinder ignited the mixture, and caused the explosion to be transmitted through the connecting pipe to the air-injection cylinder.

"5. The condition of the wreckage of the air-injection cylinder indicated that the explosion was instantaneous, and gave rise to enormous pressure. This was probably due to a rich mixture of nearly pure oxygen and oil vapour in the cylinder."

Mr. E. G. Hiller, chief engineer of the National Boiler Insurance Co., Ltd., reported as follows:—

"The explosion consisted of the development of explosive energy in the blast receiver, which destroyed the blast receiver, and caused other damage. Apparently this explosive development occurred owing to the combination of the oxygen in the blast receiver, with oil in the receiver or its passages.

"The fragments of the receiver and its connections were carefully examined, and I have to say that there are no indications of any defect of construction or condition which would account for the explosion.

"We have no record of any preceding accident of a like nature in connection with engines of this type. The accident must be looked upon as unique, and we have no evidence whatever on which blame could be fairly attributed to any person."

Mr. Donald E. McDonnell, deputy electrical engineer, reported as follows:—

"On Sunday, the 7th inst., the starting air of the Diesel was lost, and, following the instructions of the engine builders, Mr. Sowter sent to Dublin for a 40-ft. cylinder of oxygen. On the 10th we charged the blast receiver from this cylinder, raising the pressure from 350 lb. to 700 lb., and also passed a little into one of the starting receivers; the pressure in the latter was about 350 lb.

"I started up the engine in the usual manner, and, going on to platform, put the starting lever into the running position. The engine did not appear to be running properly, but before I could discover what was wrong the fuel valve on the cylinder cover of the engine exploded; the flame from this burst along the blast pipe, reaching the blast receiver, which then also exploded.

"I attach copy of the paragraph from the makers' instruction-book which relates to the use of oxygen. From this you will see that we had every reason to believe that there was nothing hazardous nor very unusual in using this gas:—'If by any mishap the air is lost, and no compressor is available, or if the engine cannot be run by external means so as to charge the receivers with its own compressor, then these may be charged with carbonic acid gas or oxygen from cylinders containing these compressed gases, as used for many purposes.'

"In the ordinary course of events there would be no explosive mixture in these receivers, and I consider that there is no danger of a repetition of such an explosion. Personally, I will have quite as much confidence in the Diesel engine as I had before the accident."

In reply to inquiries that we have made, Mr. McDonnell has kindly furnished the following additional information:—

"The broken pieces of the receiver were perfectly free from oil. It is assumed that the explosion may have removed any which may have been deposited on the inside walls. The only oil which could get into receiver would be carried over in the form of vapour from the air-compressor, and would be from the lubricating oil. It appears that this does occur sometimes.

"The connection from the blast receiver to the fuel valve of the engine consists of about 14 ft. of ⅜ in. bare copper tube. Crude Texas oil fuel has been used since the engine was installed, about 2½ years ago. No other quality has been used except to start the engine, should she have been lying off for any time or have been dismantled, when ordinary paraffin oil is used. It is difficult to see how oil could creep back to the blast receiver, as there is a practically continuous stream of air from this receiver to the fuel valve of the engine when the engine is running.

"The blast pipe always seemed clean and dry whenever it was examined."

Our comments on the circumstances will be found in our leading columns.

PARLIAMENTARY.

Sheffield Corporation Bill.

On Thursday and Friday, July 25th and 26th, a Select Committee of the House of Lords, presided over by the Duke of Wellington, considered the Bill promoted by the Sheffield Corporation. Mr. Honoratus Lloyd, K.C., Mr. Clode and Mr. Jeeves appeared for the promoters, while Mr. Ernest Page, K.C., and Mr. M. N. Drucquer represented a body of electrical engineers and contractors, who were ratepayers, in opposition to the Bill.

Mr. Lloyd, in opening, explained that the contentious part of the Bill was Clause 90, which provided that the Corporation might sell, let for hire and fix, repair and remove, but not manufacture, lamps, motors, electric fuses, switches, lampholders, motors and other electrical fittings, for lighting, motive power or other purposes. The clause also contained power for the Corporation to wire private property. Proceeding to explain the special circumstances which existed at Sheffield, counsel said that the electricity supply of the city was first carried on by a limited company under a provisional order. That company carried on the business both of manufacturing fittings and their supply to consumers and also the wiring of consumers' premises. In 1897, the Corporation gave the company notice requiring them to sell them their undertaking, and in the following year the Corporation purchased the whole of the undertaking by agreement. In 1903 the Corporation was presenting a Bill in Parliament which contained a somewhat similar clause to the one in the present Bill. At that time a number of gentlemen interested in the electrical fitting trade objected to the Corporation carrying on this particular class of business in competition with private traders. A good deal of discussion took place, and eventually the

Corporation told the objectors that they were convinced they had the power to do these things, having bought and taken over the rights of the limited company. They, however, struck the powers out of their Bill in 1903, at the same time making it quite clear to the private traders that it was not with the view of depriving themselves of any power to go on with the wiring and fitting business which they had carried on, and which they intended to continue to carry on, in the future. Three years later a Mr. Davidson, who was interested in the trade of electrical fittings, brought an action against the Corporation, and in the result Mr. Justice Eve decided that they were not entitled to carry on that particular business. The Corporation announced their intention of appealing, and under those circumstances the judge said he would not grant an injunction against them, but he would make a declaration that they were not entitled to carry on the business, with liberty to apply for an injunction if it became necessary. At that time counsel for the Corporation announced that they were proposing to apply to Parliament for a Bill to make it quite clear that they had the powers under the special circumstances of the Act of 1898, and it was under those circumstances that the present Bill came before their Lordships.

Evidence on behalf of the promoters was given by **Alderman Robert Styring**, a member of the Sheffield Electric Lighting Committee, who said his view was that the Corporation ought to have as much power in the way of providing electric light fittings as the gas companies.

Cross-examined by **Mr. Page**, witness said that under the Act of 1898 he claimed that they were acting within their powers in doing such work, but of course they were bound by the decision of Mr. Justice Eve so long as it was not altered by the Court of Appeal.

Mr. Albert Davidson, examined by **Mr. Drucquer**, said he appeared to oppose the Bill. He was a ratepayer of Sheffield, and used to carry on business as an electrical contractor. He gave up the business because he found the Corporation's competition was so keen. He thought that by their own showing the Corporation had proved that their competition was unfair. For one thing, they appointed canvassers and were first in the field. If a trader had an inquiry for work he had to give notice to the Corporation, and by that means they tried, if possible, to oust the trader. Not only were they able to get first information, but on the point of cost they possessed an advantage over the private trader. An ordinary trader had to take all things that came against the business, and had to make an adequate charge against his gross profits, whereas if the Corporation could obtain the use of premises for nothing, if they could neglect depreciation of stock and obsolescence of any stock, they did not show a proper amount of standing charges against their prime costs. If the evidence which was given that their gross profit showed 15 per cent. profit on their turnover was correct, then he submitted, as a commercial man, that when those gross profits had been subjected to the ordinary charges that appertained to an ordinary commercial business, they would entirely disappear.

After evidence had been given by **Mr. A. J. Ward**, a director of Thomas Ward & Co., secretary to the Sheffield branch of the Electrical Contractors' Association, and **Mr. R. Tweedy Smith**, the honorary solicitor to the Association, the **Chairman** said the Committee had decided that the model clause should be inserted, and Clause 90 struck out. By the model clause the Corporation are not at liberty to execute the wiring of private property except between the main of the Corporation and the consumer's meter, nor can they sell any electrical fittings except through a contractor.

The Bill will be read a third time in the House of Lords in the autumn session.

Clyde Valley Electrical Power Order Confirmation Bill.—In the House of Commons, on 5th inst., this Bill was read a third time.

Wolverhampton Electricity Supply.—The Corporation has made an arrangement with the Midland Electric Corporation for Power Distribution, Ltd., whereby the latter is to forgo its rights for the supply of electrical energy in the parish of Bushbury on consideration of the sum of £500. To this end the Corporation is to apply for a prov. order annulling the present one in favour of the company, which has 30 years to run. By agreement with the company the Corporation has been for some time supplying the Electric Construction Co., Ltd., whose works are situate within the area of Bushbury, with power; and as the Construction Co. proposes to increase the quantity of electricity supplied to its works, it follows that if the negotiations at present proceeding are brought to a successful issue, the revenue obtainable for the works will be appreciably increased.

One of the old storage batteries at Commercial Road is to be removed to the Tettenhall Road sub-station, and refixed there at an estimated cost (after sale of old surplus material) of £800.

The Australian Commonwealth.—The new building of the Australian Commonwealth in the Strand is to possess its own water supply. An artesian well and electrically-driven pump are to be constructed and supplied to the specification of Mr. W. H. Booth, of 5, Broad Street Place, E.C. The borehole will extend about 200 ft. into the chalk which underlies the Tertiary deposits of the London basin. As is well known, the chalk water from under these deposits is usually a fairly soft water, differing considerably from chalk water obtained from chalk not so covered.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Fittings.

Although metal-filament lamps are not nearly so sensitive to vibration as was the case a short time ago, even now the life of a lamp can be considerably lengthened by the use of an anti-vibration spring, and the **Electrical Engineering and Equipment Co., Ltd.**, of 109-111, New Oxford Street, W.C., have introduced new types of suspension fittings in which the springs are enclosed in porcelain caps, which serve to insulate the metal-filament lamp fitting, as well as to protect the spring. These fittings contain springs adjusted for weights from 6 oz. to 15 lb., and are generally adopted for small water-tight fittings. For fittings over 15 lb. in weight, a larger type is supplied, consisting of a cast-iron case with an insulated interior completely enclosing the spring, which is normally in compression. These are also very suitable for arc lamp suspension on tramway standards, in great measure preventing the overfeeding of the lamps.

∞ ∞

We illustrate herewith some new fittings supplied by the company, which are designed with an elaborate arrangement of ventilation. Inside the glass globe a steady circulation of air is produced, which keeps the lamp cool and ensures its running under more or less normal conditions. A small hole is made in the base of the globe, and the top of the fitting is provided with a C.I. mushroom cap which is held from the main fitting by three small bosses, giving a large air passage. The main body of the fitting is of enamelled C.I. and can be supplied with reflectors of spun sheet iron, vitreous enamelled. The fittings are made up in sizes for lamps from 100 c.p. up to multiple lamp fittings with a total c.p. of 2,400. Fig. 1 shows a fitting suitable for one 600-c.p. lamp, or as many as 7 lamps of 50 c.p. each. Several other sizes of similar design are made. Fig. 2 is a watertight fitting made up entirely of spun steel with vitreous enamel, and designed with the idea of replacing arc lamps for shop lighting; a very pleasing effect is given with the specially moulded globes illustrated, the light being diffused evenly in all directions.

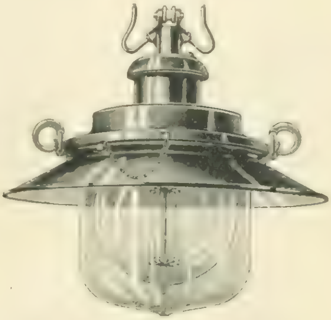


Fig. 1.—E.E.E. Cast-Iron Fitting.

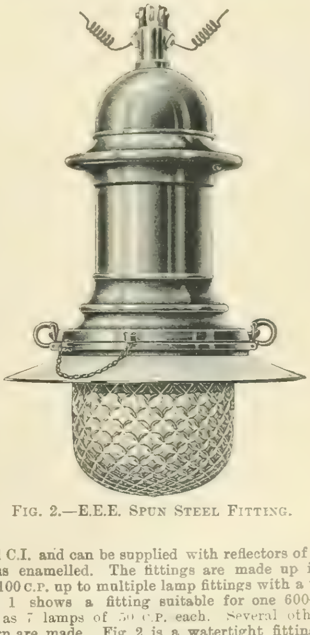
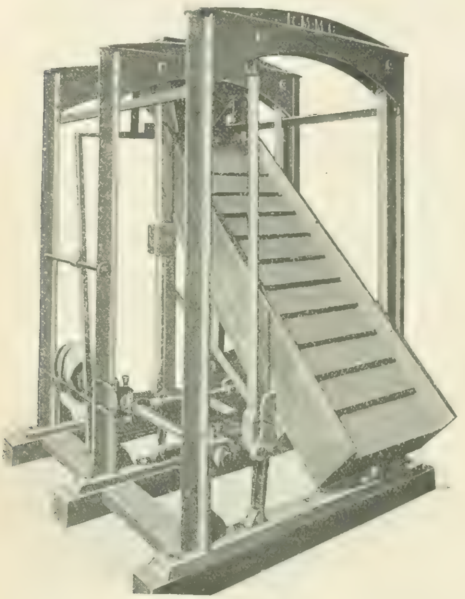


Fig. 2.—E.E.E. Spun Steel Fitting.

Magnetic Separator.

In our issue of July 5th, we described the new type of machine shown at the Non-Ferrous Metals Exhibition, by the Rapid Magnetting Machine Co., Ltd., for removing small percentages of iron completely. The accompanying illustration shows the appearance of the machine: the shoot practically consists of a staircase with brass treads and magnetised iron risers, as previously explained, and it is practically impossible for iron particles to run the gauntlet successfully.



Rapid Magnetting.

BUSINESS NOTES.

Book Notices.—*Universal Directory of Railway Officials*, 1912. London: The Directory Publishing Co., Ltd. 10s.—This useful directory has now reached its eighteenth edition. It is as usual compiled from official sources under the direction of Mr. S. R. Blundstone, and by its system of arrangement one is easily able to find out anything of importance, in the statistical or personal way, regarding home and colonial and foreign railways.

Consular Notes.—Peru.—The British Consul at Iquitos reports that the Telefunken system of wireless telegraph is being adhered to by the Telegraph Department, and it is hoped to establish direct communication with Lima, across the chain of the Andes, 6,000 m. high. A new tower has been erected at Iquitos, and another near Lima, on the Cerro San Cristobal. Experiments carried on between a steamer at Valparaiso and another at Bahia Blanca, which are 1,250 km. apart, with the Cordillera between, at a height of 6,000 m., gave an excellent communication with a power of 1·5 kw. The next important link to join up will be with Manaos.

Switzerland.—The British Consul at Zurich reports that although Switzerland has no coal, she has, on the other hand, enormous hydraulic power, and the application of this great force has made considerable headway during the last 15 years, numerous factories being now driven by electric power. The hydraulic force capable of utilisation in Switzerland is estimated at 722,600 h.p. The electrification of the Federal Railways is only a question of time, and this will, in some measure, free Switzerland from the tribute she now has to pay to foreign countries for fuel. The electrical industry in Switzerland has undoubtedly a great future before it. The cost of the application of electricity in Switzerland is less than in other European countries, and in almost all towns and in a large number of villages it is used not only for lighting purposes, but also for motive power. This is one of the reasons why the Swiss industries are able to combat foreign competition. The Commission appointed to inquire into the electrification of the Federal Railways has calculated that the horse-power for every 24 hours necessary for electric traction on a normal gauge would be 100,000 in winter and 125,000 in summer. As the horse-power in the country, which is still unused at the present moment amounts to over 500,000, only one quarter of the hydraulic power in Switzerland would be necessary for the electrification of the entire network of the Federal Railways. The Swiss engineering industry suffered somewhat during the year 1911 by reason of foreign competition and foreign protective tariffs, although towards the end of the year the exports showed a slight improvement. The electrical home trade was also considerably affected by certain cautional regulations for fiscal purposes, although this reduction was somewhat compensated for by an increase in exports. It is confidently hoped that the anticipated electrification of the Swiss railways will bring about an improvement in this industry. A Swiss engineering journal in referring to the increasing severity of competition with which Swiss engineers have to contend not only in foreign markets but also in the supply of machinery for engineering enterprises within the country, states that exports of machinery from Switzerland to neighbouring countries are becoming more and more difficult in consequence of increasing tariff rates, whilst foreign Governments and municipal bodies restrict deliveries of the necessary supplies for State undertakings, military, naval and railway departments to their home factories.

Elsewhere in his report the Consul says: "The returns for 1911 are not yet known, but the number of British commercial travellers visiting this country has never in any one year exceeded 70. There are many firms who send their representatives to Germany, France, Austria-Hungary and Italy, and a visit to the principal centres of trade in Switzerland (Zurich, Berne, Basle and Geneva) might well be included at little extra expenditure of time and money. If, however, it is not convenient to send travellers, the appointment of Swiss agents, who are generally able to correspond in English, would be the most likely way of securing a better share of trade. I have in previous reports pointed out the necessity of catalogues being printed in the French or German language, also of weights and measures being given in the metric system and prices quoted in francs. One of the principal Swiss trade organs, in an article on my last report, it is stated that British exporters would undoubtedly gain a considerable advantage by adopting such a reform, which has long been earnestly desired by the leading Swiss firms interested in the import of British goods. A further aid to the development of British trade in Switzerland would be advertising in trade journals. There are numerous special trade journals published both in French and German Switzerland which are indispensable to Swiss traders. German and French manufacturers have adopted a regular and extensive system of thus bringing their special goods before the Swiss public."

Cuba.—The British Vice-Consul at Havana reports that a concession was granted at the beginning of the year to the Palmira and Cruces Electric Railway and Power Co. to utilise the waters of the Habranilla River for the supply of its power plant. All machinery, engines, tools and rolling stock were to be admitted free of duty. The company will build a standard gauge railway 225 miles long, in Santa Clara province, opening up sugar and tobacco lands. It will probably be five years in building. Further, a concrete dam, 1,000 ft. long and 75 ft. high, will be built for the storage of water. The capital of the company, which will claim no subsidies, is £4,000,000. Plant to develop 30,000 h.p. will be installed and light and power supplied to the towns and sugar mills on its route.

Bolivia.—The British Vice-Consul at La Paz reports that the electric lighting and tramway system of the city of Cochabamba has drawn German capital to the extent of about half of the total investments, but the total amount of German capital in the Republic is probably under £1,000,000, as compared with £6,000,000 British capital, invested chiefly in mines and railways. The result is that the United Kingdom holds an overwhelming proportion of the total trade of the country. The British Vice-Consul reports that the most important work in his district to be noted is that of the Sucre water supply, now approaching conclusion. This work is on the gravitation system, starting from Cajamarca, a watershed distant about 15 miles from Sucre, where the intakes are situated. The water is thence conducted through 10,000 metres of aqueduct, 1,560 metres of tunnel, and 17,700 metres of 25 and 17 centimetre steel pipes. The supply averages approximately 100 gallons of water per minute, and is held in a high-level reservoir of 357,500 gallons capacity. Here, where the vertical fall from the storage reservoir is 350 metres, a power station is being equipped with dynamos capable of developing 208 h.p. for a municipal supply of light and power. The whole work was to be concluded in May of this year, and about £176,000 had already been expended, exclusive of the electrical plant.

The British Vice-Consul at Potosi reports that the hydro-electric light and power supply installation was completed last year by private enterprise (Vladislavia & Co.) at a cost of £64,000. The water from numerous water-courses around Potosi, the waste and surplus water from the mining establishments and the town itself, is all accumulated in a large reservoir of 300,000 cb. m. capacity, from which, through 750 m. of 24-in. piping with a vertical drop of 120 m., it is supplied to the turbine motors. The power station is distant about $2\frac{3}{4}$ miles from the city, and is fitted with dynamos capable of developing 450 h.p. Only about 160 h.p., *i.e.*, 80 for street lighting, 70 for house lighting and 10 for industrial purposes, is at present used, however, while the distributing plant is being gradually extended. The demand for private lighting and for industrial purposes is larger than can be supplied at once. In time electrical power will be available in the mines for driving air-fans, blasts, drills, for traction and for hoisting plant.

The British Vice-Consul at Oruro reports that work on the electric tramway system of Cochabamba is being actively proceeded with. The passenger traffic on the completed portion is larger than was expected, and is leaving a good profit. During the year 1911, several important British firms have established agencies in Oruro.

These firms previously did a certain amount of business in the district, but the establishment of agencies is a new departure for British firms there, and may be looked upon as an appreciation of the increasing importance of the market of this mining centre, as well as an attempt to acquire a larger share of the trade. Of this business an important part consists in supplying the mines with mining material and stores, in exporting the mine product, and in advancing money in suitable cases for the better working of the mines.

Bankruptcy Proceedings. — HENRY HALLIFIELD OXLEY (otherwise known as Oliver Huxley) consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex. The following are creditors herein :—

Anderson, John	£200	Oxley, Olive V. .. .	£110
Brit. and For. Invest. Corp.	153	Peck, T. W. .	60
General Electric Co. . .	25	Stone, Geo. .	54
Harrop, John, Ltd.	15	Trentham, N. H.	46
Jarvis, Thos. H.	156	Waring & Gillow	91
Oxley, H. .	102	Sel. Agency . .	14

JOHN WM. GARSDEN, electrical engineer, carrying on business at 24, Preston New Road, Blackburn.—At Blackburn Bankruptcy Court, on August 2nd, this first examination took place. The liabilities were £5,038, and the deficiency amounted to £4,111. Debtor attributed his failue to "being jointly and severally liable for a sum of £1,100 in connection with a previous partnership for which he did not consider himself liable." The circumstances were stated in our issue of July 26th. Questioned by the Official Receiver, debtor said it was solely in consequence of this judgment against him regarding the partnership liability that he found it necessary to file his petition. His present business was paying well, and he had been engaged in some good contracts. At the close of the case the Registrar told debtor he had been well advised to come to that Court, and he must say that it was misfortune which had brought him there. He hoped he would get out of it as well as possible. His advice to him was to give all the information he could, and he would then find that for an honest trader the Bankruptcy Court was not a bad Court at all to deal with.

Private Arrangement.—H. G. NORTON & CO., LTD., automobile, cycle and electrical engineers, Cheltenham and Gloucester.—With reference to the above, particulars of which have already appeared, the following are creditors :—

Ayres, F. H., Ltd.	£24	Henley's Teleg. Works, Ltd. ..	£33
Bransom, Kent & Co. . .	16	Kempshall Tyre Co.	101
Brown Bros., Ltd. ..	45	Michelin Tyre Co. .	120
Continental Tyre & Rubber Co.	525	Minerva, Ltd.	22
Carless, Capel & Leonard ..	107	Marshall Tyre Jacket Synd. ..	20
Cooper Steward Eng. Co. ..	50	Moeller & Co.	23
Crompton & Co.	115	Price's Patent Candle Co. ..	31
Crowden, Garrod, Ltd.	69	Palmer Tyre Co.	200
Cresswell Bros.	16	Phosphor Bronze Co.	27
De Nevers Rubber & Tyre Co.	44	Pneumatic, Ltd.	29
Elecl. Power Storage Co. ..	44	Parsons, T., & Sons	41
Falk, Stadelmann & Co.	420	Smith, S., & Son	22
Faraday & Son .	22	Simmons & Co.	26
Goodwin, A. A.	31	Vandervell, C. A., & Co. ..	33
Harlford, W., & Son	26	Weil Bros., Ltd.	26
Hyde, Archer & Co.	20	Wilson, R. W., & Son	85

and a number of others for smaller sums.

Flat-Iron Endurance.—THE BRITISH PROMETHEUS CO., LTD., have sent us a copy of a letter from a client, who says that he has had one of their 5 or 6-lb. electric irons in constant use for over 10 years without a single failure beyond a break in the flexible cord. It was first used on a 200-volt circuit, and then removed to a 230-volt one. It was not thought worth while rewinding the elements as the iron had already had such a good life, but it is found to work even better on the higher voltage. It has been so employed for the last four years, and has not yet given out.

Catalogues and Lists.—MESSRS. MASON & BROWN, Volta Works, Rutland Street, Leicester.—36-pp. catalogue (Section "M") containing illustrated particulars with prices of a variety of motor-car and cycle accessories, switches, coils, plugs, magnetos, instruments, indicators, and so forth.

THE WESTINGHOUSE BRAKE CO., LTD., 82, York Road, King's Cross, London, N.—32-pp. catalogue (third edition), in which is given a full description of their oil engines (Cross patents), which they are building in sizes from 5 H.P. upwards. Sectional views of complete engines and parts thereof are given, and the half-tone views include self-contained electric sets.

MESSRS. DAVIDSON & CO., LTD., Sirocco Engineering Works, Belfast.—New publication, containing a very full descriptive account, accompanied with numerous excellent half-tone views, of the "Sirocco" induced draught fans for electric power station, colliery, and other service.

MESSRS. W. T. GLOVER & CO., LTD., Trafford Park, Manchester.—Pamphlet describing and showing their patent Cracore solid bitumen cable for mining and other service.

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—Illustrated price list (Section "L") of electric lighting accessories such as ceiling roses, lampholders, various switches, lamps, conduit fittings, and so forth.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Two new price lists; No. 368 (16 pages) gives an illustrated description showing parts of small motors, also complete motors applied to different classes of work, such as the driving of vacuum cleaners, hat cleaners, ice-making machines, buffing and grinding attachments, air pumps and cinematograph machines. No. 369 (four pages) deals with B.T.-H. C.C. motors, type DA. Prices are tabulated in detail, and dimensional and weight information is given in both lists.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, London, N.E., as part of their efforts to popularise their tantalum lamps in China, have prepared a very useful show-card printed in 11 colours. It bears a pictorial representation of rising China eager to embrace the lamp because of its light-giving qualities, and will no doubt prove itself to be very suitable for the market, and capable of bringing demands upon the Siemens China Electrical Engineering Co., of Shanghai, Tientsin, Peking, Hankow, and Hong Kong, wherever the card may be exhibited or distributed.

Dissolutions and Liquidations.—BLACK SEA TELEGRAPH CO., LTD.—A meeting of creditors is to be held at Electra House, E.C., on August 12th. They must send particulars of their debts, &c., to Bircham & Co., 50, Old Broad Street, E.C., the solicitors for the liquidators, by September 20th.

TRACTION SUPPLIES CO., LTD.—This company on July 30th resolved to wind up voluntarily, with Mr. T. Metcalf, 48, Frederick Street, Sunderland, as liquidator. A meeting of creditors will be held on August 15th at the address mentioned.

HERBERT MOORE & CO., electrical engineers and range fitters, 3, Stratford Road, Kensington, London.—Messrs. G. and R. J. Moore have dissolved partnership. The former attends to debts, &c., and will continue the business.

LIGHTING and POWER NOTES.

Acton.—At a recent special meeting of the U.D.C., outstanding matters relating to the transfer of the electricity undertaking from the Council to the Metropolitan Electricity Supply Co. were considered. The clerk, in explaining the situation, stated that at the last interview between the solicitor and the company's secretary, it had been indicated that if the Council accepted the company's offer for main street lighting, and the supply of electricity to work the pumps at the sewage works, then the company would come to an agreement in regard to the demands of the Council in the other matters now in dispute, instead of forcing the Council into litigation. The Highways Committee had decided to recommend the Council to accept the Brentford Gas Co.'s offer for a five years' contract for the supply of intensified gas lamps for the main streets at £517 per annum, with the addition of £220 electric light capital charges. Councillor Page moved that, providing the company will agree to supply all street lighting in streets at present lighted by electricity at 2½d. per unit (including maintenance), electricity for the sewage works at 1¼d. per unit, and all public buildings at present lit by electricity at 2d. per unit, the Council would be prepared to consider favourably the settlement of the other matters in dispute. Councillor Ince moved that the motion be amended by the insertion of the words after "public buildings" "with the exception of the municipal buildings and public library." Councillor Shilliker protested against any arrangement by which the Council could not have the current for the sewage works during the peak hours, as that would not enable them to deal with storm emergencies. The amendment was carried by 5 votes to 3. Councillor Shilliker then moved that the necessary writs be served upon the company, and the matters in dispute go to arbitration. If the Council, he said, had a right to the £5,000 unexpended balance of loan, then let it be submitted to arbitration. The chairman said he thought it was patent that it was inadvisable to go to law if they could avoid it. He suggested that the following proposal be agreed upon :—"That provided the company accepts the Council's final terms, the company be informed that the Council will be prepared to accept the principle of the supplying of electricity by the company for main street lighting and the sewage pumping station upon terms to be agreed upon between the parties, and that the Electricity Sub-Committee be instructed to arrange a settlement accordingly." This was agreed to.

Argentina.—In connection with the extensions now being carried out at the Ensenada power station of the River Plate Electricity Co., two 3,000-KW. turbo-alternators are under construction by Messrs. Parsons. The existing plant at the Ensenada station consists of two 1,500-KW. Westinghouse turbo-alternators, but as these have proved inadequate to meet the growing demand for current, the additional plant was ordered on the advice of Messrs. Preece, Cardew & Snell. The Parsons turbines, each of which will drive its own alternator, are to be placed side by side in the station, and so arranged that the steam will pass in series from one to the other. Under normal full load conditions, the first turbine will expand the steam from 155 lb. per sq. in. absolute pressure down to about 15 lb. per sq. in. absolute, after which the remainder of the expansion will be carried out in the low-pressure turbine. The two turbines when run together will form one complete unit of 6,000 KW., but the connecting pipes and valves will be so arranged that the high-pressure turbine can also exhaust either direct to the condenser or to atmosphere, when the L.P. turbine is being overhauled, or the latter can be run alone, with the help of a reducing valve. Each turbine will be provided with its own oil pump, speed governor, and runaway governor, and the blading will be of the reaction type throughout. All parts of the high-pressure turbine, which will be exposed to superheated steam, will be made of cast steel, including the central section of the turbine casing. The three-phase alternators will each be capable of giving a normal full load of 3,000 KW., 0·8 power factor, 5,500-6,000 volts, 50 cycles, at 1,500 R.P.M., as well as an overload of

20 per cent. for two hours. Each alternator will be complete with its own exciter, which, however, will be large enough to provide current for the two 3,000-kw. machines.

The municipality of Bolivar received 12 tenders for installing an electric light station. Eight were rejected as not being in accord with the specification. The remaining four are being studied.—*Review of the River Plate.*

Australia.—New South Wales.—A Bill is to be brought before Parliament authorising the sale of surplus electricity generated at tramway power stations to municipalities, and authorising those bodies to erect storage plants or accumulators for power. It is considered that it will pay to sell the surplus power at a much lower rate than is charged by those who manufacture electricity solely for that purpose.

The discussion which has arisen as to electricity supply in North Sydney, seems to favour the placing of the scheme in private hands rather than handing over the business to the Sydney City Council.

Aysgarth.—Subject to the payment of 5s. per year, the Aysgarth R.D.C. has consented to the Electric Light Co. erecting posts in the district for carrying overhead electrical wires.

Barton-on-Humber.—The U.D.C. has accepted the tender of Mr. Hopper, acting for a local syndicate, to light the town with 150 electric lamps of 100 c.p. each, at £2 2s. per lamp per annum for a period of 12 years, subject to the Council having the option to purchase the undertaking during the 12 years.

Beaconsfield.—The Uxbridge Electric Supply Co. has informed the U.D.C. that it intends laying a new main from Uxbridge to Beaconsfield *via* Gerrard's Cross.

Beckenham.—The B. of T. has informed the U.D.C. that it declines to withdraw the powers of the West Kent Power Co. to supply current to the parish of West Wickham. The company has now approached the Council as to the supply of current in bulk to West Wickham by the Council.

Bridlington.—The T.C. has decided to obtain for hiring purposes six complete electric cooking outfits at a cost of £84.

Canterbury.—The T.C. has agreed with the company who carried out free wiring of premises under an agreement with the Corporation, to purchase outright the free-wired installations for £125. The original net cost for the work was £324.

Continental Notes.—Austria.—Further particulars are to hand of the Vienna municipal scheme for the building of a steam-driven electric station at Ebenfurth, drawing its coal supplies from the neighbouring Zillingdorf mines. The station will be built on the Fischa, and the current will be transmitted a distance of 22 miles to the capital. On the ground chosen a brickworks will be constructed and a railway, making junction with the Vienna-Pottendorf line. The estimated cost, inclusive of the station, office and workmen's dwellings, railway, coal and ash conveyors, cables, switch-houses on the long-distance section, switch and transformer houses in Vienna, brickworks, street installations, &c., is £270,833. The power-house alone will cost £35,416. The scheme has been formally approved by the Vienna Municipal Council.

Russia.—It is reported from St. Petersburg that the St. Petersburg Electric Co. has commissioned a firm in Viborg, Finland, to acquire extended land and water rights on the River Vuozen, with a view to utilising the small Imatra Falls. The company intends to set up a large hydro-electric station there, with an output of between 50,000 and 60,000 h.p., more or less, according to seasons. It is intended to employ a part of the power in Finland, but the bulk will be transmitted to St. Petersburg, where the company owns a large steam-driven electric station. The scheme has been several years under consideration, as the utilisation of water power for the generation of electricity is a pressing necessity for St. Petersburg, in view of any eventual difficulty in the way of obtaining sea-borne coal, either owing to a strike or to international complications. *Zeit. fur das gesamte Turbinenwesen.*

Germany.—A municipal resolution has been voted to acquire in the course of the next three years 1,000 electric cranes for the equipment of the port of Hamburg. A large expenditure is also contemplated on other harbour improvements, including the extension of electric lighting.

Great activity is being shown in various rural districts in Germany in founding electric co-operative societies to supply the members with light and power, and with electrically-driven agricultural implements. The formation of three such societies is lately announced at Weltin, Trestin and Mandelkow respectively, in the Stettin administrative district; five in the province of Pommern, at Lähmannsdorf, Schwaneberg, Messenthin, Neumark, Jährshagen and Flackenheide respectively; others at Ober-Rüdelsdorf in the Lauban Circuit; at Martinswaldau and Bertholdsdorf in Silesia; at Ossig, in the district of Frankfurt on the Oder; at Nieder Zimmern, in Saxon Weimar; and at Oedelum and Schwaförden, in Hanover.

The *Karlsruhe Zeitung* publishes the text of the Bill for the establishment of electric generating stations in the Valley of the Murg by the Government of Baden. The cost, exclusive of interest on the construction capital, and of the outlay on the long-distance transmission lines, is put at 20,771,000 marks. Of the total yearly estimated output of the stations, viz., 35,000,000 kw.-hours, the Railway Department reserves in advance 12,000,000 kw.-hours.

The steelwork of a new power station, which was being erected in a suburb of Nuremberg, collapsed last week, killing ten and injuring 37 men. It is stated that the roof was being tested.

Denmark.—So far back as 1910 steps were taken to found an electricity supply for the service of the towns and districts on the Danish islands of Lolland and Falster, and the A.E.G., of Berlin, were approached. At the end, however, the negotiations fell through, and six of the several communes in Falster interested, namely, Idestrup, Karleby, Orslev, Horreby, Tingsted and Vaggerlose, decided to carry out separate undertakings. On going fully into the matter, however, the towns named have recognised the uneconomic character of the policy of divided forces, and have resolved to build a joint high-pressure station at Idestrup, at an estimated cost of 370,000 Danish crowns. It is expected that some 30,000 lamps will be connected, and motors up to 1,200 h.p. The plans have been prepared by the firm of Degn & Johansen, of Nykojung, on the Island of Falster.—*Elektr. und Maschinenbau.*

Italy.—Negotiations are in hand in connection with the formation of a co-operative undertaking to establish a central electric lighting and power station in the town of Sestri Ponente.

Doncaster.—The Corporation Electricity and Tramways Committee has received a communication from Messrs. H. Hay and Co., of Bradford, asking at what price current for power would be supplied if they decided to erect a spinning mill at Doncaster. A Committee has been appointed to go fully into the matter.

Edinburgh.—Treasurer McLeod, in submitting the estimates of expenditure for the year at a meeting of the T.C. last week, said, as regards the electricity estimates, it was proper again to remind the T.C. that the estimated balance available at the end of the year was only £190, which on a turn-over of £135,000 seemed to be working upon a very narrow margin, and it was a question for serious consideration whether the present low rate for electric light could be maintained. The margin provided for left no room for contingencies arising throughout the year, without encroaching upon the reserve fund, which it was very desirable should be left intact. Bailie Fraser asked, if there was a deficit on the electric accounts, who had to make that good—the rates or the reserve, and the treasurer stated the reserve.

At the same meeting the following notice of motion was given:—Remit to the Electric Lighting Committee to consider and report as to the disposal of the ascertained surplus of £2,179 on the year's accounts of the electric light up to May 15th last.

Ellesmere Port and Whitby.—The U.D.C. has decided to apply for a prov. order for electric supply.

Gillingham (Kent).—The T.C. has entered into an agreement to supply current to the Royal Naval and Marine Orphan Home.

For public lighting the Council has fixed a charge of 35s. per 55-watt lamp, producing £1,436 15s. per annum.

Gloucester.—The T.C. has agreed to pay £20 to the National Electric Construction Co., Ltd., in settlement of the free wiring work installed in the city by the company.

Henley-on-Thames.—Messrs. Horace Boot & Partners have informed the T.C. that they intend applying, on behalf of the company to be formed, for a prov. order for electric supply for the borough.

Holywell.—With the extension of the premises of the Welsh Flannel Co., at Holywell, an electrical plant was installed, and this was set working last week. The plant provides electrical current for the motors driving the whole of the weaving looms, numbering 180, and also the spinning machinery, and supersedes a combination of gas, steam and water-power. Two new engines of 200 and 100 h.p. respectively were supplied by Messrs. Beliiss, and the dynamos by the Lancashire Dynamo and Motor Co.

Inverary.—Arrangements are being made for the introduction of electric light to Dunderave Castle, Argyllshire. It is hoped in the burgh of Inverary that it may be found possible to make an extension to the town.

Kingswood.—The B. of T. having intimated that it intends revoking the Electric Lighting Order, 1904, owing to the deposit of £500 not having been made and no compulsory works having been executed by the promoters, the U.D.C. has decided to support an application by the Electric Supply Co. for an extension of time, for the company offers to give a temporary supply of current by the end of September, and a permanent supply by the end of the year.

Kippax.—Negotiations are proceeding between the P.C. and the Yorkshire Electric Power Co. for a supply of current to the parish for lighting purposes.

Leatherhead.—The Leatherhead and District Electricity Co. is applying to the B. of T. for an extension of powers so as to cover the parishes of Stoke d'Abernon, Cobham, Great Bookham and Little Bookham.

Leeds.—The Electricity sub-Committee of the Corporation recommends that application be made to the L.G.B. for sanction to borrow £10,000 for the purchase of electric motors to be let out on hire. It is proposed that the motors shall range in power from ½ to 10 h.p. for single-phase motors, except by special arrangement with the manager. Arrangements will be made for the hirer to purchase the motor, if desired.

The City Council has agreed to reduce the maximum price of electricity for lighting purposes from 4d. to 3½d. per unit. As our readers will know, the Corporation electricity department felt the effect of the metal lamp very severely for some years, but apparently matters have now reached a normal state again.

Leicester.—The T.C. has confirmed the recommendation of the Tramways and Electricity Committee that application be made to the B. of T. for a provisional order to extend the limits under which the Corporation is authorised to supply electricity, so as to include the districts of New Parks, Oadby, Evington, Humberstone and Birstall.

London.—In the report of Mr. Frank Sumner, City engineer to the Corporation of London, for the year 1911, it is stated that there were 470 electric lamps in use on December 31st, of which 332 were ordinary open arcs, 92 flame arcs, and 46 metallic-filament lamps, mainly of 75 and 100 C.P.; there were 81 reported defects during the year. The gas lamps numbered 2,648, and there were 2,054 defects reported. The experimental electric and gas lighting was continued, and arrangements were made with the City of London Electric Light Co. and the Gas Light and Coke Co. to share the lighting of the City, at a saving of £6,830 per annum on the previous total of £20,873, and with an increase in illuminating power of about 600,000 C.P.

HAMMERSMITH.—The income of the electricity undertaking for the year ended March 31st last amounts to £62,745, as against an expenditure of £32,095, leaving a gross profit for the year of £30,649, which represents a percentage of 8·92 upon the amount of capital expended, as against 10·5 per cent. last year. After adding £284 to this amount for interest on bank balances, and allowing for interest on mortgage debt for the year (£8,737); redemption of loan capital (£13,567); provision for accruing loan charges (£375); and £54 as irrecoverable, there remains a net surplus for the year of £8,307, as against £12,033. The following amounts were realised from the sale of current at the prices mentioned:—3½d. per unit, £371; 3d., £25,588; 2½d., £2,09[illegible]; 2d., £2,340; 1¾d., £4,235; 1½d., £4,342; 1¼d., £7; 1·1d., £165; 1d., £15,704; ·9d., £1,349; ·8d., £936; ·4d., £1,150. During the year under review 10,903,650 units were generated and 461,470 purchased, as against 10,787,120 and 584,898 last year. Of the total quantity sold (9,335,892) 8,525,613 went to private consumers by meter, the revenue obtained therefrom averaging 1·58d. per unit, the increase over 1911 being comparatively small, the total number then sold being 8,455,665, or an average income of 1·61d. per unit. The current used for lighting public lamps totalled 810,279 units, and the income from their sale realised £4,552. The maximum demand during the year amounted to 5,828 KW. A further sum of £3,360 has been contributed by the undertaking, during the past year, in relief of the rates, this amount being equivalent to 1d. in the £. The total amount so contributed during the existence of the undertaking is £10,360. The accumulated surplus standing to the credit of the undertaking at March 31st last was £8,826, which amount has been arrived at after defraying £3,139 of capital expenditure from revenue, and writing off £6,944 in respect of scrapped machinery and plant.

ISLINGTON.—The special committee appointed to consider the advisability or otherwise of introducing electric light and power into the several institutions under the control of the Guardians, reports that it has received and considered reports from the Gas Light and Coke Co. as to the advantages of improved methods of gas lighting and the economy that could be effected, also full and detailed reports from Mr. J. Enright, consulting engineer, as to the saving in lighting by electricity, and the benefits in convenience, cleanliness and greater efficiency in using electric power. It had also communicated with the borough electrical engineer as to the lowest terms upon which current could be supplied, with the result that the B.C. would be prepared to supply at a uniform rate of 2d. per unit, upon the conditions: (1) That the supply is brought into each building at a point as near the roadway as possible. (2) That an agreement is entered into for a period of five years. (3) That during that period of five years an aggregate amount of energy for power purposes be taken of 200,000 units, that is, an average of 40,000 per annum. Taking the cost of the two systems it appears there will be an annual expenditure of £827 if electricity were adopted as against £1,043 for gas. Adding the cost of power to the electricity total the annual expenditure amounts to £1,305 as against £1,355 after adding the estimated cost for cooking on the gas total. The cost of installation of the electric scheme is put at £2,430. The Committee recommends that the L.G.B. be asked to sanction the installation of electricity for light and power, and that Mr. Enright be employed to prepare plans, specifications, &c., and to supervise the works at a commission of 5 per cent. on the expenditure.

Manchester.—The City Electricity Committee proposes to provide additional plant at its various works at an estimated cost of £87,160.

Nottingham.—The City Council has had before it a report of the Electricity Committee, embodying reports of Mr. B. M. Jenkin and Mr. W. H. Patchell, concerning the condition of the plant at the Corporation generating stations. The Committee pointed out that these reports showed that the plant is in good condition, and although not so efficient as more modern plant, they did not advise that it should be scrapped, and replaced by plant of the latest type, owing to the very large expenditure that would be involved. The Committee had come to the conclusion, after careful consideration of the experts' reports and the advice previously given by Mr. Talbot, the electrical engineer, that the most satisfactory way of dealing with the existing plant, was to install an exhaust steam turbo-generator with condensing plant at the St. Ann's Well power station, where was sufficient room for erecting the necessary cooling towers. With this plant it would be possible to supply the bulk of the day load required for lighting and power purposes, and effect a large saving in the consumption of coal. It was estimated that the approximate saving on the cost of generating electricity, based on last year's output, would be about £3,000 per annum. The total cost of installing this plant would be about £17,140, and it was proposed to provide that amount out of the reserve fund of the electricity undertaking, which now stands at £44,685. The Committee was of opinion that the other suggestions in the reports of the experts would be difficult and costly to carry out. It did not, therefore, propose, as at present advised, to make any alterations at the Talbot Street or the Eastcroft power stations as the former station would only be worked for a short time in the evenings and during the winter months.

In moving the adoption of the report, Sir John Turney, chairman of the Committee, said the recommendations had been brought about by the changed condition of things in the production of electric current. Bad as the undertaking had been for the Council, continued Sir John, in satirical vein, he realised that if instead of the Finance Committee taking the surplus earnings of this undertaking year by year the Electricity Committee had been permitted to put the money to the reserve fund, in place of a reserve of £45,000, they would have had practically £160,000, and would have been in a position to scrap the present machinery.

The motion for the adoption of the report was seconded by Major Ashworth, who expressed the opinion that in future more money should be placed to the reserve.

Mr. W. Hobson criticised the proposals, describing them as patchwork. To spend £17,000 in putting a new patch upon an old coat was, he thought, against all business principles. They would save £3,000 a year, and it would take six years to get the money back, whilst the alterations would only depend upon the life of the engines and plant. He suggested that the whole of the £44,000 in the reserve fund should be expended in fitting the Talbot Street station with up-to-date engines.

Alderman Ball referred to the proposal he brought before the Council several months ago for utilising the Colwick and Beeston weirs in the River Trent for the generating of power. "I was laughed at," said Mr. Ball, "when I introduced it, but many a good thing and many a good man have been laughed at. I am satisfied the scheme is worth consideration."

Sir John Turney replied that the expert had had to delay his report upon Alderman Ball's scheme, but he thought it would be a very interesting one when it did come. He thought it would enlighten Mr. Ball.

After further discussion, the report was adopted.

Portishead.—Messrs. Christy Bros., the promoters of the electricity scheme for the district, have applied for three months' extension from August as they cannot complete the generating station and light the streets by that time.

Rickmansworth.—Mr. R. E. H. Fisher and the Colne Valley Electric Supply Co., Ltd., have applied to the Council for permission to supply electricity to Rickmansworth. The Council has deferred consideration pending the receipt of full particulars.

Shanghai.—Referring to a note in our issue of June 14th, reviewing the annual statement of the Shanghai Municipal Electricity Department, the electrical engineer, Mr. T. H. U. Aldridge, writes to point out that Shanghai is not a Chinese city in the sense that other cities throughout China are; it is an international settlement administered by a municipal council consisting of nine foreigners, seven of whom are British, one American and one German. The Chinese authorities have practically no jurisdiction in the International Settlement, the whole of the municipal administration being under the municipal council, which is elected by the foreign ratepayers, and by the Consular body of the various foreign powers.

Shipston-on-Stour.—With reference to the electricity scheme for this parish, a provisional order is to be applied for by Messrs. Brown & Parsons, Ltd., of Leamington, and the R.D.C. has agreed not to oppose the application.

South Africa.—About four months ago arrangements were made between the Cape Town City Council and the Municipalities of Mowbray, Claremont and Rondebosch, whereby the Council by purchasing the Cape Peninsula Lighting Co.'s undertaking was able to considerably enlarge the supply area of the city's municipal electrical system, which now extends from Sea Point to the boundary of Wynberg. With a view to economy in generation, it was decided to shut down the power station at Claremont, and with this end in view considerable extensions to the plant at the Dock Road power station are now in progress.

The Corporation has made arrangements for the installation of a 2,000-KW. turbine set. This turbine plant, which is the first of any size to be installed in the peninsular, will be sufficient to meet the whole of the demand in the peninsular from Sea Point to Wynberg, and will be in operation daily from about 8 a.m. to 12 midnight, the present reciprocating engines only being used during the early hours of the morning and on Sundays when the load is not sufficient to run the turbine efficiently. The present plant will also be kept in reserve as a stand-by in the event of the failure of the turbine.

The supply in the southern suburbs of Mowbray, Rondebosch and Claremont is at present direct current, but this will be changed over to alternating current so soon as the generation is undertaken from Dock Road. The set on order for the Council consists of a turbine direct coupled to an alternating-current machine, and in order to make this plant available for the present direct-current supply in the City area, the order has been placed for a 1,000-KW. Peebles-La Cour motor-converter, and this will be in operation whenever the turbine is running. The generating plant is being further augmented by the installation of an additional boiler of 1,000 H.P. capacity, and a Green economiser.

The high-tension supply to the suburbs will be at 11,000 volts, and a sub-station is now being constructed at the power station, which will accommodate the necessary transformers and switchgear: the plant in this sub-station will transform energy from 2,200 volts (the pressure now in use for Sea Point and a portion of the Government bulk supply), to 11.000 volts: and from the sub-station cables in duplicate will be laid as far as Claremont. These cables will enter sub-stations at Mowbray, Rondebosch and Claremont, where the 11,000 volts will be reduced to 220 volts, at which pressure energy will be distributed through the various streets for public lighting, and the supply to private consumers of light and power.

In addition to the supply to the sub-stations referred to above, these cables will also supply energy to Messrs. D. Mills & Co.'s mills, Castle Bridge, with whom the Council has made an arrangement for bulk supply and the suburban waterworks at Rondebosch, where electrically-driven pumps are replacing the existing suction-gas-driven plant: at the moment negotiations are in progress with a view to the supply of energy for the electrification of Salt River Works, which, if carried through, will necessitate a further sub-station at Salt River. The total cost of the new machinery is between £20,000 and £30.000. The high-tension mains for the new supply to the municipality of Wynberg are now being erected between Muizenberg and Wynberg, and it is expected that the supply will be available about September.

According to the local press, it was resolved at a meeting of the ratepayers of Cradock, Cape Province, to instruct the T.C. to take immediate steps to light the town with electricity at a cost not exceeding £10,000.

Tunbridge Wells.—The T.C. having applied for an order to authorise current to be supplied to three premises at Speldhurst, the B. of T. has asked to be supplied with information that the occupiers of the premises are desirous of obtaining the supply from the Corporation. Copies of the applications received by the Council have been forwarded to the B. of T.

The L.G.B. has withheld sanction to a loan of £6,000 for mains, sub-station pillars, transformers and house services, pending information that the sum named is not excessive for the next three years.

Warrington.—The borough electrical engineer, Mr. F. V. L. Mathias, reports that the income of the electricity department for the year ended March 31st was £19,245; working expenses were £11,536, and the gross profit was £7,709: after paying capital charges there remained a net profit of £1,746. There was a slight decrease in the units sold, the meters having been read earlier this year. The use of turbo-generators during part of the year reduced the coal consumption per unit from 5·8 lb. to 4·6 lb. The units sold amounted to 3,187,379, of which 2,217,518 were for power.

Watford.—Of the sum of £2,122, being the profit of the electric light undertaking during the past year, £850 is to be allocated in aid of the district rates, and £1,272 to the reserve fund.

West Bromwich.—The T.C. has decided to extend the mains at a cost of £200 in order to supply current to the works of Hamblet's Blue Brick Co., Ltd.

A further extension of mains, to cost £1,000, is to be carried out to supply the district of Harvills Hawthorn, and Tame Street, Hill Top.

Witham.—The U.D.C. has agreed to lease for 15 years to Messrs. Crompton & Co., the old waterworks premises for use as a generating station, at a rental of £30 per annum.

Womersley.—Electrical plant is being installed at the Parish Church for lighting and blowing the organ.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Campania La Comercial, owners of the tramway in Concordia, are now studying the question of electrification, to see if this will suit their requirements.

Australia.—According to the secretary of the Prahran Malvern Tramways Trust, there are over 38 track miles of municipal (electrical) tramways in Melbourne, where there are also 88 track miles of cable tramways in use. It is proposed to construct a further 3 miles of route in South Melbourne, the power being supplied by the City Council or Supply Co.

A conference of representatives of the northern municipalities of Melbourne has been held to consider the route of a proposed cross-country tramway from Essendon through Brunswick to Northcote and Preston, linking up six municipal areas.

Birmingham.—It has been arranged that an application shall be made in November next for a light railway Order for the construction of a tramway from Baldon Road to Quinton.

The City Tramways Committee has been authorised to consider and report to the next meeting of the City Council on the advisability of installing a service of railless cars from the centre of the city to Harborne.

Blyth.—An expert report on a proposed local tramway scheme has been issued to the members of the U.D.C. Having regard to the population, the reporter is of opinion that the cost of ordinary street tramways would be prohibitive, but that a motor-'bus service could be run for an outside figure of 10¼d. per bus-mile if a guaranteed mileage of 450 per week per 'bus were made the terms of the contract. The report is to be considered at the next meeting of the Council.

Colne.—At the Council meeting on July 31st, the town clerk submitted a report by the General Purposes Committee upon the negotiations with the directors of the Colne and Trawden Light Railway Co. for the purchase of the undertaking which the company is desirous of selling. It was resolved that such report be adopted and filed, and that the town clerk be instructed to confirm the special terms offered by the sub-Committee.

Continental Notes.—GERMANY.—Plans are being prepared in respect of a projected electric tramway to connect the towns of Ludwigshafen and Kaiserslautern.

The Elektricitäts Unterelbe Actien-Gesellschaft has been registered, with a capital of 6.500,000 marks, with the object of taking over the Altona-Blankenese electric tramways, the Altona generating station, the supply of light and power current in that city, and also to Nienstedten, Klein Flottbeck, &c., for a period of 40 years, on the basis of an arranged tariff.

AUSTRIA.—The negotiations connected with the electrification of the Vienna municipal railway and the construction of tube lines are making steady, if slow, progress. Differences of opinion prevail between the Vienna group and the French group as to the need for a State subsidy, the latter deeming it unnecessary so far as the tube lines are concerned, as they promise to be sufficiently remunerative. The conclusion which will, it is presumed, be eventually arrived at is that the Vienna group will carry out the electrification of the municipal railway, leaving the undertaking of the tubes to the French group.—*Der Elektrotechniker.*

The negotiations regarding the electric local line from Vienna to the Austrian frontier through Hainburg have been concluded by the granting of the concession. The Lower Austria Provincial Council is the concessionaire, and will hand over its rights and duties to a company which is to be formed. The cost of the line is put at £541,666. A portion of the projected route utilises existing lines, and at its termination, the line will join the frontier station of the Hungarian railway from Pressburg. The line will provide a new and speedy access from the Danube rural districts to the markets of the centre of Vienna, thus facilitating the better provisioning of the city.

ITALY.—On July 1st the Milan-Gallarate-Varese line was opened for electric working, the new double trains which have been rendered possible by the transformation of the line being destined to improve the working of the traffic. The current will be supplied from the hydro-electric station at Varzo, which has 30,000 H.P. It is transmitted to Gallarate at a pressure of 45,000 volts, where a portion is transformed into continuous current at 650 volts, and fed to the third rail, the remainder, still at 45,000 volts pressure, being diverted towards Milan and Varese, where, after being transformed to continuous current at 650 volts at the sub-stations at Basto Arsizio, Parabiago, Rho, Boviso, Albizzate, and Gazzada, it is fed to the third rail on those sections. It is expected that by the coming autumn, five powerful locomotives of 1,500 to 2.000-H.P. capacity, now in course of construction, will be ready for service.—*L'Ingegneria Ferroviaria.*

SWITZERLAND.—A railless electric motor-train (system Schiemann's) is to be installed on the Cauta Berne, on a 10-km. line from Herzogenbuchsee to Wangen and Wiedlislac. The service will consist of three motors and three trailers, and will carry passengers, goods and mails. Current at a pressure of 100 volts will be used.—*Electro.*

TURKEY.—The Canea municipal authorities are open to receive tenders for a concession to install an electric tramway system. Particulars of the municipality.

RUSSIA.—A company, styled the Tramways and Electric Enterprises of the Suburbs of St. Petersburg, has been formed to electrify existing lines and build extensions in the suburbs of the Russian capital. The population to be catered for numbers 270.000 in winter and 360,000 in summer. The new company will not interfere with existing companies, and notably with the Electric Light Association, of St. Petersburg, or the Eclairage Electrique de 1886, as its scope is wholly confined to the suburbs.—*La Lumière Electrique.*

Plans are being prepared in respect of a projected electric tramway between Riga and Majorenhof, a distance of 9½ miles.

NORWAY.—H.M. Consul further reports, on the authority of the local press, that it is expected that the existing private trackless electric traction system at Drammen will be replaced by a tramway system.

A Bill is being introduced for the electrification of the entire railway section between Christiania and Drammen; the Randsfjord section is to be reconstructed.—*Board of Trade Journal.*

Chile.—The Government has sanctioned the laying down of a new electric tramway line from Santiago to Penaflor.—*[illegible]*

Coventry.—Application is to be made to the B. of T. for a loan of [illegible] for the purchase of additional cars, the extension of the car-shed, and the provision of additional passing places. Later the Committee will consider the matter of extension of lines and diversions and other work connected with general routine.

Croydon.—The T.C., on the recommendation of the Tramways Committee, has decided to seek Parliamentary powers to run motor-omnibuses.

Dundee.—It was reported to a meeting of the Corporation Tramways Committee that the route for railless traction at the east end was now completed, and that the plant and equipment were almost ready to be sent north. The new system will be opened for traffic in a month. The fare for the route, which extends to fully a mile, will be 1d., with intervening ½d. stages.

Gloucester.—On the tramways during the past year there has been an increase of over £1,000 in the receipts, and of more than a quarter of a million in the passengers carried. The working expenses were the lowest since the tramways were inaugurated, and the lowest of any tramway in the country. The current consumption showed a reduction of 23 per cent. owing to the introduction of car-meters and the bonus system. The gross profit of £4,700 was the largest in any one year, and enabled the Committee to pay off £1,077 of a long-standing debt. The business of the parcel system has increased by 65 per cent. in four years.

Halifax.—The B. of T. has sanctioned the borrowing by the Corporation of £3,750, repayable in 15 years, for the purchase of six new cars to use on the tramways.

The Tramways Committee has decided to serve notices upon the owners and occupiers of premises in Waterhouse Street of the intention of the Corporation to lay down in that street double lines of tramway, in lieu of single lines, and also to apply to the B. of T. for consent to such doubling.

Lancs. and Yorks. Railway Electrification.—A start has been made in electrifying the branch line from Bury to Holcombe Brook. The track, which is over three miles long, is of a very hilly nature, and it is intended to work the line with a high-pressure D.C. electrical equipment. A start has been made with the relaying of the track, part of which includes the main line to North-East Lancs. It is expected that the new system will be commenced before Christmas, and, according to our correspondent, it is intended eventually to extend the system from Bury to Manchester, and afterwards to other Manchester suburban lines as early as possible, with a view to meeting the keen competition of the tramways.

The same correspondent also states that the electric system between Southport and Liverpool has been such a pronounced success that the company has decided to construct two fresh sets of electrified lines into Exchange Station, Liverpool. In order to cope with the increasing passenger traffic from the Southport line, the company has also decided to continue the electrification of the railway from Town Green to Ormskirk, thus linking up the line from Liverpool to Ormskirk with the live rail. It is expected that the new work will be completed before the end of the present year. In addition, the train service between the two places is to be greatly supplemented.

Leicester.—In order to cope with exigencies of the traffic, the Corporation has decided to purchase 10 additional tramcars, at an estimated cost at £7,000, the cars to be on the "pay-as-you-enter" principle.

Llandudno.—The B. of T. has confirmed the Llandudno and Colwyn Bay Light Railway (Extension No. 2) Order of 1912.

New Zealand.—The ratepayers of Invercargill have sanctioned by poll proposals to borrow sums of £15,000 for the completion of electric tramways and £10,000 for the installation of a lighting and power plant.

The municipality of Thames has decided, on a poll of the ratepayers, to expend a sum of £14,000 on the installation of electric light.

The ratepayers of Palmerston have agreed to the proposal to borrow £60,000 for the construction of an overhead electric tramway system at that place.—*Board of Trade Journal.*

North-Eastern Railway.—The accounts of this railway for the past half-year contain the following figures respecting the electrical section :—

	Half-year, June, 1912.	Half-year, June, 1911.
Passenger train-mileage	564,934	597,953
Goods ,,	2,477	2,569
Passenger car-mileage	1,873,094	1,892,439
Revenue expenditure	£16,218	£16,168

South Africa.—The proposed Johannesburg-Pretoria electric railway is again attracting attention, largely, no doubt, on account of the cheap power now available.—*African Engineering.*

Stockport.—The Corporation has now ordered three railless cars. The system adopted is the Bremen, and is in service at Bremen, Ludwigsberg, Braslau, and Brockau. The two overhead wires are in vertical parallel. The current collector consists of two trolley wheels running on the upper (negative) wire connected to a double sliding bow, which is kept rubbing by spring pressure against the lower (positive) wire. Below is first a swivel joint enabling the current collector to be freely turned, and beneath that a sensitive spring loop which interrupts all shocks and vibration caused by uneven road surface. There is no trolley pole, but in lieu thereof a flexible cable. The type of 'bus adopted is provided with a single electric-motor, which is used to drive the back axle through worm gearing. Starting, stopping, and changing speed, are done by means of a lever operated by the left foot. The ordinary brake is worked by the right foot, and the driver has nothing to do with his hands except to steer the vehicle, save on rare occasions when he uses the emergency brake.

U.S.A.—According to the *Times*, of New York, Winchester and Boston high-speed suburban electric railway, a connection of the New York, Newhaven and Hartford line, has been brought into service.

West Bromwich.—At a meeting of the T.C. last week, it was reported that the Local Government Board had sanctioned a loan of £4,500 being obtained for removing the tramway poles from the centre to the side of the road. It was also stated that the South Staffordshire Tramways (Lessee) Co., Ltd., had consented to the alteration on certain conditions which the Council were recommended to accept. The Mayor said they hoped to proceed with the work forthwith. The report which was presented by the Highways Committee was approved by the Council. When the alterations are completed, the tramway service will be considerably accelerated. The Mayor told the Council that this was the first occasion the L.G.B. had treated the removal of tramway poles from the centre of the road as a street improvement.

Wolverhampton.—The T.C. last week sanctioned the expenditure by the Tramways Committee of £5,860 for the extension of the tramcar depôt, this sum including the cost of the new building, together with the tracks, plant, &c. The expenditure is to be borne by the Tramways reserve fund.

TELEGRAPH and TELEPHONE NOTES.

Australia.—Litigation regarding the system of wireless telegraphy employed by the Commonwealth Government is still in progress. The Marconi Wireless Telegraph Co., which had brought an action for infringement against the Government, applied to the Court for an order for the inspection of the Government's apparatus, which was refused; on appeal to the High Court, the Postmaster-General put in an affidavit to the effect that to allow any such inspection would be prejudicial to the public interest, that the system employed was the invention of Mr. J. G. Balsillie, and that it was the intention of the Government to apply for letters patent for the invention of the system employed at the stations at Melbourne and Hobart within three months (from June 25th). The hearing was adjourned to enable the Government to patent the method.

Automatic Telephony at the G.P.O.—On Friday last, at the invitation of the Automatic Telephone Manufacturing Co., Ltd., we had the pleasure of inspecting the automatic exchange at the General Post Office, London, which has just been completed by the company, on the Strowger system. The exchange provides for some 350 lines, and serves the group of Post Office buildings which dominates this portion of the city; it is housed in a remarkably small space in the basement of the G.P.O. West. As some of the lines serve private branch exchanges, there are in all some 800 telephones working through the "official switch" as it is called. Over 10,000 calls were registered on the first day of its operation. We understand that in the view of the Post Office, its performance so far has been admirable, and after watching its industrious operations for an hour, we can well believe it. The mechanism is of fascinating ingenuity, and appears to fall but little short of thinking; it seems to be prepared for every conceivable contingency that may arise in ordinary working, short of violent disruption; the occurrence of a defect of any kind is immediately signalled, as in the human subject, by a rise of temperature (in a coloured incandescent lamp) accompanied by an audible complaint, and these symptoms have the advantage that they indicate to the medical attendant the nature and situation of the trouble far more definitely than is often the case with the human patient. Moreover, a series of optical signals is provided, which enables the attendant to watch the normal working and almost to anticipate a possible failure. It must be added, in fairness, that the numerous signals of trouble recorded during our visit were artificially produced by the officials in order to demonstrate their operation. A very complete description of the system, which has also been installed at Epsom, was published in the *Post Office Engineers' Journal* recently; it was also described in the paper read before the Institution of Electrical Engineers by Mr. W. Aitken last year, and abstracted in our issues of June 23rd and 30th, 1911. The order for a similar installation, serving 6,800 subscribers, for Leeds has been placed with the Automatic Telephone Mfg. Co. by the Post Office, which indicates that the latter is satisfied not only with the technical efficiency of the system, but also—what is of equal importance—with the commercial results obtained. The use of the automatic principle enables a call to be put through in less than four seconds; after that, it is the fault of the called subscriber if delay ensues in obtaining a reply. The average time occupied in getting through on the manual system is about 16 seconds. There is no possibility of the delay in obtaining the attention of the operator, which is often so irritating, as the caller is "through" the moment he has completed his prescribed cycle of operations. When a person is called up on the manual system, he may unkindly take his own time in answering the bell, knowing that the delay will probably be ascribed to the operator; but with the automatic this subterfuge is inadmissible, as the caller knows that the delay must be due to the subscriber, and can take him to task therefor. Another great advantage is the instantaneous cut-off the moment the calling subscriber has hung up his receiver; this obviates a most annoying cause of loss of time and of the use of the instrument, and also relieves the junctions to a great extent.

Dundee Telegraphs.—The Postmaster-General has written the Chamber of Commerce that he does not feel justified in recommending expenditure for the extension of the underground telegraph from Edinburgh to Dundee. The work was estimated to cost £70,000. Great dissatisfaction exists among business men, as the present exposed wires during the time of storm are frequently out of order and great inconvenience results. The directors of the Chamber of Commerce will continue to agitate for the underground system.

Imperial Wireless Stations.—The South African Government has agreed to take part in the Imperial scheme, and has selected a site at Pretoria, where a long-distance station will be built on the same lines as the others composing the chain. The cost will be £80,000, which will be borne by the Union Government.

The discussion on the agreement between the P.M.G. and the Marconi Co. in the House of Commons has been postponed until after the vacation. According to a statement made by Mr. Samuel on Wednesday last, when the Government decided to embark upon an Imperial system a special Committee was formed to consider the enterprise, comprising representatives of the various Governments and the High Commissioners of South Africa, Australia and New Zealand. It was thought inadvisable for the Government to attempt to carry out the work without the aid of a contractor experienced in long-distance telegraphy, and it was useless to invite tenders, as no company except Marconi's had the necessary experience. Negotiations with the Marconi Co. were therefore opened, and the special Committee was kept fully informed as to their progress at every stage. The cost of each station (£60,000, exclusive of sites, foundations and buildings) was not considered excessive by the experts on the Committee, in view of the high power required, and the fact that each of the stations other than the terminal ones would have to be completely duplicated for duplex working; the steel masts alone, of which 30 will be required for each station, 300 ft. high, are estimated by the Post Office engineers to cost £30,000 per station. No monopoly is created by the contract; the Government reserves the right to install additional apparatus other than Marconi's if it pleases, and can at any time substitute another system altogether which does not infringe the Marconi patents, whereupon the royalty payable to the Marconi Co. will cease. It was impossible to lay the contract before Parliament at any earlier date than the day on which it was signed (July 19th), as many points of detail remained to be settled when the agreement was arrived at in March.

Strong opposition to the agreement has been evinced; in particular, Major M. Archer-Shee, in Parliament and in the Press, has raised objections to the contract and to the statements of the P.M.G., and demands an inquiry by a Select Committee.

Norway.—The Norwegian Telegraph Department intends to include in the estimates for 1913-14 the necessary amount for the erection of a radio-telegraphic station a few miles north of Christiania, on a height known as Tryvandshöiden, about 1,800 ft. above sea-level.—*Board of Trade Journal.*

Portugal.—The provisional contract entered into between the Government of the Portuguese Republic and Marconi's Wireless Telegraph Co., for the erection of wireless stations in Portugal and Portuguese possessions, has been ratified by Parliament, and considerable extensions have been made therein.

War Office.—Col. Seely has appointed a Committee to consider recent developments in wirelesss telegraphy, and the application of these developments to the needs of the Army.

West Africa.—Wireless telegraphic communication has now been established in the Congo between Boma, Elisabethville, Kindu, Kongolo, and Stanleyville.—*African Engineering.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—NEW SOUTH WALES.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" July 26th.

September 25th.—Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

October 2nd.—N.S.W. Government Railways. Six 1,000-KW. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

SOUTH AUSTRALIA.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Austria.—VIENNA.—November 30th. Plans are required for the erection and working of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Batley.—August 23rd. High-tension cables, for the Corporation. See "Official Notices" August 2nd.

Bedwas.—September 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Canary Islands.—August 22nd. The municipal authorities of Arresife de Lanzarote (Canary Islands) are inviting tenders for the concession for the electric lighting of the town during a period of 30 years.

China.—August 13th. High and low-tension sub-station switchgear, for the Shanghai Municipal Council. See "Official Notices" July 26th.

Costa Rica.—December 9th. Tenders will be received for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Doncaster.—The general manager of the Corporation Tramways has just invited tenders for the supply of a 30-H.P. petrol motor-tower wagon for use in connection with the maintenance of the overhead conductors.

Gateshead.—August 10th. Installation of electrical plant at the new lunatic asylum at Stannington, for the Visiting Committee. See "Official Notices" August 2nd.

Hungary.—BESZTERCEBANYA.—August 24th. Tenders are invited for the supply of a 500-H.P. crude-oil engine with accessories, a three-phase generator and a switchboard with connections. Deposit 5 per cent. Particulars (5 kronen), Ingenieur Tibor Szeberenyi, Josef-utea 12, Budapest VIII.

DUNAFOLDVAR.—August 16th. Tenders are invited for the erection of a generating station. Particulars from the municipal authorities.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" to-day.

London.—L.C.C.—August 23rd. Electric lighting bells and telephones at the County Secondary School, Plumstead, S.E. See "Official Notices" to-day.

Manchester.—September 10th. One 12,000-KW. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" to-day.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Shipley.—August 14th. (*a*) One 300-KW. rotary converter with E.H.T. and L.T. switchgear and (*b*) supply and laying of E.H.T. cables, ducts, telephone cables, &c., for the U.D.C. Mr. S. D. Schofield, electrical engineer, Dockfield, Shipley. (Returnable deposit for each contract of £1 1s.)

South Africa.—September 11th. Durban Corporation. One-ton electric storage battery vehicle. A statement on the matter can be seen at the Board of Trade C.I. Department, London, E.C.

CRADOCK.—A meeting of ratepayers of Cradock was recently held, when it was resolved to instruct the Town Council to take immediate steps to light the town with electricity, at a cost of £10,000. A letter received by last mail says that tenders were to be advertised for at once.

Spain.—MADRID.—October 22nd. Concession for installation and working of an electric light service for 15 years. Deposit, 5 per cent. of the offer, eventually 20 per cent. Particulars from Hotel de Ville, Madrid.

August 16th.—The Spanish Post and Telegraph authorities in Madrid are inviting tenders until August 16th, for the concession for the establishment of a telephone exchange in the town of Castro Urdiales (Province of Santander) and for the working of the same during a period of 15 years.

CLOSED.

Australia.—The Reason Manufacturing Co., Ltd., of Brighton, have, through Messrs. McIlwraith, McEacharn & Co., of London, secured the Melbourne City Council's contract for 600 electrolytic meters, namely, 2½, 5 and 15-ampere sizes.

Bath.—Messrs. Stothert & Pitt, Ltd., have secured a contract for an electric traverser for goods' wagons at Moor Street G.W.R. Station, Birmingham.

Canterbury.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son for a year's supply for coal for the electricity works, at the following prices :—

Nixon's Navigation large steam, £1 10s. 8d. per ton; Rochester house coal, 18s. 1d. per ton.

Croydon.—The T.C. has accepted the tender of the Easton Lift Co., Ltd., for an electric lift for the Town Hall, at £118; that of Messrs. Babcock & Wilcox, Ltd., for pipe work, steam and exhaust connections, and erection of valves at the E.L. works, at £525; and that of Messrs. J. Hopkinson & Co., Ltd., for valves, at £260.

The Education Committee has accepted the tender of Mr. Sydney Hunt, Croydon, for installing the E.L. at South Norwood Schools, at £50.

Dewsbury.—The Electricity and Tramways Committee has accepted the following tenders :—

Brush Electrical Engineering Co.—1,000 kw. turbine and generators.
W. H. Allen & Co., Ltd.—Condensing plant

Dublin.—Messrs. W. Coates & Sons, Ltd., have secured the triennial Board of Works contracts for all electrical supplies and work in all Government offices and institutions in Dublin and its vicinity.

Folkestone.—The contracts for the lighting installation and the cable work for plant and batteries at the *Folkestone Herald* printing and bookbinding works, for Messrs. F. J. Parsons, Ltd., have been awarded to Mr. E. Arthur Pinto, A.M.I.E.E., of Hythe and Dover.

Halifax.—The Tramways Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., for 20 top covers to tramcars.

Johannesburg.—The Council has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for truck and electrical equipment for 10 double-decked bogie cars, to specification, at £513 10s. per car.

Liverpool.—The tender of the Palatine Engineering Co., Ltd., has been accepted by the Corporation for an electrical transmitter and recorder in connection with the installation of electrical communication between Woolton Hill Reservoir and Dudlow Lane pumping station.

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have obtained a further contract for the supply of 20,000 tantalum traction lamps to the L.C.C. for use on its tramcars.

Maidenhead.—The T.C. has accepted the tender of the Klein Engineering Co. for the repair and partial reconstruction of the cooling tower at the E.L. works, at £64.

Maidstone.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for a motor-generator, at £373.

Morley.—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for a 12-H.P. motor to replace a gas engine at the highway depôt.

Newcastle-under-Lyme.—The T.C. has accepted the tender of Messrs. J. Bagguley & Son, of Newcastle, for the supply and laying of mains in Liverpool Road, at £760.

Portsmouth.—The E.L. Committee of the T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for Insdale screened nuts, at 16s. 4d. per ton, with an option on Insdale small, at 14s. 10d. per ton. The price shows an increase of about 3s. per ton; this will cost the undertaking £1,500 extra.

Rugby.—The Hospital Board of Management has accepted the tender of Mr. S. P. Marsh, of Rugby, for wiring Brookfield for the E.L. and bells, at £35.

Stafford.—The T.C. has accepted the tender of Mr. John Thompson, of Wolverhampton, for a superheater for a new boiler at the electricity works, at £70.

Stoke-on-Trent.—The T.C. has accepted tenders for coal for the electricity works, as under :—

Sneyd Collieries, Ltd., cockshead slack.
Shelton Iron, Steel and Coal Co., great row slack.
Florence Coal and Iron Co., washed slack.
Mossfield Colliery Co., Ltd., slack.

Stockport.—The Tramways Committee has ordered three railless cars, costing £682 each, from the Brush Electrical Engineering Co., Ltd., to serve a hilly and narrow route wholly within the county borough.

The Electricity Committee has placed with Messrs. Belliss and Morcom, Ltd., an order for a 1,500-KW. mixed-pressure turbo-alternator, and a 500-KW. engine set.

Tunbridge Wells.—The T.C. has accepted the tender of the Western Electric Co., Ltd., for cables.

For coal for the E.L. works, the following tenders have been accepted :—

Wm. Cory & Son, Ltd., Bwlfa, £1 5s. 5d. per ton.
Harris, Hardman & Co., Ltd., washed [illegible], 17s. 8d. per ton.
Medway Coal Co., South Hetton, [illegible], 1[illegible]s. 2d. per ton.

Wimbledon.—The T.C. has accepted the tender of Wm. H. Gaze & Sons, Ltd., at £97, for installing an intercommunicating telephone system at the Isolation Hospital; also to maintain the system for a period of three years from the end of the first year after completion for £7 19s. per annum. The tender of A. How and Co., has also been accepted, at £54, for wiring the administrative block extension at the Isolation Hospital.

Warrington.—The B.G. has accepted the tender of Mr. H. Bibby, of Warrington, for electric equipments at the workhouse kitchen, at £90.

Watford.—The U.D.C. has accepted the tender of the Union Electric Co., at £260, for the supply of a motor-generator.

West Ham.—For an electric light installation at the Forest Gate Sick Home, 95, Forest Lane, E., for the Guardians of the West Ham Union, the following tenders were submitted. Architect: Mr. J. Williams Dunford, 100c, Queen Victoria Street, E.C.

Foote & Milne	£2,[illegible]
Waring & Withers	2,048
Ryan & Son	1,[illegible]
Newbald & Son	1,[illegible]
Duncan Watson & Co. ..	1,750
West Ham Corporation ..	1,780
Polden & Co.	1,645
Lund Bros. & Co.	1,615
J. C. Christie	1,[illegible]
Savill & Watson	1,[illegible]
Durell Walker & Co.	1,498
Cathcart & Co.	1,[illegible]
Pinching & Walton	1,[illegible]
Malcolm & Allan..	1,400
Cash & Co...	1,359
New Century Arc Light Co. ..	1,307
Fryer & Co.	1,[illegible]
Weston & Sons	£1,[illegible]
H. J. [illegible]	1,[illegible]
Hammond & Co.	1,276
B. A. Pilkington (Edinburgh)..	1,274
H. J. W[illegible]	1,[illegible]
W[illegible] & Bach	1,[illegible]
Hancock & Rixon	1,249
Arthur Newton	1,215
Tilley Bros.	1,1[illegible]7
Holmes & Sons	1,1[illegible]
J. T. Ha[illegible]	1,11[illegible]
Herring & Son	1,[illegible]
Tredegars	1,[illegible]
W. R. Reynolds, Ltd. (accepted)	[illegible]
Mechanical and Electrical Engineering Co. (Walsall) ..	987

Architect's estimate .. £1,270

AUSTRALIAN TRADE.

By this mail from Australia we have received a full report of the instructions issued by the Premier of Victoria to the various contracting departments, establishing the principle of facilities to be given to British firms in competition with foreign. These instructions lay down that a preference is to be given to British tenders; that sufficient time for tendering is to be given to allow of mail service from and to Australia, and of adequate time to prepare tenders in England, and that inspection of deliveries is to be effected in England and not in Australia, as formerly. We shall have occasion next week to refer to this matter in greater detail. In the meantime, we desire to record our appreciation of the attitude now taken up, which, if rightly understood, means a tremendous impetus to British trade. We hear from Australia that this attitude is the result of the valuable work carried on in Australia by our own Trade Commissioner—Mr. Hamilton Wickes—to whose activities we have previously been pleased to call attention. Mr. Wickes, we understand, is now in England on his way to a new post in Canada; and while congratulating him on his new appointment, we cannot but regret that he is leaving Australia just at a time when this important success has been achieved. Agents in Australia of large British firms are anxiously anticipating the appointment of the new representative of the Government, and are hoping that he will be able to gain the confidence of the Australians as Mr. Wickes has done.

Post Office Factories.—In the Parliamentary questions Mr. Nannetti asked the Postmaster-General if he would state what was the total force at present employed in Post Office and telephone factories and mechanics' workshops in Great Britain and Ireland, respectively; and what would be the estimated numbers when the recommendations of the Factories Committee had been carried into effect. Mr. H. Samuel replied that the figures were 1,465 in Great Britain and 12 in Ireland. It was not yet practicable to furnish an estimate of the numbers as they would be when the recommendations of the Factories Committee had been carried out.

NOTES.

A Motor Trouble.—The reliability and usefulness of electric power have compelled recognition at the hands of owners of industrial plants, and a great many of these have adopted electricity as the motive power for their works; but it cannot be too strongly emphasised that it is not sufficient simply to plant a motor in any convenient position and run a few indiscriminate wires to it. Care should not only be taken in the lay-out of the plant to be driven and in the installation of the motors themselves, but adequate means should be taken to see that the cables connecting the motors to the power supply are arranged in a systematic and workmanlike manner; otherwise, trouble is sure to occur. This may be exemplified by an incident which caused a good deal of mental friction to the owner of an industrial undertaking which was driven by several motors of the shunt-wound type. The behaviour of one of his motors was somewhat puzzling. When it was first started up, this motor would run quite smoothly until some load was put on the machine which it was driving. Within 10 minutes after this had been done, and sometimes less, the motor would start racing, frequently getting up an enormous speed before the attendant could get to the starting switch and trip the motor out of circuit. When the armature was felt, it was found to be extremely hot after this performance. Eventually the motor was overhauled, and it was found that the shunt wire, which was only a small, insignificant-looking affair, had been brought into the motor at a sharp bend and, owing to subsequent strain on it, due to bad arrangement of wiring circuits, the end of the wire had pulled out slightly from underneath the screw in the motor-terminal. Contact was still maintained, but it was only very slight. What happened, therefore, was that the wire would make contact sufficiently to allow the motor to be started up, but directly some load came on the machine and vibration was set up, the end of the lead would start shaking and causing small arcs. In other words, the field windings would be intermittently magnetised, and as the machine was shunt-wound, there would be short, spasmodic rushes of heavy current through the armature every time the field failed, and the speed gain would be enormous, while the heating effect of such rushes of current would be excessive. The matter was, of course, remedied by making the lay-out of the wiring a little different, so that the sharp bend and straining action were done away with, after which the motor ran quite well without any further trouble.

Educational Note.—We have received the programme of the Ducal Technical High School of Brunswick for the year 1912-13, which commences on October 22nd. It includes courses in engineering, of which some particulars are given; Prof. Dr. W. Peukert is at the head of the electrotechnical department.

Appointments Vacant.—Resident electrical engineer, for the Tunbridge Wells Corporation (£300); works superintendent, for the Whitehaven electricity works (£2 2s.); assistant engineer, for the burgh electricity department, Paisley (£182); log-book keeper and voltage regulator, for the Stepney B.C. (25s.). See our advertisement pages to-day.

Indentured Apprentices and Electrical Pursuits.—It appears from the annual report of the National Institution of Apprenticeship that under the auspices and influence of that organisation 1,230 apprentices are now indentured to masters in different trades. Of that number, 12 are serving their time as electrical fittings makers, nine as electrical instrument makers, and 67 as electrical engineers, whilst 58 are learning to be general engineers. The report states that during the year 2,682 applicants were interviewed, but that, as in previous years, a large number of parents withdrew their applications upon learning that the wages paid to apprentices during the first year or two were substantially lower than those paid to errand boys and the like, which disadvantage, added to the cost of the fares to and from the workshop, entailed a sacrifice they could not afford to make.

Fires on Tramcars.—A considerable amount of attention has been paid in recent times by traction engineers to the question of fireproof construction of rolling stock, more particularly as regards electric trains, and this is a very wise precaution, inasmuch as the slightest indication of a fire, or even the smell of burning in an electrical conveyance of this nature, is liable to cause a panic among the passengers which may lead to very disastrous consequences. Even in the smaller transport units which are usual in the ordinary town electric tramway systems, it is highly desirable that every precaution should be taken to see that risk of fire is avoided as far as possible, inasmuch as should an electrical fire break out in a crowded tramcar, there is every probability that a rush would be made for the doors, and people would injure themselves in trying to drop off the car when it was running at a fairly high speed. Fortunately instances of fires on tramcars are comparatively rare, and when they do happen they can usually be traced to some simple cause which can be easily rectified. Modern design has largely eliminated the fire risk from tramcar construction, and in those isolated cases where instances of this nature have happened, the cause could hardly have been foreseen. In order to illustrate this, it may be interesting to refer to two typical examples of the class of trouble which may lead to fire, or at any rate to charring, in order that so far as possible these danger symptoms may be eliminated, not only on account of the potential danger, but also of the bad impression any untoward incident of this nature leaves upon the minds of the general public. In one case while a car was in service it was noticed by passers-by that the car was smoking very badly, the origin of the smoke appearing to be situated underneath the car. The attention of the driver was drawn by the fact that his circuit-breaker opened rapidly and repeatedly, and he came to the conclusion that there was trouble in the electrical equipment of the car, which was confirmed when he saw the smoke. On looking round, however, everything appeared to be all right, but in order to make sure of this the pole was removed from the line. After inspecting the car it was discovered that the smoke was proceeding from the lightning arrester which was placed under the car, and then the cause of the trouble was discovered. Owing to the wet weather and to dirt getting into the box, a short-circuit had occurred, and small arcing had been going on for some time. The heat of this arcing had gradually caused the wood box in which the arrester was placed to char, and eventually opened the circuit-breaker. The car was run home to the depôt, and in order to repair the matter the cable was taken off and dried, and when a new box was fitted the woodwork was painted with lead paint in order to render it impervious to moisture. With these precautions no further trouble was experienced from this cause. In another instance the trouble was, perhaps, a little more spectacular, although no actual danger to passengers was caused. In this case the cable burnt out, which was behind the door inside the car. The cable concerned was the trolley cable brought from the roof to the circuit-breaker, and then down a body pillar on the inside of the car to the controller. This cable was cleated to the body pillar, but it was not quite clear of the roller on which the door ran, and every time the door was opened it fouled the cable. The insulation of the cable was therefore destroyed and the cable earthed through the door-wheel to the iron floor tread, with brilliant results. In order to repair this defect it did not take much trouble to renew the insulation of the cable, and the body pillar was recessed enough to allow the cable to be carried clear of the door. This incident is mentioned here in order to show that a very slight oversight, such as described, can easily cause a certain amount of insecurity to the passengers travelling in the car. The point of the above incidents is, that although the actual danger incurred was so slight as to be insignificant, the occurrences were undesirable on account of the feeling of alarm which might easily have been created in the minds of passengers, and therefore it is worth attention on the part of tramway engineers to see that the electrical equipment on a tramcar is maintained in a thoroughly fireproof condition.

Street-Box Covers.—Inspection-box covers laid in the pavement, when filled with broken brick concrete of proportions of 1 : 2 : 5 are apt to wear unevenly, as the filling is of a softer nature than the surrounding pavement. This is overcome by surfacing the cover with a layer of granolithic concrete, ¾ in. thick, laid on the top of the concrete filling while the latter is green.

A surfacing mixture which has good wearing qualities consists of fine granite, no particle being larger than will pass a ⅛-in. ring; take one part cement and three parts granite, including the dust, which dispenses with the addition of any sand; mix rather dry and trowel a hard surface. The setting of the cement greatly affects the wearing qualities; covers filled in and allowed to dry in the atmosphere turn to a powdery nature, due to the contraction of the cement liberating small particles of granite, which tend to grind the surface in wear. When allowed to set rapidly in a warm atmosphere, the cohesion of the cement is secured by contraction and produces a crumbling mass, as though made of poor cement.

Cement set under water expands and produces a harder concrete by the cohesion of the cement on the individual particles of granite dust. With large or heavy covers not easily handled, a hardening process should be applied by covering the surfaces for at least two weeks with bags or common sheeting kept moist with water. The effect of this method in summer is better than total immersion, as evaporation reduces the temperature of the surface of the concrete, and retards the setting of the cement sufficiently to produce hardness. To further the hardening, a wash of equal parts of water and silicate of soda may be applied.

Cover tops are sometimes cambered and stand above the surface of the pavement. The raised surface is not observable by the average pedestrian, who makes no change in his step in passing over, so that the camber comes in contact with the foot before a man has completed his step; this rubbing action by every footstep is an important consideration affecting the wearing away of the surfacing of the cover.

To increase the durability some resisting material should be worked into the surfacing. This can be effected by mixing steel lathe turnings in with the granite. They should be broken up small and be free from grease.

It is advisable to make the surface non-slipping by serrating or chequering the surface. If lead rings cut from a ¾-in.-1-in. diam. lead pipe are imbedded in the granolithic they will provide a good non-slipping surface: should the box be situate on an incline, more effective non-slipping may be produced by inserting ¾-in. square plugs of carborundum, which gives a positive hold to the foot, wet or dry.

For Sale.—The Newport Corporation electricity and tramways department has for disposal a quantity of scrap copper, brass, &c. See our advertisement pages to-day.

Electricity and Hygiene.—At the Health Exhibition held in connection with the Congress of the Royal Sanitary Institute last week, a silver medal was awarded to the City of York Electric Lighting Department for the hygienic value of its exhibit of electrical appliances; an additional silver medal was also awarded to the department for the "Tricity" electric cooker.

(*Continued on page* 224.)

DEPTFORD GENERATING STATION OF THE LONDON ELECTRIC SUPPLY CORPORATION, Ltd.

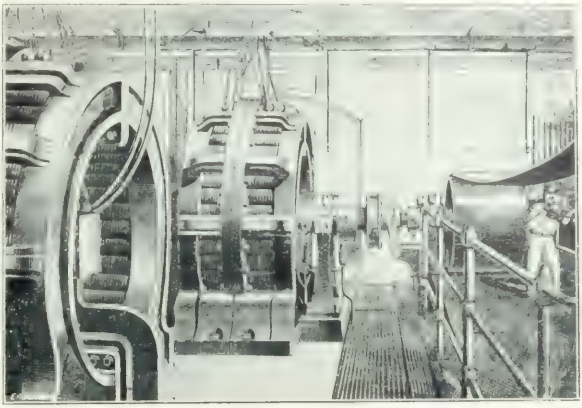


Fig. 1.—Old Alternators at the Grosvenor Station.

It was with particular pleasure that we accepted the invitation of Mr. G. W. Partridge, chief engineer to the Corporation, again to revisit this, the pioneer high-pressure electric generating station of the world, at a moment when the man whose genius gave it birth occupied the chair of President of the Institution of Electrical Engineers. In that capacity, Mr. de Ferranti during the past two years has recalled to mind many interesting reminiscences of those stirring times when they did things, and each day gave rise to new and unexpected (often, indeed, undesired) discoveries. It was in 1887 that, owing to the increasing demand, the London Electric Supply Corporation was formed with a capital of £1,000,000, and decided to build a large generating station at Deptford, where an unlimited water supply could be obtained for condensing purposes and cheap sea-borne coal procured at low prices, with ample space for extensions. The whole scheme at that time was severely criticised by leading engineers in all parts of the world, but in spite of the uphill work which such an enterprise necessitated, including the expenditure of enormous sums of money on experimental work, the 10,000-volt extra-high-pressure system was finally made a success, and has since been adopted by engineers all over the world. It is interesting at this time to reproduce a print of the old Grosvenor Gallery dynamos, which were at that time the largest generators in use in this country. Two 1,500-H.P. 10,000-volt machines were manufactured and erected in 1889, and the engines, which were made by Messrs. Hick Hargreaves, are to-day running on load and giving very economical results. These machines were by far the largest in the world at the time, but still larger steam alternators of 10,000 H.P. were actually put in hand shortly afterwards. We illustrate one of these sets on p. 223, and, as the new turbines have also a similar capacity of 10,000 H.P., they are shown for comparative purposes alongside the original 10,000-H.P. generators. The shafts of these giants were 36 in. in diameter, and the armatures about 46 ft. in diameter; the speed was 60 R.P.M.; and the weight of the alternator, exclusive of the engine, about 500 tons. The site was laid out for a final capacity of 120,000 H.P. The whole of this work was designed by Mr. S. Z. de Ferranti, and although

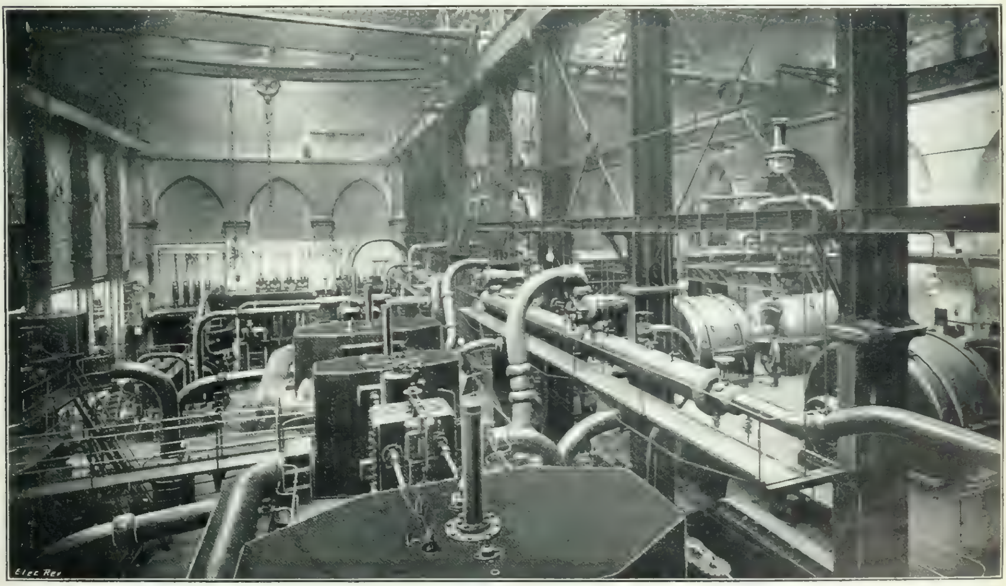


Fig. 2.—General View of the Engine-room at the Deptford Works.

these large generators were never put into actual work, one cannot but admire the boldness and ingenuity of the designer.

Numerous breakdowns and difficulties occurred in transmitting current at a pressure of 10,000 volts from Deptford to London, and the London Electric Supply Corporation was obliged to manufacture its own cables, designed by Mr. Ferranti, and made up of an inner and outer copper tube forming the two conductors, arranged concentrically with each other, and separated by a radial thickness of ½ in. of paper insulation, each conductor having a sectional area of 0·25 sq. in. The insulation used consisted throughout of paper impregnated under pressure with "ozokerite" wax. About 28 miles of it in all were laid down, which for years ran satisfactorily, at a pressure of 10,000 volts, in spite of the numerous joints (over 7,000 in all). Considerable lengths of this main are still in use at the present time, running satisfactorily at a pressure of 10,000 volts. This cable was the pioneer of all high-pressure paper-insulated cables in the world.

This station is now giving four distinct supplies to its different customers in various parts of its area. They may be described as follows :—

1. The original 85-cycle 10,000-volt single-phase system used for lighting purposes.

2. Direct-current three-wire 460 and 230 volts, used for power and lighting purposes.

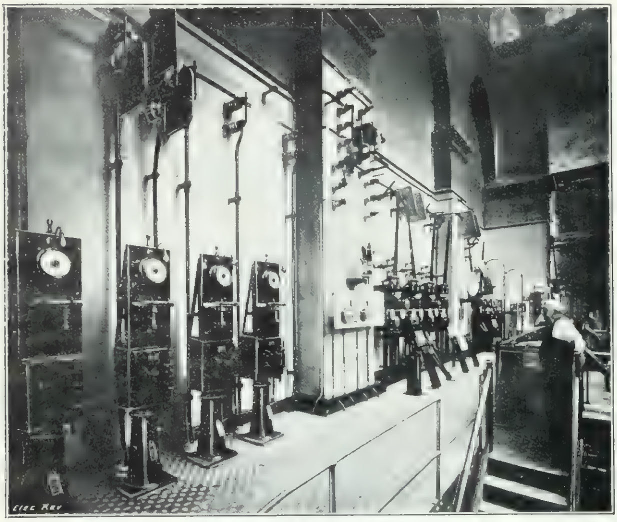


Fig. 3.—Original 10,000-Volt Single-Phase Switchboard (in use for 17 Years).

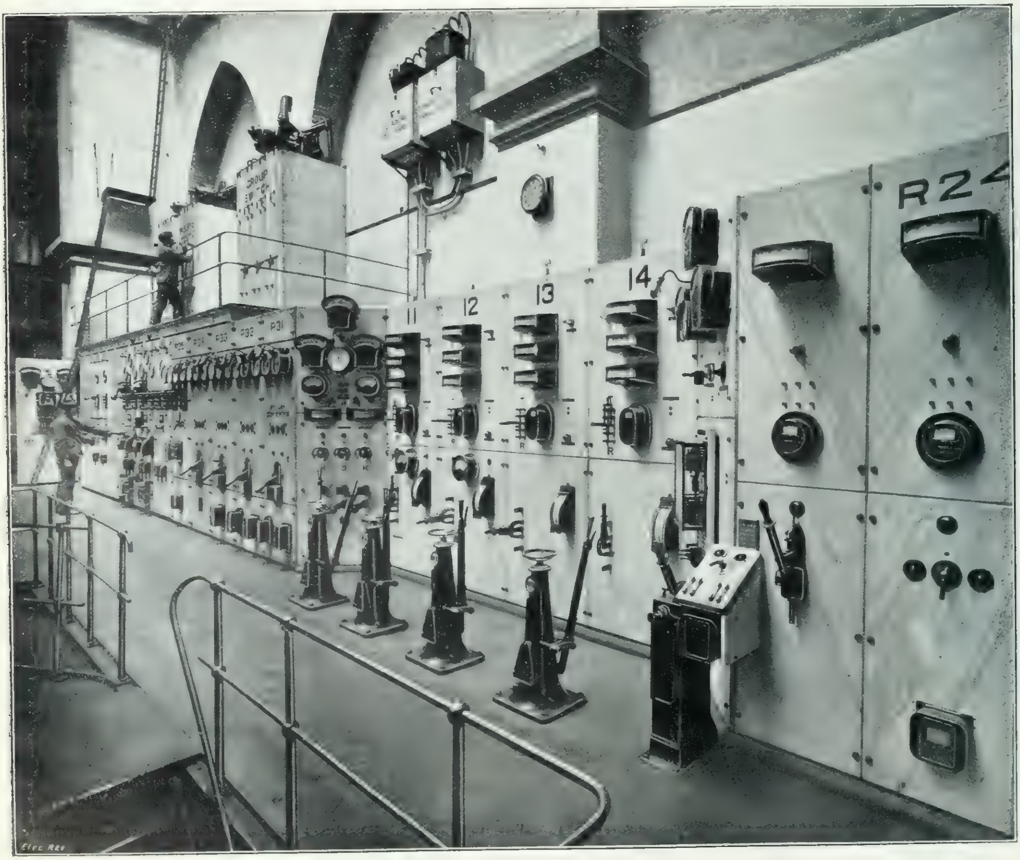


Fig 4.—New Traction and Power Switchboard.

3. Three-phase 25-cycle 6,600-volt, for large power consumers or traction purposes.

4. The single-phase 6,600-volt 25-cycle system used for the Brighton Railway.

One of our views, which is taken from the top of the traction board, gives a general view of the station, the engines in front being the 2,500-KW. reciprocating sets, which were in the first place used for supplying energy to the tramway system of the London County Council, and later for the supply to the first of the electrified sections of the Brighton Railway. These generators are three-phase star-wound machines, so arranged as to be able to give either a single or three-phase supply. They are now being used in conjunction with two 10,000-H.P. turbines which have recently been installed and are shown on the right-hand side of the illustration.

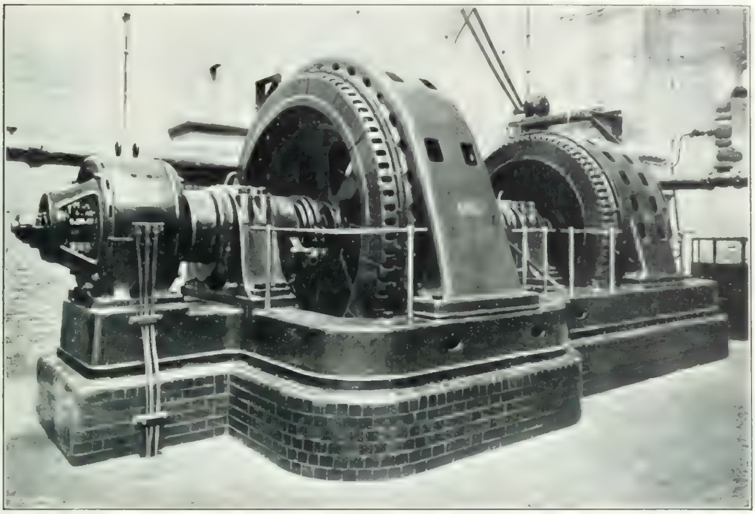


Fig. 5.—Westinghouse 2,000-H.P. Motor-Generator.

The station is divided, generally speaking, into two sections, one for railway traction and power supply, the other for lighting purposes. The lighting plant consists of Ferranti and British Thomson-Houston 10,000-volt 85-cycle single-phase machines. We illustrate the original 10,000-volt 85-cycle switchboard, the machine switches of which have been in actual use for 17 years. These switches have an air-break of 4 ft. 6 in., and have never given any trouble since they were first installed. No automatic control is used on the generators, the switches being worked by mechanical remote control, the first instance of this type at that time in the country.

It is interesting to note that a special 10,000-volt oil switch was designed to work in conjunction with these air-break switches at that early period (1895), but as the air-break switches put out the arc satisfactorily the oil switch was not used on this particular switchboard, although oil switches had been in actual use on the company's circuits working at a pressure of 2,500 volts since the year 1892; these were the first oil switches ever used in commercial practice.

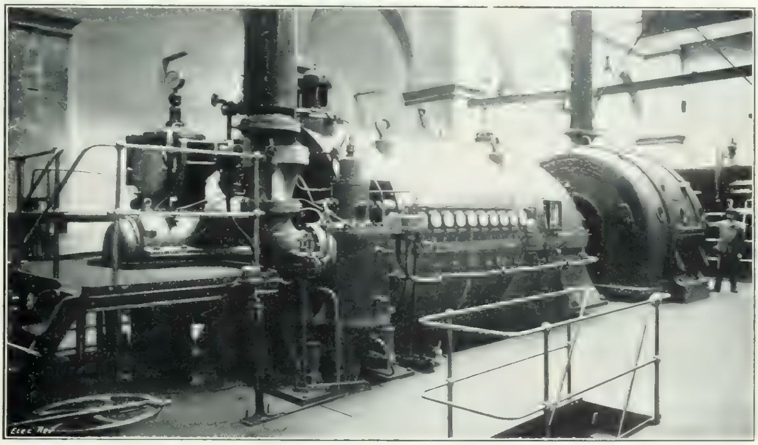


Fig. 6.—Steam End of Parsons-Brown, Boveri 10,000-H.P. Turbo-Alternator.

The switches in the foreground of the illustration are modern oil switches controlling the 10,000-volt trunk mains. Each of these switch panels is provided with a special charging switch used for preventing the rise in pressure when trunk mains are switched on or off. Owing to the early troubles experienced when these 10,000-volt mains were first used, a mains-charging apparatus was first designed in 1894 and has been in daily use ever since. The whole of this early type of switchgear, including the original oil switch, was designed by Mr. G. W. Partridge, the present chief engineer of the company.

A very interesting motor-generator set, manufactured by the British Westinghouse Co., and shown in the adjoining view, has recently been installed, having a capacity of 2,000 H.P. The motor of this set is driven from the three-phase 25-cycle system on the traction side, and drives a generator giving single-phase 10,000-volt 85-cycle current. By this means both sides of the generating station can be connected together when required, and the large turbines used at their maximum efficiency and capacity. This set, besides being used at times of light load, is also used at times of peak load in the lighting section with the rest of the lighting generators in parallel with it, and although the motor-generator alone is fitted with a Tirrill regulator, this one set enables the pressure of the whole of the lighting section to be kept absolutely constant, all irregularities being apparently taken care of by the motor-generator. The set is made specially strong, so as to resist any mechanical shocks due to short circuits or bad synchronising taking place on either section of the generating station. The Deptford generating station ran regularly in parallel with the London County Council station for some years, and it was demonstrated that the chief difficulties, such as induction, &c., were overcome by having a 25-cycle instead of a 50-cycle system.

The six single-phase 10,000-volt lighting sets have already been described in earlier years. The modern side of the station has recently been completed. One of our illustrations shows the traction switchboard from the front. This board controls four 2,500-KW. reciprocating sets and also the two 7,500-KW. three-phase turbo-generators. The switchboard controlling the four reciprocating sets is divided into three galleries, while the turbine switchboard at the further end is divided into four galleries. From this board run four traction single-phase feeders for the railway service, and five three-phase feeders for power supply to various factories in the Corporation's South London area. The section controlling the reciprocating sets is laid out with bare copper bus-bars and connections in stone cell-work in a similar manner to other high-tension boards in this country, but has this special feature—that the generator connections are provided with throw-over switches so that any machine may be connected to either the three-phase or the single-phase traction supply, automatic pilot lamps on the control board showing the attendant which system the generators are running on or available for.

Owing to the difficulties which have been experienced on this type of board, due to cleaning live conductors, Home Office requirements, &c., it was thought desirable to go one better in the recent additions for controlling the two turbines and new feeders. This new section is divided into four galleries, the oil switches and group switches controlling the turbines being placed on the top gallery, whilst the oil switches controlling the feeders are placed in the lowest gallery.

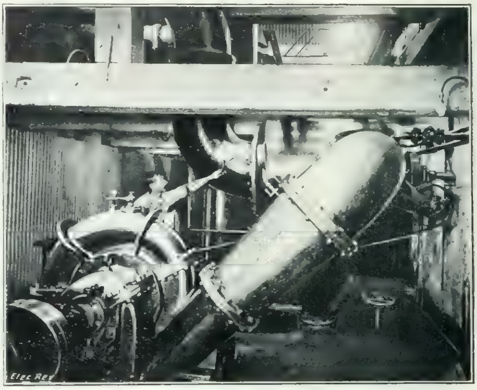


Fig. 7.—Rotary Strainer.

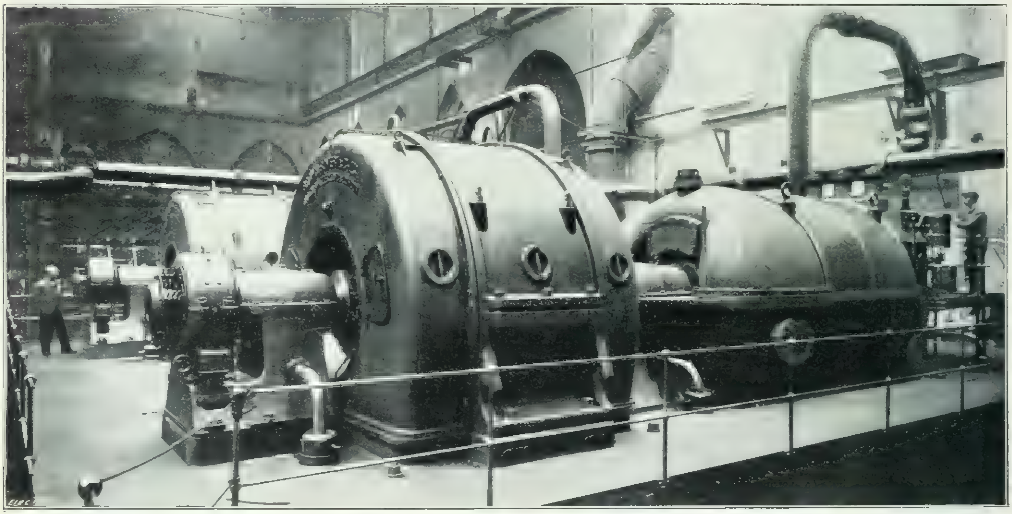


Fig. 8.—Generator End of 10,000-h.p. Turbo-Alternators.

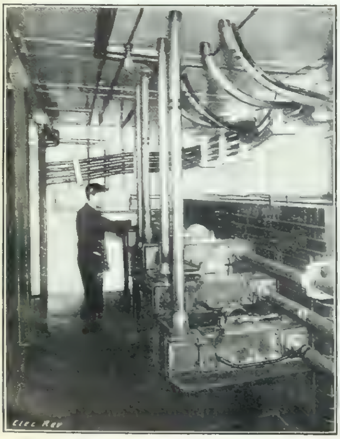


Fig. 9.—Back of Traction Switchboard.

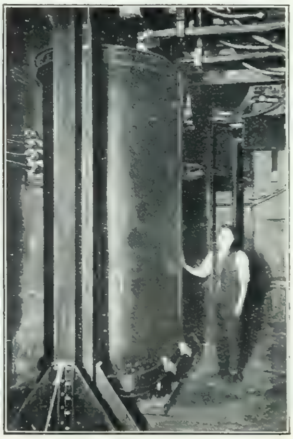


Fig. 10.—Reactance Coil for 10,000 Amps.

The whole of the high-pressure conductors are laid out in such a manner that each conductor and isolating switch is enclosed in an earthed shield. The advantages claimed for this system are as follows:—

1. It does not require cleaning.
2. Live conductors cannot be touched or short-circuits caused by rats or other live animals.
3. Any arc that may be set up is not liable to short-circuit all three phases.
4. The series transformers, a weak point in all other systems, and the cause of many serious breakdowns, are clamped outside the earthed covering, thereby making a failure in this part of the system almost impossible.
5. Heavy short-circuits, which before now

have broken insulators due to the repulsion between conductors, can in no way affect this system.

6. Isolating switches are locked in the "on" and "off" positions.

Another view shows the back of the traction board. Several special interlocking devices are used with this particular system. For example, it is impossible for an attendant to get at the key of the isolating switches without opening the oil switch of the main generator, thus automatically preventing the isolating switches from being opened under current. By means of pilot lamps the attendant on the control board can see the exact position of the isolating switches. The lamps in question will only indicate if all three phases are in the "on" or "off" position. Many other advantages are claimed for this system.

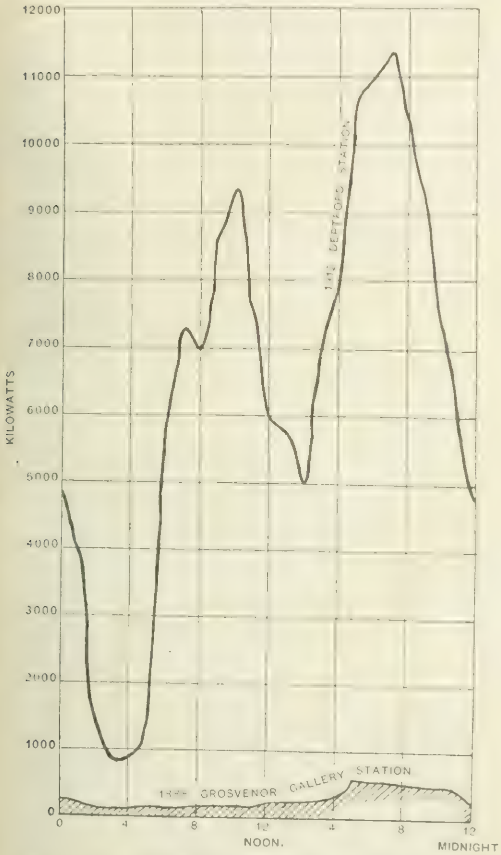


Fig. 11.—Load Curves: Grosvenor Gallery, 1888, and Deptford, 1912

The generator and group switches are of especially large type, motor driven, and are capable of carrying a current of 2,000 amperes and breaking at the moment of short circuit 40,000 amperes. These switches have been actually tested by switching one of the large 10,000-h.p. generators on to a short circuit and switching it off again.

Owing to the enormous currents given by turbo-generators on short circuit it was thought advisable to install reactance coils, so as to reduce the current as much as possible and prevent undue stress on the windings of the generators, &c. One of our illustrations shows a reactance coil used in connection with the railway supply. This coil, which has a reactance of about 4 per cent., is designed to withstand a short-circuit current of 10,000 amperes. The weight of the coil is about 15 tons.

We give two views of the two 10,000-h.p. turbo-generators. The turbines, which are of the impulse-reaction type, were made by Messrs. C. A. Parsons & Co. The impulse blades are fixed in the grooves of the velocity wheel by two layers of caulking pieces, each independently caulked so as to get the strongest possible mechanical fixture. The intermediate and low-pressure ends of the turbine are of the usual standard reaction blading, built up on segments beforehand on the Parsons rosary threaded root system. There are three groups of nozzles on these turbines, each group controlled by a special design of automatic valve, which by opening brings the group of nozzles into operation as soon as the preceding group is utilised to its full capacity. The use of these automatic valves enables the lowest possible steam consumption to be obtained at all variations of load. There is a fourth group of nozzles controlled by hand, which can be used to deal with overloads if it becomes necessary.

The well-known Parsons type of steam relay governor controls the speed of the turbines, which have a variation of not more than 3 per cent., notwithstanding the rapid changes of load which take place when the machines are on the railway service.

The electric generators were manufactured by Messrs. Brown, Boveri & Co., and are the largest hitherto constructed in this country. These generators are specially designed to operate under the very special conditions which prevail on the traction system. This particular type of construction was adopted by the Corporation principally on account of its mechanical strength, in view of the heavy overloads with which the machines will have to deal. The generators are specially arranged so as to give either a single-phase or a three-phase supply. The capacity of each of these machines is 7,500 kw. normal rating, when running three-phase, with an overload of 50 per cent. for half an hour. They are at present dealing with loads up to 7,500 kw. when running as single-phase machines. The generators are arranged for self-contained induced draught; the cool air enters the machine from below, passes through the various parts, and then, through a special duct running through the engine

Fig. 12.—Comparison between the 10,000-h.p. Steam Alternators of the London Electric Supply Corporation, 1889 and 1912.

room, is discharged outside the building. Two special air filters are provided for each machine, capable of dealing with 27,000 cb. ft. of air per minute. The pole shoes of the rotors are provided with heavy copper damping windings to reduce the pulsating field set up when they are giving a single-phase supply. Mica is used throughout for the insulation of the armature, the end connections of the windings being specially secured, not only at the end of the coil, but where each bar leaves the slot.

The voltage regulation of these large generators is entirely controlled by an automatic Tirrill regulator, which, considering the variations of power factor, load, &c., which take place, gives wonderful results.

The boiler house contains 22 Babcock & Wilcox boilers and 10 Paxman boilers, with complete superheater and economiser equipment. Two new Babcock & Wilcox boilers, each having a capacity of 25,000 lb. of steam per hour, are now being installed, making a total capacity of boiler plant of 760,000 lb. of steam per hour. There is ample capacity on the wharf for further extensions of boilers and generating plant, and also for large quantities of coal, so that the generating station may be regarded as practically independent of coal strikes, &c.

The water for condensing purposes is taken from the River Thames, and the method of straining the water is of special interest, as an entirely new form of strainer (shown in one of our views) has been designed for the purpose. Two of these strainers are at present in use in Deptford. The chief points of interest in this type of strainer are its first cost—which is about one-third of that of other self-cleaning strainers on the market—its low cost of upkeep and power required to operate, and the small space occupied.

The strainer proper is in the form of a drum, the surface of which is perforated with a large number of holes. The drum, which is contained in a closed cast-iron housing, rotates at a speed of 3 to 5 R.P.M. by means of a reduction gear driven from the centrifugal pump shaft. The water entering the housing passes through the perforations into the interior of the drum, and thence into the pipe system to the condensers. Any *débris* carried in by the water adheres to the outside of the drum until it reaches a scraper, so placed as to act on the lower surface of the strainer. This scraper has a shaving action on the drum, and causes any *débris* adhering to the perforated surface to fall into a settling chamber formed in the bottom of the strainer body, quite outside the flow of water. The *débris* can be discharged to the river by opening either automatically or by hand a sludge valve, which is connected to the return pipe from the condensers. These strainers have been dealing with the full quantity of water required by the generating station for the last two years, and have been giving every satisfaction. Both strainers were made by the Corporation in their own workshops.

The coal supplies are all obtained from the river, coal being delivered alongside the Corporation's frontages in barges of 200 tons and upwards. For unloading these barges special grab cranes are provided, by which the coal is worked out into a weighing hopper, whence it gravitates into large skips; these are picked up by a Temperley transporter, which conveys the coal over the boiler house, depositing it on the coal floors or in the bunkers. Ample storage facilities are available not only over the boiler house, but also on the wharf, and previously to the recent coal strike sufficient coal for several months' supply was stored on the premises, which quantity could be very largely increased should the necessity arise.

As it was by virtue of necessity in the early experimental days, so in later times it has been the policy of the Deptford works to be as far as possible independent of all outside contractors, not only for their repairs but also largely as regards new material for extensions. In addition to the workshops which have been previously referred to, the station is provided with a large drawing office and staff, where some of the main engines, including one of 2,000 I.H.P., and other important parts of the plant have either been designed originally or redesigned, the construction or reconstruction, as the case may be, being subsequently largely carried out in the Corporation's workshops. These shops are well equipped with machine tools, which are capable of handling the largest parts of the generating plant for repair purposes. When not engaged on repairs the shops are kept going on new work. In addition to strainers and other parts in connection with the condensing plant, a large number of the valves required for recent extensions, from high-pressure steam valves up to 48-in. diameter exhaust valves, have been made in the Corporation's shops. It will be readily understood that the advantage of having such great facilities for works of construction and repair on the premises cannot be over-estimated.

The immense progress that has been made during the last 24 years is well illustrated by the load curves which we reproduce on the previous page. It is interesting, too, to note that in our issue of May 8th, 1891, we gave a number of views of the original Deptford plant, including the huge 10,000-H.P. alternator then in course of construction but never completed.

There can be, we should think, few, if any, other electricity supply undertakings in this or any country which can boast of a more loyal and devoted staff than the London Electric Supply Corporation has the good fortune to possess; several of its members have been employed in the Deptford works from the very beginning, and are still actively engaged in the company's service. Foremost among these is, of course, Mr. Partridge himself, whose technical ability and charming personality are too well known to need description. To call Mr. Partridge indefatigable would be the barest justice; no personal effort is too severe or too distasteful for him to undertake it, be it crawling through boiler flues or designing new equipment, and his acquaintance with every individual item of his plant is intimate and expert.

The history of the Deptford station, like that of most pioneer undertakings, has been one of innumerable difficulties and continual change; we are glad, therefore, to record the triumphant outcome of its long battle. Its total working costs for the year 1911 were 0·82d. per unit—about 19 per cent. lower than those of any other company in London for that year. We offer our congratulations to Mr. Partridge, with the hope that a bright and prosperous future may lie before his historic undertaking.

NOTES.

(*Concluded from page 218.*)

Devonport Dockyard Trip to Guernsey.—About 140 members of the Electrical Engineers' Department of H.M. Dockyard, Devonport, including the chief of the department, Mr. Z. H. Kingdon, took part in a trip to Guernsey during the August bank-holiday week-end. The party embarked on the G.W.R. steamer *Antelope* at the Millbay Docks, Plymouth, about 10.30 p.m. on the Friday night, arriving at St. Peters Port, Guernsey, about 6.30 a.m. on the Saturday morning. After landing, the party were photographed, and then proceeded in chars-à-bancs to the Masonic Hall, where breakfast was served. The party spent all day Saturday and Sunday visiting the chief places of interest, and left St. Peter's Port, Guernsey, on the Sunday night at 10.30 p.m., arriving at Millbay Docks about 7 a.m. on Monday morning. The weather was not all that could be wished, but the enjoyment of the party was little interfered with.

Post Office Engineering Staff.—In the Parliamentary questions the other day, Mr. Snowden asked the Postmaster-General whether, in view of the fact that the special board appointed to inquire into and report upon the cases of those engineers denied the new scales of pay authorised under the reorganisation of the engineering department completed their labours some weeks ago, and also that the delay which had taken place in announcing the result of the reconsideration was giving rise to a feeling of unrest and discontent amongst the officers affected, he would give some indication of the nature of the points of difficulty not yet settled. The Postmaster-General replied that he had now been able to come to a decision on this matter, and he found that he would be justified in granting the new scales of pay to a considerable number of engineers who were left on their old scales in the first instance. The changes would take effect as from July 1st, 1911.

Electric Light Staff (General Post Office).—Mr. Crooks asked the Postmaster-General the other day whether he was aware that the men in the electric light department of the General Post Office who were promised an increase of salary to commence January, 1908, had not yet received it, and would he make arrangements to enable these men to receive their long-delayed back pay. Mr. Herbert Samuel stated that the payment of arrears to the electric light staff, consequent on the antedating of their revised rates of pay from October, 1910, to January, 1908, had already been carried out in a number of cases, and the settlement of the remaining claims was being proceeded with; the amount of work involved was considerable, as it was necessary to make a week-to-week examination of the pay-sheets for each man concerned during two years and threequarters.

A Liverpool Charge.—At the Liverpool Police Court on Saturday, August 3rd, Arthur Evans Kennedy, electrical engineer, was committed to the Assizes for trial on a charge of menacing Sir Charles Petrie (chairman of the Tramways and Electricity Committee) by sending threatening letters demanding money. The case for the prosecution showed that Kennedy was formerly employed in the electricity department of the Corporation and after his discharge for unsatisfactory conduct he commenced to write letters and address public meetings with the object of showing that he had a grievance against Sir Charles Petrie, Mr. Clough (city electrical engineer), and Mr. J. Witter (foreman). He had previously, in 1909, spent six months in prison in default of entering into recognizances in respect of a charge of writing a letter to Sir Charles Petrie. The letter complained of in the present case dealt with what he styled "The Liverpool Dreyfus case," and contained a sentence: "I further tell you that no matter what it costs, you will be bound to settle the matter between us." Further he wrote: "If you do not care to meet me, send to me what is known as a blank cheque and a letter. I have a price, of course. I will then write you out a receipt in full settlement of my claim against you, Mr. Clough, and Mr. Witter."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At the offices of the Guernsey Electric Light and Power Co., Ltd., recently, Mr. C. T. Westlake, chief assistant engineer, was presented by the staff and employés with an onyx timepiece on the occasion of his marriage. Mr. A. N. Rye, the engineer and manager, made the presentation.

A proposal to increase the salary of Mr. W. Churchyed, station engineer at Bridlington, from £156 to £166 per annum, has been referred back. The Committee made its recommendation after Mr. Churchyed had received a Lowestoft appointment, the chief engineer (Mr. Beckett) not desiring to lose his services at Bridlington.

Mr. G. D. Vickers, station superintendent at the Smethwick power station of the Shropshire, Worcestershire and Staffordshire Electric Power Co., has been presented with a handsome chiming clock in fumed oak case (subscribed for by the management and staff of the company) in celebration of his marriage, which took place at Blackburn on July 18th last.

Mr. E. Calvert, electrical engineer to the Finchley undertaking, has had his salary raised from £575 to £600 per annum.

The Newcastle-under-Lyme T.C. has increased the salary of Mr. A. J. C. de Renzi, electrical engineer, by £25 per annum, as from August 1st, with a further increase of £25 a year hence.

The Tunbridge Wells T.C. has decided to postpone until after October 30th the appointment of a chief electrical engineer in succession to Mr. J. W. Beauchamp. Until a successor is appointed Mr. J. Bemrose, chief assistant electrical engineer, will have charge of the undertaking.

Mr. J. D. Knight, borough electrical engineer at Ealing, has been unanimously voted an increase in salary from £575 to £600, commencing September 30th next. Increases, amounting to £69 11s. for the ensuing half-year, have been granted to all the staff at the electricity works.

General.—As reported in the Press, among the five Englishmen who were arrested on Saturday night at Eckenförde, near Kiel, on suspicion of espionage, are Messrs. W. R. MacDonald, electrical engineer, and L. H. Sheffield, solicitor, who are co-directors of Submersible Motors, Ltd.

The Council of the Institution of Civil Engineers has resolved to propose at the next meeting the election of Mr. Thomas Coltrin Keefer, C.M.G., of Ottawa, Canada, as an honorary member of the Institution, because of the distinguished part he has taken in the engineering enterprises which have aided so largely the development and prosperity of the Dominion; and on account of the services which he has rendered to civil engineering during his long association with it since his entry into the profession in the year 1838.

Mr. H. S. Watkins sailed on August 2nd for Ceara, Brazil, to supervise the construction of a complete tramway and electric light installation and power station, on behalf of the consulting engineers, Messrs. McCarter and Kerr Bock. Mr. Watkins anticipates being in Ceara for about 12 to 18 months.

Capt. J. R. Garwood, Royal Engineers, has been appointed chief instructor at the Army School of Electric Lighting at Portsmouth.

The Perth (W.A.) City Council, after a three hours' debate, has appointed Mr. Herbert Broadbent to prepare plans and specifications for the new city electric lighting installation and to supervise the carrying-out of the work when it is taken in hand.

Mr. J. Sutherland Warner has returned to England from the United States, where a number of cars equipped with St. Louis-Warner Non-Parallel Axles, and manufactured by the St. Louis Car Co., of St. Louis, Mo., U.S.A., are now in operation.

NEW COMPANIES REGISTERED.

Galletti's Wireless Telegraph and Telephone Co., Ltd. (12[illegible]).—Registered July [illegible]th, by Bristows, Cooke and Carpmael, 1, Copthall Buildings, E.C. Capital £[illegible],000 in 1,[illegible] shares of £1 each and 1,000 shares of 1s. each. Objects: [illegible] connected with wireless telegraphy and telephony, and apparatus, instruments and appliances connected therewith, to develop and turn to account the same and to manufacture and supply machines, instruments and apparatus for use in connection therewith. The signatories (with one share each) are:—T. W. Stratford-Andrews, 18, Old Broad Street, E.C., managing director; R. C. Galletti, 23, Quai du Mont Blanc, Geneva, engineer. Private company. The first directors (to number not less than [illegible] or more than [illegible]) are J. H. Tritton, Sir Francis Mowatt, G.C.B., Sir William R. Brook, K.C.I.E., R. C. Galletti, A. N. K. Macklin, C. Holland and T. W. Stratford-Andrews; qualification £250; remuneration (except managing or technical directors), £100 each per annum (chairman £[illegible]) and a percentage of the profits.

A letter from the G.P.O., London, to the Indo-European Telegraph Co. conveys the consent of the Postmaster-General to this registration, provided that such consent confers no right to use the system in the U.K. without the usual licence, and does not in any way bind the Postmaster-General to grant such a licence. The same letter states that the Postmaster-General has no objection to raise to the revised Memorandum of Association of the Indo-European Telegraph Co.

Vacuum Electric and Gas-Heating Appliances, Ltd. (123,545).—Registered July 31st, by C. R. Cran, 15, New Broad Street, E.C. Capital £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in geysers and appliances for the heating of steam, water and air by electricity, gas, oil or other method, and fittings and appliances connected with electric, gas and oil lighting, founders, electrical engineers, oil refiners, &c., to acquire, work, develop and turn to account certain inventions and patent rights for the heating of steam, water and air by gas and electricity, and to adopt an agreement with J. Mann. The subscribers (with one share each) are:—M. F. Berkeley, 2, Ormonde Terrace, Regent's Park, N.W., gentleman; O. Cuffe, Finsbury Circus Buildings, E.C., gentleman; D. W. Cassy, 133, Cannon Street, E.C., insurance broker; G. J. Smith, 20, Adamson Road, N.W., gentleman; C. G. Chatterton, 32, Finsbury Square, E.C., solicitor; A[illegible] J. A[illegible], [illegible], W[illegible] Road, Leytonstone, clerk; R. I. Marsden, 18, Eldon Street, E.C., chairman and secretary. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than 10) are M. F. Berkeley, O. Cuffe and G. J. Smith; qualification, 100 shares; remuneration £200 each per annum (chairman £250).

African Mica Mines, Ltd. (123,517).—This company was registered on July 31st, with a capital of £40,000 in 5s. shares, to acquire, work, develop and turn to account mica mines, mining rights and properties in Africa and elsewhere, and to adopt agreements with P. F. Haupt and the V.R. Syndicate for the acquisition of mica property in North-Eastern Transvaal. The subscribers (with one share each) are:—C. E. Gudgeon, 19, Eastcheap, E.C., asbestos merchant; W. E. Reiffenstein, 1, Cromwell Mansions, Ravenscourt Park, W., director; H. A. Corbett, 61, Erithville Gardens, W., gentleman; J. S. Home, 75, Grand Parade, N., journalist; L. H. Rusby, 73, Cheapside, E.C., chartered accountant; T. Grimes, 19, Eastcheap, E.C., traveller; W. T. Veroni, 65, Fenchurch Street, E.C., gentleman. Minimum cash subscription, seven shares; the number of directors is not to be less than two or more than seven; the first are J. B. Gates and C. E. Gudgeon; P. F. Haupt shall become a director after first allotment of shares; remuneration, £100 each per annum (chairman, £200), free of income-tax. Registered office, 73, Cheapside, E.C.

Universal Wireless Supply Co., Ltd. (123,514).—This company was registered on July [illegible]th, with a capital of £2,000 in £1 shares (200 founders), to carry on the business of manufacturers of, agents for, and dealers in wireless telegraph apparatus, machinery and implements of all kinds, &c., and to acquire the property and rights of T. H. Lyon and J. C. Smith in the patent Lyon-Smith detector. The subscribers (with one share each) are:—T. H. Lyon, 32, Morris Road, Southampton, master mariner; J. C. Smith, 23, Oxford Street, Southampton, marine optician; F. P. W. Allen, 70, Bullar Road, Bitterne Park, Southampton, wireless operator; H. E. Chalmers, 11, Hanley Road, Southampton, master mariner; H. Cook, 11, Arthur Road, Southampton, marine optician; F. Woolley, 5, Portland Street, Southampton, incorporated accountant; H. J. E. Batchelor, 63, Howard Road, Southampton, clerk. Minimum cash subscription, £500. The number of directors is not to be less than two or more than three; the first are T. H. Lyon and J. C. Smith. Registered office, 5, Portland Street, Southampton.

Southwold Electricity Works, Ltd. (123,568).—This company was registered on August 1st, with a capital of £10,000 in £1 shares, to take over the business carried on at Southwold and Reydon, Suffolk, for the electric lighting of the town of Southwold and parish of Reydon, and to adopt an agreement with the Coast Development Corporation, Ltd. The subscribers (with one share each) are:—Col. Sir Thomas S. Cave, Kilworth, Woking; C. F. Pritchard, 3, Temple Gardens, Temple, E.C., barrister; G. Riley, Granville House, Clacton-on-Sea, engineer; H. R. Spence, 5, Alexandra Court, Queen's Park, S.W., director; W. J. Taylor, 12, Ashgrove Road, Goodmayes, accountant; H. F. Worboys, 54, Brockley Rise, Honor Oak Park, S.E., clerk; C. J. Freeman, Elmcroft, Recreation Road, Sydenham, S.E., cashier. The first directors are Col. Sir Thomas S. Cave, C. F. Pritchard, G. Riley, and H. R. Spence. Registered office, Belle House, Fish Street Hill, E.C.

Gambrell Bros., Ltd. (123,557).—This company was registered on August 1st, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of and dealers in electrical instruments and appliances carried on by T. E. Gambrell and C. T. Gambrell, at 23, North Side, Clapham Common, S.W., as Gambrell Bros. The subscribers are:—F. W. Gordon, Graylands, Augustine Road, Wimbledon Park, Surrey, gentleman, 1,500 shares; T. E. Gambrell, 23, North Side, Clapham Common, S.W., electrical engineer, 1 share; C. T. Gambrell, 23, North Side, Clapham Common, S.W., electrical engineer, 1 share. Private company. The number of directors is not to be less than two or more than six; the first are F. W. Gordon, T. E. Gambrell, and C. T. Gambrell; qualification, £100; remuneration, £15 per annum, divisible. Registered by Druces & Attlee, 10, Billiter Square, E.C.

Maximum Magneto Co., Ltd. (123,507).—This company was registered on July 30th, with a capital of £5,000 in £1 shares to acquire inventions relating to motor-cars and motor-car parts, to promote companies, &c., and to adopt an agreement with W. H. F. Muen., J. Sherwood, H. M. Harris and B. J. Samuels. The subscribers (with one share each) are:—B. J. Samuels, 10, Dean Street, W., motor accessory dealer; J. Sherwood, 26, Red Lion Square, W.C., merchant. Private company. The first directors are H. M. Harris, C. Oppermann, B. J. Samuels, J. Sherwood and F. Kubler; remuneration as fixed by the company. Registered office, 10, Dean Street, W.

Photos Miners' Electric Lamp, Ltd. (123,479).—This company was registered on July 29th, with a capital of £5,000 in 4,700 10 per cent. preferred ordinary shares of £1 each and 6,000 deferred ordinary shares of 1s. each, to carry on the business of electrical and mechanical engineers, electricians, &c., and to adopt an agreement with K. R. Smith for the acquisition of the patents, inventions and rights referred to therein. The subscribers are:—K. R. Smith, Woodlands, Paignton, South Devon, inventor and patentee, 900 preferred ordinary shares; E. R. Smith, Melford Lodge, Muswell Hill, N., stockbroker, 925 preferred ordinary shares; G. W. Cook, 3, Broad Street Buildings, solicitor, [illegible] preferred ordinary shares. Private company. The number of directors is not to be less than two or more than five the first are E. R. Smith, K. R. Smith and G. W. Cook. Registered by Waterlow & Sons, Ltd., London Wall, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Windermere and District Electricity Supply Co., Ltd. (41,461).—Trust deed dated June 25th, 1912 (supplemental to trust deed dated November 11th, 1902, securing £20,000 first mortgage debenture stock), charged on land at Troutbeck Bridge, and company's other property, present and future, including uncalled capital and benefit of all present and future provisional orders for electrical lighting. Trustees: A. M. Sing, Dawstone, Windermere; and A. H. E. Wood, Browhead, Windermere. The supplemental deed extends time for repayment of stock until December 31st, 1932, and increases rate of interest from 4 to 5 per cent. per annum and otherwise varies principal deed.

Cleveland and Durham Electric Power, Ltd. (89,539).—Charge dated May 29th, 1912 (supplemental to agreement dated June 13th, 1911), to secure £31,600 or such other sum as may be payable under the terms of the agreement. Property charged: Above-mentioned agreement relating to generating and other plant at or near Horden and Shotton Collieries, and benefit of wayleaves and leases required for carrying out the same. Holders: Industrial Plant Co., Ltd., Milburn House, Newcastle-on-Tyne.

British and Colonial Lighting Co., Ltd. (100,650).—Issue on June 25th, 1912, of £500 debentures being part of a series of which particulars have already been filed.

Callender's Share and Investment Trust, Ltd. (121,778).—Trust deed dated March 30th, 1912, to secure £115,000, charged on securities amounting in all to £115,000 in the Anchor Cable Co., Ltd., Lancashire Power Construction Co., Ltd., Yorkshire Electric Power Co., and the Uxbridge and District Electric Supply Co., Ltd., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Sir Henry S. King, K.C.I.E., 65, Cornhill, E.C., and Sir James F. Flannery, Bart., M.I.C.E., 9, Fenchurch Street, E.C.

Power Gas Corporation, Ltd.—Agreement dated July 9th, 1912, to secure all moneys not exceeding £75,000, which the mortgagees may pay to Parr's Bank, Ltd., under or by virtue of a certain guarantee, charged on Parkfield Works, at Stockton-on-Tees, contained in mortgage to the Corporation by virtue of deposit of deeds, to secure not more than £100,000. Holders: R. L. Mond, J.P., Combe Bank, Sevenoaks; Sir Alfred M. Mond, Bart., 35, Lowndes Square, W.; E. S. Mond, 22, Hyde Park Square, W.; and B. F. Hawkesley, 30, Mincing Lane, E.C.

Reason Manufacturing Co., Ltd. (64,701).—Mortgage dated July 4th, 1912, to secure £2,000, and any other present or future indebtedness of the company to the mortgagees (Barclay & Co., Ltd.. 54, Lombard Street, E.C., and North Street, Brighton), charged on present and future indebtedness of company's customers.

Barbados Electric Supply Corporation, Ltd. (104,367).—Particulars of £15,000 debentures created June 27th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being stated). Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital, and sums payable in respect of 4,828 preferred and participating shares unissued, and/or any new shares hereafter created and issued. No trustees.

Luken Co., Ltd.—Debenture for £1,200 dated July 4th, 1912, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: The Lunkenheimer Co., Cincinnati, Ohio, U.S.A.

Foster Engineering Co., Ltd. (94,371).—Particulars of £10,000 debentures, created May 31st, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Evershed & Vignoles, Ltd. (43,206).—Issue on June 28th, 1912, of £2,500 debentures, being balance of a series for £15,000, particulars of which have already been filed.

Indicating Fuse and General Manufacturing Co., Ltd.—Debenture dated June 28th, 1912, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Capt. W. J. Seton, Trunk Cottage, Cove, Farnborough, Hants.

Aluminium Corporation, Ltd. (106,421).—Trust deed dated June 17th, 1912, to secure £10,000 second mortgage debenture stock, charged on certain lands and premises in Carnarvonshire, and rights, privileges and powers, &c. Trustees: Mortgage Investment and Contract Corporation, Ltd., 60, London Wall, E.C,

Durell Walker & Co., Ltd.—Particulars of £1,000 debentures, created July 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital (if any). No trustees.

British Union Lamp Works, Ltd.—Particulars of £10,000 debentures, created June 26th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Urban Electric Supply Co., Ltd. (57,986).—Return dated June 12th, filed June 27th, 1912; capital, £640,000 in 80,000 ordinary shares of £3 each; 50,000 preference shares of £5 each and 150,000 shares of £1 each; 80,000 ordinary and 50,000 preference shares taken up; £3 per share called up on the ordinary and £5 per share on the preference; £490,000 paid. Mortgages and charges: £376,723.

Union Electric Co., Ltd. (71,115).—Return dated May 6th, filed May 9th, 1912; capital, £25,000 in £1 shares; 24,250 shares taken up; £1 per share called up on 4,250 and 1s. per share on 19,500; £5,225 paid; £500 considered as paid on 500 shares. Mortgages and charges: Nil.

Northwood Electric Light and Power Co., Ltd. (66.312).—Return dated June 21st, filed July 12th, 1912. Capital £30,000 in £1 shares (15,000 5 per cent. cumulative preference). 12,357 ordinary and 6,730 preference shares taken up. £1 per share called up on 8,132 ordinary and 6,730 preference. £14,862 paid. £1,225 considered as paid on 1,225 ordinary. Mortgages and charges: £2,875.

Rhymney Valley and General Electric Supply Co., Ltd. (89,413).—Return dated June 17th, filed July 1st, 1912. Capital £6,000 in £1 shares (2,500 preference). 1,877 ordinary, and 140 preference shares taken up. £1 per share called up on 1,200 shares. £1,110 paid, leaving £90 in arrears. £917 considered as paid on 917 shares. Mortgages and charges: £1,100.

Shanghai Electric Construction, Ltd. (86,795).—Return dated May 30th, 1912, filed same date. Capital £320,000 in £10 shares. All shares taken up. £317,000 paid. £3,000 considered as paid. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd. (86,932).—Return dated May 14th, filed June 29th, 1912. Capital £500,000 in 50,000 preference shares of £5 each and 250,000 ordinary shares of £1 each. 50,000 preference and 177,001 ordinary shares taken up. £5 per share called up on 50,000 preference and £1 per share on 112,001 ordinary. £361,999 paid, leaving £2 in arrears. £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges: £198,896.

Birmingham and Midland Tramways, Ltd. (19,077).—A memorandum of satisfaction in full on February 29th, 1912, of mortgages advised as outstanding under Sec. 12 of Company's Act, 1907, securing £4,750, has been filed.

Woking Electric Supply Co., Ltd. (46,175).—Issues on various dates from February 8th to June 8th, 1912, of £2,850 debentures, parts of a series of which particulars have already been filed. A memorandum of satisfaction to the extent of £3,000 of trust deed dated March 1st, 1906, securing an indefinite amount, has also been filed.

Leatherhead and District Electricity Co., Ltd. (70,637).—Trust deed dated July 2nd, 1912, to secure £15,000 debenture stock, charged on land in Fetcham, Surrey, with buildings thereon and company's other assets, present and future, including uncalled capital. Trustee: P. P. Ralli, Ashstead Park, Surrey.

A. Reyrolle & Co., Ltd. (70,210).—Issue on July 12th, 1912, of £300 debentures, part of a series of which particulars have already been filed.

Roger Dawson, Ltd.—Deed of charge on 1, Berners Street, Oxford Street, W., and a sinking fund policy, dated July 17th, 1912, supplemental to mortgage dated June 18th, 1908, securing £6,500 and further advances, now £9,500. Holders: Alliance Assurance Co., Ltd., 1, Bartholomew Lane, E.C.

Safety Light, Ltd.—Particulars of £17,500 debentures, created June 21st, 1911, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being issued on July 3rd, 1912. Property charged: The company's undertaking and property, present and future. No trustees.

CITY NOTES.

Central London Railway Co.

The half-yearly meeting was held on Thursday last week at the Holborn Restaurant, Dr. H. F. Parshall presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, p. 184), said that during the half-year the balance of the 4½ per cent. preference stock, £95,000, had been issued. The capital expenditure had been £78,501, the principal item, namely, £71,991, being in respect to the Liverpool Street extension. Notwithstanding the difficulties under which that work had been carried out owing to industrial unrest and the very considerable delay caused thereby in the delivery of all kinds of materials, this extension was opened for public traffic on July 28th. Great credit was due to the contractors as well as to their own staff in having achieved that result. It was, of course, too early to say what benefit the company would derive from the extension, but during the past few days it had been a great convenience to the public, and they had every reason to believe that it would prove to be a valuable source of revenue to the company. As regarded further capital expenditure, there was to be spent on Liverpool Street during the coming half-year £36,000 and in subsequent half-years £20,000, making a total of £56,000, to complete this extension. In connection with the Ealing and Shepherd's Bush extension the expenditure during the half-year would be £38,000, and in subsequent half-years £120,000, making a total of £158,000. Additional rolling stocks would cost £71,000. The completion of the Ozonair system of ventilation, installation of automatic signalling, fireproofing of platforms and sundry items would cost £23,000, making a total expenditure of £308,000. To meet this they had unissued debenture stock amounting to £160,000. There was also a small balance due in respect of the unissued 4½ per cent. preference stock of £600, which with the balance at credit of capital account of £165,526, made a total of £326,126. They would remember that the Metropolitan Railway Co., in the present session of Parliament, promoted a Bill whereby they sought to obtain running powers over the Ealing and Shepherd's Bush Railway. He was pleased to say that by the joint efforts of their company, and the Great Western Railway Co, the portion of the Bill affecting their railway was rejected. The Great Western Railway Co. were now pushing ahead as rapidly as possible with the construction of their portion of the line and work had been commenced on their connecting portion at Wood Lane. Turning to the revenue account, the railway last half-year had carried 17 million passengers which compared with the same period last year was a decrease of 2,757,000 passengers with a decrease in receipts of £18,875. The decrease in receipts was principally due to various forms of competition, mainly by motor-'buses. The coal strike in the early part of the year was also responsible for a portion of the decrease, since during that period there were generally fewer passengers travelling. There was also to be taken into account the fact that the receipts for June of last year were abnormal owing to the Coronation festivities. Against this decrease in passenger receipts there was an increase in miscellaneous receipts of £3,399, bringing the net decrease in revenue to £15,476. Against those decreases there had been effected a further reduction in the working expenses, which, including rates and taxes, amounted to £12,239 so that the balance to net revenue showed a diminution of [illegible]. The percentage of working expenses to traffic receipts was [illegible] against [illegible] in the corresponding period last year, being an decrease of 1·65 per cent. The gross receipts amounted to [illegible], and after deducting working expenses amounting to £71,969, there was a balance to net revenue of £62,664. After providing for debenture interest and other payments amounting to [illegible] there was an available balance of £76,670, as compared with £76,878 last year. The interest on the 4½ per cent. preference stock amounted to £10,800. A dividend on the undivided ordinary stock at the same rate as last half-year, viz., 3 per cent., and 4 per cent. on the preferred ordinary stock, would take £30,538, leaving a balance of £30,238 to be carried to the next half-year. The season-ticket facilities had been very largely extended, and the greatest advantage had been taken by the public of the monthly seasons, and also the short-distance tickets.

The Right Hon. VISCOUNT ST. ALDWYN seconded the motion, and the report was adopted.

The CHAIRMAN, in reply to a question, said they had no idea of extending the line in the West End, except the Ealing extension which was near completion.

Indo-European Telegraph Co., Ltd.

AN extraordinary general meeting was held on Thursday last week, at the offices, 18, Old Broad Street, E.C., Mr. J. Herbert Tritton presiding.

The CHAIRMAN, in moving the resolution approving of a fresh clause (3) in substitution of the present clause in the memorandum of association, said that at the time when their existing memorandum was drafted, as far back as 1868, the practice in drafting such documents, and the law concerning their interpretation, seemed to have differed considerably from present usage. In those days it was the practice to state the main objects of the company in somewhat general terms, and to leave all subsidiary matters to be covered by general words, or to be provided for in the articles of association. According to present practice the reverse plan prevailed, namely, to define with some fulness and considerable precision in the memorandum of association the powers exercisable by the company, and to treat matters not so specifically authorised and defined as outside the powers of the company; and the authority of the directors or the power of the company to do any act was open to question, unless the act was in terms authorised by the memorandum of association. When they altered their articles in June, 1911, they expunged a good many of the directors' powers then contained in the articles as they obviously had no place in them, after they had revised them and brought them up to date. Consequently, the directors' powers remaining in the memorandum, as it stood before alteration, were very meagre—except by implication—in fact, as meagre as they possibly could be. The directors had hitherto avoided the revision of the memorandum (although strongly recommended by their legal advisers to do so) on account of the various complications involved in going to the concessionary Governments, the shareholders, and the High Court for approval. They felt, however, that they could not do justice to the business of the company which naturally became extended with succeeding years, without taking the alteration of the memorandum in hand, and they came to the shareholders for that purpose that day.

SIR FRANCIS MOWATT seconded the resolution, which was carried unanimously.

Metropolitan Railway Co.

THE half-yearly general meeting was held on Wednesday last week at the Great Eastern Hotel, E.C., the Right Hon. Lord Aberconway presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 186), said it was of a satisfactory character, having regard to the adverse conditions under which they had been working during the past six months. The receipts showed a decrease of £9,000 and the expenditure a decrease of £4,000. The traffic decreases were in the carriage of passengers and coal. The strike amongst the miners throughout the country was the direct cause of the falling off in their coal traffic, and was one of the causes of the falling off in their passenger traffic. He was happy to say that throughout the period of the strike they were able to maintain a very efficient service of trains over their system, and when it was over they had still several weeks' supply of fuel at their works. In view of the labour difficulties generally, they adopted a policy some 12 months ago of keeping a considerable stock of power-house coal stored at Neasden, and when the recent miners' strike became imminent they increased that stock to what they considered a sufficient extent to tide over the stoppage at the pits. In this way they were able at very small increased expense to run their train services without interruption, and with only a few modifications, during the slack periods of the day. They were still feeling the effects of increased 'bus competition, but they were doing all that they could to meet the situation by offering counter-attractions by their frequent, regular, and comfortable services. Their receipts from season tickets had advanced by nearly £2,000, which was evidence of the growing popularity of the line. On the expenditure side of the account the only items that called for mention were the locomotive and generating expenses, which were down to the extent of £4,000, and carriage and wagon repairs, which showed a saving of about £1,800. With regard to the first of these items, he thought, considering the higher price they had had to pay for coal during the last half-year, it was exceedingly gratifying to be able to show so substantial a reduction in the cost of their electrical power. They had now three of their reconstructed machines in commercial operation at Neasden, and they were showing very favourable results. From their experience up to the present time he had no hesitation in saying that, when the whole of the work was completed, the results in economical working would fully justify their expectations. While on that subject he would remind them that they were paying for the replacement of the machines out of the renewal fund which they had been building up for some years past, and their only charge to capital was such a proportion of the total cost as was represented by the increased productive capacity of the power house. They had during the half-year, by the introduction of more economical methods of working their steam services, made considerable savings in engine power and in the consumption of locomotive coal. In the net revenue account the only item calling for special mention on the debit side was the electrical renewal and depreciation fund, to which they proposed to place £7,500 this time compared with £5,000 12 months ago. They had already proved the usefulness of that fund, and he was sure they would agree with him that it was a wise precaution to keep it up to a good level. The average fare per passenger during the last half-year had been 1·486d., as compared with 1·487d., and the ratio of expenses to gross receipts 48·91 per cent. compared with 48·82 per cent. in the corresponding period, while the ratio of expenses to traffic receipts alone was 51·42 per cent., compared with 53·98 per cent. last year. The balance available for dividend was £158,815, or £7,913 less than in the corresponding period. They had dividend to pay on increased ordinary capital which they had issued to the extent of £729,706 during the past half-year. They were able out of the balance to pay the full dividends on their several preference stocks, and also to pay a dividend at the rate of 1½ per cent. per annum on the full amount of their ordinary stock, and to carry forward £4,600, which was about £500 more than last year. He was sorry that it should be necessary to declare a somewhat smaller dividend than a year ago, but the circumstances had been entirely exceptional, and nearly all the companies whose accounts had been published up to the present time, and who had been affected by the deplorable strike among the coal miners, had had to show a smaller return for the half-year. The National Insurance Act would cost the company approximately £2,500 a year. The electrification of the East London line was being pushed on with, and they expected it to be completed in the early months of next year. As soon as this was done they would resume the running of through trains from their line to New Cross, and by arrangement with the other lessee companies they had undertaken to provide the rolling stock for, and to run, the local services on the East London line. There was a distinct community of interest between places served by the East London line and certain parts of their system, and they looked forward to a very considerable development of traffic from the new services that would thus be opened up. The Bill that they promoted in the present session of Parliament for the making of a branch line at Watford and for the widening of their existing line between Finchley Road and Wembley had, notwithstanding the strenuous opposition of the L. & N. W. Co., passed both Houses of Parliament, and was now awaiting the Royal Assent. He explained at the Wharncliffe meeting last January their reasons for promoting this Bill, and he thought that they were entitled to assume from the fact that after very searching inquiry before Committees of both Houses the powers they sought had been granted, that they were right in their judgment as to the necessity for the two extensions they had in view. He did not think that their friends the North-Western Co. need fear that they would permanently affect their business in Watford, because they considered that their advent there would tend to such a development of the place that any traffic they lost in the first instance they would regain later on by the general enlargement of the town. During the last half-year they had increased their ordinary capital to the extent of £729,000. As they knew, it was some time since they raised any new capital, and as they had been expending in various directions their capital account became overdrawn, and they had in hand and in prospect various works which would cost a considerable amount of money. They had been waiting for some time for a favourable opportunity to get out some new stock, and when the price of the ordinary stock rose a few weeks ago they took advantage of the situation to sell the stock which they had created but not issued. The transaction was an eminently satisfactory one from the point of view of the price they obtained for the stock, and their capital account was now well in credit. While the past half-year had not shown as satisfactory a result as some preceding half years, there had been very exceptional circumstances operating against them, and his colleagues on the board and he saw no reason to alter the view they had expressed to them previously, namely, that if they could be secure from unfair competition they had every reason to be optimistic as to the future of the line. Their undertaking was sound in every way, it met, and met well, a great public demand, and with the continuance of a liberal policy on the part of the board and the assistance of a zealous staff of officers and men, they thought that they might look forward with confidence to a better return on the capital that they had invested in the company.

LT.-COL. CLIFFORD PROBYN seconded the motion and the report was adopted.

Brompton and Kensington Electricity Co., Ltd.—The directors announce an interim dividend at the rate of 9 per cent. per annum.

Liverpool Overhead Railway Co.

In their statement for the half-year ended June 30th, the directors report that the gross revenue receipts amount to £41,407, and the working expenses to £28,313.

The number of passengers carried during the last two years is as follows:—

	Half-year to December, 1910.	Half-year to June, 1911.	Half-year to December, 1911.	Half-year to June, 1912.
First class	567,911	579,328	617,097	628,352
Third class (incldg. trmwys.) ..	3,260,261	3,113,073	3,398,069	3,323,291
Workmen (spec. ret. tickets) ..	1,563,128	1,701,196	1,723,340	1,919,696
Total.. ..	5,391,300	5,393,597	5,738,506	5,871,339

The improvement in the extent of the traffic during the past half-year is an encouraging feature. The coal strike increased the working expenses, but a service was maintained throughout the trouble, which proved a great convenience to the trade of the Port. The permanent way and rolling stock are in excellent condition.

The receipts from passenger traffic were £40,082, and miscellaneous receipts and interest £1,325, making £41,407, less working expenses and transfer to renewal fund £28,313, leaving £13,094. After deducting interest on mortgage debentures, and on calls paid in advance £4,329, there remains £8,765, plus £4,763 brought forward, leaving available for dividend £13,528, out of which the directors recommend dividends at the rates of 5 per cent. per annum on the preference shares, and 2 per cent. per annum on the ordinary shares, payable on and after August 15th, leaving £4,852 to be carried forward.

The meeting is called for August 13th.

Metropolitan District Railway Co.

The half-yearly meeting was held on Thursday last week at the Westminster Palace Hotel, S.W., Lord George Hamilton in the chair.

The Chairman, in moving the adoption of the report (see Elec. Rev., p. 185), said the half-year had to be compared with the six months of the previous year, when the receipts were abnormally increased by the Coronation festivities. During the past half-year they had had no assistance of that kind, but instead they had had to deal with two strikes, both of which had materially affected them. They had been obliged to pay a large sum to ensure a supply of coal during the coal strike, and they had also been put to considerable expense to get coal up the river to their power house at Chelsea owing to the dock strike. Yet, notwithstanding those untoward expenses, the gross revenue had amounted to £344,000, being an increase of £9,800 over that of the corresponding half of last year. The working expenses showed an apparent decrease of £13,000, but that was due to a change in the form of accounts necessitated by the acquisition of the power house undertaking by that company and the London Electric Railway Co. The cost of electric train working for the half-year amounted to £63,373, as compared with £79,215, showing a decrease of £16,000, but in addition they had had to pay £17,212 as rent for the Lot's Road power house. Speaking generally, the acquisition of the Lot's Road power house by the railway companies had quite fulfilled their anticipations. It had been a distinct advantage to them, as it had given them control of their own supply of energy, and if they were fortunate enough to make contracts by which they could sell their surplus power to outside companies the cost of supply to themselves ought to be diminished. The balance of net revenue amounted to £83,491, against £82,900. They were able to pay the full dividend of 4 per cent. on the guaranteed stock, 4½ per cent. on the preference stock, and 2 per cent. on the second preference. That payment of 2 per cent. on the second preference gave the holders of that stock 2 per cent. for the whole year. He hoped that as their progress went on they would be able to gradually increase that dividend until it attained its maximum of 5 per cent., and then there would be nothing to intervene between the ordinary shareholders and a dividend. During the last half-year £150,000 prior lien debenture stock had been sold to provide the cost of additional rolling stock and various other improvements. Apart from that issue, the capital expenditure during the half-year was £30,744, and they estimated their further capital expenditure in subsequent years at £143,000. The train service continued to show substantial improvement, especially in the western extension, and there were two very satisfactory facts in connection therewith. The first was that the train-mileage showed an increase of 640,000 miles, notwithstanding which the earnings per car-mile were 9·59d., an increase over the corresponding period last year of ·19d. The increase in passenger receipts was £11,862; the parcels and goods traffic showed a small decrease of £410, and season tickets showed an increase of £6,014. The first class ordinary receipts showed a decrease of £348, or 1·94 per cent., and the third class, including workmen's trains, an increase of £6,196, or 2·48 per cent. The number of passengers carried was 42,910,000, being an increase of 1,406,000 or 3·39 per cent., which constituted in itself a record in the history of the company as to the number of passengers carried in any one half-year. Considering the difficulties under which they had had to work during the past half-year, he thought it would be generally admitted that the net result was satisfactory, particularly when they took into consideration that their traffic, especially for short distances, was affected by the motor omnibus. The Insurance Act would cost the company about £1,600 per annum. Dealing with the general situation, he would point out that during the past 12 months they had had to deal with three strikes, all affecting the transport service of the country. They first had the railway strike of last autumn, they then had the coal strike of last spring, and they were only just emerging from the throes of the dock strike. He wished to make only one comment on those strikes. The attention of everyone who took an interest in the social welfare of this country had been directed towards the rise in price of the necessaries of life during the past few years. Every strike of this kind tended to aggravate that rise, for in each one of the strikes to which he had alluded, the price of some necessities of life went up in consequence, and they did not return to the figure at which they were before the strike. It was well to bear the fact in mind that these strikes did not merely affect the employer and employed, but they prejudicially affected, in their after consequences, the consuming interests of the whole working classes of the country. Let them sincerely hope that, if differences of opinion should arise in the future between those managing railroads and their employés, that some form of settling the difference would be taken less suicidal to the interests of the wage-earning class than those to which he had alluded.

Sir Charles Dalrymple, Bt., seconded the motion, and the report was adopted.

London Electric Railway Co.

The half-yearly meeting was held on Thursday last week at the Westminster Palace Hotel, S.W., under the presidency of Lord George Hamilton.

The Chairman, in moving the adoption of the report (see Electrical Review, page 186), said that the traffic and the working expenses had been both affected adversely during the half-year under review by the coal strike and the transport strike. They had caused the expenditure of large sums to secure the necessary coal supply, and, as a result, the train services were not materially affected during the strike, but a true comparison between the period under review and the corresponding six months of 1911 was almost impossible, as they were comparing with the Coronation half-year. The gross recepts had amounted to £389,011, being a decrease of £3,800, and taking into account the different circumstances prevailing, that small decrease was not unsatisfactory. The working expenses showed an apparent decrease of £18,750, but that decrease was apparent rather than real. In previous half-years, the charge for the use of the electrical plant was part of the operating expenses. Since the acquisition of the Lot's Road power house, that charge appeared in another form as rent, amounting to £15,900. The ratio of working expenses throughout the lines to gross receipts was 40 143 per cent. The passenger receipts showed a decrease of £6,000, but advertising was up some £1,900. After providing for all fixed charges and setting aside £7,500 for renewals, they had a balance of £121,653 available for dividends, sufficient to pay the full dividend of 4 per cent. on the preference stock, and 1 per cent. on the ordinary, carrying forward a balance of £12,014. The traffic, especially the short distance, had been adversely affected, both by motor-omnibuses and the L.C.C. tramways. The company's Bill had passed both Houses of Parliament, and was only awaiting the Royal Assent. The only change of any importance made in the Bill was the deletion of a provision for an exit to the street at the Oxford Circus Station. The necessary plans for the extension of the railway connecting the Bakerloo line with the London and North Western Railway at Queen's Park were in preparation, and the extension of the Hampstead line from Golder's Green to Edgware had also advanced, and they hoped to commence actual work on both sections at an early date. The capital expenditure during the half-year had amounted to £76,600, of which £24,000 was spent on the Charing Cross extension and £39,000 on the Paddington extension. They hoped that both those important developments would be completed and in working order in the course of the year. To complete the two extensions authorised and to provide escalators at certain stations, they estimated that further capital expenditure amounting to £461,000 would be required. The Insurance Bill would cost the company about £1,500 a year, and they had formed an approved society for their employés, the solvency of which would be guaranteed by the company.

Sir Algernon West, G.C.B., seconded the motion which was adopted.

Metropolitan Electric Tramways, Ltd.—An extraordinary general meeting is called for August 14th at Electrical Federation Offices, W.C., to confirm the resolutions as to capital rearrangement passed on July 26th.

"Harper" Electric Piano (1910) Co., Ltd.—The directors announce a dividend at the rate of 3½ per cent. for the half-year to June 1st.

Mather & Platt, Ltd.—The directors have declared an interim dividend on the ordinary shares of 5 per cent., being at the rate of 10 per cent. per annum, free of income-tax, for the half-year ended June.

Oldham, Ashton and Hyde Tramways Co., Ltd.—The directors have declared an interim dividend of 5 per cent. per annum on the ordinary shares for the half-year.

Porto Rico Railways Co., Ltd.

In their report for 1911 the directors state that the gross earnings amounted to $748,802, as compared with an increase of $187,140, or 33·32 per cent. The net income was $379,[illegible], an increase of $112,025, or 11·8[illegible] per cent. After providing for interest on bonds and dividends on preferred stock, the surplus was $199,559, being equal to 6·65 per cent. on the common stock. This surplus has been appropriated as follows:—Sinking fund on first mortgage bonds, $29,040; transferred to contingent account, $25,000; dividends on common stock, last two quarters of year, $60,000; transferred to surplus account, $85,519.

The number of passengers carried by the tramway was 6,344,334, an increase over the previous year of 1,337,093, equal to 26·73 per cent. The extension of the tramway lines through the new suburb "Condado" was completed during the year, and the earnings from same have been satisfactory.

The light and power division continues to show satisfactory progress, the number of customers being 5,200, an increase of 714 during the year. The following comparative statement shows the addition in connected load during the year:—

	1911.	1910.	Increase.
Commercial Incan. Lamps connected	30,583	18,023	12,560
Arc Lamps	296	235	61
Municipal Incandescent Lamps	937	728	209
Electric Fans	745	611	134
Motors	1,001 H.P.	449 H.P.	552 H.P.
Heating Appliances	273	248	25
Total Load (16-C.P. equiv.)	81,276	56,588	24,688

Good progress has been made in the construction of the new storage dam and extension of the power house at Comerio. The transmission lines have been extended to Naguabo and are now being extended to San Lorenzo. Toa Baja, Toa Alta, Dorado, Vega Alta and Vega Baja, contracts having been closed with these municipalities. Extensive improvements and additions have been made to the auxiliary steam plant and sub-stations. Additional yard room has been provided for the handling of freight at the various terminals, and further sidings have been constructed where necessary. In all, there has been expended on capital account during the year $551,751. An application has been made for a franchise authorising the extension of the transmission lines to towns in the north-western and south-eastern parts of the island not covered by existing franchises.

In view of the company's greatly improved financial position, and of the large capital expenditures necessary by reason of the rapid development of the property, the board had decided not to issue at present the $500,000 of additional preferred stock authorised and they asked approval to an issue of £1,500,000 5 per cent. 50-year refunding general mortgage debenture stock and/or bonds. Of this amount it was proposed to issue £200,000 immediately to provide for capital expenditure already made and in progress. £600,000 of the issue would be held in escrow to be exchanged for first mortgage bonds outstanding. This would leave a balance of £700,000 available for future extensions as required.

During the year there was expended and charged to operating account on physical maintenance and improvement $104,854. Two quarterly dividends on the Common stock, at the rate of 4 per cent. per annum, were declared in respect of the last two quarters of the year. General conditions in the Island of Porto Rico are highly prosperous. The directors record their appreciation of the efficient services rendered by Mr. F. W. Teele, general manager, and all other officers in Porto Rico.

Company Registrations in 1912.—The returns of new Company Registrations for the first half of 1912 are remarkably satisfactory, says the *Investors' Guardian*, in its half-yearly review. The abnormal speculative movement which dominated the returns of 1910, and which was still operative last year, has died down, but the reaction has not affected other departments of enterprise. On the contrary, there is decided evidence of a strong and healthy expansion in joint stock enterprise. The number of companies registered in the half-year increased by 11·4 per cent., and the registered capital by £7,032,000, or 8·3 per cent. A notable feature of the statistics for groups of companies is the large amount credited to finance and investment concerns (nearly £10,000,000). Fifteen companies were registered with a capital of £1,000,000 and over, these 15 representing an aggregate of £24,500,000 capital. We extract the following figures:—

First half of	1910	1911	1912
Number of companies	3,744	3,102	3,458
Aggregate capital registered.—	£	£	£
Electric	1,522,507	509,145	1,628,500
Engineering and hardware ..	3,818,057	3,531,302	5,845,908
Gas	170,462	645,700	224,600
Railways and tramways	3,505,110	1,630,600	1,163,450
Rubber..	86,627,740	8,004,505	1,762,010
Totals	181,823,169	85,066,932	92,099,698

The figures for the engineering trade reflect the greater activity in that industry; shipping also shows well. The motor industry takes a more prominent position than for several years. Textile manufacturing and drapery companies show steady development.

Continental.—France.—The report of the Société d'Energie Electrique du Littoral Mediterranéen for the last financial year shows a net profit of £66,361, as compared with only £58,938 in the preceding 12 months.

A company has lately been registered in Guernsey with the title La Compagnie Lyonnaise d'Entreprises Electriques et Téléphoniques, the capital being £8,000.

Montreal Light, Heat and Power Co.

We have now received a copy of the annual report of this company, to which brief reference was made on page 104 of our issue of July 19th. In addition to the points already mentioned, the directors touch upon the questions of depreciation and rates. In regard to the former they say that their policy is to amply provide from year to year for deterioration and obsolescence of plant, and while the reserves to date for this account represent a large amount, in the opinion of the directors it is none too large bearing in mind the nature of the company's business, and it will be necessary as heretofore to make adequate annual provision for this purpose. In respect to reduction in rates, they say that in pursuance of its adopted policy to sell its products at minimum rates consistent with the best possible service, the company has just announced a further reduction (effective from July, 1912, meter readings) in electric lighting and gas service rates, and it is expected, as heretofore, that additional business will compensate the resultant loss in revenue. In view of the repeated reductions in rates for electric service which the company has effected in late years, it will not be inopportune to mention that the City of Montreal has in contemplation an extensive system of underground conduits for the burial of wires, and incidentally the removal of poles from the streets in the commercial and congested districts of the city. The company has every sympathy with the city and citizens in this movement; at the same time, the fact must not be lost sight of that the low prevailing rates have been permitted, in large measure, by the relatively low investment cost for aerial or overhead service, and it is only fair to the shareholders to state that the extra capital entailed for underground service will inevitably increase the cost, and consumers will have to bear in mind that a fair differential in rates will be justified for this class of service as soon as the civic conduit system has been inaugurated.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

British Columbia Telephone Co., Ltd.—Fully paid scrip for £[illegible] 4½ per cent. first mortgage debenture stock, and [illegible],000 6 per cent. cumulative preference shares of [illegible] each fully paid.

General Electric Co., Ltd.—Further issue of 15,000 6 per cent. cumulative preference shares of £10 each, fully and partly paid.

The Committee has ordered the under-mentioned securities to be quoted in the Official list:—

Canadian Western Natural Gas, Light, Heat and Power Co., Ltd.—£[illegible] 5 per cent. first mortgage debenture stock.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of $350,000 general mortgage [illegible] per cent. 50-year gold bonds of $1,000 each, Nos. 10,583 to 10,932.

Prospectus.—*Clevedon, Portishead, and District Electric Supply Co., Ltd.*—The prospectus is published offering 30,000 ordinary shares of £1 each at par out of a total capital of £50,000. The company has been formed under special agreements with the Urban District Councils of Clevedon and Portishead (Somerset), to establish an electric supply in those seaside resorts, together with a portion of the rural district of Long Ashton, the whole area having a total population of about 17,000. Public lighting contracts for a period of years in each case have been made with both the Urban District Councils of Clevedon and Portishead, and the company will receive from the start about £700 a year from this source. Negotiations have also been opened with three Parish Councils, and it is expected that similar contracts will be secured. The construction of the power house at Portishead is in progress, and it is hoped that the supply at Clevedon and Portishead will be available this year, and in the rural districts early next year.

Dublin and Lucan Electric Railway Co., Ltd.—The directors report that the gross receipts for the June half-year amount to £3,637, an increase of £182, whilst the expenditure is £23 less. After providing for debenture interest, and the half-year's dividend on the preference shares, £200 is put to renewals of overhead wire, and £445 is carried forward.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares for the half-year ended June 30th last at the rate of 8 per cent. per annum.

STOCKS AND SHARES.

Tuesday Afternoon.

In the August Bank-holiday week, and with the Stock Exchange in the middle of a nineteen-day account, there is so little going on that we are glad of the opportunity to look back upon what has happened during the progress of the year up to the present. So far as electric issues are concerned, the feature, beyond a doubt, is the enormous amount of business—and in many cases the dramatic rises which have occurred—in what, for want of a better name, we have to call the Latin-Canadian group.

There was a Home Railway boomlet in the spring, which fizzled out dismally as labour troubles involved the railway market as a whole. Speculation in Marconis and in National Telephone Deferred—the former especially—ran at a giddy pace, so much so that the boom in Marconis came to an ignominious collapse: although, on balance, the prices show substantial rises since the beginning of 1912.

Coming to prices, the movements in electrical supply shares are very interesting in view of the rumours referred to repeatedly here as to the possibility of a general working agreement being arrived at between the companies and the local authorities. It will be noticed that there are a few big rises in the following list:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Brompton and Kensington, Ordinary	8[illegible]	8[illegible]	[illegible]
Charing Cross, West End and City	3[illegible]	4[illegible]	+ 1
Chelsea, Ordinary	4½	4⅝	[illegible]
City of London, Ordinary	12½	18[illegible]	+ 5[illegible]
County of London, Ordinary	9½	11[illegible]	+ 2[illegible]
Kensington and Knightsbridge, Ordinary	7	7[illegible]	[illegible]
London Electric, Ordinary	1[illegible]	1[illegible]	—
Metropolitan	3[illegible]	3[illegible]	—
St. James' and Pall Mall, Ordinary	8[illegible]	8[illegible]	+ [illegible]
Westminster, Ordinary	8½	8[illegible]	+ [illegible]

The extraordinary rise in City of London shares is due, of course, to the expectation of the company being taken over by the Corporation, hopes of which are not yet wholly scotched by the categorical denials given by the company to the rumours that this was going to happen. Counties have followed much more soberly, the advance in their case being due mainly to an increase in the dividend on the Ordinary shares.

We have space only sufficient to show some half-dozen of the most interesting of the Latin-Canadian issues, but it will be seen that the movements are particularly noteworthy. They have been accompanied by an immense volume of business; and though the latter has fallen off to some extent just lately, this has been the outcome of the summer season rather than of dwindling interest on the part of investors:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Canadian General Electric, Com.	112½	115½	+ 3
Mexican Light and Power, Com.	90	94[illegible]	+ 4[illegible]
Mexico Tramways, Com.	125	126[illegible]	+ 1
Montreal Light, Heat and Power	198	238	+ 40
Rio de Janeiro Tramways	117	151[illegible]	+ 34[illegible]
Sao Paulo Tramways, Light and Power	195	262[illegible]	+ 67[illegible]
Shawinigan Water, Capital	127	154[illegible]	+ 27[illegible]

Coming to the Home Railway market, although quotations have fallen away very materially from the best, the advances on the whole are not at all bad. There have been lively dealings in Districts and in Underground Electric Railways shares and bonds, with the result that the following changes have taken place since New Year's Day:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Central London Railway, Ordinary	69	77	+ 8
„ „ Preference	85	82	— 3
„ „ Deferred	58	74	+ 16
City and South London, Ordinary	31	33	+ 2
Metropolitan Railway, Consol.	46[illegible]	53¼	+ 6¾
Metropolitan District, Ordinary	35	37[illegible]	+ 2[illegible]
Metropolitan Electric Trams, Ordinary	[illegible]	1[illegible]	+ [illegible]
Underground Elec. Railways	3[illegible]	4½	+ 1
„ „ „ 6% Income	78	88	+ 10

In the Telegraph market, business in the older issues has been quiet, and, in consequence, prices are merely steady, the developments of the Marconi system still causing a certain amount of timidity amongst holders of cable companies' shares. Marconi's began the year at 3¼, but touched £9 a share, from which they fell to 4¾ before rallying to their present level. National Telephone Deferred stock and the Third Preference shares commanded wide interest by reason of the arbitration before the Railway and Canal Commissioners. The sharp fall in West India and Panama shares is due to a disappointing dividend statement, prior to which there has been a good deal of vague bullishness in respect to these shares. The six selections give some idea of the net movements during the past seven months:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Anglo-American Telegraph Deferred	26¼	26⅝	+ ⅜
Eastern Telegraph Ordinary stock	139½	129½	— 10
Eastern Extension	13[illegible]	13¼	— [illegible]
Marconi's Wireless Telegraph	3¼	5¼	+ 2
National Telephone Deferred	131	143	+ 12
West India and Panama Telegraph	3[illegible]	2[illegible]	— 1[illegible]

Finally, we have to append a few representative shares taken from the Manufacturing group. In the case of Babcock & Wilcox, the number of shares has been doubled and the price therefore halved. General Electrics went ahead on an excellent report; but, speaking generally, this little department has plodded along without sensational developments, and it will be noticed that the movements on balance are quite moderate:—

	Jan. 2nd.	Aug. 6th.	Rise or fall.
Babcock & Wilcox	6¼	[illegible]	—
Callender's Cable	9[illegible]	10[illegible]	+ 1¼
Dick, Kerr & Co.	$\frac{13}{16}$	[illegible]	[illegible]
General Electric Preference	9	10[illegible]	+ 1[illegible]
Henley's Ordinary	12¼	12[illegible]	+ [illegible]
India-Rubber, G.-P. & T.	11	8[illegible]	— [illegible]
Telegraph Construction	35	33½	— 1[illegible]

It is only necesary to add that dividend deductions have not been taken into consideration in any of the above cases. To have attempted this would have merely complicated and confused the tables, which were finally allowed to stand, reflecting the difference between the prices on January 2nd and those of to-day, Tuesday, August 6th.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	July 31	3,459	— 25	9	14,324	— 851	14·4	..
Ayr	Aug. 8	1,067	— 11	11	5,224	+ 184	8	..
Bath	„ 8	1,984	— 9	31	27,027	+ 1,599	..	..
†Birkenhead	July 28	1,168	— 8	16	19,603	— 613	13·68	..
Birmingham Corp.	„ 27	21,562	+3,471	17	180,318	+47,048	57·17	..
Blackburn	„ 31	2,896	21	18$\frac{3}{7}$	22,279	+ 263	14·62	..
Blackpool Corp.	Aug. 1	5,193	+ 66		28,755	+ 3,964	11·87	..
Blackpool-Fleetw'd	„ 3	2,787	+ 86	5	6,784	— 141	8	..
Bournemouth	July 31	3,954	— 119	17$\frac{3}{7}$	32,496	+ 697	21·95	..
Bradford	„ 27	11,422	+ 2	17	96,564	— 1,254	56	1·2
Brighton	Aug. 4	2,609	469	18	19,264	— 965	9·5	..
Bristol	„ 2	15,151	+ 402	..	209,841	+17,147	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	July 26	607	+ 212	30	8,780	+ 2,317	3·65	..
Barnsley	„ 26	578	+ 198	„	5,102	279	..	..
Barrow	„ 26	1,028	+ 317	„	11,124	+ 2,789	5·37	..
Devonport	„ 26	1,108	99	„	16,003	+ 1,792	8·85	..
Gateshead	„ 26	2,221	7	„	30,635	— 101	11·25	..
Gravesend	„ 26	424	— 78	„	6,058	— 117	6·5	..
Greenock	„ 26	1,907	+ 315	„	23,716	+ 2,747	7·25	..
Hartlepool	„ 26	638	— 73	„	7,571	— 140	6·72	..
Kidderminster	„ 26	315	+ 4	„	3,400	+ 100	..	..
‡Leamington	„ 26	557	+ 67	„	5,981	+ 454	..	..
Merthyr	„ 26	433	— 12	„	5,780	375	2·9	..
Metropolitan	„ 26	18,823	— 969	„	264,103	+ 5,186	22	..
Middleton	„ 26	801	+ 22	„	9,934	— 15	8·5	..
Mid. Joint Com'tee	„ 26	6,849	+ 590	„	95,054	+ 4,130	..	..
Oldham—Ashton	„ 26	1,812	+ 100	„	18,174	+ 1,965	9·18	..
Peterborough	„ 26	307	+ 86	„	4,020	+ 303	5·31	..
Potteries	„ 26	4,130	+ 301	„	55,6[illegible]6	— 1,723	29	..
Rothesay	„ 26	1,810	+ 310	„	5,947	+ 400	2·75	..
Southport	„ 26	709	— 8	„	8,763	— 99	8·17	..
S. Metropolitan	„ 26	1,897	— 139	„	25,194	— 57	..	..
Swansea	„ 26	2,505	+ 43	„	33,406	12	12·5	..
Tynemouth	„ 26	819	130	„	6,768	— 405	3·75	..
Weston-s-Mare	„ 26	754	— 107	„	3,359	— 527	3	..
‡Worcester	„ 26	710	+ 17	„	8,477	— 66	5·75	..
Wrexham	„ 26	242	+ 31	„	3,275	+ 339	..	..
Yorks. Wool. Dist.	„ 26	2,413	+ 11	„	32,769	+ 1,075	17	..
Miscellaneous	„ 26	522	2	„	6,774	+ 214	..	..
Burnley	Aug. 3	3,017	+ 179	..	..	.	11·73	..
Burton-on-Trent	„ 4	629	+ 7	18	4,893	— 238	6·6	..
Bury	„ 4	2,570	— 325	18	24,071	— 11	22·5	..
Cardiff	July 27	5,291	14[illegible]	17	41,141	— 2,928	17·35	..
†Chatham and Dist.	Aug. 1	1,849	— 171	81	25,8[illegible]2	— 84	14·98	..
Cork	„ 1	1,019	— 127	31	14,984	— 439	9·89	..
Croydon	July 26	3,850	+ 5	17	32,037	— 240	11·6	·75
Darlington	„ 20	257	— 6	16	8,598	+ 62	4·87	..
Darwen	Aug. 2	521	+ 8	18	5,652	+ 121	4·36	..
Dover	July 27	592	— 21	17	4,246	— 242	4·75	..
Dublin	Aug. 2	11,553	851		29,211	— 7,762	54·25	..
East Ham	„ 3	2,1[illegible]9	12	18	19,245	— 319	7·87	..
Exeter	July 26	357	65	17	5,663	480	5·5	..
Glasgow	Aug. 3	33,932	—2,161	..	16[illegible],816	+ 4,890	98	..
Hastings	„ 6	2,396	255	..	..	..	19·3	..
Huddersfield	„ 3	3,949	32	18	36,223	+ 712	29·5	5
Hull	„ 3	5,876	+ 112	18	51,791	— 242	13·5	—1
Ilkeston	„ 1	249	33	18	1,848	583	..	..
Ipswich	„ 3	1,070	— 24	18	8,369	+ 84	10·5	..
Kilmarnock	July 27	436	129	10	1,840	— 178	4·25	..
Lancashire United	„ 31	2,744	— 112	31	40,610	— 215	39	..
†Leeds	„ 27	7,835	— 157	17	134,047	+ 4,788	112·7	..
Leicester	„ 27	5,610	+ 218	..	..	..	20	..
Leith	Aug. 3	1,451	40	11[illegible]	8,460	+ 136	3·72	..
Liverpool	July 27	25,447	+ 972	29[illegible]	356,112	+11,986	116	..
‡L.C.C.	„ 24	86,228	—4,025	..	719,816	—29,788	140·6	..
London United	Aug. 3	13,817	— 949	..	155,703	— 7,289	..	..
†Lowestoft	July 27	3[illegible]8	20	..	7,200	— 364	8·5	..
Manchester	Aug. 3	32,764	+ 469	18	305,099	+11,998	105	..
Newcastle	„ 3	8,698	— 158	..	79,464	+ 329	31·3	..
†Newport	July 20	765	+ 37	15	11,127	887	7·25	..
†Oldham	„ 28	2,077	+ 25	18	87,354	+ 961	28	..
†Pontypridd	„ 27	425	+ 65	17	6,235	— 961	5·5	..
Portsmouth	„ 27	4,962	— 388	17	38,249	— 2,[illegible]64	30·9	..
†Preston	„ 24	817	+ 29	17	13,877	+ 364	10	..
Rotherham	„ 31	1,491	— 146	17$\frac{3}{7}$	12,611	+ 434	12	..
†Salford	„ 29	4,9[illegible]8	— 69	17	88,284	+ 2,547	41	..
Sheffield	Aug. 6	13,316	+ 567		124,841	+ 8,304	40	..
Southampton	July 31	2,744	— 91	17	22,474	+ 347	11	..
Southend-on-Sea	„ 31	2,083	+ 192	18	14,316	+ 1,854	7	..
South Shields	Aug. 3	1,377	— 71	18	11,438	— 186	10·25	..
†Tyneside	July 31	531	— 40	[illegible]	2,287	— 418	11	..
Wallasey	Aug. 3	2,456	82	17$\frac{3}{7}$	20,658	— 414	8·72	..
†Walthamstow	July 27	836	+ 9	17	13,776	+ 93	9	
West Ham	„ 25	5,382	— 267	16$\frac{4}{7}$	45,022	— 1,438	16·45	1·2
Wolverhampton	„ 31	2,045	+ 11	18	18,104	+ 135	13·75	..
Cen. London Rly.	Aug. 3	8,511	— 57	5	21,989	— 1,903	6·82	..
City & S. Lon. Rly.	„ 4	5,693	— 536	5	14,803	— 1,343	7·26	..
†Dublin-Lucan Rly.	„ 2	152	16	5	717	— 97	7	..
G.N. and City Rly.	3	2,661	+ 17	5	6,920	+ 119	8·5	..
†L'pool Overh'd Rly.	July 28	1,676	+ 39	.	6,780	+ 299	6·6	..
Llandudno-Col. Bay	Aug. 2	1,178	— 14	35½	8,831	+ 292	6·5	..
Lond. Elec. Ry. Co.	„ 3	23,870	+ 415	5	62,245	— 30	21·25	..
Mersey Railway	„ 3	3,958	+ 223	5	9,956	+ 446	4·5	..
Metropolitan Rly.	„ 4	33,582	+ 673	5	86,261	+ 927	25·75	..
Met. District Rly.	„ 3	23,934	+2,2[illegible]5	[illegible]	61,273	+ 3,[illegible]13	25	..
Anglo-Argentine	„ 5	98,320	+10,767	..	1,575,224	+63,526	..	..
§Auckland	June 28	18,989	+1,662	..	227,976	+18,322	23·31	..
Bombay (B.E.T.)	July 4	5,837	+ 175	27	81,247	+ 4,550	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 6	8,185	+ 491	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	June	8,[illegible]51	..	6	18,657	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	.
Madras	July 31	1,677	+ 116	..	23,135	+ 2,605	13·5	·6
§Montevideo	July	25,495	+3,423	9	263,857	+37,599	..	..
Perth (W.A.)	Aug. 2	8,715	+ 593	..	57,848	+ 8,225	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 6th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	[illegible]		5 2 [illegible]
Do. 4½ % Pref.	10	4½	4½	[illegible]		4 10 [illegible]
Do. Second 6 % Pref.	10	6	6	10½— 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8½— 9	..	5 11 2
Do. 7 % Cum. Pref.	5	7	7	[illegible]	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 [illegible]
Charing Cross, West End & City	5	5	5	[illegible]	..	[illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	[illegible]		4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	[illegible]	..	5 [illegible] 0
Do. Do. 4 % Deb.	100	4	4	[illegible]	..	[illegible]
Chelsea, Ord.	5	5	5	4 — 4½	.	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 [illegible]
City of London, Ord.	10	7	8	17½— 19½	..	4 2 1
Do. 6 % Cum. Pref.	10	6	6	[illegible]	1	[illegible] 17 [illegible]
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	[illegible] —102	..	4 [illegible]
County of London, Ord.	10	5	6	[illegible]	.	[illegible]
Do. 6 % Pref.	10	6	6	[illegible]		[illegible]
Do. 4½ % Deb.	Stock	4½	4½	106 —108	.	4 [illegible]
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 [illegible]
Edmundson's, Ord.	5	Nil	Nil	[illegible]		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	[illegible]	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	.	5 [illegible]
Folkestone	5	6	6	[illegible]	.	[illegible] 11 [illegible]
Do. 5 % Cum. Pref.	5	5	5	[illegible]	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	[illegible]	.	4 14 9
Hove	5	9	9	7 — [illegible]		[illegible]
Kensington & Knightsbridge, Ord	5	9	9	7¼ — 7¾	..	[illegible] 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93 xd	..	4 [illegible] 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	[illegible]	..	5 [illegible] 9
London Electric, Ord.	3	2	2½	[illegible] — 1	..	[illegible]
Do. 6 % Pref.	5	6	6	[illegible]	..	5 9 1
Do. 4 % First Mort. Deb.	Stock	4	4	[illegible]	..	[illegible]
Metropolitan	5	5	4	3½— 4	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	[illegible] — 4		4 17 [illegible]
Do. 4½ % First Mort. Deb.	Stock	4½	4½	[illegible]	..	4 [illegible]
Do. 3½ % Mort. Deb.	Stock	3½	3½	[illegible]		[illegible] 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	[illegible]	..	4 1 [illegible]
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	[illegible]	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgage Red.	100	5	5	[illegible]	.	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	[illegible]	..	[illegible]
St. James' and Pall Mall, Ord.	5	10	10	[illegible]	..	[illegible]
Do. 7 % Pref.	5	7	7	[illegible]	..	[illegible] 7
Do. 3½ % Deb.	100	3½	3½	83 — 86		4 1 [illegible]
Smithfield Markets, Ord.	5	Nil	2	[illegible]— 1½	..	..
South London, Ord.	4	5	[illegible]	[illegible]		5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101		4 19 0
South Metropolitan, 7 % Pref.	1	7	7	[illegible]		5 17 8
Do. 4½ % First Deb. Stock	100	4½	4½	[illegible]	..	4 19 [illegible]
Urban, Ord.	[illegible]	5	..	[illegible]	..	..
Do. 5 % Cum. Pref.	5	5	[illegible]	[illegible]	..	[illegible]
Do. 4½ % First Mort. Deb.	100	4½	4½	[illegible]		5 1 [illegible]
Westminster, Ord.	5	10	10	[illegible]	..	[illegible] 14 [illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	[illegible]	..	[illegible]

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 6th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	[illegible]	..	5 2 2
Calcutta, Ord.	5	8½	[illegible]	[illegible]	.	[illegible]
Do. 5 % Pref.	5	5	5	[illegible]		4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	[illegible]	.	5 2 0
Canadian Gen. El. Com.	$100	7	7†	113 —118	—1	5 18 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	3†	[illegible]	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 [illegible] 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 [illegible] 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	99 —101	[illegible]	4 19 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— ¼	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	[illegible] 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	[illegible]	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	[illegible]		[illegible]
Do. 7 % Cum. Pref.	$100	7	7	108 —111	..	6 [illegible] 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	97 — 99 xd		5 1 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	[illegible]	..	[illegible] 11 1
Montreal, Lt., H. and Power	$100	7	8	233 —243 xd	.	[illegible]
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	[illegible]	[illegible]	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —[illegible]	..	4 [illegible]
Do. 6 % Non-Cum. Pref.	Do.	6	6	[illegible] —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	[illegible]	1	3 [illegible]
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	[illegible] —101½	..	[illegible]
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	[illegible]		5 8 1
Victoria Falls Power, Pref.	1	Nil	11½d.	[illegible]	+	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½—107½	.	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 6th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	Nil	4†	7¼— 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½— 98½	.	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	149 —151	−1	5 6 0
Do. Collat. Trust	$1000	4	4	93½— 95½	− ½	4 3 9
Anglo-American Telegraph	Stock	3¾	3	67½— 69½ xd	−2	5 7 11
Do. 6 % Pref.	Do.	6	6	112¼—113¼ xd	+ 1¼	5 5 11
Do. Def.	Do.	30/-	30/-	26¼— 26¾	+ ½	5 12 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½—104½	..	4 16 2
Chili Telephone	5	7	..	7½— 7¾	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82 — 84	..	4 15 3
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅜— 7⅞ xd	+ ⅛	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128 —131	..	5 6 10
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	98½—100½	..	3 19 7
Eastern Extension	10	7	5†	[illegible]	+ ⅛	5 4 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12⅜— 13	— ⅛	4 12 4
Great Northern Telegraph	10	18	18	28¾— 29¼	+ ¼	6 3 1
Indo-European Telegraph	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	[illegible]	..	3 15 2
Do. 7 % Cum. Partic. Pref.	1	16	17	[illegible]— 4½	— ⅛	3 13 7
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	[illegible]	+ [illegible]	5 6 3
National Telephone	Stock	..	..	..	..	..
Do. Def.	Do.	6	6	142 —144	— ½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99½—100½	..	4 9 7
Oriental Telep. and Elec.	1	8	8	[illegible]	..	4 10 0
Do. 6 % Cum. Pref.	1	6	6	[illegible]	+ [illegible]	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	11 — 11½	..	3 9 [illegible]
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	[illegible] xd	− ⅛	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼— 5¾	..	4 11 0
West Coast of America	2½	2½	2½	[illegible]	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	½	2¾— [illegible]	..	1 16 4
Do. 6 % Cum. 1st Pref.	10	6	6	10¼— [illegible]	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	[illegible]— 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17 7
Western Telegraph, Ltd.	10	7	6†	[illegible]	±	5 4 [illegible]
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 [illegible]
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 6th.	Rise + or Fall	Present Yield p.c.
		1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/16 — 11/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 3 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	40 — 43	—1	..
Do. 5 % Perp. Deb.	100	5	5	97 —100	..	5 0 0
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8	76 — 78	+2	3 16 11
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	2	73 — 75	..	2 13 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & South London, Ord.	100	1½	1¾	32½ — 33½ xd	— ½	4 18 0
Do. 5 % Pref., 1891	100	5	5	106 —108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1901	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1903	100	5	5	101 —103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½ — 11½ xd	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1¾ — 2¼	..	Nil
Hastings Trams, 6 % Pref.	1	Nil	6	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	5 — 5½	..	..
Do. 4 % Deb.	100	4	4	73 — 77	..	5 4 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 6th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol.	100	1⅜	1¾	53 — 53½	-1	3 10 1
Do. Surplus Lands	100	2¾	2⅝	67 — 69	..	4 3 4
Do 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 — 87	—1	4 0 6
Metropolitan District Ord.	100	Nil	Nil	37½ — 38	— ½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	-1	3 19 3
Do. 4½ % First Pref.	100	3½	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛		5 6 8
Do. Def.	1	Nil	..	1/16 — ¼	..	Nil
Do. 5 % Pref.	1	5	5	⅞ — [illegible]	..	5 4 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	98 —101	+1	4 19 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	⅝ — ⅞	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4¼	— ⅛	Nil
Do. "A"	1/-	..	..	⅝ — 11/16	— 1/32	
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	87 — 89	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	6 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5 3/16 — 5 7/16	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 15/16 — 5 3/16	..	5 6 0
Do. 4 % Deb.	100	4	4	93½ — 95	— ½	4 4 3
Do. 4½ % Deb.	100	4½	4½	99½ —101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord.	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99½ —102½	+ ½	4 7 10
B. Columbia Elec. Rly., Def.	100	8	8†	135 —140	..	5 14 4
Do. Pref. Ord.	100	6	6	115 —120 xd	+ ½	5 0 0
Do. 5 % Pref.	100	5	5	106½ —109½	..	4 11 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6½ — 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5 9/16 — 5 13/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	+1	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0
La Plata Elec. Trms, Ord.	1	..	..	½ — ¾	..	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6	1 — 1½	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 —105	..	4 15 2
Mexico Trams Com.	$100	7	7	125 —128	+3	5 9 5
Do. Gen. Con. 5 % Bonds	..	5	5	100 —102	..	4 18 0
Do. 6 % Bonds	100	6	6	102½ —104½	+ ½	5 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	7¼ — 7¾	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	150 —153	—1	3 5 4
Do. 1st Mort. 5 % Bonds	..	5	5	102¾ —103¾	..	4 16 5
Do. 5 % Mort. Bonds	100	5	5	99¾ —100¾	..	4 19 3
Sao Paulo Tram, Lt. and P.	$100	10	10†	260 —265	+3	3 15 6
Do. 5 % 1st Deb.	$500	5	5	106 —108	..	4 12 7
Singapore Trams, 5 % Deb.	100	5	5	82½ — 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video	5	6	7	5⅞ — 6	+ ⅛	5 16 8
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	— ½	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝ — ⅞	..	8 0 0
Do. 6 % Pref.	1	[illegible]	6	11/16 — 15/16	..	7 7 8
Babcock & Wilcox	1	26	28	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1⅜ — 1⅝	..	4 0 0
British Aluminium, Ord.	1	..	..	1/16 — 3/32	..	..
Do. 6 % Cum. Pref.	1	..	..	⅜ — ⅝	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	6⅜ — 6⅝ xd	⅛	4 14 1
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref.	3	Nil	..	7/16 — 11/16	..	Nil
Do. Deb.	100	4	4	58 — 61	—1	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¼ — 11	..	6 16 4
Do. Pref.	5	5	5	4 15/16 — 5 1/16	+ 1/16	4 14 1
Do. Deb.	100	4½	4½	98½ —100½	..	4 9 6
Castner-Kellner	1	17½	20	3⅝ — 3¾	..	5 6 8
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	8	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	66 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb.	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid	5	Nil	..	7/16 — 11/16	— ⅛	Nil
Do. fully paid	5	Nil	..	1⅝ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	¾ — 1 xd	..	7 10 0
Do. Pref.	2	7	7	1⅞ — 2 xd	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb.	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾	..	5 16 8
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	8¼ — 9¼	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	32½ — 34½	..	6 16 6
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

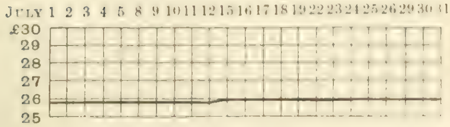
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

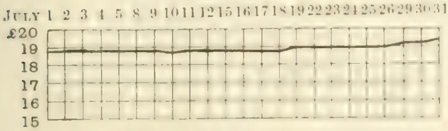
METAL MARKET.

Fluctuations in July.

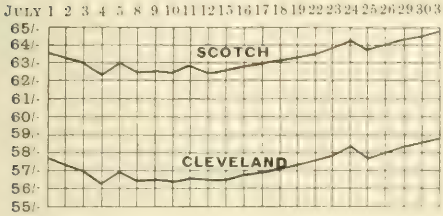
SPELTER (G.O.B's.).



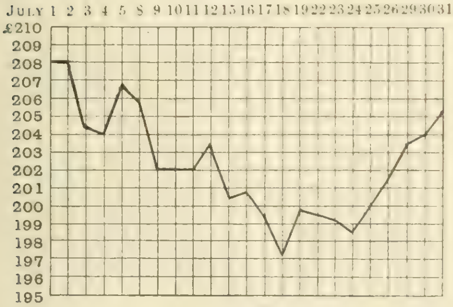
LEAD (ENGLISH).



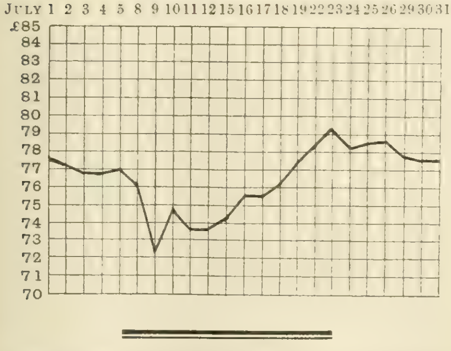
IRON.



TIN.



COPPER (G.M.B's.).



Leigh-on-Sea Electricity Supply.—The U.D.C. has declined to grant an interview to Mr. Speight respecting his proposed application for a prov. order, but has promised to consider any written details respecting his scheme. Alternative schemes for the supply of electricity to the district are shortly to be submitted by the Southend T.C.

OIL FUEL FOR STEAM BOILERS.

Though immense quantities of crude Texas and other petroleum have been burned for power generation under American boilers, the general trend of America in respect of the use of liquid fuel is towards the use of the residual oils, which remain after the lighter portions have been distilled. These residues are generically known as fuel oils, and have come steadily into use during the present century. They are by nature much safer to burn than the crude oils, and can safely be handled by men of a less skilled order, and this is a great factor in pushing their use. While coal prices have been advancing in New England and the Eastern States, the price of fuel oil has been falling to meet the rise, until at present fuel oil is actually cheaper in New England than it is in Texas.

It is more expensive to send oil in tank cars to Western Texas than it is to ship it in barges and tank steamers to New England. And such are the advances in construction and working of tank steamers that petroleum products can be carried more cheaply than any other cargo, and as safely.

According to Mr. B. R. T. Collins, who writes in the *Electrical Review and Western Electrician*, this fuel oil originates chiefly in Texas, Louisiana, Oklahoma and Kansas, a group of States producing 62 million barrels of oil in 1909. This is over a third of the annual production of the United States, though in that year California produced a fifth more than her 1908 production. The four States added 10 million barrels in 1910, and California produced 77 million barrels, thus bringing up the United States production to 216,500,000 barrels. These figures sound large, it is true, but, after all, do but amount to less than two-thirds of a barrel of oil for each ton of coal raised, or less than 10 per cent. of the coal production. The author of the article notes these small ratios, but relies on the rapid increase of oil production to furnish fuel for that increasing class of power plants, which can use it economically, such as—

(*a*) Plants where coal handling is abnormally high by reason of local conditions, such as bad wharfage facilities that can be obviated by a cheap pipe line and storage tanks.

(*b*) Plants which are hand fired. Thus, a plant of 500 H.P. would require four firemen, a water tender, and a coal passer, whereas one man could fire, water-tend, do all tube blowing, and cleaning. This, however, seems to put the case unfairly against coal, for we do not see how a four-boiler plant of 500 H.P. should demand so much labour. We have seen a man fire 75 tons of coal in a factory week, and this represents over 500 H.P.

(*c*) Oil fuel enables an additional power of 35 per cent. to be secured from the same boiler plant, and this is a very cogent argument in favour of oil fuel, where there is not room for further boiler plant, and the same remarks apply—

(*d*) On the ability of a too small stack to do the work when oil fuel takes the place of coal. The bulk of the resistance to draught in a steam boiler is made up by the fuel on the grate, and since this disappears with oil fuel, the area of the stack need not be more than 60 per cent. that necessary for coal.

(*e*) A particular advantage of oil fuel is the ease with which it can be burned without smoke, a feature of very considerable importance in certain factories where soot is undesirable and would damage the goods made. Smoke also is an important feature where

(*f*) There are stringent anti-smoke laws in operation. There is no difference of importance between crude and fuel oil by way of density. The annexed table gives particulars of four crude oils and one fuel oil. The fuel oil has the highest calorific capacity, flash and fire points, and the most desirable sulphur contents per pound. Oil has a calorific value 30 per cent. above coal, and since it can be stored in a less space, its heat value per cubic foot of bunker space is 50 per cent. above that of coal. And this is not all, for oil can be stored in such very awkward corners, that space can be utilised on ships especially, which could not be used for coal. In a modern ship the problem is to get fuel to the boilers, and here, oil lends itself particularly well for it can be piped and involves no labour. Nor does oil deteriorate by storage, though on this point we have M. Bertin to the contrary. But probably M. Bertin spoke of oil not so far reduced as the American reduced fuel oils.

TABLE I.—Properties of Crude and Fuel Oil.

Oil.	Field.	Carbon.	Hydrogen.	Sulphur.	Oxygen.	Specific gravity.	Flash.	Fire.	B.T.U.
Crude	Sour Lake, Tex.*	...	...	...	...	0·9266	198°	...	18,460
Crude	Beaumont, Tex.*	...	...	...	...	0·9179	...	...	18,500
Crude	Beaumont, Tex.†	84·6	10·9	1·63	2·87	0·9240	180°	200°	19,060
Fuel	Beaumont, Tex.†	83·3	12·4	0·50	3·83	0·9260	216°	240°	19,481
Crude	Whittier, Cal.‡...	...	...	...	...	0·9416	...	...	18,513

Authority :—* Prof. A. C. Scott, Texas University. † U.S. Naval Liquid Fuel Board. ‡ Prof. W. C. Blasdale, University of California.

With oil the furnace doors may be always shut and the waste gases may go away cooler because of the greater cleanliness of heating surfaces. Combustion once regulated to its best air supply can be kept so. As a practical point none better is urged than the ability instantly to extinguish a fire if, for any reason, water becomes or threatens to become too low. Equally, the fire can be put into full commission again when the trouble has been surmounted. This is really a most important point, and so also is the case for automatic adjustment of the fire to the steam pressure.

It is only necessary to touch lightly on the absence of dust and ashes, firing tools and general labour costs.

Liquid fuel has its disadvantages, and no oil should be used with a lower flash point than 140° F. This is lower probably than would be considered safe in Great Britain or generally in naval work. Underwriters require oil to be stored underground. Gravity feeds are not permitted in the United States, which is perhaps as well, with flash points of 140° F., and fuel oil must be stored 30 ft. from any building—a somewhat prohibitive clause in a congested area.

With scaling water oil, with its high temperatures, will cause damage to plates, and increase the cost of repairs, though with a proper setting and not too bad a water it is claimed that repairs should be less. One hears whispers, however, that liquid fuel does tend to increase boiler repairs, but those best qualified to tell us seem disinclined to do so, as though, to admit increased repairs, would reflect on their judgment in using liquid fuel at all.

The author of the paper says that steam is a better atomising agent than air, and that the steam to drive an air compressor will do the atomising first hand. But he is not thinking of marine conditions and make-up water. May it not be asked what of the many burners which atomise solely by heavy pressure of the oil itself, using neither steam nor air.

He also advocates a flat flame form of burner as most efficient, and heating of the oil as an aid to economy so long as the oil is not decomposed and carbon deposited in the supply pipes. He advises that the temperature should not exceed the flash point temperature.

Duplicate oil-pressure pumps are recommended to raise the oil from a tank below the lowest supply pipe, the heater to be heated by exhaust steam, a relief valve to return oil when the pressure given by the pump passes a given maximum; gravity return of all oil in pipes to storage, and automatic regulation of both oil and steam to the burners in accordance with the boiler pressure.

It is stated that with Babcock boilers the best results are obtained when the oil is injected from the bridge towards the doors or boiler front.

The general claim for smokelessness made on behalf of liquid fuel is really a signal proof of the efficacy of perfect air mixture in producing perfect combustion. The same effect would be produced with coal smoke if it could be agitated equally violently in close touch with hot coals. Coal dust can also be mixed with air and burned smokelessly. The gases of bituminous coal fail to be smokeless, because they are not burnt hot. Temperature is essential. It seemed once to be necessary with oil to provide refractory-lined furnaces as with coal, but to-day a good deal of oil burning seems to be smokelessly carried out without furnace lining. This is due to the perfection of atomisation obtained.—W. H. B.

REVIEWS.

The Wireman's Pocket-Book and Electrical Contractor's Handbook. By A. W. Robinson and W. E. Warrilow. London: The *Electrician* Printing and Publishing Co., Ltd. Price 5s. net.

A substantial narrow book, handy for the pocket and able to withstand the hurried fumbling of dirty thumbs. The six years which have elapsed since the last revision have wrought many changes, which are reflected in the contents. The authors appear now to cater more for the wireman and contractor than for the mains engineer; even the cover is blue, whereas the reviewer's 1906 copy appears to have been red. All the leading features of the earlier editions concerning cable work are included and brought up to the latest I.E.E. rules. The useful data of fall of potential and current density appear again, but a few more pages on mains testing would have been appreciated by the station men, who, however, will find the present edition a sound excuse for retiring the old red book to the decent seclusion of the book-case.

The authors devote considerable attention to wiring systems. The leading varieties of conduit fittings are illustrated, and there are a few useful notes on wood casing, the value of which material for certain purposes appears to be unknown to many modern contractors.

Concentric systems are clearly described, but comparative costs and notes on the particular advantages and disadvantages of these methods for different classes of work would have been useful.

A new method or material appeals to some because it is new, and it is apt to be employed indiscriminately, whilst others will not use it even for those purposes to which it is particularly adapted on account of personal conservatism, or lack of knowledge of practical points which can only be remedied by experience.

Open wiring is very briefly dealt with. It is now possible to obtain wire insulated with enamel or light rubber and cotton covering, which may be run on porcelain insulators in many cases without breach of regulations, and some notes on these so-called Continental systems, with a clear statement of how and when they may not be used, should be in the hands of every electrical contractor. Open wiring is the original system, it is rational, cheap, subject to few faults, and would probably be a great success if some powerful firm could be persuaded to patent it and endow it with a greco-cockney name.

The chapters on illumination are amongst the most valuable in the book.

The latest arrangements and designs for reflectors and fittings for houses and shops are illustrated, and their correct use is clearly described. Between pages 129 and 172 lies information which should be part of the mental equipment of every canvasser and foreman wireman.

The section dealing with mains work in the former edition has been replaced by copious and practical notes on isolated generating plants; these should be of value to contractors, many of whom neglect this branch of the business although the development of small oil engines and the reduction in capacity of machines and batteries with metal-filament lamps has made the private plant a more attractive proposition to the owners of premises in isolated districts than formerly. The authors make the valuable suggestion that temporary electric supply work should be more sought after, and there can be no doubt that the contractor who will speculate in a portable oil-driven generating set of fair capacity should find ample reward for his enterprise where no public supply is available.

The book concludes with brief but clear notes on A.C. and D.C. motors, diagrams of connections, and a copy of the I.E.E. Rules. Single-phase commutator motors are not discussed, but they will no doubt figure in future editions; at present it is not always recognised by those who work on a single-phase system that any class of power work can be dealt with, and a motor be employed which has all the characteristics of the D.C. machine, and in addition can be controlled by a simple switch.

American Electric Central Station Distribution Systems. By H. B. Gear and P. F. Williams. 1912. London: Constable & Co. Price 12s. net.

A number of articles appeared several years ago in the American *Electrical Age* on central station distribution work. These articles have been revised and extended, and the result is the book under review.

Chapters I, II and III deal respectively with distribution systems, transmission and conversion, and voltage regulation. In Chapter I we have a number of obsolete systems described, as well as the usual modern ones, in Chapter II a quantity of general information—largely quite elementary—and in Chapter III really good descriptions of regulators and compensators, together with the principles of voltage regulation.

Chapter IV treats of line transformers, and since the book pre-supposes "a general knowledge of electrical theory such as is possessed by more advanced students," a great deal of it ought surely to be quite unnecessary.

Chapter V deals with secondary distribution in a more or less familiar style, and there is again a considerable amount of historical and elementary matter. It must be remembered that the economic, industrial and social conditions in the United States are widely different from those obtaining in this country, and data given in books similar to the one under consideration must only be accepted and used after close examination.

Special schemes of transformation and protective apparatus are discussed in Chapters VI and VII respectively. It may at once be said that the information given is distinctly good and accurate, and is, of course, to a large extent independent of what may be termed national conditions.

Overhead construction receives attention in Chapters VIII and IX. These chapters have been carefully and accurately written, and are, perhaps, the best in the book.

Chapter X deals with underground construction. A number of figures relating to the cost of construction are given, some of which are practically identical with those for similar work done in a high-class manner in this country.

Chapter XI is devoted to cable work, and some useful information is given for the heating of paper-insulated cables.

Distribution economics and properties of conductors are treated in the next two chapters, the first subject being admirably discussed, while the latter might easily have been omitted, since the information is practically all contained in an ordinary electrical pocket-book.

The concluding chapter deals with alternating-current circuits and is certainly up-to-date, whilst the formulæ and worked examples appear to be correct.

The book is primarily intended for American engineers and students. It consists of 342 pages only, and the price of 12s. net appears to be excessive.—H. G. S.

Wechselstromversuche. By Dr. Anton Lampa. Brunswick: Fried. Vieweg & Sohn. 1911. Price 5 M.

This book deals with some of the less known branches of alternating current work which are more of scientific interest than of immediate practical importance.

In Chapter I the general problem of an alternating current circuit containing resistance, inductance and capacity is handled, including the production of high-frequency condenser discharges and Tesla currents, and skin-effect phenomena. Chapter II deals with mechanical forces set up by electromagnetic actions, including the Thomson repulsion effect, capacity and inductance measurements by weighing, &c. Chapter III is on the revolving magnetic field and its production by means of direct current, single-phase, and polyphase supplies.

The last chapter deals with the production of electrostatic revolving fields, and their power to set up mechanical rotation, &c.

The writer assumes a fair mathematical knowledge of the subject, and the experiments given are chiefly of a laboratory nature, but full particulars of the apparatus required are given in most cases, so that the book will prove useful for demonstration purposes in the directions mentioned.

Illumination: Its Distribution and Measurement. By A. P. Trotter. London: Macmillan & Co., Ltd. Price 8s. 6d. net.

The writer of this little work is such an accepted authority on his subject that his readers will expect to find it a mine of useful information, and in this they will be by no means disappointed. The great regret one experiences after reading the book is that the author was not able to allow himself time enough to produce a larger treatise. As the book, however, is addressed to engineers of whose work illuminating engineering will probably form only a comparatively small part, the author was no doubt wise in restricting himself almost exclusively to matter which has a direct bearing on the immediate practical side of the subject.

Chapter I deals with "Units and Standards of Candle-Power." Your reviewer cannot agree with the opening statement that candle-power is an accurate expression, "since it is the measure of the rate of expenditure of energy." If the author had referred to spherical candle-power the statement would have been acceptable, but this quantity is rarely referred to in practice, and to confuse intensity with a rate of expenditure of energy is surely very misleading. From this statement it would be right to assume that the output from the lamp can actually be increased by fitting a reflector or lens. Provided that such a fitting does not materially affect the size of the light source, it is still accurate to speak of its "candle-power," and this may be increased in almost any desired proportion. The rate of expenditure of light energy obviously remains as before.

All through, the author seems very fearful least anyone should imagine that light flux is the real entity and candle-power or intensity is merely one of the mathematician's ways of describing its location or distribution. A little more might have been said with reference to glow-lamp sub-standards, as these are now by far the most important to the practical engineer.

Chapter II, "Illumination and Derived Units," deals chiefly with a comparison of various units, and explains how the illumination of a surface may be defined in terms of a distance and a candle-power. The whole difficulty which is discussed on page 16 disappears if illumination be defined in terms of the lumens per unit area. The values given on lines 14 and 15 on page 17 are apparently incorrect, according to the values given for the corresponding standards of intensity in Chapter I. The definition of the lumen at the bottom of page 23 is not at all clear.

Chapter III, on "The Distribution of Illumination," gives instructions as to how to fix the relative spacing and height of uniformly distributing light sources in order to obtain a definite minimum illumination. How to vary the polar curve in order to obtain uniform horizontal illumination might well have been included.

Chapter IV is on "Illumination over a Plane." This chapter contains some interesting examples ingeniously worked out. On page 53 there is a further condemnation of the practice of referring to an illumination in terms of flux per unit area, but on page 56 the author himself falls back on this method. In figs. 29 and 48 the distance between the two lamps in one line should be stated. In referring to diversity factor on page 64, some reference might advantageously have been made to the excessive glare which sometimes accompanies a very low diversity factor.

Chapter V, dealing with "Photometers," is the best in the book, and not only describes the development of every important modern photometer, but, in doing so, gives the reader a clear insight into the best ways of working with them.

Chapter VI is entitled "Accessory Apparatus." This is in every way an excellent chapter, and well supplements the previous one. In fig. 90 the distances should be dimensioned in terms of the diameter of the disk or length of the filament. The denunciation of black photometer rooms is not altogether reasonable. Screens are often inconvenient in practical work, and may sometimes be dispensed with altogether in a black room. The section on the control of electric sub-standards should appear in Chapter I, as the devices described are an essential part of the standard. In the potentiometric arrangement described for measuring pressures, the measuring resistances take a current of 1 ampere; this should be more like $\frac{1}{100}$ ampere, or the resistances should be 100 ohms per volt to be measured.

Chapter VIII relates to "Photometry of Coloured Lights." This is a very suggestive chapter on what is probably the most difficult part of photometry. The use of selective screens appears to require a much higher illumination on the photometer than otherwise in order to make it practical. The work also seems to indicate that to obtain the maximum visual efficiency one should use yellow light.

Chapter IX deals with the usual sources of error and their reduction and estimation. The differention into "candle-power" and "illumination" photometry seems awkward and somewhat unnecessary.

Chapter X, on the "Measurement of Illumination," deals with the construction and use of various illumination photometers. Rather too much space has been devoted to the history of one type of photometer. The daylight "constants" referred to on p. 247 have been shown to be practically meaningless.

Chapter XI, "Examples of Measurements," deals with practical illumination photometry, and indicates the chief difficulties and sources of possible error which are encountered in this class of work.

Chapter XII treats of "Dioptric Distribution and Diffusion of Light." It is not quite evident why the author has dealt only with this method of varying the polar distribution of a light source, as there are obviously many others of equal or greater importance. At the same time the chapter is useful and very instructive.

The Appendix contains various tables referring to cosine functions, and descriptions of short methods for determining the shapes of refracting prisms.

The author's style is very readable, and the illustrations are clear and accurate. Those engineers who desire to become acquainted with modern photometry will find this work a great help, but it is essentially a practical book, and in order to gain the full benefit of the information contained, the reader should also be practising photometry. —L. M.

COMPULSORY PURCHASE OF TRAMWAYS.

[FROM A LEGAL CONTRIBUTOR.]

A correspondent of the Review recently suggested that "As the time must be approaching when many towns will have the option of buying out their tramways from existing companies, I think an article on the compulsory purchase of tramways would be welcome."

Although the matter has been dealt with on former occasions the suggestion is opportune, for the law on the subject is by no means settled. It is the subject of frequent discussions in the Courts; and owing to the fact that various new and important interests have to be considered, it is by no means easy to find every case governed by authority.

The purchase of a tramway takes place compulsorily under and by virtue of Sec. 43 of the Tramways Act, 1870, which is as follows:—"Where the promoters of a tramway in any district are not the local authority, the local authority, if by resolution passed, at a special meeting of the members constituting such local authority, they so decide, may within six months after the expiration of a period of 21 years from the time when such promoters were empowered to construct such tramways, and within six months after the expiration of every subsequent seven years, or within three months, after any order made by the Board of Trade, under either of the next two preceding sections with the approval of the Board of Trade, by notice in writing require such promoters to sell, and thereupon such promoters shall sell to them their undertaking, or so much of the same as is within their district, upon terms of paying the 'then value' (exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale, or other consideration whatsoever) of the tramways, and all lands, buildings, works, materials, and plant of the promoters suitable to and used by them for the purpose of their undertaking within such district, such value to be in case of difference, determined by an engineer or another fit person nominated as referee by the Board of Trade on the application of either party, and the expenses of the reference to be borne and paid as the referee directs, and when any such sale has been made all the rights, powers and authorities of such promoters previous to the making of such order in respect of the undertaking sold, shall be transferred to, vested in, and may be exercised by, the authority to whom the same has been sold, in like manner as if such tramway was constructed by such authority under the powers conferred upon them by a provisional order under this Act, and in reference to the same they shall be deemed to be the promoters."

The section then sets forth the regulations whereby the local authority is to act, &c., and continues, "Subject and according to the preceding provisions of this section, two or more local authorities may jointly purchase any undertaking, or so much of the same as is within their respective districts."

A number of interesting points arise in connection with this section, the importance of which to "undertakers" has been enhanced in recent years. Among the points which arise, the following, with which we propose to deal in order, seem to be the most material:—"(*a*) The length of the period within which the right of compulsory purchase may be exercised; (*b*) the meaning of the term 'undertaking'; (*c*) the correct method of assessing the 'then value'; (*d*) the question whether the section makes adequate provision for the development of an electric tramway system over an area which includes the districts of several local authorities."

(*a*) *The Length of the Period within which the Power of Compulsory Purchase may be Exercised.*—It has often been a subject of complaint that the period of 21 years is too short, having regard to the fact that at the conclusion of that period the local authority are empowered to buy up the tramway company's undertaking at old iron prices without any compensation whatever for compulsory purchase. If such period were too short in the case of a tramway system where horse traction was in vogue, it is clear that a very much longer period should be allowed when the company has been put to the expense of laying down a costly permanent way and trolley wires, together with a power station. It is with this end in view, that the length of the period is usually increased where special powers to change from "horse traction" to electricity are conferred by a special Act. In this connection it is significant to remark that the Legislature has made a concession of further time in the case of electric lighting installations. Thus, while the Electric Lighting Act of 1882 provided that the local authority might purchase an undertaking at a cost price within 21 years, the clause being very similar to that set out above, the Act of 1888 extended this period to 42 years. It is submitted that the same course might with equal justice be adopted in the case of tramways.

(*b*) *The Meaning of the Term "Undertaking."*—This word is not defined in the Tramways Act, 1870, and reliance has to be placed on the Provisional Order itself. Thus, in the Metropolitan Street Tramways (Extension, &c.) Order, 1873, it is provided that the expression "the tramways," or "the undertaking," shall mean the tramways and works and undertaking by this order authorised. Such a definition, however, fails in the important particular that it does not differentiate between tramway and undertaking. It was said by Lord Watson, in the case of the London Street Tramways Co. *v.* the London County Council (1894), A.C. p. 474, that: "The word 'undertaking' is not defined in the Act, but it appears to me that it must signify all the real and movable property belonging to the promoters necessary for conducting tramway traffic, together with all rights and interests in, or connected with, such property which belong to the promoters, and are capable of being transmitted from them to the purchaser. I do not think the word can reasonably be construed so as to include any property, or any right or interest, which does not belong to the promoters, and does not pass from them to the purchaser under the compulsory contract of sale. On the assumption that the promoters' privilege of use is personal, and, therefore, limited to the period during which they may continue to be owners of the tramway, the privilege of use after the expiry of that period, which they did not possess, cannot be regarded as part of the undertaking which they are required to sell."

But, even assuming that "undertaking" includes, to use the words of Mr. Sewar Brice in his work on "Tramways and Light Railways," everything possessed by a company in respect of its enterprise. the question remains, Can any part of the undertaking be purchased at one time, and the purchase of the remainder be postponed? It frequently happens that the undertakers are working one entire scheme under a number of independent provisional orders, each applying to some part of the whole. In such circumstances, can the right under one provisional order be taken over to the exclusion of others? In the North Metropolitan Tramways Co. *v.* The London County Council (12 T.L.R., 101), it was shown that the company's tramways were authorised by three private Acts, passed in 1869, 1870, 1871. The London County Council gave notice requiring the company to sell only so much as was authorised by the Act of 1871. The company claimed that the Council, if they purchased any, were bound to purchase the whole of the company's undertaking, as the word "undertaking" as used in this Act of 1871, meant the undertaking of the company as authorised by all three Acts. The Court of Appeal, however, determined that when there are successive special Acts or Provisional Orders, the separate sets or groups of tramway lines may each be an undertaking, and that the local authority can in such circumstances purchase compulsorily the whole undertaking piecemeal. The existence of such a power militates against that unity of working which is so essential to the successful working of every tramway system.

The authority will be bound to take and pay for a depôt which is "suitable to and used for the purposes of" the undertaking within their district, although the depôt is situated outside their district. A finding that a "depôt" is used "with" and is suitable to on undertaking is sufficient to create this liability. The words "within such district" in the section qualify the word "undertaking," and not the words "lands, buildings, works, materials and plant of the promoters." The "then value" means the value at the date of the notice to the promoters, and not the value to the purchasing authority. The promoters are under no obligation to make a good title to the adjuncts and accessories for which the purchasing authority has to pay; but defects in title may be taken into consideration by an arbitrator when fixing the price to be paid (*in re* Manchester Carriage and Tramway Co. *v.* Swinton and Pendlebury U.D.C. (1906) A.C. 277).

If the arbitrator finds as a fact that all the depôts and plant are suitable to, and are used for, every part of the system, his finding on this question of fact cannot be disturbed (Manchester Carriage and Tramway Co. *v.* Manchester Corporation (1903) 67 J.P. 14.)

(*c*) *The Correct Method of Assessing the then Value.*—It is necessary to approach the determination of the question, What is the then value? with the understanding that while past and future profits cannot be considered, the undertaking is a profit-earning concern at the time of the valuation. It is clearly established that the term "value," as here used, is something distinguishable from "price." So in Elston *v.* Rose (L.R. 4 Q.B. 4) the "value" of certain tenements was decided to be actual marketable value, of which the rent at which the premises would let was a fair criterion. Again, in the case of Dobbs *v.* Grand Junction Water Works Co. (9 A.C., 57) Earl Selborne said: "When we have to deal with the word "value," we must take that word in its natural sense, unless there is something in the Act which points to an artificial or arbitrary sense, which I do not discover." An inquiry into the exact meaning of the word "value," and the accurate estimate thereof, is the more important seeing that no generous 10 per cent. is allowed as compensation for the compulsory purchase. The fact that future profits may not be taken into consideration will shut out all evidence to the effect that the annual income of the undertaking is on the increase, or that the company had contemplated, or might in the future contemplate, the substitution of electricity for horse power.

As to what other powers may lawfully be taken into consideration in order to enhance the purchase price, there are statutory powers connected with the use of a tramway which are of considerable value—such, for instance, as the use of the highway. These statutory rights are often sold for large sums by one company to another. It is sometimes argued that, as soon as the conveyance of a tramway undertaking is executed, or as soon as the award is made, these statutory rights come to an end, and that they cannot, therefore, pass to the purchaser. That such a contention is fallacious appears to be established by the fact that a mere licence revocable at will, is often made the subject of valuable consideration. In Holt *v.* Gas Light Co. (L.R. 7 Q.B. 728), for instance, a gas company were held liable to pay compensation to the plaintiff when taking over certain land over which he had by mere verbal licence a right of shooting. Again, in Metropolitan Board of Works *v.* McCarthy (L.R. 7, H.L. 243), the right of the defendant, as one of the public, was held to be proper subject matter for compensation, as "the Legislature never intended that the community should profit at the expense of a few of its members."

In the London Street Tramways Co. *v.* the London County Council ((1894), A.C. 489), the following facts were proved: Sec. 44 of the London Street Tramways Act, 1870 (33 and 34 V. cclxxi), enacts that the Metropolitan Board of Works may, after 21 years from the passing of the Act, require the London Street Tramways Co. to sell to them their undertaking upon terms identical with those prescribed by Sec. 43 of the Tramways Act, 1870, viz.: upon the terms of paying the then value (exclusive of any allowance for past or future profits of the undertaking or any compensation for compulsory sale, or other consideration whatsoever) of the tramway, and all lands, buildings, works, materials and plant of the company suitable to and used by them for the purposes of their undertaking. The London County Council, as successors to the Metropolitan Board of Works required the company to sell. It was decided, Lord Ashbourne dissenting, that the word "tramway" meant the structure laid down and nothing more, and did not include the statutory powers conferred upon the company; and that the arbitrator was right in rejecting all evidence of the rental value of the past and future profits, including evidence of the rental value of the tramways considered as let or capable of being let to a tenant, and in awarding that the then value of the tramway, and all lands, buildings, works, &c., must be measured by what it cost to establish the tramway if it did not then exist, subject to a proper deduction in respect of depreciation. In the Edinburgh Street Tramways Co. *v.* the Provost of Edinburgh (1894) A.C. 456, a case practically on all fours with that to which we have just alluded, it was decided that on a compulsory sale to the local authority, the local authority becomes entitled to the exclusive use of the tramway, not by transference of any right from the promoters, but by virtue of the Statute alone. Secondly, that the word "tramway" cannot be read as synonymous with "undertaking," but is used in the Act as meaning the structure laid down on the highway, and nothing more; therefore, the "then value of the tramway" must be measured by what it would cost at the date of the sale to construct the lines, subject to a deduction for depreciation, and that rental value must not be taken into consideration.

Mr. Seward Brice commenting upon the above case in his able treatise on "Tramways and Light Railways" submits, in spite of these decisions: (*a*) That as the undertaking is sold, so it is to be paid for; (*b*) that subject to this, there is not to be any addition to or subtraction from the amount which would be otherwise arrived at for past or future profits, the whole of "the tramway and all lands, buildings, works, materials and plant of the promoters suitable and used by them for the purposes of their undertaking," are to be valued *en bloc* as a united entity, and not piecemeal; (*c*) that this valuation in substance amounts to a valuation of the undertaking in question as a going and present profit-earning concern, and includes a proper sum in respect of the statutory powers and privileges; (*d*) that the statutory powers and privileges pass by the conveyance and not by the statute, and even if the statute transfers them, they are a benefit vested in the seller and taken from him by the purchase, and therefore to be paid for, there being no words to negative this; (*e*) that "value" in the section has its ordinary meaning, and is not altered into or synonymous with "cost."

In an arbitration to settle the amount payable by a local authority upon the purchase of a tramway undertaking under Sec. 43, the arbitrator must take into account the costs incurred by the undertakers in obtaining Parliamentary powers to construct and work the tramways, and no allowance should be made for depreciation under that head. The arbitrator, however, must not take into account the costs incurred by the undertakers in opposing Bills in Parliament for the purpose of protecting their undertaking (*in re* Manchester Carriage and Tramway Co., Ltd., *v.* Ashton-under-Lyne Corporation (1905) 68 J.P. 576). It has also been held that in assessing the then value of the tramway under Sec. 43 the arbitrator ought not to take into consideration the fact that the local authority would contribute towards the street widening if they constructed the tramway at the date of the notice to purchase (*in re* London, Deptford, and Greenwich Tramways Co. *v.* London County Council (1905) 1 K.B. 316). In North Metropolitan Tramways Co., Ltd., *v.* Leyton U.D.C. (1907) (71 J.P. 536), it appeared that a tramway sought to be purchased, passed for some distance over private land, and for at least a distance of 62 ft. penetrated within the entrance gates of a large car factory erected on their land by the company, and for at least 4 ft. 8 in. under the roof, and within the walls of the car factory. An arbitrator found that the car factory was not suitable to and used by the company for the purposes of their undertaking within the district, and his award determined the value of the portion of the permanent way of tramway No. 13, which was on the private land, including the entrance gates, but not including the value of any buildings, to be the sum of £125. It appeared that upon a contention as to whether the car factory was severable or not, the Council and the company had agreed that the Council should either purchase the whole of the car factory, or none at all. It was held that as part of the tramway No. 13 ran into the car factory on to private ground, the Council must pay for not only the materials of the tramway, but also for some easement or some estate or interest in the soil on which the tramway ran; it was further held that the agreement made between the Council and the company did not, on that account, oblige the Council to purchase the whole of the car factory, as the agreement was not made with reference to this easement or interest. As it did not appear that the arbitrator had not allowed for this easement or interest in the £125 awarded for the part of tramway No. 13, the award would not be remitted to him upon that point.

(*d*) *Does the Section make Adequate Provision for the Development of an Electric Tramway System over an Area which includes the Districts of Several Local Authorities?*—We have seen that two or more local authorities can only enter into an agreement to buy up a tramway undertaking subject and according to the provisions of Sec. 43. They must, therefore, conform to the periods of time referred to. It is not difficult to see that this rule may hamper, if it does not entirely prevent, the development of a system of intercommunication between neighbouring districts under the care of several local authorities. To take an illustration: Suppose that a private company obtained a Provisional Order for a tramway in Blackacre in the year 1880, and that a second company obtained a similar order in the neighbouring district of Greenacre in 1883. The rural district Councils of these two districts come to the conclusion that the two systems should be united, and that the united tramways should be worked by the local authorities. The Blackacre Rural District Council can purchase in 1901 or in 1908, &c., the Greenacre Rural District Council cannot take over the trams in their district until 1904, or at the end of each recurring period of seven years. A serious difficulty is thus placed in the way of the development of tramway systems over wide areas in the hands of local authorities.

THE RIGHT TO SUPPLY ELECTRICITY PRIVATELY.

[FROM OUR LEGAL CONTRIBUTOR.]

The fact that queries relating to the supply of electricity, otherwise than in accordance with the terms of a provisional order, continue to be addressed to the Editors of the Review, goes to show that there are a good many people who do not wholly appreciate the effect of the Act which came into force in 1910.

For the benefit of such persons it may be well to set forth and explain the leading provisions of the Act of 1909. Prior to April 1st, 1910, the law gave no direct power to authorised undertakers to interfere with, or prevent, the private supply of electricity in their district. No such restriction was to be found in the Electric Lighting Acts. The Act of 1882 made no provision for regulating the supply of electricity, otherwise than under a provisional order or a special Act. Thus, after that Act was passed, whereas persons who supplied electricity under a provisional order were subject to elaborate rules made by the Board of Trade in carrying out the details of their undertaking, the owners of an installation who furnished their neighbours with a private supply were under no restrictions whatever.

For instance, by regulations made under the Act of 1882, the use of aerial lines was very much restricted, but these rules only applied to statutory undertakers.

The law is different owing to the Electric Lighting Act, 1909, which came into force on April 1st, 1910. The private supply of electricity in an area where there is a provisional order in force is absolutely prohibited—except in certain special cases. Of course, the prohibition does not affect any area where there is no provisional order in force. In such places private supply may go on as before.

The exceptions to the general rule are of considerable importance. In the first place, it merely prevents anyone from commencing to supply electricity in the prohibited area after April 1st, 1910. Further, in the case of a district where there is now no provisional order, the fact that a provisional order is hereafter obtained to allowed a supply to be given in that area, will not enable the company or local authority obtaining the order to secure the closing down of all private installations in the district.

Again, the provision does not apply to a man who makes no business of supplying electricity, but who happens to have an installation and who allows his neighbour to have a supply. Whether a man is making a business of this kind must, of course, be decided as a question of fact, and will probably come before the Courts before long. Again, the question is sure to arise whether the charging of accumulators constitutes a supply within the meaning of the Act.

It follows that although the private supply of electricity is limited it continues to exist; and it is therefore necessary to follow the rules and regulations under which such business may be carried on.

It was in order to bring private supply companies and persons supplying electricity privately under this jurisdiction of the Board of Trade that a special clause was inserted in the Electric Lighting Act of 1888. By Sec. 4 of that Act it is provided that where in any case any electric line or other work may have been laid down or erected in, over, along, across, or under any street for the purpose of supplying electricity, or may have been laid down or erected in any other position for such purpose, in such a manner as not to be entirely enclosed with any building or buildings, or where any electric line or work so laid down or erected may be used for such purpose otherwise than under and subject to the provisions of a licence or provisional order, the Board of Trade may, by notice served upon the body owning or using the line, require that such line shall be continued and used only in accordance with the conditions and rules which they may prescribe.

A proviso excepts from the operation of that section "every electric" line or work laid down or erected by any body or person for the supply of electricity generated upon any premises occupied by such body or person to any other part of such premises.

Any person failing to observe the Regulations and Orders of the Board of Trade is subject to penalties. The Board of Trade regulations are similar to those which have to be observed by companies and local authorities which supply electricity under statutory powers. Regulation 2 prohibits earth connections except in the manner there provided. Regulation 4 limits the pressure between any two conductors or between any part of either conductor and the earth to 3,000 volts. Regulation 14 substitutes 100,000 watts for the 300,000 in the ordinary regulations as the limit which a high-pressure electric line may be used for transmitting. Regulation 17 provides precautions against injurious effects due to induction, while Regulation 18 contains special provisions for the protection of the Postmaster-General.

Compliance with the Board of Trade Regulations does not always completely protect a man who supplies electricity in the manner above described. He may have to observe certain by-laws issued by the local authority of the district in which his works are situated.

If a person supplying electricity without a provisional order desires to extend his operations, considerations arise which must be duly observed. Thus, he may find it necessary to place his mains under or across a highway; and the highway authority must, as a rule, be consulted, either when the surface of the road is to be torn up, or when wires are to be suspended above it. In some cases the local authority own the freehold, in which case they are entitled to everything which is below and above the surface of the street. In other cases their authority extends merely to the surface, and so long as the surface and the free passage of the public to and fro are not interfered with, the landowners on either side, in whom the freehold of the road is vested, can authorise the suspension of the wires over the road at any height they choose, so long as the wires are sufficiently high to be out of the reach of the passing traffic.

In urban districts the local authority by adopting Part II of the Public Health Acts Amendment Act, 1890 (53 and 54 Vic., c. 59), may acquire power to make by-laws for the prevention of danger or obstructions to the public from posts, wires, tubes or any other apparatus stretched or placed above, over, along, or across any street (whether before or after the adoption of that part of the Act) for the purpose of any telegraph, telephone, lighting, railway signalling or other purpose. Again, in the case of London, overhead wires can only be erected in accordance with by-laws made under the London Overhead Wires Act, 1891.

Having drawn attention to the fact that the regulations made by the Board of Trade and the local by-laws must be observed by those who undertake the private supply of electricity, we have enumerated all the matters to which the attention of a person who desires to supply electricity should be directed. In other respects he is upon the footing of a trader in any commodity. He can make what contracts he likes with his consumer, he can grant a supply at whatever price he thinks proper. Moreover, his operations cannot be interfered with by any local authority or company, unless such body has statutory powers to supply electricity in the district.

THE CORROSION OF IRON AND STEEL.

The importance of the question of the relative amounts of corrosion which take place in iron and steel is becoming more fully recognised every day; but it is doubtful whether engineers who have to design and specify for submarine cables have yet grasped the full significance of the matter. An exception, however, must be made as regards the British Post Office; this Department has for some time recognised that, as regards its cables, the question of durability is of more importance than initial strength, and that although steel sheathing wires (or what is practically steel) may have a greater breaking strain than iron, yet this strength (which is unnecessary for the very moderate depths in which the cables have to be laid) is obtained at the expense of durability. Recent cables (the Anglo-Belgian telephone cable, for example) have accordingly been sheathed with iron wires of the quality technically known as "ball-furnaced iron," and it is intended, we believe, that this practice shall be continued for the future, and the use of steel wire entirely abandoned. In connection with this matter, the following article, which appeared in the July issue of *The Telephone Engineer*, is of great interest:—

While steel has greater tensile strength, greater rigidity, and is cheaper to produce in large quantities than wrought or "puddled" iron, it is far more susceptible to the corroding influences of moisture, coal gas, smoke fumes, or sea water. Besides its weakness in the last-mentioned respect, steel is also greatly influenced by electrolytic action, or by intermittent currents of electricity, in spite of its greater hardness and density. It should be understood that in this article we refer only to the common grades of carbon steel, produced by the Bessemer and open-hearth processes, and not to the recent alloys, any of which are far superior to iron in their corrosion-resisting properties.

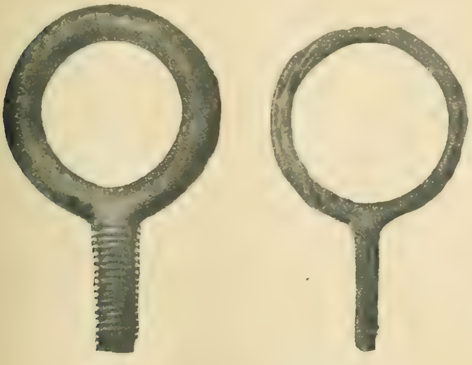


Fig. 1.—Iron and Steel Eye Bolts.

Relative effects of corrosion on iron and steel have long been noticed on sheet metal and terne plate roofs, where the life of steel is only a small fraction of that of iron, especially when subjected to sulphur-laden gases from burning coal. A common explanation of this phenomenon that is current among steel men is that the slag which always exists in wrought iron forms a protective coating around the iron, shielding it from the effects of moisture, while steel, lacking this silicious coat, is attacked immediately.

In a pamphlet issued by the United States Department of Agriculture, Dr. A. S. Cushman, the author, arrives at the following conclusion in addition to the one just named:—

That the presence of, and the irregular distribution of, manganese in steel, there being little if any of this substance in iron, causes the disintegration of the steel through electrolytic action set up by the minute local currents maintained by the difference of contact potential between the two metals. In addition to the manganese, current flow also results from the various metalloids.

Since the conditions which produce electrolytic action also produce corrosion, the purer the iron the greater the homogeneity of the iron, and the less the segregation of metalloids, the less likely are the electrolytic effects to become serious. These points constitute the essential problems which confront the manufacturer who desires a metal that will have a high resistance to corrosion.

In order to produce a steel that would approach puddled iron in its resistance to corrosion, the American Rolling Mill Company of Middletown, Ohio, began experiments to determine whether a steel could be produced in an open-hearth furnace that would be free from carbon, manganese and impurities of a like sort that are instrumental in producing electrolytic action. This led to burning out even more carbon than was common in the ordinary process of manufacturing steel, and was an elimination process, pure and simple, as no elements were afterward added either in the furnace or in the ladle. The iron thus produced was of more than ordinary purity, which was afterwards cast into ingots and rolled.

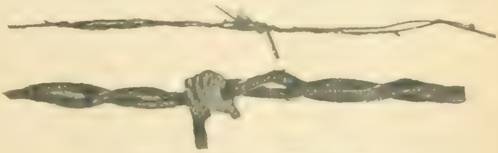


Fig. 2. Iron and Steel Wires.

The analysis of this new process iron, in comparison with commercial steel, averaged as follows

	Commercial steel.	American ingot iron.
Sulphur	0·048	0·020
Phosphorus ..	0·086	0·006
Carbon	0·110	0·026
Manganese ..	0·480	Trace
Silicon	Trace	Trace

It should be borne in mind that these determinations were made from fractions of the same original ingot, and consequently the results show the complete elimination of two elements that existed in the original source.

After the analyses, corrosion tests were made of the two samples, which consisted of an immersion in a 5 per cent. solution of sulphuric acid for twenty-four days. The loss of weight was as follows:—

Loss in weight, commercial steel	14·41 per cent.
Loss in weight, ingot iron	0·21 per cent.

This shows that the loss in the case of the commercial steel was very nearly 70 times that of the ingot iron in the same time, and under equal conditions. The ultimate strength of the ingot iron was from 49,000 to 51,000 pounds per square inch; elastic limit, from 35,000 to 41,000 pounds per square inch, and elongation from 40 to 48 per cent.

The two illustrations accompanying this article show the comparative rates of solution of steel or charcoal iron and ingot iron after immersion in a 25 per cent. solution of sulphuric acid. The eye-bolts in fig. 1 were treated in the bath for six hours, one being of charcoal iron and the other ingot iron. At the end of this time the ingot iron bolt showed a loss of 15·5 per cent., and the charcoal iron bolt a loss of 77·3 per cent.

In fig. 2 are shown two specimens of wire, of ingot and steel respectively. The difference in rate of solution was even greater in the case of the wire than with the eye-bolts, as the ingot iron wire lost but 6·1 per cent. in one and one-half hours, and the steel wire 92·3 per cent. in the same length of time.

Wimbledon Lighting.—In regard to the agreement between the T.C. and the Fixed-Price Light Co., Ltd., as to the terms upon which electrical energy would be supplied to customers of the company within the Corporation's area of supply, Clause 11 of which provided that the Council might determine the agreement if, at any time after December 31st, 1915, the sum payable by the company to the Corporation for electrical energy supplied to the customers of the company, should, for two consecutive periods of 13 weeks each, be less than £100, the Electricity Committee has decided to alter the clause so as to read, "should, for four consecutive periods of 13 weeks each, be less than £400 in the aggregate."

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,992. "Apparatus for the production of electric power for use in connection with wireless telegraphy or wireless telephony on aeroplanes and waterplanes." C. Grahame-White and H. Fothergill. July 22nd.

17,029. "Device for automatically adjusting the time of ignition in internal-combustion engines using magneto-electric ignition." Firm of R. Bosch. (Convention date, September 2nd, 1911, Germany.) July 22nd. (Complete.)

17,031. "Electric cooking and heating apparatus." R. F. Venner. July 22nd.

17,086. "Cell-testing voltmeter." A. H. Clutterbuck. July 23rd.

17,110. "Switchboard connecting-cords and the like." P. P. Craven. Addition to 11,306/12.) July 23rd.

17,151. "Plug connections for electrical work." A. A. Warner. July 23rd. (Complete.)

17,152. "Automatic electrical machine." L. Bauer and A. Ficker. July 23rd. (Complete.)

17,153. "Electric synchronisation of clocks by signals from observatories or distributing centres." W. J. Polyblank. July 23rd.

17,164. "Electric lighting systems and means for eliminating sparking in rotating switches or commutators." A. F. D'Andria and F. R. S. Eeles. July 23rd.

17,171. "Telephone mouthpieces." E. Björnson and J. Hilditch. July 23rd. (Complete.)

17,214. "Device applicable to boots and the like for use with amusement devices of that kind which are in the form of magnetised or like floors or tracks." J. Lear. July 24th.

17,214. "Recording instruments and the like." Evershed & Vignoles, Ltd. and G. W. Binstead. July 24th.

17,247. "Electric floor lamps." G. Maurice and L. G. Byng. July 24th.

17,306. "Control of electrically-operated self-propelled vehicles." H. B. van Daalen and H. P. Schreiber. July 25th. (Complete.)

17,346. "Apparatus for transforming direct electric current into alternating current." P. Hildebrand. (Convention date, February 14th, 1912, Germany.) July 25th. (Complete.)

17,357. "Loud-speaking attachment for telephones." H. W. Prance. July 26th.

17,369. "Electric motors." A. Downes. July 26th.

17,386. "Distribution of electricity by alternating currents." A. W. Ashton. July 26th.

17,388. "Electrical recording instruments." W. R. Cooper. July 26th.

17,391. "Construction of field-magnet for dynamo-electric machines." M. A. McLean. July 26th.

17,437. "Magneto-electric and alternate-current machines." Societe d'Electricite Nilmelior. (Convention date, February 16th, 1912, France.) July 26th. (Complete.)

17,442. "Cord grip for electric lampholders." T. M. Cockroft. July 27th.

17,443. "Apparatus for use on aeroplanes and hydro-aeroplanes for radiating and receiving electromagnetic waves in connection with wireless telegraphy and wireless telephony." H. Fothergill and C. Grahame-White. July 27th.

17,453. "Manufacture of foot, step or insulator bracket for telegraph and like poles." H. Lench. July 27th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Methods of and Means for Changing the Frequency of Alternating Electric Currents. A. M. Taylor. 8,853. (Cognate applications 9,493 of 1911, 11,775 of 1911, 20,761 of 1911, and 21,321 of 1911.) April 10th.

Printing Telegraphy. C. Kinsley. 15,559. July 4th.

Gyro-Navigation Apparatus. E. A. Sperry. 15,669. July 5th.

Gyro-Navigation Apparatus. E. A. Sperry. 15,679. July 5th.

Telephones. C. F. Killar. 15,725. July 6th.

Senders for Electric-Signalling Systems. G. Brown. 16,074. G. Brown. July 11th. (July 11th, 1910.)

Electric Transportation Systems. A. G. Seaman and New Transport Co. 16,160. July 12th.

Electric Arc Lamps. A. Ogilvy-Webb and R. C. A. Reinecke. 16,367. July 15th.

Conduits or Casings for Electric Conductors. A. E. Woodhouse. 16,489. July 18th.

Automatic and Semi-automatic Telephone Exchange Systems. F. R. McBerty. 16,869. July 22nd. (July 23rd, 1910.)

Telephones. B. Gwozdz. 17,363. July 29th. (June 3rd, 1911.)

Control of Trackless Trolley Vehicles and the like having Auxiliary Batteries for Independent Propulsion. W. A. Stevens. 17,281. July 31st.

Reversible Galvanic Batteries. W. Morrison. 18,360. August 14th. (October 10th, 1910.)

Interrupters for Use in Electric Ignition Systems for Internal-Combustion Engines. L. J. Flint. 18,701. August 19th.

Multiple Arc Lamps. J. Wetter. (Ges. fur Maschinen und Metall-Industrie.) 18,025. August 23rd.

Magneto-Ignition for Internal-Combustion Engines. J. E. F. Cambessedes. 19,025. August 24th. (August 24th, 1910. Addition to 13,633 of 1911.)

Method and Arrangement for producing Electrically Luminous Letters, Inscriptions, Lines, Figures and the like by Means of High-tension Discharges. A. Laszlo. 20,201. September 12th. (March 16th, 1911.)

Telescoping Masts. Société d'Electricité Mors. 22,403. October 11th. (October 13th, 1910.)

Electric Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 22,548. October 12th.

Regulation of Alternating-Current Dynamo-Electric Machinery and Means therefor. Siemens Bros. Dynamo Works, Ltd. (F. E. Thrupp.) 22,757. October 16th.

Electrical Switches. C. L. Terry and P. Townsend. 22,895. October 17th.

Apparatus for Electric Light Advertising and Illuminations. A. B. Barker and J. H. Barker. 23,546. October 25th.

Common-Battery Telephone Systems. Aktiebolaget L. M. Ericsson & Co. 23,824. October 27th. (November 9th, 1910.)

Common-Battery Telephone Systems. Aktiebolaget L. M. Ericsson & Co. 23,918. October 28th. (February 7th, 1911. Addition to 23,824 of 1911.)

Electric Arc Lamps. A. H. Railing and A. E. Angold. 23,990. October 30th.

Dry-Battery Cells. J. Rudolphs. 24,031. October 30th.

Dynamo-Electric Machines of the Compensated Type. British Thomson-Houston Co. and Neild. 24,570. November 4th.

Methods for the Determination and Transmission of the Direction of the Earth's Magnetic Field. W. Burstyn. 28,725. December 20th. (December 21st, 1910.)

Process for Sterilising Water or other Liquids by Means of Ultra-Violet Rays produced in a Quartz Lamp and Apparatus therefor. W. P. Thompson. (Ozongesellschaft.) 28,757. December 20th.

1912.

Electric Circuits and Fittings therefor. J. H. Cave. 1,264. January 16th.

Masts for Use in Wireless Telegraphy Installations. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 2,770. February 2nd.

Means for attaching Dynamo-Electric Machines adapted to be driven by Velocipedes, Wheels and the like. C. Schlick. 3,061. February 6th.

Process or Method of Nickel-Plating. W. Feuerhake. 4,125. February 19th.

Method of and Means for Jointing Electric Wires and Cables. J. Stratton and E. A. Claremont. 4,671. February 24th.

Sparking Plugs. H. Zimmermann and R. Slaby. 5,302. March 2nd. (March 10th, 1911.)

Sparking Plugs for Internal-Combustion Engines. L. Revault. 6,398. March 14th. (March 18th, 1911.)

Detectors for Wireless Telegraphy. G. W. Pickard. 7,251. March 25th. (July 24th, 1911. Addition to 18,842 of 1907.)

Manufacture of Electric Accumulator Electrodes and Means for Use therein. R. Pape. 7,999. April 2nd.

Arrangement for Indicating the Interruption of a Circuit in Electric Lighting Installations on Motor-Cars or like Vehicles. C. A. Vandervell and A. H. Midgley. 8,039. April 3rd.

Electricity Meters. Isaria Zahlwerke Akt.-Ges. 8,226. April 4th. (Apri 7th, 1911.)

Arrangements for Determining Position by Means of Electro-Magnetic Waves. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 8,559. April 11th.

Drawn-wire Tungsten Filaments.—The drawn-wire tungsten lamp has now been openly marketed as such for more than a year; it is easier and cheaper to make than those with squirted filaments, and it is far stronger than the latter until it has been in circuit for some time. The advantage of the new type to the consumer appears to be limited to the lower retail price and greater robustness of the lamps before use. These views have been expressed by a number of competent judges during the past few months, and the following explanation of the matter was published in a recent issue of *l'Industrie Electrique* by M. A. Bainville.

After a preliminary review, of no immediate interest in the present connection, the author remarks that whereas "squirted" filaments have an agglomerate structure, drawn-wire filaments have a far better structure, mechanically, when new. But, whereas the expansive forces in the heated filament and the sustained high temperature during working tend to improve the sinter or weld between the particles of a squirted filament, thus leading to a slow and slight increase in mechanical strength, pure tungsten which has been reduced to a malleable state by hammering, rolling, and so on, before drawing, gradually assumes a brittle and crystalline structure during working, and the mechanical strength is then seriously reduced. Drawn tantalum filaments show a similar molecular change which is, however, slower in evolution, probably owing to the less severe rating of the filament. It is suggested that the rapidity of crystallisation varies with the working temperature and mass of the filament for any particular metal, with a different coefficient for different metals.

According to M. Bainville, the practical case for and against squirted and drawn-wire filaments is as follows:—

"Squirted" or "Chemical" Filaments have to be made individually, and differ considerably one from another, thus involving careful trials, which are costly to conduct and which involve a considerable percentage of breakages. The mounting of the filaments is a difficult and costly process owing to the fragility of the filament and the number of joints required (two per loop). A serious percentage of breaks in the filaments of completed lamps occurs at each handling before they are put in service. Once in service, the filament gradually but appreciably strengthens.

"Drawn-Wire" Filaments.—It is a difficult matter to bring tungsten to a sufficient degree of purity and ductility to enable it to be drawn into fine wire, and the diamond dies employed need frequent supervision and renewal. Once the filament is made, it is relatively easy to build into the lamp. It is flexible and strong, and can be wound round the supporting frame with no intermediate joints. In fact, the manufacture is much cheaper and easier than in the case of squirted filament lamps. Although the mechanical strength of the drawn filament is considerably reduced during the incandescence required in the final stages of manufacture, it is still much stronger than the squirted filament, and the percentage of breakages in handling, storage, and transport is very low.

When in regular use, however, the drawn filament rapidly weakens and, after a time, the lamp cannot safely be removed from its socket. An even more serious objection urged against the drawn filament is that more serious bulb blackening occurs, as compared with squirted filaments. For the present, M. Bainville considers that the drawn-wire tungsten filament offers great advantages to the manufacturer and the distributor, but no corresponding advantages to the consumer.

THE

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AUSTRALIAN TRADE.

IN a short notice last week we called attention to a new phase in the Australian attitude towards British trade which was destined to have an important effect, and were pleased to congratulate Mr. Hamilton Wickes, the former Trade Commissioner in Australia, to whose activities this new phase is due, on the excellent work he has done in the interests of British firms. We have since had an opportunity of discussing this and other Australian questions with Mr. Hamilton Wickes himself, and can more fully appreciate the value of his work in Australia and the direct beneficial results which it should produce.

It is common knowledge that for some years certain foreign firms, and notably Krupp's, have been securing a large amount of business in Australia for all classes of goods, but most of all for supplies to the various State railway authorities. For our purpose it does not much matter now to what causes this result may be attributed—whether to the activities of foreign agents, the lack of enterprise of our own, or a wrong impression in Australia as to the relative qualities of British and foreign material. It is sufficient that British firms had not been doing the business they should, and that one order to a foreign firm had been adequate precedent for another, and yet another, until it had become almost a habit of the various buying authorities to specify German brands and manufactures.

To tackle such a situation meant no small amount of courage and not a little tact. Fresh from our interview with Mr. Hamilton Wickes we can understand why he succeeded where others might lamentably have failed. At the same time it must be said in all fairness that immediately the facts became known every true Australian supported the attitude that the Mother Country must be given every opportunity of supplying such of the needs of the Commonwealth as could not be supplied from within. Mr. Hamilton Wickes particularly acknowledges the sympathy he received from Mr. Watt, the Premier of Victoria, and the courageous stand taken up by the *Melbourne Age* in favour of British manufactures. The grasp of highly technical matter displayed by Mr. S. W. Biggs, of the *Age*, was particularly useful.

It would seem almost foolish to say here that in railway material of all kinds British goods are quite as good, if not better, than any that can be produced abroad. But Australia is a very long way off, and for some unaccountable reason the impression has prevailed there, at any rate, amongst the buyers immediately responsible, that some special qualities attached to German materials which were unknown to British. With the co-operation of the Board of Trade at home it was possible to prove that on all the first-class railways of the world British material had been and was being used in very large quantities. A careful examination of methods of buying in Victoria showed that a system had grown up "by which orders that with reasonable business precaution might have been placed with British manufacturing firms have been placed with foreign tenderers." As the result of long and close investigation, which revealed an unsatisfactory state of affairs, this system received the consideration of the Victorian Cabinet, and it was decided to give certain directions to the buying authorities for future work.

We quote these directions at length on another page, and consider that they should receive the careful attention of all British firms, and particularly contracting firms interested, or likely to be interested, in the Australian market. The first direction states definitely that "taking into consideration the quality, time of delivery and price of the goods, orders are to be given to British manufacturers as against foreign tenderers." Furthermore, when orders are given abroad the buying authorities responsible must "explicitly state" their reasons. This was the attitude which it was desired the Government should take up, but in its patriotic enthusiasm a great deal more was given. We have for some time agitated for longer periods to be given for the submission of tenders in our self-governing Dominions. The Victorian Government have now laid down that the time during which tenders will be admitted shall be long enough to allow of specifications being sent home by mail, and tenders being sent back by mail. This is a concession, the importance of which to British manufacturers cannot be overestimated. At the same time, it will be no less an advantage to the Victorian Government. Other directions provide for the acceptance of the lowest tender in all cases unless specific and adequate reasons are given for adopting another course; for the limitation of the purchasing powers of the railway buying authorities without public calls for tender; and for the giving of trial orders to such reputable firms as have not previously contracted for supplies to the Railway Department.

It will be seen that the above-named directions apply only to the Railway Department, but the principle of preference to British tenderers has been adopted by the Government for other Departments. Moreover, we are assured by Mr. Hamilton Wickes, and we have also heard in other directions, that the effect of the movement which has been started in favour of British trade is not limited to any section of the community either public or private, but that in other States besides Victoria, the same feeling exists. From the point of view of the electrical trade, this is a matter of great and far-reaching importance. Apart from the electrification of the Melbourne Suburban railways, tenders for which are now on the board, electrical development in all parts of the Commonwealth, and in all branches of life, is rapidly increasing. Continental and American firms are regarding with considerable anxiety the new position which has been so speedily established, and if there ever was a time when opportunity offered itself for British firms to gain a firm and unassailable standing that time is now.

Our interview with Mr. Hamilton Wickes has been very illuminating, and has covered a range of subjects which it would be impossible to discuss here. It has confirmed us in a number of views we have set forward from time to time, and it has added others which could only be formed by close touch with Australia. We regret that Mr. Wickes is leaving Australia, we regret that his present stay is England is short, but we would urge our large electrical firms who have interest in Australia, to see him and reap the advantages of a close insight into Australian conditions. Mr. Hamilton Wickes is of the opinion that our selling organisations in many cases need a close examination and improvement. From our knowledge of the methods of some Continental and American concerns, we are inclined to agree with him. It is only natural that there are some things which he could tell private firms which it would not be right that he should tell us, and we hope that these firms will see him now at a time when conditions are particularly favourable to British trade in the Commonwealth.

For the Australian attitude now expressed we have nothing but praise. It will mean advantage to us, but it will also mean advantage to Australia. The new Trade Commissioner must be in a position to advance the work Mr. Hamilton Wickes has begun. Meanwhile, it is "up to" British firms to see that the trust that is being placed in them is not betrayed and that some recognition of the Victorian Government's action is forthcoming, so that the Commonwealth, as a whole, may be assured that we appreciate the direct impetus which is being given to British interests in this important market.

THE PROPULSION OF SHIPS.

All great movements of necessity progress slowly, and especially is this true of matters connected with the marine world, where the force of conservation has from time immemorial been strongest. An impending revolution in the methods of ship propulsion has, however, been clearly foreseen for many years past by most of those who had sufficient knowledge to understand all sides of the question, and were unbiassed enough to be able to keep outside the prejudices of bygone ideas.

It has for so long been customary to look upon Great Britain as the natural pioneer in all matters connected with the sea, that the little band of enthusiasts who have continually been urging that greater attention should be paid to the great impending changes in ship propulsion, were regarded as little less than fanatics. In the last year or so, however, it has become apparent to even the least initiated that the question of new types and arrangements of ships' machinery could no longer be neglected, and one of the results—belated as it is—has been the recent appointment of a Royal Commission to inquire into the oil supply question and the future methods of the propulsion of ships.

The success of the *Selandia* and other oil-engine driven ships has led some who are insufficiently acquainted with the subject to assume that the whole of the difficulties in the construction of marine oil engines have been satisfactorily overcome, and that we are on the immediate eve of the motor-driven battleship. Such an assumption is almost as detrimental as the obstinate pessimism of these same people. It is necessary to face the fact that in this country at any rate, we are very little nearer the production of an oil engine suitable for driving a battleship than we were five years ago. Unfortunately, however, the matter is different on the Continent, where engines of far larger size than those contemplated in England are already constructed and under test. Such is the position which confronts the Royal Commission, and unless it tackles the problem boldly and radically, it must inevitably fail in its purpose and fail badly.

From the composition of the Commission one is apt to conclude that too much attention will be devoted to the minor question of the improvement of oil-fired boilers, and that more important matters will be side tracked as being beyond the scope of the inquiry. In this connection it would have been preferable had it been clearly stated that the investigation was to cover an examination of all possible methods of propulsion including the electrical driving of ships. This matter has already been taken in hand in a practical manner by shipowners in this country and by the United States Naval Authorities, but has certainly not received great consideration by our own Admiralty. Whilst stating that the subject of electric driving should be tackled by the present Commission, we must not be understood to be advocating its employment in battleships. It must be admitted that the great success which has attended the directly reversible marine oil engine has somewhat altered the case as regards the necessity of the electrical system, but there are undoubtedly certain instances where it could with advantage be adopted. It is also possible that until the very high-powered oil engine has been thoroughly developed, electrical transmission might be employed with advantage on large war vessels in conjunction with steam turbines, but this would in all probability be but a transition stage.

Everything, however, depends on the oil supply. If this is not likely to be sufficient for all the demands which would arise in the event of the oil engine being universally adopted for warships, then the whole matter assumes yet another aspect. The oil engine in that case as a means of propulsion is condemned *ab initio*, and it seems then that the employment of electro-mechanical propulsion must be most seriously considered. It is impossible to continue indefinitely with the present uneconomical method of direct steam turbine drive, which is far too inefficient for the present stage of development, and it is beyond all doubt that a very considerable saving could be effected by the electrical method, more particularly in large war vessels, which are operating so uneconomically during practically the whole of their service. There are no insurmountable difficulties, since all the factors are known, and the problem is far too serious to be lightly passed over.

The first duty of the Commission seems, therefore, to be to ascertain the exact present and future position of the oil supply. If there is to be a shortage in the oil supply, then the Commission should turn its attention to the improvement of the economy of existing methods of propulsion, which means an investigation of the various methods of transmission—electrical, mechanical and hydraulic. If, however, the conclusion is arrived at that the oil supply is likely to cope with all demands, attention should be concentrated on the direct drive of the largest war vessels by oil engines.

It is more than likely that the Commission will be unable to come to any very definite conclusion on the oil question as the factors are so diverse, and the uncertainties are numerous. In that case, the only course seems to be a consideration of all the possible methods of propulsion enumerated above, with the exclusion of none. What is vitally important, however, is that the matter be investigated in the very broadest spirit, and that all side issues be rigorously avoided, since the scope of the inquiry is far too wide to allow valuable time to be spent in discussing matters which really do not affect the final issue. And it cannot be too strongly urged that time is a most important consideration; so much so, that it would be preferable to reduce the matter under discussion rather than delay the issue of the report of the Commission.

Foreign Trade Returns.

THERE is every reason to be satisfied with the returns just published for our foreign electrical trade during the month of July, as well as for the full seven months of the year to date. The following are the figures :—

Imports :—

Electrical goods and apparatus other than machinery and telegraph and telephone wire. For the month of July, £96,659, a decrease of £9,886.

Ditto. For the seven months, £818,480, an increase of £23,415.

Machinery. For the month of July, £553,811, an increase of £127,334.

Ditto. For the seven months, £3,981,186, an increase of £406,061.

Exports :—

Electrical goods and apparatus (as above). For the month of July, £293,413, an increase of £105,713.

Ditto. For the seven months, £2,359,746, an increase of £817,613.

Machinery. For the month of July, £2,758,505, an increase of £535,895.

Ditto. For the seven months, £18,447,691, an increase of £495,673.

So that in electrical goods and machinery items together export values for the year, so far as it has gone, have advanced by £817,613 and £495,673 = £1,313,286, which is not bad when we remember that this year has been attended with widespread industrial disputes practically from the beginning, whereas last year the railway and transport strike only began late in July. Taking the gross figures, the imports for 1912 down to date reflect an advance of 27 millions, the exports an advance of nine millions, and the re-exports one of getting on for two millions. In respect to the total import figures, these are affected to some extent by the higher food prices. In the interests of manufacturing we may hope, and probably with some reason, that the export figures for articles wholly or mainly manufactured, which are better in value by £5,059,584, are also affected by better prices. What we want to maintain in the electrical industry is an increasing volume, with a more than correspondingly increasing value, in the matter of exports, for, unfortunately, it is complained that export prices, though better than those in the Home market, are not so satisfactory as they should be. With the increasing burdens that are now put upon our manufacturers and the higher cost of raw material and labour, selling prices must inevitably rise, especially in the electrical industry, and to some extent the electrical export values will be higher in consequence, but an increase of £105,713 in electrical goods sent out during the month means a fine advance in volume as well as higher prices, and being, we believe, the result of the greater activity of our manufacturers and traders, it is a cause for gratification. We hope that the rate of advance will long continue, for, as we have said repeatedly, there is still almost unlimited scope, notwithstanding the greater attention that our own and other firms have been paying to the world's requirements in recent years.

Berlin Railway Proposals.

The *Railway Gazette* correspondent in Berlin recently referred to the postponement of the report on the electrification of the Berlin City Railway, which he attributes partly to the possibility that the results obtained with the electric locomotives on the Bitterfeld line have not come up to expectations, and partly to the action of the German locomotive builders, who claim that the superheated steam locomotive has not been properly tested against the electric locomotive—it having been proposed to operate the Berlin lines with locomotives in preference to motor-cars. It appears that the locomotive manufacturers on hearing of the proposed conversion, immediately petitioned the Prussian Minister of Railways to discuss with them the relative merits of the rival traction systems.

If all the technical points of superiority urged in favour of the superheated steam locomotive by its makers could be accepted, there would be little to be said for the electric locomotive, but disregarding a naturally biased view, the most important point urged against the electric traction proposal is the expenditure, representing both capital and working cost.

But bare figures of cost, such as are given, are really insufficient to discredit the prospects of electric traction, which experience shows has far wider claims to consideration than are indicated by the "facts" which the rival interests have placed before the Prussian Minister.

The matter is of some interest to railway men in this country, and particularly in London, where electric traction is so rapidly ousting steam traction on all heavy traffic lines, and with such excellent results from the traveller's point of view, that the idea of steam operation on city railways such as the Metropolitan and District is now quite untenable.

Our contemporary appears to think that the Berlin postponement is principally due to the feeling of doubt on the question of system, "overhead" direct-current having now entered the field as a competitor of the alternating and third-rail systems. For ourselves, we shall be somewhat astonished if the single-phase system is set aside at Berlin in view of the unanimity with which it has been adopted by Continental railway authorities, but political and military considerations may obscure the purely commercial and technical sides of the question.

What is an Electrical Installation?

THE question as to what does and what does not constitute an electrical installation has recently been very prominently discussed in Australia. It is well known that in the Australian States labour questions have during the past few years been very sympathetically considered. Under a Labour Government, legislation has been very active and the legally fixed wage has been applied to many industries. Whatever the final result may be the immediate effects of many of these enactments have been far from satisfactory. A fictitious value has been given to money, and though wages have risen the general testimony is that the cost of living has risen in a far higher ratio.

The dispute as to the meaning of the term "an electrical installation" arose as follows :—Under the Victorian "Factories and Shops Act" a Wage Board was formed to deal with electrical installations. This Board consisted of three wiring contractors and three wiremen, and it contended that it had full powers to decide the wages and conditions that should prevail in connection with the whole of the electrical undertakings in the State of Victoria. It will be noticed that the electricity supply undertakings had no representative on this Wage Board, although the capital and the number of employés controlled by these undertakings were considerably in excess of the comparatively small industry comprising installation work in the State. This Wage Board issued a "Determination," which came into force on the 11th of last March. It decided "the lowest prices or rates which may be paid to any person, persons or classes of persons wheresoever employed in any business or occupation connected with the installation of electrical fittings, appliances, motors and heaters, including the laying of wires."

The principal awards were a minimum wage of 63s. per week of 48 hours to electrical mechanics or wiremen, 66s. per week to electrical fitters, 69s. per week to cable jointers, 63s. per week to persons engaged in patrolling and effecting repairs to external electric supply or transmission mains, and 54s. per week to electrical labourers and assistants. There were in the "determination" a number of other clauses dealing with hours, overtime rates, and payments to boys, apprentices and improvers.

The Wage Board's claim to control the working conditions of the whole electrical industry has, ever since its appointment, been disputed by the various electricity supply undertakings, with the result that they have declined to recognise the award. As one result, however, of their joint representations, the Minister of Labour has agreed to form a new Wage Board, on which the undertakings will be represented to deal with the employés of these undertakings.

Notwithstanding this, the State Factory Inspectors have proceeded against the Electric Supply Co., of Victoria, Ltd., for breaches of these regulations, and two test cases were recently decided, one at Ballarat, on the 6th ult., and one at Bendigo, on the 8th ult. In both cases the claim was that employés of the supply company had been engaged in installation work and paid less than the rates declared legal minima by the "determination."

At Ballarat the charge was that the workman who connected the company's mains to the consumers' and fixed the meter was engaged in installing the light. The company contended that the work of installation began at the meter and consisted in the fitting up of the wires on the consumers' premises and the fixing of all lamps and electrical fittings. They were a statutory company supplying electrical energy, and inasmuch as they had to be satisfied, by test or otherwise, that the contractors did their work satisfactorily before they would supply energy, they and their employés were not in the same category as ordinary electrical contractors. In one instance, the workman mentioned in the charge had been engaged in work to which the term installation work might be applied, and for this he had been paid at the award rates. Further, the fact that the Minister of Labour had agreed to the formation of a new Wage Board for their employés showed that they were not bound by the existing award. The Court held that the company had established their case that they were outside the award, and dismissed the case.

At Bendigo the following week the charge against the company was that a labourer who was employed in effecting temporary repairs to consumers' wires and lamps should be paid 54s. per week, whereas he was only receiving 40s. per week. It was proved that the man's regular work was recarboning arc lamps. He had done this work for 4½ years. Until recently he had described himself as a trimmer, but latterly had altered the designation to "private arc attendant." On two occasions the man disconnected a lamp, and replaced a negative lead. The inspector claimed that this brought the work under the terms of the award, inasmuch as it was installing the light. The company, however, resisted this interpretation, and elicited from the witness that until he was overruled by the chief inspector he was of their opinion, and had even told the man he was outside the award. In the end the company were successful, and the charge was dismissed.

We are of opinion that the company were right in their course of action, and that "technically" an electrical installation commences at the meter terminals. The point has not become important in this country, but similar difficulty may at any time be experienced, and it is well that the distinction should be clearly established.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

News from Western Canada states that the Hart Accumulator Co., of London, have under consideration the establishment of a branch works over here at Winnipeg, or Fort William, which is in the Province of Ontario, though it lies some 450 miles west and 300 miles north of Toronto, on the shores of Lake Superior. At Port Arthur, which is only a few miles from Fort William, it is reported that another British firm—Ham, Baker & Co., of Westminster—will erect a factory.

The City of Regina, Saskatchewan, is asking for tenders for electrical plant, the closing date being September 14th. Specifications may be obtained at the office of the City Electrician. A certified cheque for 5 per cent. of the amount of the tender is required.

The Provincial Government of Ontario has recently benefited by a decision of the Privy Council at home by about $100,000.

Different interpretations of the agreement between them were made by the Government and the Power Companies at Niagara Falls respectively. The Privy Council upheld the view taken by the former, and it now appears that back rentals amounting approximately to the sum named are due from the companies.

The Montreal Electrical Society has adopted a novel scheme for increasing its membership. Existing members are to be divided into two sections called "Volts" and "Amperes," the idea being that they shall compete in the effort to obtain new members, thus introducing the stimulating effect of rivalry.

The power and lighting plant of the City of Edmonton, Alberta, will, according to report, very probably have to be replaced, as it is not sufficiently modern to suit present requirements.

Like many other Western towns, Medicine Hat, Alberta, is developing very quickly, and the city generating plant must keep pace with the requirements—$10,000 is to be spent on extensions.

Wear on the Trolley Wheel.—The reduction of wear and tear in traction systems is a very important factor of efficient maintenance. A large amount of such deterioration is, of course, inevitable owing to the severe conditions under which the plant is frequently called upon to operate, involving irregular loads due to gradients, starting and stopping and also due to dirt and wet weather. At the same time there is no doubt that the wear can be diminished considerably if due attention is paid to the restoration of worn parts at as early a date as is consistent with considerations of prime cost, and also if means are taken to avoid unduly increasing the wear by improper use. The design of electric traction equipment has now progressed to such a stage that the majority of the parts which suffer severe wear can be replaced at very small cost, and thus there is not much excuse for highly concentrated forms of wear and tear occurring at particular portions of the equipment, owing either to bad practice from the commencement or to postponement of overhaul, allowing accumulation of wearing action to take place. One of the parts of the traction equipment at which the largest amount of wear takes place is the trolley wheel, and care should be taken to see that the wheel is not exposed to anything more than the inevitable minimum of attrition. In one case it was noticed that a new trolley wheel fitted to a trolley head was worn out very rapidly, and upon examination it was discovered that this was due to the fact that there was too much tension on the trolley. Some little time previously the trolley standard had been overhauled and the tension on the springs had been put on by guess-work. The wear on the trolley wheel drew attention to the matter, and on measurement, it was found that the tension was as high as 42 lb. When it is mentioned that the trolley tension for centre running should not exceed 20 lb., while for side running it is not necessary to have more than 25 lb., it will be seen how very seriously increased was the tendency to wear on this part of the equipment. When trolley standards and their subsidiary parts are being renewed, the trolley tension should be measured with a spring balance tied to the trolley rope, care being taken at the time of measurement to keep the trolley head at the normal height of the overhead wire. The tension on the springs can then be adjusted until the reading is just sufficiently high to avoid undue flashing and sparking of the wheel as it passes the more awkward points on the route. Attention to this small detail will, in the course of a year, show a considerable difference in the bill for new trolley heads.

BELGIAN HIGH-TENSION TESTING LABORATORIES.

By Dr. Alfred Gradenwitz.

The high-tension testing laboratory of Messrs. De Fuisseaux, at Baudour, Belgium, formerly comprised a 10-k.v.a. 220-110,000-volt transformer which, however, eventually proved insufficient for the work, especially for testing the insulators of high-tension transmission lines. The managers of the works, therefore, decided on installing a new testing laboratory, the electrical equipment of which, as supplied by the Ateliers de Constructions Electriques, of Charleroi, consists mainly of a static transformer with its pressure regulator and testing troughs (fig. 1).

The single-phase transformer is designed for a normal permanent output of 50 k.v.a. at 250 volts primary and 250,000 volts secondary pressure and 40 cycles per second (fig. 2). A special point was made of ensuring a constant ratio of transformation with any load, absolute safety in working, and prolonged loading without any material heating.

The housing of the transformer consists of iron sheets of very ample dimensions assembled by riveting. Its useful capacity is about three tons of oil. It is provided at its lower part with an oil outlet and at its top with an oil level.

The cast-iron lid is bolted to a flange riveted to the housing. It carries the four terminals of the primary windings. On the top are five circular openings to receive the high-tension terminals, and two filling openings. Two suspension hooks have been provided.

The magnetic circuit of the transformer consists of two cores and two yokes of soft iron sheets of great permeability, ·35 mm. in thickness. The primary winding consists of two coils (one for each core) which only comprise one layer of turns wound on an insulating tubular armature. Between the primary and secondary coils are arranged several concentric tubes of a special compressed insulating material between which there is a free circulation of oil. The secondary winding comprises a set of series-connected coils concentric to the primary coil on each core. These coils are separated from one another by varnished card-board tubes; they are fitted between the yokes by means of two superposed rows of fluted porcelain insulators arranged on thick wooden disks impregnated with insulating varnish. These different parts are so arranged as to allow the oil ready access to all parts of the windings.

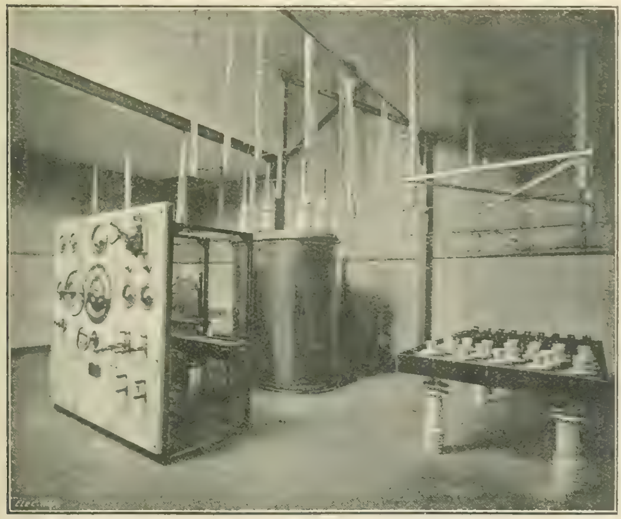


Fig. 1.—View of the De Fuisseaux Testing Laboratory.

The manufacture of the high-tension coils offered special difficulties because of the cross-section of the wires and the considerable number of layers superposed in each coil with a small height and considerable diameter. The terminals of the primary and secondary windings of each core are connected up to low and high-tension terminals arranged on the lid. The two primary coils are thus connected up in series by means of the low-tension terminals.

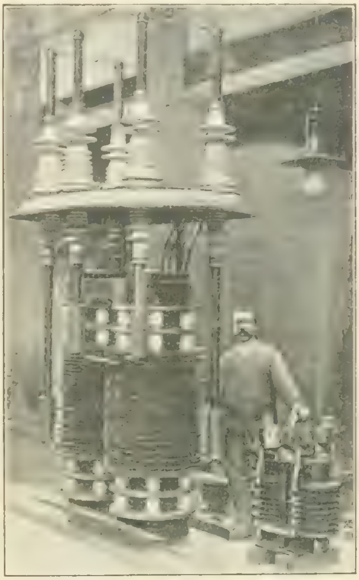


Fig. 2.—Transformers for 50 k.v.a., 250,000 volts and 250 volts

The high-tension terminals (fig. 3) consist of three parts, viz., first, a tube of compressed insulating material containing in its interior the conductor; secondly, a concentric porcelain insulator fixed to the lid; and thirdly, the terminal proper of polished brass which is fitted on the insulating tube.

The insulating tubes separating the primary and secondary windings as well as those of the terminals were produced by the aid of special machinery designed by the Ateliers de Constructions. They have a very high dielectric constant and great mechanical strength, and are so impervious to oil that these large tubes are free from any deformation and can be kept indefinitely in the outside air as well as in a hot oil bath. Before being mounted they were placed repeatedly in a furnace at high temperature and submitted to a vacuum.

The porcelain insulators, constructed by the Societe des Usines De Fuisseaux, are in four separate parts, viz., an outside cover to which the bronze ring for fixing the terminals to the lid is attached, a fluted tube traversed by the insulating tube, and two high-tension tubular insulators with two superposed sleeves. The metal cap constituting the top of the high-tension terminal is free to tilt on a rod fixed to the insulating tube and soldered to the conductor connecting with each terminal of the secondary windings. It is traversed by a freely-sliding micrometer rod, which allows the test pressure to be limited by controlling the distance of the poles, and the secondary pressure to be determined by reference to a table giving the disruptive distances in air in terms of the voltage. By connecting the secondary windings in series or in parallel, the following working conditions are obtained in permanent operation :—First, 50 K.V.A., with 250,000 volts between the terminals, that is, 25 K.V.A. at 125,000 volts in each core (series connection), and second, 50 K.V.A. with 125,000 volts between terminals (parallel connection).

The transformer proper, instead of resting on the bottom of the tank, is suspended from the lid by four threaded rods fixed by nuts. This arrangement allows the secondary windings to be readily and rapidly inspected. All that is required in order to lift the transformer out of its housing is to raise the lid by its two suspension hooks, by means of a tackle fixed to the timberwork of the testing room.

There has been provided a fifth high-tension terminal connected up to the first two series coils of one of the secondary windings. This is intended both for checking directly the transformation ratio and for effecting certain scientific tests.

Tests made on delivery at the Charleroi Works have given as an average of a number of figures obtained on the whole of the secondary coils of each core, a transformation ratio very closely approximating $\frac{1}{1000}$.

The pressure regulator consists of a metallic rheostat inserted in the primary circuit (low tension). This regulating method was chosen, as the primary current was to be derived from two phases of an existing three-phase power and lighting plant. In order to allow a quite gradual scale of pressure to be obtained under load and with no load, the rheostat was made in two sections, each of which can be connected up gradually in series with each division of the other. The number of divisions of each section is such as to allow a scale of pressure between 0 and 250,000 volts to be obtained by their combination, in steps of 500 volts, at no load, as well as with full load.

In order to protect the operator controlling the primary circuit, as well as the three-phase line of the remaining installation against any excess pressure due to an accidental contact between the high and the low-tension windings, the following arrangement was adopted :—

The current at 250 volts, 40 cycles, is conveyed by an overhead line from the central station of the works to the laboratory. It is received at first on a switchboard panel through a two-pole switch and two porcelain-handle fuses. From the switch it goes through the regulator, after registering its amount in an ammeter, and feeds the primary of an auxiliary oil-bath transformer (with a ratio of transformation = 1), the primary and secondary windings of which are carefully insulated.

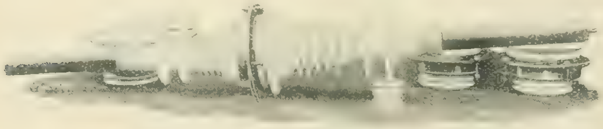


Fig. 3. H.T. Terminal, 250,000-volt Transformer.

This arrangement allows one of the terminals of the primary windings of the high-tension transformer to be grounded. Between the other terminal and the ground is an excess voltage cut-out arranged immediately on the lid of this transformer.

This excess voltage cut-out consists of a system of alternate zinc and mica plates placed one above another. The thickness and number of these plates are such that as the pressure between the ground and the conductor reaches 350 volts, the zinc plates are short-circuited, thus short-circuiting at the same time the two terminals of the primary circuit of the main transformer. As the operator and the feeding line are separated from the circuit by an auxiliary transformer, they are safe against any danger.

The secondary of the auxiliary transformer (250/250 volts) is connected to the primary of the main transformer by a single-pole switch and a single-pole maximum current, zero-tension automatic cut-out.

In order to prevent any access to the testing troughs while under pressure, the laboratory has been subdivided into three compartments. Each of the two outer compartments contains a testing trough, the transformer being installed in the middle compartment, which is partly closed in front by a switchboard comprising three white marble panels. These compartments are closed by doors carrying switches connected up to the zero-tension coil of the cut-out abovementioned. On opening one of these doors, the corresponding compartment being under pressure, the circuit of the coil is interrupted, which results in the switch being released and the bus-bars being made dead.

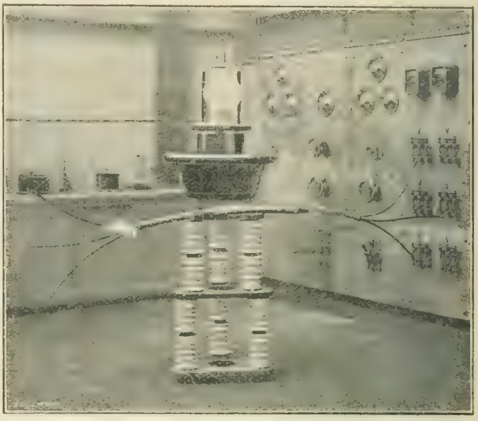


Fig. 4.—Cable-testing Laboratory: Puncture Test at 99,000 Volts.

In order to allow any insulators to be removed after testing, and new insulators to be placed on one of the testing troughs while one set of insulators is being tested in the other trough, the high-tension bus-bars have been sectioned on both sides. As the operator only has two section switches at his disposal, he is compelled in order to place trough No. 2 under pressure, to withdraw the section switches from trough No. 1, thus insulating this completely from the transformer.

The testing voltage is generally measured by means of five voltmeters connected up to the primary, which are graduated directly for high tension, the ratio of transformation having been found accurately to be $\frac{1}{1000}$.

The scales of these voltmeters, which can be connected up successively to the circuit by means of a double-pole switch are as follows: 0-20,000, 10-50,000, 40-100,000, 60-150,000, 0-250,000 volts. This arrangement allows the testing voltage to be determined most accurately throughout the range of 0 to 250,000 volts.

Another testing laboratory installed by the Charleroi Co. at their own cable works comprises, in addition to instruments for measuring the resistance, capacity and insulation of cables, a set of apparatus allowing cables to be submitted to testing voltages considerably in excess of working voltages, as well as apparatus for research work on such insulating materials as are used in cable manufacture.

The energy required for these tests is supplied to the laboratory by underground conductors in the form of three-phase current at 50 cycles, 6,600 volts, which is transformed both for the requirements of the laboratory and for feeding the numerous motors actuating the machinery of the cable works, by means of two static oil-bath transformers with a transformation ratio of 6,600/230 volts.

The 6,600-volt current serves in its turn to actuate a motor-generator set consisting of an asynchronous motor of 125 H.P. at 6,600 volts coupled rigidly to an 80-K.V.A. single-phase alternator rotating at a speed of 960 R.P.M., and producing alternating current at pressures between 0 and 250 volts. This alternator is excited by an exciter machine mounted on its shaft, which produces continuous current at 110 volts. This exciting current is controlled by means of a specially constructed field rheostat, comprising a large number of resistance steps, so as to allow all intermediary pressures between 0 and 250 volts to be obtained at the terminals of the alternator. The field rheostat of the exciter allows this regulation to be completed.

The alternator is designed for supplying two static single-phase transformers. One of these is of similar construction to the one previously described, and gives 80 K.V.A. at its secondary terminals under pressures variable between 0 and 250,000 volts. By coupling the two parts of the high-tension winding in series or in parallel, an output of 80 K.V.A. can be obtained either at 0 to 125,000, or at 0 to 250,000 volts.

The other transformer is intended for testing work at lower pressures; its ratio of transformation is 250-25,000 volts; the two parts of the secondary winding may be connected up in series or in parallel, thus giving 25,000, or 12,500 volts. These two transformers have been tested at 350,000, and 40,000 volts respectively.

In fig. 4 the laboratory is shown during a cable-puncture test. The cable under test comprises three copper conductors 50 sq. mm. in cross-section insulated with impregnated paper, a homogeneous lead sleeve, and a double iron armature covered with asphalted threads. This cable, designed for working at 11,000 volts, was found to break down at 99,000 volts.

The cable works are equipped for manufacturing armoured cables, designed for working pressures of up to 150,000 volts.

The same cable works also contain a portable cable-testing station comprising the following parts:—A generating set consisting of a 45-H.P. gasoline motor and a single-phase alternator of 30-K.V.A. at 125 volts, 50 cycles, and 1,000 R.P.M., which is installed on a truck, and a transformer set consisting of single-phase transformer for 0 to 125 volts, 50 cycles, and capable of developing at its secondary terminals 30 K.V.A. at 20,000 or 40,000 volts, a set of six adjustable self-induction coils for compensating the capacity of the cables under test, and a switchboard carrying in addition to any measuring apparatus, the field rheostats of the alternator and the exciter. This second part of the installation is carried by another truck connected during tests with the former by removable couplings.

This portable station allows 5 km. of armoured cable with a copper section of 3 × 35 sq. mm. and a capacity of ·2 microfarad per km. to be tested at 30,000 volts, the testing voltage being ascertained by means of a portable electrostatic voltmeter of the Hartmann & Braun system.

A Telephone Time-Saver.—For the purpose of saving the time usually wasted in "holding the line" a "Telephone Time Saver" has been invented by Mr. H. Waymouth Prance, of Dudley House, Southampton Street, Strand, W.C. In brief, the device consists of a sound magnifying trumpet, of flattened form similar to certain types of motor horns, behind which is a platform adapted to support the telephone receiver. Upon receiving or making a call upon the telephone, and being asked to "hold the line a moment," the user, instead of "holding on" with the telephone receiver pressed to his ear, merely drops the receiver on to the platform of the "time saver," where it automatically slides into position with the earpiece against the small end of the spiral trumpet. The user is then free to go on with his work until the voice from the trumpet shows him that the person at the other end is speaking. Conversation can then either be carried on using the loud-speaking trumpet—thus affording the advantage of leaving the user's hands both free for the purpose of turning up references, taking down a message from dictation, &c., or the receiver may be lifted off the instrument and used in the ordinary way. It is possible for the user of one of these instruments to move some little way from the telephone and yet hear when the person at the other end is speaking.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Municipalities and Contractors at Cape Town.

There seems to have been a fair amount of discussion lately relative to the friction between municipalities and contractors. I enclose you a letter addressed to the local contractors here from Mr. Long, the city electrical engineer.

Some time ago the Council obtained the consent of the ratepayers to put in three points free to any future applicants for electric light, and the Council, in due course, advertised for tenders, and received them as per Mr. Long's letter. The successful firm did not complete the work quickly, so the arrangement has now been come to that any of the local contractors will accept any work offered to them by the Council at 22s. 6d. per point for plain flex pendant, 16-50-C.P. metal-filament lamps and opal shade, minimum three points, the work to be equally distributed.

Any contractor can, therefore, canvass for work; the price is fixed beforehand, and the contractor is free from bad debts. The consumer has to sign the agreement with the Council, and has to get the consent of the landlord as well. The arrangement works splendidly; the installation may consist of any number of points.

The consumer may use as much current as he likes up to 3·33 units per point, *i.e.*, $\frac{2s.\ 6d.}{9d.}$ = the total amount of revenue received per point per month divided by the rate, which is 9d. per unit.

Say a consumer has 10 lights; he can use 33 units a month for 12 months. From his point of view, he pays 9d. a unit, and if he uses his full quantity, he has paid his 25s. per month (2s. 6d. per point) for current used. There is no limitations as to how he shall consume his units; he can put in radiators if he likes, but he must pay 9d. a unit for all over 3·3 units. It is, however, most unlikely that a consumer with 10 lights will exceed, say, 10 or 12 units a month.

From the Council's point of view, they pay the contractor, for 10 points, £11 5s., and draw as revenue £15 (2s. 6d. per point per month for 12 months), which leaves a balance of £3 15s. for current.

Taking the worst case of a consumer who uses 396 units per annum: $\frac{£3\ 15s.}{396}$ = about 2¼d. per unit, which is quite a fair return to the Council for these extra units supplied. Interest does not count. On the other hand, suppose a consumer says he will pay cash for his installation = £11 5s., he then pays a minimum of 5s. per month for current, and gets only 7 units for his whole installation, and saves only 15s. during the year. (*All* consumers pay a minimum of 5s. per month.) So it is very much to his benefit to pay monthly. It practically amounts to the Council giving all new consumers current at a little more than cost for the first year, as an inducement to take electricity.

I thought this might be of interest to the general body of electricity suppliers and users as being a very satisfactory solution to a difficult problem.

Your Correspondent at the Cape.

July 23rd, 1912.

[COPY.]

CORPORATION OF THE CITY OF CAPE TOWN.

Electrical Department,
City Electrical Engineer's Department,
Dock Road, Cape Town.
July 20th, 1912.

Messrs. X Y Z.

Re FREE WIRING.

Dear Sirs,—I beg to acknowledge the receipt of a letter dated the 19th inst., signed by yourself and several local electrical contractors, regarding the price per point to be paid for work done, under the Corporation system of free wiring.

My offer of £1 1s. per point was founded on the tenders that were received recently for this class of work, the lowest of which was £1, and the next £1 0s. 10d.

In view of your remarks regarding the rise in prices, I am prepared to accept your terms, namely, £1 2s. 6d. each for all plain flexible points with plain opal shade. The question of the price for a rise and fall, fancy fittings, &c., need not be discussed here, as it is a matter entirely between the contractor and consumer.

All switches to be placed as indicated by the consumer, provided such positions are reasonable.

All fancy shades, spider or ornamental fittings, outside fittings, higher candle-power that 16-50 metal-filament lamps required, to be paid for direct by the consumer to the contractor. The same also applies to wiring carried out other than on the surface, with the exception of wiring placed above the ceiling of single-storey houses, and the top floor of houses other than single storey.

In this connection, I might mention that as the consumer is more or less given into the hands of the contractor, it is expected that extras will be carried out at a reasonable remuneration.

I have to inform you that the present free wiring is being extended to any number of points, provided the consumer agrees to pay 2s. 6d. per point per month for the first year. The minimum charge for current per month to be 7s. 6d. as at present. Of course it must be thoroughly understood that all proposed installations must be approved of by myself or representative, and that I may refuse payment should the work be completed before such is obtained, or on finding the applicant not a desirable consumer.

The contractor must guarantee to maintain the installation and to execute all repairs due to bad materials or workmanship for 12 months from the date of connection. Otherwise this work will be carried out at the contractor's expense, and the amount deducted from any sums due to such contractor in the Council's possession.

If the above terms be accepted, full payment for the installation will be made in due course, according to the Council's regulations, after the work is passed and the connection made.—Yours faithfully,

(Signed) WALTER F. LONG,
City Electrical Engineer

The Bray Explosion.

As the finding on the above explosion is inconclusive, perhaps those engineers who have had similar trouble (though in a lesser degree) will state their experiences and help to arrive at a true conclusion.

In my own case, I have experienced both explosions though not simultaneously.

The fuel valve explosion occurred on a two-cylinder engine. Before turning on the starting air the attendant has to make sure that fuel oil is reaching the fuel valve on the cylinder cover. The main oil valve is turned on and when a good flow of oil is observed coming out of the test cocks, these latter are closed and the engine started up without delay. If there is a slight delay, it is advisable to close the main oil valve until ready.

One day the attendant did not close the main valve, and delayed starting up for over five minutes, consequently an excess of fuel oil accumulated in the combustion casting containing the fuel valve, and when the air starting lever was thrown up into running position, an explosion occurred in the fuel valve, blowing the top off the combustion casting cap and the fuel needle valve through the roof. The trouble did not go further.

The other explosion was on a four-cylinder engine, which had already been running satisfactorily nine hours. During the last two hours the load increased, and the air blast was raised to 820 lb. from 710 lb., as required, and had been at the higher pressure some little time when the copper delivery pipe, from the H.P. air pump to the blast receiver, commenced reeking (due to the presence of oil on an overheated pipe), close to the air pump, and immediately afterwards an explosion occurred at the top of the blast receiver vessel, which blew the safety valve, with which these vessels are fitted, across the engine room, and burst off the copper delivery pipe (*i.e.*, the pipe conveying air from the blast receiver to the fuel valve) at its connection with the receiver, bending the pipe up into the air and twisting it into two neat coils at the end. No other damage was done. The pipe was straightened out and reconnected after a new nozzle had been brazed on, the safety valve hole plugged temporarily, and the engine restarted, finishing the day's run satisfactorily in parallel with a second engine.

In the first case, the fuel valve explosion was undoubtedly caused by an excess of fuel oil at that particular place; the combustion became excessive and was carried into the fuel valve before it closed.

In the second case, I am strongly of opinion the trouble arose through the valves of the H.P. air-pump allowing the pump pressure to be overcome by the pressure of combustion in the main cylinders. The blast receiver, though undamaged, was extremely hot after the event. Later a faulty valve spring was found in the pump.

In neither of these cases was there an excess of oxygen.

What I wish to point out is that an explosion can occur at the fuel valve due to an excess of fuel oil there, also if the cylinder pressure overcomes the air-pump it will show itself in or about the blast receiver.

I am not convinced as yet that "the root cause of the trouble was undoubtedly the oxygen," as you suggest, though it certainly could have been, but I am of opinion that the *severity* was due to its presence, also that "a plug of oil was driven into the blast vessel and ignited by the following flame."

Perhaps Mr. McDonnell will kindly state what caused the starting air to be lost in the first instance? Was the fuel valve examined for correct adjustment and tension between this stoppage and the restart with oxygen? And how many (about) revolutions had the crankshaft made before the explosion occurred?

E. A. Wood.

Tramways Department,
Castleford, York,
August 13th, 1912.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

THE following is the second instalment of definitions of electrical terms adopted by the British Electrotechnical Committee to assist the work of the Commission. The first instalment appeared in our issue of August 7th, 1908, p. 237.

Sub-Committee on Nomenclature:—Mr. A. P. Trotter (Chairman); Messrs. S. Z. De Ferranti, W. Duddell, F.R.S., Robert Hammond, R. W. Hammond, H. W. Miller, F. H. Nalder, Dr. A. Russell, A. Siemens, Dr. S. P. Thompson, F.R.S., C. H. Wordingham, and P. F. Rowell (Secretary).

Note.—Words printed in SMALL CAPITALS are already explained or will be explained later.

SUPPLEMENTARY TERMS (A to E).

Absolute.—A system of magnitudes is said to be absolute when all the magnitudes of the system can be defined in terms of units adopted as fundamental. An instrument for absolute measurements is one which can be standardised by means of measurements which involve only the fundamental units.

Admittance.—The reciprocal impedance. The quotient obtained by dividing the current in a conductor by the electromotive force which produces it.

Alternation.—A term not recommended. A half period. See PERIOD and FREQUENCY.

Antenna.—A conductor or system of conductors for the emission or reception of Hertzian waves.

Balancer.—A motor-generator or accumulator used to equalise differences of potential between the different wires of a multiple-wire system.

Ballistic.—An instrument in which the period of the moving part is long compared with the time of the duration of the transient force which the instrument is intended to measure.

Bifilar Suspension.—The suspension of the moving part of an instrument by two threads, so arranged that the restoring force is mainly produced by gravity.

Bow.—A bow-shaped appliance for effecting a sliding connection between an overhead conductor and an electrically-propelled vehicle.

Carcel.—The name of a standard oil lamp, the official standard of candle-power used in France.

Characteristic.—A curve or graph representing the relations between two magnitudes, which characterise the behaviour of an apparatus; *e.g.*, the exciting current of a dynamo and the electromotive force generated.

Charge.—(*a*) Of a conductor. The total quantity of electricity on it.

(*b*) Of an accumulator. See ACCUMULATOR.

(*c*) Of a condenser. See CONDENSER.

Verb to charge. The operation by which any apparatus receives a quantity of electricity, part or the whole of which it returns on discharge.

Coercive Force.—The magnetic force required to annul the residual magnetism of a substance.

Coil.—One or more turns of a conductor wound side by side in one or more layers.

Condenser.—An apparatus consisting of two conducting surfaces separated by a dielectric.

Conductance.—The conductance of a conductor is the quotient of the current by the potential difference between the terminals of the conductor, usually expressed in MHOS.

Conductivity. The conductivity (specific conductance) of a substance is measured by the current which flows parallel to an edge through a unit cube of the substance, when unit difference of potential is maintained between the two faces perpendicular to that edge. The reciprocal is Resistivity.

Conductor.—A body or substance which permits the passage of electricity.

Counter Electromotive Force or Back-Electromotive Force.—An electromotive force which opposes the flow of the current in the circuit.

Decohere.—To restore a coherer to its original state of resistance.

Delta.—A mode of connection in three-phase alternating-current working, in which three windings or apparatus are so connected that they may be diagrammatically represented by a triangle. A particular form of mesh.

Diamagnetic.—A substance having a magnetic permeability less than that of a vacuum (unity).

Direct Current.—A term not recommended. See CONTINUOUS CURRENT.

Discharge.—(*a*) Of a condenser. An operation which tends to bring the two conducting surfaces of a condenser to the same potential.

(*b*) Of an Accumulator. An operation which tends to bring the two plates of an accumulator to the same potential, and which permits the chemical energy to be reconverted into electrical energy, and utilised in an outside circuit.

Disruptive Discharge.—The breaking down of a dielectric under electrical stress, accompanied by sparking.

Eddy Current.—A current induced in a conducting body either by a varying magnetic field or by the body moving relatively to a fixed magnetic field.

Efficiency.—(1) In case of generators, motors, converters or transformers: The ratio of the total output to the total input. (For instance: In case of a separately excited synchronous generator the excitation power should be added to the power received at the shaft).

(2) In case of Accumulators:

(*a*) The ratio of the amount of energy available during the discharge to the amount of energy required during the charge (watt-hours).

(*b*) The ratio of the amount of current available during the discharge to the amount of current required during the charge (ampere-hours).

Electrometer.—An instrument which utilises electrostatic forces for the measurement or comparison of differences of potential.

Extra Current.—An obsolete term. The current during the variable period on closing or opening an inductive circuit.

Extra High Pressure. See PRESSURE.

Factor of Safety.—In mechanics, the ratio of the ultimate breaking stress to the maximum normal working stress.

Farad.—In the practical system of units the farad is the unit of electrical capacity. It is inconveniently large, and therefore capacities are usually expressed in microfarads.

Fault.—Any local defect in the insulation or continuity of a conductor which may interfere with its use.

Feeder.—A conductor for conveying electrical energy from the place where generated or transformed to feeding-points or sub-stations. Feeders are not used for supplying consumers directly, owing to the varying pressure along their length.

Feeder Box or Pillar.—A box or pillar which may contain switches, links or fuses for connecting feeders with distributing networks.

Feeder, Negative.—See RETURN FEEDER.

Feeding Point.—The junction of a feeder with the network.

Ferro-Magnetic.—A substance whose permeability is greater than that of a vacuum (unity). See PARAMAGNETIC.

Field, Electromagnetic.—See FIELD, MAGNETIC.

Field, Electrostatic.—Any region in which there are electric lines of force, as in the space between a positively charged and a negatively charged surface.

Field Magnet.—Any permanent magnet or electromagnet employed for the purpose of providing a magnetic field. (It is incorrect to speak of the field magnets of a dynamo or motor as its fields; they should be called its magnets, if the term field magnets is too long.)

Field, Magnetic.—Any region in which there are magnetic lines of force, as in the space between or surrounding the poles of a magnet or within a magnetising coil. The strength of the field is usually expressed in C.G.S. measure as the number of lines per square centimetre. One line per square centimetre is called a Gauss. See LINE and MAXWELL.

Figure of Merit, of a Galvanometer.—(*a*) The deflection in millimetres per micro-ampere at a scale distance of one metre when reduced to a period of 10 seconds and a resistance of one ohm.

(*b*) The current in amperes required to produce a deflexion of one millimetre at a scale distance of one metre. Sometimes expressed as the number of megohms through which one volt will give that deflection.

Of a telegraph instrument. The minimum current necessary to work the instrument with absolute certainty.

Flame Arc.—An arc in which the major portion of the light is given by the flame instead of by the electrodes.

Flashing.—(*a*) Any process of manufacture involving the temporary electrical overheating of a glow lamp filament.

(*b*) The coating of a glow lamp filament with a layer of carbon by heating it electrically in a hydro-carbon vapour.

Flashing Over.—The temporary formation of an arc from brush to brush on a commutator.

Flash Test.—The momentary application of a high electrical pressure between two conductors insulated from each other.

Flux.—(*a*) MAGNETIC. The number of lines of magnetic induction which pass round a magnetic circuit. See INDUCTION.

(*b*) PHOTOMETRIC. The whole luminous radiation of a beam of light, or the candle-power multiplied by the solid angle of the beam.

(*c*) CHEMICAL. Material used for reducing or dissolving the oxides of molten metals in casting, soldering, brazing, &c.

Foot Candle.—The illumination produced by a source of one candle-power falling perpendicularly on a surface at a distance of one foot from the source.

Form-Factor.—The ratio of the effective value to the mean value of a periodic function.

Fourth Rail.—See CONDUCTOR RAIL.

Friction Loss.—Loss due to mechanical friction exclusive of windage.

Frog.—In tramway overhead work. A fitting uniting two diverging trolley wires with a single wire (*a*) provided with a spring tongue, or (*b*) of the fixed type.

Fuse.—The actual wire or strip of metal in a cut-out which is fused by an excessive current.

Galvanometer.—An instrument for measuring small electric currents.

Gap, Air-, Magnetic.—Any air space in a magnetic circuit.

Gap, Spark.—Any break in the continuity of a metallic conductor so arranged as to permit of an electrical discharge across the break.

Gauge.—(*a*) A general term applied to various kinds of measuring instruments.

(*b*) The thickness of a plate, or the diameter of a wire, on the inch, millimetre, or on any arbitrary scale.

(*c*) The distance between the rails of a railway or of a tramway. In the case of a railway it is the distance between the inner sides of the heads of the rails. In the case of a tramway it is the distance between the inside edges of the tread of the rails, *i.e.*, over and including the grooves.

Gauss.—A name given to the absolute electromagnetic unit of magnetic induction in the C.G.S. system. See FIELD, MAGNETIC, and LINE.

Generating Set.—The combination of a generator and a prime-mover.

Glow Discharge.—A silent discharge of electricity through a gas which causes the gas to have a uniformly luminous appearance or glow, and which does not volatilise the electrodes.

Glow Lamp.—A lamp in which the filament or wire is caused by the current to glow or incandesce. A term recommended instead of incandescent lamp in order to avoid confusion with the incandescent gas mantle.

Gramme Calorie. See CALORIE.

Great Calorie. See CALORIE.

Grid.—In an accumulator. The framework supporting the active material.

Ground.—A term used in America having the same meaning as earth.

Henry.—The practical unit of the coefficient of self-induction or of mutual induction in the electromagnetic system.

High Pressure.—See PRESSURE.

High Tension.—Obsolete term for high pressure.

Homopolar, Dynamo or Motor.—A dynamo or motor in which the inductive action takes place in a magnetic field or a series of magnetic fields without change of sign.

Homopolar Induction.—A term sometimes applied to the induction which occurs when a conductor is moved through a magnetic field, so as to cut the lines of force in the same direction continuously. Sometimes called unipolar.

Horse-Power.—The industrial unit of power. The British horse-power is equivalent to 33,000 foot-pounds per minute or (approximately) 746 watts.

Hot Wire Instrument.—An instrument the indication of which depends on the expansion of a wire or wires through which flows an electric current.

Hysteresis.—The lagging of the strain behind the stress, which when the material is taken round a complete cycle and brought back to the initial state, involves a dissipation of energy.

Hysteresis, Magnetic.—The tendency by which changes of magnetism lag behind the changes of magnetic force which cause them.

Impedance.—The ratio of the electromotive force to the current which is produced by it in a conductor. The term is used with varying or alternating currents.

Incandescent Lamp.—See GLOW LAMP.

I.H.P.—Abbreviation for indicated horse-power.

Inductance.—(*a*) Synonym for coefficient of self-induction.

(*b*) The reactance due to self-induction. See REACTANCE.

Induction.—When an electric or a magnetic force acts, through the ether, upon a body so as to alter its electric or magnetic state, that alteration of state is said to be induced in it, as distinguished from alterations of state communicated to it by conduction or contact. The operation of inducing alteration of state is called induction. The three chief induced actions are (*a*) induced electrostatic charge: (*b*) induced magnetism; (*c*) induced electromotive force.

Induction, Electrostatic.—When a body is brought into an electric field, thereby causing an electric charge or charges to appear on the body, these charges are called induced charges; and the operation is called electrostatic induction.

Induction, Magnetic.—When a mass of iron, &c., is brought into a magnetic field, thereby causing magnetic poles to appear on the mass, these poles are called induced poles, and the magnetism so acquired is called induced magnetism; and the operation is termed magnetic induction. (The magnetic lines of force so imparted to the mass of iron, &c., are called magnetic lines of induction.)

Induction, Magneto-Electric.—When a body is subjected to the action of a varying magnetic field, thereby causing electromotive force to be generated in the body, these electromotive forces are called induced electromotive forces; and any currents that result in the body are called induced currents; and the operation of thus inducing electromotive forces and currents is called magneto-electric induction.

Induction Motor.—An alternating-current motor in which the secondary part receives its current by magneto-electric induction and not by conduction.

Induction, Mutual.—The (magneto-electric) induction exercised between two circuits, whereby the variations of the current in one circuit generate electromotive forces in the other circuit is called Mutual Induction. This mutual relation may be quantitatively expressed by means of a Coefficient of Mutual Induction.

Induction, Mutual, the Coefficient of. (M) is the sum of the effective linkages of the turns of one circuit (the secondary) with the flux due to unit current in the other circuit (the primary).

Induction, Self.—The (magneto-electric) induction exercised upon the turns of a circuit by the current in itself is called Self-Induction. It may be quantitatively expressed by means of a coefficient of self-induction.

Induction, Self, the Coefficient of. (L) is the sum of the linkages of flux and current when the current in the coil is unity. The (total) self-induction of any coil is the product of its coefficient of self-induction and the current it is carrying.

Induction, Unipolar.—See Homopolar.

Inductive Capacity, Specific.—See Capacity.

Inductive Circuit.—A circuit in which the self-induction at the working frequency or at make or break is appreciable compared with its resistance.

Inductive Load.—An output at a power factor which by reason of self-induction is less than unity.

Inductive Resistance.—A resistance having appreciable self-induction.

Inductor Generator.—A generator with stationary field and stationary armature coils and in which masses of iron or inductors by moving past the coils alter the magnetic flux through them.

Inductors.—In inductor generators. The masses of iron employed to effect variations of the magnetic flux passing through the armature coils.

Input.—The total power received at the shaft or terminals of a machine or apparatus.

Insulate (v.a.).—To surround or support a conductor by non-conducting bodies or materials so as to restrict the flow of electricity to the desired path.

Insulator.—(*a*) Any material which does not appreciably conduct electricity.

(*b*) An appliance used to insulate and usually to support a conductor.

Integrating Meter.—A meter which sums up or integrates the quantity to be measured, with reference to time.

Intermediate.—The intermediate or neutral or middle wire or wires of a three-wire or multiple-wire system.

Intensity.—There is an increasing disposition to restrict the use of the word intensity in English physical science to a ratio, the denominator being an area. The older meaning was synonymous with strength.

Intensity of Current.—An obsolete expression. It has been replaced by strength of current.

Intensity of Field, Magnetic.—See Magnetic Field.

Intensity of Light.—The illuminating power or candle-power of a source of light.

Intensity of Magnetisation.—The magnetic moment per centimetre.

Interrupter.—Sometimes called break. A mechanism or device used to break the primary circuit of an induction coil.

Ion.—An ion is a charged atom or molecule, or a group of atoms or molecules carrying a charge.

Joule.—A unit of heat equivalent to 0·24 = calorie, or one watt-second.

Joule Effect.—The heating in a conductor by the passage of an electric current through it, and due to the resistance of the conductor.

Kathion.—The ion which is carried to the kathode.

Kathode.—(*a*) In an electrolytic cell. The conductor through the surface of which the current leaves the electrolyte.

(*b*) In a primary cell. The conductor (generally carbon) through which the current leaves the electrolyte.

(*c*) The electrode by which the current leaves a cell or other apparatus, such as a vacuum tube.

Keeper, of Magnet.—An iron bar for completing the magnetic circuit (usually of a permanent magnet). See Armature.

Kelvin.—A term officially proposed and authorised by the Board of Trade, May, 1892, but which has not come into common use, for a kilowatt-hour.

Key.—An appliance consisting essentially of a lever carrying a contact or contacts, generally used in signalling and in testing.

Kicking Coil.—Name given to a choking coil used in conjunction with lightning arresters.

Kilowatt.—A unit of power. One thousand watts. Equivalent to 1·34 British horse-power (approximately).

K.V.A.—Contraction for kilo-volt-ampere, or one thousand volt-amperes.

KW.—Contraction for kilo-watt.

Lag.—The interval of time or angle by which one event follows another. See Phase Difference.

Lagging Current.—An alternating current the phase of which is retarded in time relatively to the impressed electromotive force.

Lamination.—The division of a mass of material into thin sheets either to prevent eddy currents or to give flexibility. The thin sheets or stampings of iron forming part of a magnetic circuit are often called the laminations.

Lay, in a Cable.—The pitch or length parallel to the axis of one complete turn in the spiral arrangement of a stranded cable may be expressed (*a*) as a multiple of the diameter of the layer considered; or (*b*) as the increase in length of a strand above the length of the cable, expressed as a percentage of the length.

Lead.—(*a*) Of a conductor or pipe. Its direction or run.

(*b*) Sometimes used as a synonym for a conductor.

(*c*) Of an alternating quantity. The interval of time or angle by which one event precedes another. See Phase Difference.

Leading Current.—An alternating current the phase of which is in advance in time relatively to the impressed electromotive force.

Leakage.—(*a*) The passage of electricity from one conductor to another or to earth, caused by want of perfect insulation.

(*b*) Magnetic. That part of the magnetic flux which does not follow the path provided for it.

Leakance.—The reciprocal of insulation resistance.

Leyden Jar.—A condenser in the form of a jar, generally of glass, having a conducting surface inside and out.

Lightning Arrester.—An appliance for protecting electrical apparatus by providing an alternative discharge path.

Limiter.—A device for giving warning when a predetermined current is exceeded.

Line, Telegraphic.—That part of a telegraph, telephone or railway signalling circuit, whether aerial, underground or submarine, which does not include the controlling or operating apparatus and the source of power. Used also, collectively, for a group of wires including poles, pipes, junction boxes, &c.

Lines of Force.—(1) A line such that the tangent to it at any point represents the direction of the force acting at that point.

(2) **Magnetic.**—A line such that the tangent to it at any point represents the direction of the magnetic force at that point.

By convention the magnitude of the magnetic force at any point is represented by supposing as many magnetic lines of force to be drawn through one square centimetre (situated around the point) as there would be dynes exerted on unit pole if placed at that point. Unit intensity, *i.e.*, one dyne per unit pole, or one line per square centimetre is called one **Gauss.** See Magnetic Flux.

(3) **Electrostatic.**—A line such that the tangent to it at any point represents the direction of the electric force at that point.

By convention the magnitude of the electric force at any point is represented by supposing as many electrostatic lines of force to be drawn through one square centimetre (situated around the point) as there would be dynes exerted on one unit of positive electricity placed at that point.

Link.—A readily removable conductor forming part of a circuit, generally in the form of a flat bar.

Linked Switches.—Switches linked together mechanically so as to operate simultaneously.

Load.—(*a*) Synonym for output.

(*b*) Synonym for weight.

Loaded. Telegraph Line or Cable.—A line or cable of which the self-induction has been intentionally increased.

Load Factor.—The number obtained by dividing the actual output of a generator or of a whole generating station during a given period by the output if the maximum had been maintained during that period.

Loop Test.—A method of testing employed to locate a fault in a telegraph or other conductor when it can be arranged to form part of a closed circuit.

Looping In.—Bringing a wire as a loop to and from a terminal to avoid making a T-joint.

Loss, Total.—The difference between output and input.

Low Tension.—Obsolete term for low voltage.

Magnet Coil. Magnetising Coil.—The winding used to magnetise an electromagnet, such as the field magnet of a dynamo, sometimes called field coil.

Magnet, Permanent.—A body which, having been magnetised, retains its magnetisation.

Magnet, Winding.—A set of magnet coils.

Magnetic Blowout. An apparatus so arranged as to produce a magnetic field which breaks the arc formed on opening the circuit.

Magnetic Flux.—The number of magnetic lines which pass through any area is called the flux through that area. In the case of a closed magnetic circuit, the number obtained by multiplying magneto-motive force by reluctance. Unit, one line or Maxwell.

Magnetic Flux Density.—The number of magnetic lines per square centimetre. The number obtained by dividing magnetic force by permeability. Sometimes called the induction, a term not recommended in this sense.

Magnetic Force.—The force at any point in a magnetic field experienced by a unit pole placed at that point, sometimes called field intensity or strength of field. (At any point in a closed magnetic circuit, the magneto-motive force at that point.) (In a closed magnetic circuit, the magneto-motive force per unit length.)

Magnetic Permeability.—Magnetic conductivity or specific permeance compared with vacuum. The number obtained by dividing magnetic flux density in a substance by magnetic force.

Magnetic Permeance.—Sometimes called magnetic conductance. The number obtained by dividing magnetic flux by magneto-motive force.

Magnetic Reluctance.—The reciprocal of magnetic permeance (sometimes called magnetic resistance, a term not recommended).

Magnetic Reluctivity.—Specific magnetic reluctance. The reciprocal of permeability of a substance.

Magnetic Remanence.—Residual flux density after the magnetic force has been removed.

Magnetic Susceptibility, or Magnetisability. The number obtained by dividing magnetic intensity by magnetic force.

Magnetisability. See MAGNETIC SUSCEPTIBILITY.

Magnetisation.—(1) The process or the result of communicating magnetism to a body.

(2) The (intensity of the) magnetic moment per unit of volume of a magnet.

Magnetise.—To give a body the properties of a magnet.

Magneto.—Contraction for magneto-electric generator. A generator whose field magnets are permanent magnets.

Magnetometer.—An instrument for measuring magnetic force.

Magnetomotive Force.—That which causes or tends to cause a magnetic flx. The unit is $4\pi / 10 \times$ ampere-turns. The industrial unit is the ampere-turn.

Main.—Any conductor forming part of a distributing network. The principal conductors are collectively called the mains. (See FEEDER and TRUNK MAIN.)

Maxwell.—The name given to the magnetic line of force or unit of magnetic flux.

Mesh.—A mode of connection in polyphase alternating current working, in which the windings or apparatus are so connected that they may be diagrammatically represented by a closed figure.

(*To be continued.*)

PROCEEDINGS OF INSTITUTIONS.

The Association of Consulting Engineers.

THE first meeting of duly elected members of this Association was held at the Institution of Electrical Engineers on Monday, July 22nd, MR. G. MIDGLEY TAYLOR, M.Inst.C.E., presiding.

The hon. secretary, MR. A. H. DYKES read the list to date, 80 in all, explaining that some had only joined conditionally on their being satisfied with the rules in their final form.

The CHAIRMAN then said the business of the present meeting was to receive the rules presented at the meeting held in January and the report and proposals of the Provisional Committee, and to elect the first Committee of the Association. The Committee had, after consultation with their legal advisers, adopted the following definition:—

"A consulting engineer is a person possessing the necessary qualifications to practise in one or more of the various branches of engineering who devotes himself to advising the public on engineering matters or to the designing and supervising the construction of engineering works and for such purpose occupies his own office and employs his own staff, and is not directly or indirectly concerned or interested in commercial or manufacturing interests such as would tend to influence his exercise of independent professional judgment in the matters upon which he advises."

The Committee thought that probably not 5 per cent. of the members of the Institutions of Civil, Electrical and Mechanical Engineers complied with the definition of a consulting engineer that the Committee had already laid down, and that there had, up till now, been no source from which any one could obtain definite information as to who was an independent consulting engineer and who was not. The Association, subject to the rules being amended, would be composed of those members of the three Institutions on whom the rules of professional conduct drawn up by the Institution of Civil Engineers, and since accepted by the Institution of Electrical Engineers, were always binding, as distinguished from those members who were only bound by them when acting in a consultative capacity. The Association did not suggest that any duly-qualified engineer should not be consulted on any engineering matter on which he was an expert; but they did say that it should be possible to distinguish the independent consulting engineer from the expert who might be closely identified with manufacturing or contracting interests. The objects of the Association were set out in the Articles of Association, and they were, briefly, to uphold the standard of professional conduct and to promote the professional interests, rights, powers and privileges of consulting engineers. The Articles of Association and the rules, as proposed by the Committee, were in the members' hands, including the alterations of the original rules, which the Committee now asked the members to approve, and which were as follows:—

1. That the subscription be raised from one guinea to two guineas.

2. That corporate membership of the Institution of Civil Engineers or full membership of the Institutions of Electrical or Mechanical Engineers be accepted as evidence of technical qualifications for membership of the Association.

3. That members be entitled and requested to use the abbreviation M.Cons.E. when stating their qualifications.

4. That the Committee be increased to 18, of whom not more than 12 shall be London members.

After the rules had been finally approved by the meeting, the earliest opportunity would be taken to submit the memorandum and articles of association for the approval of the Board of Trade, and to register the Association, after which the final rules and list of members would be printed and circulated amongst the members, and Government Departments and engineering and public bodies would be notified of the formation of the Association. It was felt that the Association, as the only body representing consulting engineers, would form a useful channel through which the opinions of consulting engineers could be ascertained and with which bodies representing other engineering interests could usefully confer.

The meeting approved the alterations and the addition (with regard to the use of the abbreviation "M.Cons.E.") set out above.

The CHAIRMAN then moved, and MR. W. R. COOPER seconded, a resolution that the memorandum and articles of association and the rules as amended and as printed in the document before the meeting, be received and adopted, which was duly carried.

MR. J. H. BLIZZARD proposed that the members suggested by the Committee (Messrs. J. S. Alford, H. P. Boulnois, W. T. Douglass, B. Latham, E. L. Mansergh, W. M. Mordey, W. H. Patchell, H. Rofe, J. F. C. Snell, E. H. Stevenson, J. Swinburne and G. M. Taylor) be the London members of the Committee for this year. MR. A. A. CAMPBELL SWINTON seconded, and the motion was duly carried.

The CHAIRMAN then proposed that the list of country members of the Committee be left vacant for the present, on the understanding that the Committee would fill the list up with the best names they could find for the provincial towns, and the motion was duly carried.

Wire Ropes for Lifting Appliances.

By DANIEL ADAMSON, of Hyde.

(*Abstract of paper read before the* INSTITUTION OF MECHANICAL ENGINEERS, *at Belfast, July*, 1912.)

THE question of the durability of the parts of mechanical structures seems to be strangely neglected by all authorities. A designer has generally the choice of several formulæ for calculating the mere strength of a given member, but usually he has to depend upon his own experience for the correctness of the proportions that will ensure for it a reasonable length of life. The durability of wire ropes in particular is of great importance to all engineers.

The wire used for lifting ropes is of crucible steel having a tensile strength varying from 80 to 130 tons per sq. in. Although ropes made from material having a high tensile strength are of smaller diameter for a given load and a given factor of safety, yet this is not a great advantage to the crane designer, because the stiffer character of the wires makes larger drums desirable, if the durability of the rope is to be considered.

The ratio of the diameter of the individual wires to the diameter of the completed rope is an important factor. If the wires are too large they are stressed considerably when passing over the pulleys, and accordingly the material is quickly fatigued and the wires break. Smaller wires, on the other hand, are more quickly worn through by rubbing against the pulleys and against their neighbours in the body of the rope.

Abrasion is the principal factor limiting the life of wire ropes, and taking two ropes of equal strength, of which one has four times as many wires as the other, it may reasonably be expected that with a pulley-diameter bearing the same proportion to the diameter of the wires, the life of the rope with fine wires will be one-quarter of that of the rope of coarser wires working over a pulley of correspondingly increased diameter.

A German investigator (Ernst Heckel) refers to the very great surface pressures on the wires at the place of contact with the pulley (amounting in his opinion to as much as 12 tons per sq. in.) as a vital point in connection with the wear of wire ropes. This high pressure, accompanied as must be the case by relative movement even if quite small, readily accounts for the wear which takes place on the surface of the wires where they touch the pulleys or the other wires in the rope.

The author has felt for many years past the want of information as to the effect of using pulleys of different diameters; the experience of users afforded no reliable guidance, presumably on account of the great difference in the conditions under which ropes work in different shops. Inquiries addressed to the users of cranes elicited very various replies; ropes working upon cranes of the same general design were found to last for periods of from two years to ten years and upwards, and one correspondent suggested that 20 years might be expected from ropes on cranes (of from 5 to 20 tons capacity) if damage from accidental causes could be eliminated.

The most reliable and consistent information that the author has been able to discover is contained in a paper by Mr. A. S. Biggart published in 1890.

The effect of oiling the ropes is shown to be very beneficial, increasing the life of a given rope by two or three times. This is obviously due to the reduction of the cutting action of the wires upon each other. Experiments were also made to ascertain the effect on the life of a rope of running it over pulleys so arranged that the rope was subjected to reverse stresses. The results obtained from this series of experiments showed that generally the life of a rope working under such conditions was only one-half as long as that of a similar rope bent in one direction only.

When the first wire breaks, the rope may be assumed to have passed through one-half of its life, and as no one knowingly works a rope until it breaks entirely, the breakage of even a few wires is a sign that a rope should be carefully watched, and replaced by a new one at an early opportunity.

The effect of varying the proportions of diameter of pulley to diameter of rope is one of the most important features to be noticed. Speaking generally, Mr. Biggart's experiments show that increasing the diameter of the pulleys by an amount equal to two circumferences of the rope will double the life of the rope.

Whether two, four, or six falls are adopted, the diameter of the drum and pulleys should remain about the same, if the ropes are to have equal durability.

The ropes make two bends at the lower pulleys to one at the drum, and, therefore, if the lower pulleys are made of the same diameter as the drum, they will be responsible for two-thirds of the wear and tear of the rope. Now it is usually difficult to increase the diameter of the working barrel or drum of a crane, but a simple means of improving the durability of crane ropes is at the disposal of the designer, namely, to increase the diameter of the pulleys in the blocks, leaving the drums of the original size. This alteration can usually be effected without serious alteration of the design, and may even be carried out on existing cranes.

The result of increasing the diameter of the pulleys by an amount equal to two circumferences of the rope, will be that the effect of the double bend round the lower pulley is halved, and the resultant effect of the three bends will be equal to two only, and the relative life of the rope will be increased by 50 per cent.

Where, as is usually the case, the average height of lift in a shop does not reach half the maximum available, then that portion of the rope which passes under the lower pulley does not reach the upper drum, and accordingly is only subject to the wearing action of the two bends at the lower pulley. If, therefore, the effect of the bends at the lower pulley is reduced to one-half, by the proposed increase in diameter of the pulley, then the actual life of the rope will be doubled, instead of only being increased by 50 per cent., as was first assumed.

Where there are more than two falls of rope, the effect of increasing the diameter of the pulleys by an amount equal to two circumferences of the rope is also very marked.

Some Continental makers point out, very rightly, the desirability of making the compensating pulleys of reasonable size. The motion over such pulleys is apparently considered as negligible by some designers (judging by the forms of construction adopted), but this point of view overlooks the movement of the rope due to the swinging of the load, and the repeated bending of the rope at the same place over a small radius has an appreciable effect upon the durability of the rope.

Although the deductions laid down here appear too simple to need elaboration, a glance at the designs of many modern cranes shows that neither the designers nor the purchasers are aware of the importance of the principles involved, otherwise we should not see modern cranes in this country with reverse bends in the ropes, and as many as eight plies of rope to carry the load on cranes of only 15 tons capacity, while at the recent Brussels Exhibition there were cranes exhibited by well-known Continental makers showing the same faults.

The "lay" of the strands and the lubrication of the rope when in use have each a considerable effect upon durability. "Lang's lay" has more than double the life of ropes of ordinary "lay," and ropes that are oiled last more than twice as long as when this precaution is neglected, as already mentioned. The superiority shown by "Lang's lay" naturally gives rise to the question why it is not exclusively used, and the answer the author has obtained from rope makers is that such ropes must be very carefully handled to avoid "kinks," and also they are found to be more liable to "spin."

The Commercial Utilisation of Peat for Power Purposes.

By H. V. Pegg.

(*Abstract of paper read before the* Institution of Mechanical Engineers, *at Belfast, July,* 1912.)

It has always appeared to the author that, in order to bring the utilisation of peat to a commercial level, the first consideration would be the utilisation of the peat as far as possible in the condition in which it leaves the boglands, without any preliminary and expensive machine treatment.

The author had the opportunity about seven years ago of experimenting with air-dried hand-cut peat, fired into a special form of gas-producer. With all gas-producers using bituminous fuel the main trouble is to get rid of the tarry by-product. In this instance the gas-producer was arranged to work intermittently, there being periods of "blowing" during which the fuel in the producer was urged to incandescence, and periods of gas-making during which the tarry by-products were passed through the incandescent fuel where they were split up into gas. The chief difficulty experienced with this plant was the high thermal value of the gas generated, about 330 B.TH.U. Owing to the high and varying percentage of hydrogen in the gas, it proved unsuitable for use in the works gas-engine; and although the plant was running more or less continuously for 10 days driving the whole works, very considerable trouble was experienced, not only in the engine, but also in the plant, owing to the varying moisture content of the peat, the producer plant being decidedly sensitive in regard to this latter point.

From the experience then gained it appeared evident that it would be wiser to extract the tar from the gas, rather than to try to utilise the same by converting it into gas, and further that the producer must be comparatively non-sensitive to the amount of moisture in the peat fuel. Some two years ago the author discussed the question of the utilisation of air-dried peat fuel with Mr. Hamilton Robb, of Portadown, who, having large supplies of such fuel convenient to his factory at Portadown, was strongly of opinion that it should be possible to utilise such fuel in order to generate the power required in the factory. As the result of various tests run with an experimental plant at the works of Messrs. Crossley Brothers, Openshaw, a special plant was eventually manufactured by them under their designs and patents and to the author's specification. This plant has been running since last September.

Last October it was subjected to a test run of six hours' duration with a load of 250 B.H.P., the peat consumption per B.H.P.-hour averaging 2·55 lb., the peat fuel containing 18·98 per cent. of water; this was with both producers running, although the load was considerably below the total capacity of the plant. When necessary it has been found that the above load can be safely carried with either producer working singly, and the plant has run under these conditions for several days.

The percentage of moisture in the fuel during the above test was unusually low, owing to the unusually dry summer of 1911. During November and especially December last the fuel fed to the plant was extremely wet, as the rainfall in those months was very heavy and the fuel supply was and is entirely exposed to the weather. The plant, however, worked just as well with sodden peat as it did with the drier peat, the only difference being the amount of fuel consumed. The amount of water in this "sodden peat" varied considerably from day to day; as near as could be estimated, it was at least 70 per cent.

The separation of the tar from the gas was the chief difficulty to be overcome; it was found far better to rely on an ample water-spray through which the gas passed than any form of coke-scrubber, as the coke rapidly became clogged with tar. The main portion of the tar was thrown out into a tar sump by a centrifugal tar extractor; but unless the gases were subjected to a thorough washing and cooling by the water-spray above referred to, it was found that a certain proportion of tar got past the extractor, collected in the gas mains and finally found its way into the gas engines. It was a matter of experiment as to the precise amount of water sprayed into the cooler which was necessary in order to ensure that the tar vapour should be sufficiently condensed before reaching the centrifugal extractor, so as to enable the extractor to effect the needful separation. As now arranged, the proportion of tar in the gas after passing the extractor is small, and the engine valves do not want cleaning out more than once a week.

When first started, the plant generally, and especially the producers, required a thorough cleaning once a week; at the present date the plant can be run if necessary for three weeks without cleaning, though the weekly cleaning generally takes place as a matter of policy. This result has been obtained owing to the increased amount of washing water used, which now amounts to about 7 gallons per B.H.P. per hour. The proportion of tar recovered is about 5 per cent. of the weight of fuel consumed, and during the initial stages of the running of the plant a certain amount of this tar was sold to tar-felt manufacturers at a price of 35s. per ton, but sales in this direction ceased owing to an, at present, ineradicable pyroligneous odour which persistently clings, not only to the tar itself, but to all the various oils distilled therefrom.

Experiments have also been made with the tar in oil-burning boilers, but owing to the very high percentage of water in the tar —up to 50 per cent.—and the large quantity of solid matter also present, a very large amount of preliminary treatment is necessary. At the present time the whole factory at Portadown is run entirely on peat fuel, the consumption being about 44 tons per week, of which the producer plant takes about 22 tons. The nature of the peat varies considerably; with good black heavy peat the weekly consumption for all purposes drops as low as 35 tons; and with light top peat from the surface of the boglands the consumption rises to 54 tons. The barges bring a load of 35 tons with heavy peat and 24 tons light peat. The peat is unloaded from the barges and conveyed to the producer platform and boiler house by a transporter. Clinker troubles are not often experienced, and only when burning the inferior grade of peat, the presence of sand in the fuel causing the trouble.

The author is indebted to Mr. W. A. Mullen, manager at the factory of Messrs. Hamilton Robb, Ltd., for the following figures in regard to the cost of fuel, these figures being given on the 12th of June last :—

Cost of Running Factory on Coal per week :

		£	s.	d.
8½ tons of anthracite at 35s. ...	...	£14	17	6
19 tons of steam coal at 17s. . .	...	16	3	0
		£31	0	6

Cost of Running Factory on Peat per week :—

		£	s.	d.
Say up to 50 tons of peat at 6s.	...	£15	0	0
Weekly saving ...	...	£16	0	6

Allowing for 15s. for extra labour, the net weekly saving figures out at £15 5s. 6d.

ANALYSIS OF SAMPLE OF PEAT.

(Received on September 14th from Mr. Hamilton Robb, Portadown.)

PROXIMATE ANALYSIS.

	Per cent.
Water	18·98
Volatile matter	55·17
Fixed carbon	21·75
Ash	1·10
	100·00

ULTIMATE ANALYSIS.

	Per cent.
Carbon	44·60
Hydrogen	5·42
Nitrogen...	0·97
Ash	1·10
Moisture	18·98
Oxygen (by difference)...	28·93
	100·00

ANALYSIS OF AVERAGE SAMPLE OF GAS DURING A 10-HOURS TRIAL.

Moisture in Fuel 26 per cent.

CO_2	10·6
CO	21·0
H_2	13·0
CH_4	3·7
Total combustible	37·7 per cent.
Calorific value (calculated from analysis) ..	144·0 B.TH.U.

THE PARKS ELECTRO-CYANIDE PROCESS.*

By JOHN R. PARKS.

HERETOFORE, practically all successful metallurgical processes in which cyanide salts have been used to extract gold and silver from their ores have contemplated :

1. Removal of coarse particles of the precious metals by amalgamation in a separate device before the ore is submitted to cyanide attack.
2. Presentation of the more or less finely crushed ore to chemical attack by an aqueous solution of cyanide salt, to which is added an alkali to neutralise acid radicals of the ore, to save cyanide salt; this solution must also contain oxygen, either the normal amount that water will dissolve from the atmosphere, or a super-abundant amount added by aero-agitating devices.
3. Separation in a clear state, by settling and filtering devices, of the aqueous solution containing gold and silver cyanides, unused cyanide salt, and complex impurities, cyanates, sulphocyanates, &c., of the base metals.
4. Continued and perfect contact of the cyanide solution with the shavings or dust of an inexpensive base metal which precipitates part or all of the precious metals.
5. Separation of the precipitated precious metals from the remaining base metal, washing, collecting, drying and compressing the finely divided precious metals for melting and casting into bullion.

The object of the Parks electro-cyanide process is to apply economically all of the chemical and physical forces necessary to extract and collect the precious metals, applying them at their highest potency, and simultaneously. This necessitates economy in chemicals, their almost instant presentation under their best operating conditions to every particle of precious metal in the ore, and for only such length of time as is required for a thorough chemical interchange. That this has been accomplished will be shown by quoting results of its application to simple and to refractory ores; all of these ores, in their raw state, were made to yield their precious metals rapidly in the form of amalgam, in a single operation, in a single machine, eliminating all filtering and precipitating devices.

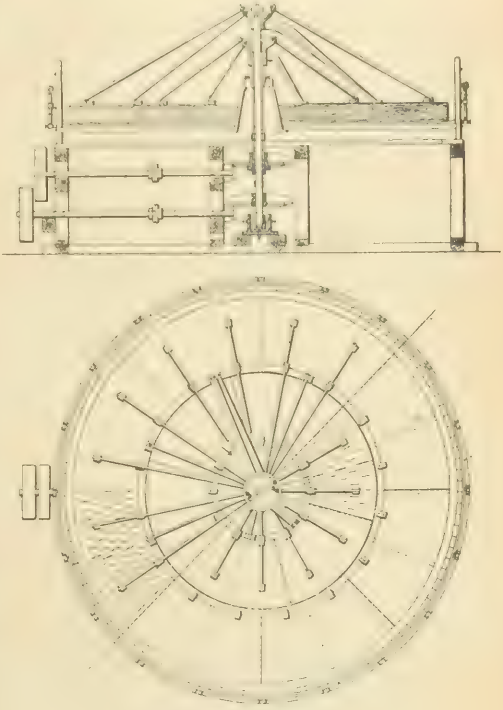
PARKS ELECTRO-CYANIDE PAN.

The Parks electro-cyanide pan consists of a wooden tub, 15 ft. diameter and 30 in. deep, through the centre of which projects a small conical casting for the passage of the working shafts. Practically the entire bottom of the pan is covered by an amalgamated copper plate, to which quicksilver is automatically added during operation, in proportion to the amount of precious metal in the ore being treated. About 9 in. above the copper, or cathode, plate, a cast-iron anode plate equal in area to the copper plate is mechanically suspended. The cast-iron plate is divided into two annular rings, the outer one containing 60, and the inner one 40 per cent. of the anode area.

These annular anodes are revolved in the same direction, and independently, by means of pulleys, gears, and a solid and a hollow shaft, so that any midway point of the inner ring travels practically the same number of feet per minute as any midway point of the outer ring. On the lower side of each of the anode rings, wooden paddles 7 in. deep are fastened radially, about 5 ft. apart, the bottom of the paddles being 2 in. above the copper plate.

The compound rotary motions of the anode rings and their paddles give to the pulp confined between them and the cathode plate a very uniform spiral motion outward, keeping the ore in a perfect state of suspension, and at a little higher speed than pulp travels down a stamp-battery plate. By the centrifugal force of the paddles, the pulp on reaching the staves of the pan is forced up between them and the outer edge of the outer anode to a height of about 16 in. above the anode, retaining the rotary motion imparted by the paddles and now endeavouring, by gravity, to seek the lower level at the centre of the pan; the resultant motion is a downward and inward spiral until the ore passes over the inner edge of the inner anode, near the centre cone, when it again meets the paddles and starts to repeat its cycle of travel.

At the periphery of the pan, and on a level with the cathode plate, 20 jets of compressed air are admitted through needle valves set at regular intervals around the pan. The air pressure—about 12½ lb. per sq. in.—is sufficient to overcome the centrifugal force of the pulp against the valve exits and to keep them clear. The amount of air is calculated from the oxygen demanded by Elsner's formula for dissolving the precious metals by cyanide salt, with an allowance for unavoidable waste in mixing. The air, on leaving the valves, travels against the outward spiral motion of the pulp between the anode and cathode plates, and nearly all the excess makes its appearance as a slight effervescence around the centre cone, being thoroughly incorporated with the pulp; comparatively little escapes by rising to the surface without passing between the plates. At 100 lb. pressure, 1½ ft. of air per minute is an ample supply for the pan during treatment.



THE PARKS ELECTRO-CYANIDE PAN.

The writer, during the past eight years, has experimented with iodine, bromine and many other chemicals, seeking economy and efficiency, and has found nothing so effective and economical as commercial potassium or sodium cyanide, or the commercial double salt, together with common lime and common salt, aided by the sodium amalgam and caustic soda generated by the process.

The electrical factor of the process, which consumes from 75 to 80 per cent. of all the physical power necessary to operate it, and accounts for the speed, efficiency and economy of this as compared with other processes, is worthy of considerable attention.

From a 10 to 12-volt, 400-ampere, D.C. generator, the positive wire, after leaving the switch and indicator board, is led to the mechanical portion of the pan in four branches, each of which terminates in a suitable brush; two play against a copper collecting ring on the solid shaft which drives the outer annulus of the anode, and two against a similar ring on the hollow shaft which drives the inner annulus of the anode. By this means the electric current passes up the vertical driving shafts, insulated from the cone through which they pass, and proceeds down the driving arms and supporting rods to the anode annuli, where it is uniformly distributed.

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* *School of Mines Quarterly*, Columbia University, July, 1912.

The negative wire from the electric generator, after passing through the switch and indicator board, also terminates in four branches, each of which connects with a copper tail piece projecting through the pan, each tail being a portion of one of the four segments of the copper plate forming the cathode. Owing to the insulation of the machine, all the electric current must pass from anode to cathode through the pulp.

In treating a charge consisting of 7½ tons of ore (dry weight) with an equal weight of water, and containing its quota of lime previously added during the crushing of the ore, such an amount of strong cyanide solution is added as to equal 1 lb. of cyanide salt per ton of ore in the pan. The correct weight of cyanide per ton of ore may be previously determined by titrating filtered samples from the pan charge during a test run for cyanide consumption. After addition of the cyanide, finely crushed common salt is added until the ammeter registers 300 to 500 amperes, at 9·5 to 10 volts, as determined by a test run. The pan is then put in motion, the air is turned on, and the quicksilver is put into its distributor.

Many complex chemical compounds are formed, some of which are decomposed, in a manner which baffles the skill of the electro-chemist to explain, but among the established effects of the electric current the following may be stated :—

The salt is decomposed by the electric current and metallic sodium is constantly precipitated on the mercury-coated copper plate, forming sodium amalgam ; the sodium is converted into caustic soda, by its reaction with water, which, uniting with acid radicals in the ore, protects the cyanide from compounds from which the lime does not so readily protect it, thus saving a much larger portion of cyanide salt than can be saved without the current. Chlorine is also generated, but rarely indicates its presence, probably being united with basic radicals of the complex charge.

These several ions travel very slowly in quiet solutions, but in this mechanical device the pulp travels an average of seven miles over the copper plate in a 2½-hour treatment, presenting the cathions rapidly for discharge and deposition. This is analogous to the method by which copper is precipitated on a platinum dish, in modern electro-analysis for copper, by a revolving anode in a small fraction of the time required for precipitation in quiet solutions.

The cyanide anion probably seizes a potash or soda radical and is reconverted into nascent cyanide salt, unless a particle of precious metal, for which it has a greater affinity, presents itself first. However, there can be no question as to the so-called restoration of cyanide, for the writer has frequently found much more free cyanide of potash or soda in a sample of solution taken a half-hour or an hour after a previous sample.

Theoretically no mercury can be lost by scouring or flouring in the charge, as any subdivided particle of this metal too small to seek the cathode by gravity is sufficiently small to yield to electro-cyanide solution, whereby it is electro-chemically precipitated back on the plate. Practically, a small amount is lost, for in a 2,500-ton run on Ruth ore a loss of about 5 lb. was reported.

On samples containing 0·8575 oz. of gold per ton, the writer has reduced the average tailing sample to 0·0075 oz. per ton, showing an extraction of 99·1 per cent. by six hours' treatment in the electric pan, using 1 lb. KCN per ton of ore ; the same ore, reduced to the same fineness, yielded but 92 per cent. to solution in 48 hours' treatment in Pachuca tank (generally recognised as one of the best aero-agitating devices) using three tons of solution containing 3 lb. KCN per ton, or 9 lb. of cyanide salt per ton of ore.

Many of our western precious-metal ores from oxidised zones are contaminated by carbonates of lead, zinc and copper, which preclude economic treatment by the ordinary cyanide methods, owing to the difficulty in precipitating the precious metals in the presence of the cyanides of the base metals, aside from the excessive consumption of cyanide salt. The electric current, however, precipitates the base metals as well as the precious metals, on the amalgamated plate. The writer has produced, by the electric pan, bars of bullion worth $1,200 or $1,400 which averaged but 512 fine in precious metals, the other 50 per cent. of the bars being lead, zinc and copper, alloyed with the precious metals. The refining charges on such bullion are low.

As precipitation of precious metals takes place more rapidly from strong than from weak solution, in treating certain ores economy can be introduced by discharging the pan at a fixed value of unprecipitated precious metals in solution (50 c. to $1 per ton). After passing the charge through a revolving settler used as a precautionary amalgam trap, it may then be sent through a Dorr thickener, whereby 50 per cent. of the solution from a 1 : 1 charge, and 80 per cent. of that from a 1½ : 1 charge, can be returned clear for original charges ; this not only saves time and increases the daily capacity of the plant, but secures a higher percentage of recovery of the precious metals, while preventing undue waste of common salt and unused cyanide.

The total horse-power required for a single pan is 0·6 h.p. for mechanical agitation ; 1 to 1·5 h.p. for compressed air ; and 4·5 to 6 h.p. for electric current.

The capacity of the pan depends on the amount and character of gangue in the ore and on the nature of its precious metal minerals. The proportion of gangue determines whether one ton of ore may be treated with 1 ton or will require 1½ tons of water ; none but the very clayey types require 1 : 1½ charge.

A single pan charge of the 1 1 class is 7·5 tons of ore, dry weight, and of 1 : 1½ ore, is 6 tons ; the time required for treatment varies from 1 to 12 hours, generally being 2½ to 4 hours ; hence the capacity of the pan, allowing for charging and discharging, varies between limits of 15 and 90 tons per diem, but on the average run or ores it varies from 36 to 60 tons per diem.

The large capacity of the pan, the small tonnage of ore under treatment in the mill at one time, and the small amount of machinery and apparatus required, reduce the total cost of installing mills using this process to 30 to 60 per cent. of the amount necessary to install any other process of equal daily capacity.

A few examples will show the efficiency of the process.

Ruth Gold Mining Co.'s mill, Kingman, Arizona.—Daily capacity 50 tons. Quartz ore with large amount of manganese minerals ; little free gold. Values occur in sulphide minerals ; ratio of gold to silver 1 to 12. Test in 40-in. testing plant. Pan charge, 215 lb. ; 1 lb. KCN per ton of ore, six hours' treatment ; 200-mesh pulp. Results : Precipitated as amalgam, gold 96·76 per cent. ; silver, 87·7 per cent. ; monetary values, 95·6 per cent. Shortly after the mill was turned over to the Ruth Co., three pans being used, each with 7½-ton charges, the mill foreman's samples and his assayer's results showed as follows :—Precipitated as amalgam, gold 96·66 per cent. ; silver, 87·77 per cent. ; monetary values, 95·09 per cent. ; 1 lb. KCN per ton of ore, six hours' treatment ; value of ore, $18 per ton.

Maginnis Mill, Maiden, Montana.—One pan ; 7½-ton charge ; 30-mesh pulp. Oxidised ores containing 0·33 to 0·50 oz. gold and from 1·5 to 4 oz. of silver per ton, contaminated with carbonates of lead, zinc and copper. One pound KCN per ton ; 2½ hours' treatment. Precipitated as amalgam, 86 to 92 per cent. gold, 62 to 72 per cent. silver. The low silver contents of this ore prohibited the economic use of cyanide salt in stronger solutions, in order to secure higher extraction from its silver minerals.

Gold ores from Kendal, Fergus County, Montana.—Decomposed, porous limestone, impregnated with gold ; an ideal cyanide ore. Test of 225 lb. in testing pan ; 12-mesh ; 1 lb. KCN per ton ; after one hour, 90·5 per cent. of gold as amalgam ; after 2½ hours, 97 per cent. of gold contents of the ore reduced to amalgam. Ore valued at $8 per ton in gold.

Orient, Washington.—Auriferous, fine crystals of pyrite in andesite ; no free gold. Average value, 1·03 oz., $21·29 per ton. Four hours' treatment on 230 lb. lots ; 4½ lb. NaCN ; pulp 120-mesh. 95·35 per cent. of gold contents saved as amalgam.

Whitman Mine, Pearl, Idaho.—Ore contained arsenical pyrites, 25 to 27 per cent. ; pyrite 40 per cent. ; gangue 35 to 37 per cent. Six hours' treatment with 4 lb. KCN ; 120-mesh. Gold, 1·3385 oz. per ton, worth $27·67 ; saved in form of amalgam, 88·8 per cent.

Metates Mine, Sinaloa, Mexico.—Ore contained 5 per cent. pyrrhotite, with galena and antimonial sulphide minerals, in quartz gangue. Twelve hours' treatment ; 230 lb., 120-mesh ; 12 lb. KCN used ; 7·7 lb. consumed. Gold, 0·625 oz. ; silver, 63·015 oz. ; value, $44·43 per ton. Extracted in form of amalgam, 99 per cent. gold, 91·1 per cent. silver.

All of the results cited above were obtained by direct pan treatment, without returning any solution once passed through the pan.

PARLIAMENTARY.

Falkirk Electric Lighting Order.

The inquiry into the Provisional Order promoted by Falkirk Town Council for the extension of the burgh boundaries was concluded last Friday, when Sir John Dewar, the chairman of the Commission, intimated refusal of the Order.—Mr. C. M. Aitchison (advocate) represented the Falkirk and District Tramway Co., while Mr. James Keith (advocate) was counsel for the Scottish Central Electrical Power Co.—Mr. C. D. Murray, K.C., addressing the Commissioners on behalf of the objectors, said there had been no change in circumstances since the burgh's last application for powers to extend. The only pretence of change was that Mr. Balfour had promoted his Electric Lighting Order for the districts which the town now wanted to annex. The apprehension that the gas undertaking of Falkirk would suffer by electrical competition was an absolute bogey.—Mr. Balfour Browne, K.C., replying on behalf of the promoters, said the Balfour Order was one reason for the burgh being before the present Commission with an extension scheme. If Mr. Balfour had got his Order before they promoted their extension scheme that scheme would have been blocked, and it would have been said that they had not been supplying electricity. That was one of the reasons why the Town Council did not oppose Mr. Balfour's Order. The whole question had been one of tactics.—Mr. James Learmouth, county clerk, in the course of his evidence, spoke of the attitude of the County Council with regard to Mr. Balfour's Electric Lighting Order. Mr. Balfour agreed to supply the County Council with electric light on reasonable terms, and the County Council made that a condition for not opposing the Order. The Town Council were very anxious that the County Council should oppose the order, and they had a conference with the Town Council on the subject. The proposal was made at that conference that if the Town Council promoted an Electric Lighting Order the County Council should take their electricity in bulk from the Corporation. Witness pointed out that he did not see what difference the electric lighting was to make to the Corporation gas undertaking if the electricity was taken from the Council or Mr. Balfour in bulk. If the Council had promoted an order to supply electricity to the districts the rates would be fixed by Parliament. At the conference Treasurer Wallace said he would be satisfied if the

County Council promoted an Electric Lighting Order of their own. That was said without any question as to their taking any supply from the burgh. It was afterwards that it became a *sine quâ non* that the electricity should be taken from the burgh. Then the burgh had extension so little at heart that the Town Council said that if the County Council promoted an Electric Lighting Order, the Town Council would indefinitely postpone another Burgh Extension Order. The inquiry lasted over 11 days.

Royal Assent.—Among the Acts to which the Royal Assent has just been given are the following:

Electric Lighting Orders Confirmation Acts, Nos. 1, 2 and 3.
Bradford Corporation Trolley Vehicles Order Confirmation Act, 1912.
Tramways Orders Confirmation Act, 1912.
Clyde Valley Electrical Power Order Confirmation Act, 1912.
North Ormesby, South Bank, Normanby and Grangetown Railless Traction Act, 1912.
Bognor Gas Light and Coke Co. (Electricity) Act, 1912.
Metropolitan District Railway Act, 1912.
London United Tramways Act, 1912.
Preston, Chorley and Horwich Tramways Act, 1912.
London Electric Railway Act, 1912.
Edgware and Hampstead Railway Act, 1912.
Ericht Water and Electric Power Act, 1912.
Lanark County Tramways Act, 1912.
National Electric Construction Co., Ltd., Act, 1912.
Midland Railway (L.T. & S.R. purchase) Act, 1912.
Metropolitan Railway Act, 1912.
L.C.C. Tramways and Improvements Act, 1912.

AUSTRALIAN TRADE.

THE directions which were recently issued to the Victorian Railway Commissioners for the future, and to which reference is made in our leading columns this week, include the following:—

"Taking into consideration the quality, time of delivery, and price of the goods, orders are to be given to British manufacturers as against foreign tenderers. Wherever the Commissioners recommend an order for a contract to be entered into with a foreign tenderer, they must, under the conditions of the Act, for the future, explicitly state their reasons in a memorandum to the Minister, who will then decide, in view of all the circumstances presented to him.

"Other matters came up in connection with the inquiry. One is that although certain regular contracts are entered into by the Commissioners with Australian and oversea contractors, there are some considerable quantities of materials purchased, apparently for emergency work; and although invitations to quote for these materials are publicly advertised, in accordance with the Railway Act, we feel that quite a number of lines purchased in this way should be included in the biennial and periodical contracts. We propose to give directions, therefore, so that the goods purchased on quotation in this way shall be reduced to the minimum.

"Questions arise as to the encouragement that should be given to competitive tendering. It has been alleged, and the Government is satisfied that it is true, that the time allowed to distant tenderers to consider the specifications and requirements of the department is not sufficient to elicit the widest competition. We propose, therefore, to recommend that more time be in future given to firms who have not all the data at hand in Australia, so that they shall have time to send particulars home by the mail, and send their offers out by the mail.

"Some of the tenders—and they are from reputable business houses in England—have been rejected for tires, wheel centres, axles and blooms, because the chief mechanical engineer, studying the matter from the standpoint of public safety, said that the goods were not sufficiently known to him to warrant their acceptance at the price, although, in some cases, the prices were lower than those of the accepted tenders. We found that many of these firms have been for many years supplying most of the other Australian States in these particular lines, and that the specifications for their goods complied with the requirements of the British Board of Trade. We decided that offers from firms of this character in future shall not be rejected on the ground of the goods not being known, but that where their business has been so wide-spread with British and Australia railway companies and States, if their prices do not justify acceptance of all their tenders, trial orders should be given to them to test the durability of their goods.

"It is the practice of the Victorian Railway Department, apparently alone amongst all the States of Australia, to insist on applying tests, chiefly at Newport, to goods ordered, particularly rolling stock. This, we find, has a tendency to be objected to by many British manufacturers, and within a limited area there is objection amongst tenderers. We consider that, for the future, the place of the tests should be at the point of manufacture, and that a specially qualified engineering officer should be appointed to take charge of this work. No officer should be kept at it for more than about 12 or 18 months. We believe that, if such men as these are sent abroad, as was done in connection with the engines recently imported from the Baldwin works, and Beyer, Peacock & Co., they will secure a wider experience, which, when they return to Victoria, will be of great use to the construction branches of the railways.

"There have been a great number of cases revealed in the inquiry of a tender being accepted by the Railway Department which was not the lowest. This applies to all kinds of goods, British, foreign and Australian, and it appears to the Government that, unless there are good and sufficient reasons that could be suggested for this by the recommending officer, and endorsed by the Commissioners, for the acceptance of the higher tender, the lowest tender should, in the ordinary course of business, be accepted."

LEGAL.

ATTORNEY GENERAL *v.* THE LONDON ELECTRIC RAILWAY CO.

THE Attorney-General, at the relation of the Gordon Hotels, moved before the vacation judge (Mr. Justice Bankes) on Thursday, August 8th, for an interim injunction to restrain the defendant company from pumping in alleged breach of their Act of Parliament.

At the outset MR. BRAMWELL DAVIS, who represented the railway company, asked for an adjournment to answer the plaintiffs' evidence. The matter, he said, was one of great importance to his clients, and they only had the plaintiffs' affidavits on Tuesday. He asked that the motion might stand over for a fortnight.

MR. FELIX CASSEL, who appeared for the Attorney-General, said he had no objection if the defendants would undertake to do no more pumping in the meantime.

MR. BRAMWELL DAVIS said he could not do that.

His LORDSHIP asked whether the defendants' Act of Parliament did not prevent pumping.

MR. BRAMWELL DAVIS said they commenced pumping in December last, and had been going on ever since. The plaintiffs knew of the pumping last March.

MR. CASSEL pointed out that that would not affect the Attorney-General.

MR. BRAMWELL DAVIS said the pumping could not do the relators any harm, and his contention would be that this was not vacation business. When he came to argue on the construction of the Act of Parliament, he should submit that the defendants were not doing anything in breach of the Act.

MR. CASSEL said that the Act of Parliament expressly prohibited pumping. The plaintiffs first knew what was going on in March, and they at once communicated with the defendants. Not being satisfied, they sank a shaft on their own land, and on June 17th discovered that the water had fallen 3 ft.

MR. BRAMWELL DAVIS said that as they knew what was happening so long ago as June 17th, he should submit that this was not vacation business, but if his Lordship thought the motion ought to come on in the vacation, he must ask for time to answer the evidence. The importance of it was that if this pumping was stopped serious consequences might arise with regard to the whole of the electric railway system. This pumping was at present taking place in close vicinity to some new works of the District Railway. The works were, in fact, a transformer station, which, if stopped by flood, would affect three railways, as the electricity was taken from the transformer station for a portion of each of them. If the station were flooded the three railways must be stopped.

His LORDSHIP thought that if this had been going on since December last a fortnight's adjournment could not hurt the plaintiffs.

MR. CASSEL said things had been getting worse and worse. The plaintiffs, it was true, first found it out in March, but they were given assurances by the defendants' engineers, which appeared to be satisfactory. Since then the plaintiffs had taken steps by digging a hole on their own premises to ascertain exactly what was happening, and had discovered that a point had been reached when any further abstraction whatever would be a very serious thing to the Hotel Metropole and other buildings in Northumberland Avenue.

His LORDSHIP thought the defendants must have an opportunity of answering the evidence.

MR. CASSEL asked that the adjournment should be for a week only.

MR. BRAMWELL DAVIS said they wanted to place before the Court the best expert evidence that could be obtained, and it was difficult to procure at this time of year.

His LORDSHIP directed the motion to stand over for a fortnight.

MR. CASSEL asked that the defendants' evidence should be filed by next Monday week, so that the motion might be effective the following Thursday, and, further, that the defendants should undertake not to increase their pumping in the meantime.

MR. BRAMWELL DAVIS said they did not propose to increase the pumping, and would not, unless something unforeseen occurred. They would do their best to have their evidence ready by next Monday week.

On that understanding his Lordship directed the motion to stand over until August 22nd.

Torquay Electric Supply.—At a meeting of the T.C., the electrical engineer (Mr. C. W. Salt) reported that, in consequence of the increasing demand for current, more plant would shortly be required, and he recommended the installation of a 1,000-KW. turbo-alternator, at an estimated cost of £6,500, in the winter of 1913-14. The Committee recommended that the Council invite tenders for this plant, and that £3,000 be taken out of revenue towards the cost. Mr. W. Langton said that if this plant were obtained it would not be necessary to remove the station to another site for many years. The alternating current supply had increased by something like 60 per cent. Mr. J. Glanfield thought the consumers should be considered in this matter. They were entitled to a price reduction. Mr. E. T. Blackler said that as a matter of fact a reduction was probable shortly. The report was adopted.

BUSINESS NOTES.

Bankruptcy Proceedings.—Thomas Parker, 66, Friar Stile Road, Richmond, late 14, Mortlake Road, Kew Gardens, Surrey, engineer.—The receiving order herein was made on a creditor's petition, and according to the accounts filed the liabilities amount to £530, to meet which there are no assets. It appears that the debtor was articled to a firm of engineers, and stayed with them until 1890. He then travelled abroad for them until 1897, and also acted as a general consulting engineer on his own account. In that year he returned to this country and formed the Electric Street Car Syndicate, Ltd., of which he became managing director, at a yearly salary of £350. The business did not prove successful, and at the end of 1899 it was sold, and the debtor became chief engineer to a limited company in Cheshire, at £350 per annum and a bonus which averaged £100 a year. In 1902 he left them and opened offices at Darlington Street, Wolverhampton, and at Colmore Row, Birmingham, where he traded as a consulting engineer until 1904. He then came to London to act as engineer to a motor company, with a salary and 5 per cent. on the net profits, amounting to about £400 a year. In June, 1905, he left their employ and opened offices at 217, Piccadilly, trading on his own account as a consulting engineer. Subsequently he removed to Holborn, where he acted as chairman of a company and carried on his own business. He was also chairman of another limited company in connection with motor-cars, which did not prove successful. The debtor invented and patented an electrically-wound regulator clock, for three of which he obtained orders at £75 each. These clocks, however, were not satisfactory, one was sold and the other two are in his wife's possession. He incurred law costs and expenses to the extent of £1,000, of which £600 could only be recovered in connection with the manufacture of these clocks. He also invented and patented a carburettor and a new steering gear, for which his wife provided the money. In order to exploit the patents he entered into partnership with two others, and traded at 18, Berkeley Street, Piccadilly. A partner was introduced in October, 1910, and put in a capital of £3,000 and paid a premium of £750 to the then partners. He had to sue for his share of the premium and he recovered £250, which was paid to his wife, to whom he had previously assigned his interest therein and all his other assets. A private company was formed to work his inventions, his shares being allotted to his wife. A resolution for voluntary liquidation was passed in March of last year, and an injunction was obtained against him restraining him from going on the company's premises. In July, 1911, he and his wife surrendered all their shares in the company in consideration of their being released from the company's costs against him in respect of an abortive attempt by himself and his wife to obtain a compulsory winding-up order, and on his giving a promissory note for £50 at six months. This promissory note, however, he failed to meet, and it came into the possession of another, who obtained judgment against him and filed the petition. The failure is ascribed to losses in business ventures with others, and the law costs of proceedings arising therefrom. No books of account appear to have been kept. The following are creditors :—

Banks, G.	£248	Burrell & Payne	£13
Parker, C. H.	100	Edwards, Evans & Co.	25
Wall, N. C...	82		

Henry Hallifeld Oxley (otherwise known as Oliver Huxley), consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex.—The adjourned first meeting of the creditors of the above was held on Monday, August 12th, at the offices of the Official Receiver, 14, Bedford Row, W.C., Mr. F. T. Garton, Assistant Official Receiver, presiding. The statement of affairs showed unsecured liabilities amounting to £1,423, and assets estimated to produce £116 10s. The Official Receiver having again dealt with the proofs, said that the meeting had been adjourned at the debtor's request, to enable him to bring in a scheme of composition, but no such scheme had been lodged. The debtor's solicitors said it was still his intention to propose to the creditors a composition of 7s. 6d. in the £, and he had every reason to hope that the necessary funds would be forthcoming from the debtor's friends if the meeting were further adjourned. He suggested a month's adjournment, as it was exceedingly difficult at this time of the year to get into communication with people and complete details. A creditor: As far as the debtor is concerned, we have had experience of some of his promises. They have not always been fulfilled. If someone could show that he had been in communication with the debtor's friends on the matter, and the subject was being entertained, it might be different. The solicitor said it was only on the previous day that negotiations with the family had broken down. Up to a few days ago there was every reason to suppose they would have assisted. Debtor: I may say these negotiations may still go through—it is simply a matter of using some persuasion. After some discussion, the Official Receiver said it was a matter for the creditors. So far as the assets in the statement of affairs were concerned, there was nothing to be jeopardised by delay, but his experience was that even in the most hopeless cases debtors were in the habit of urging adjournments in some vain hope of something turning up. The solicitor said the debtor's friends would still help him; in fact, they blamed him for not going to them before the receiving order was made. Creditors complained of the probability of being brought to another meeting unnecessarily, but the Official Receiver pointed out that if there was a proposal to be lodged, it must be done so that the creditors could have it before them prior to the next meeting. If there was no proposal, it would not be necessary for them to attend, but simply to send a proxy in favour of adjudication. He did not think it would be a case for adjournment after this. It would be no use blaming the time of the year—that was no reason for these adjournments. Eventually the creditors agreed to give the debtor an opportunity of bringing in his scheme, and the meeting was, therefore, adjourned, the debtor's solicitor undertaking to pay the costs of calling the further meeting.

Andrew George Adamson, electrical engineer, Acton, and late of Christopher Street and other addresses in London.—A third dividend of 7¾d. in the £ is now payable at the Official Receiver's office, 14, Bedford Row, W.C.

T. M. Mackay, 15, Beresford Terrace, Ayr, trading as T. Mackay and Co., electricians, and as the Ayr County Motor Co.—In Edinburgh Bankruptcy Court on the 6th inst., the debtor appeared under sequestration of his estate. There were no questions. The statement of affairs showed that the liabilities were £7,658 and the assets £1,936.

Joseph Perkins, electrical engineer, Ebrington Street, Plymouth.—August 31st is the last date for the receipt of proofs for dividend, by Mr. A. N. F. Goodman, 7, Buckland Terrace, Plymouth, the Official Receiver.

Dissolutions and Liquidations.—Lamplough and Son, Ltd., mechanical, electrical and general engineers, Albany Works, Willesden Junction, N.W. Under a winding-up order made last May, meetings of the creditors and shareholders were held on Tuesday, at the Carey Street Offices of the Board of Trade, Lincoln's Inn Fields, W.C., Mr. W. J. Warley, Official Receiver, presiding. The accounts filed under the liquidation showed unsecured debts £12,572; loans on debenture bonds, £8,910; and preferential claims, £124; making a total indebtedness of £21,606. The assets are valued at £12,316, and after allowing for payment of the debenture and preferential claims, there remains an estimated balance of £3,282 to meet the unsecured liabilities, consequently there is a deficiency of £9,290 in assets to meet the liabilities of the company, and a total deficiency of £15,583 as regards contributories. The failure of the company is attributed to mismanagement, and to the fact that large quantities of parts of engines, &c., which were in an experimental stage, were ordered, and the company has not been able to utilise them. Mr. Lamplough does not admit that the company is insolvent. Mr. H. J. Gully, C.A., was appointed to act as liquidator with the assistance of a committee of inspection.

Electric Prepayment Meters, Ltd.—This company on July 15th, resolved upon voluntary liquidation, with Messrs. B. Bernheim and F. E. Stanley, as liquidators. A meeting of creditors is called for August 21st, at 3, Laurence Pountney Hill, E.C.

Digby & Biggs, inspecting and consulting engineers, 28, Victoria Street, London, S.W., and 49, Deansgate, Manchester.—Messrs. W. Pollard Digby, C. W. V. Biggs, and A. C. Heap, have dissolved partnership. Debts will be attended to by Mr. Digby, and the business will be in future carried on by Messrs. Digby and Heap, under the style of Heap & Digby.

Bradford Electrical Co., Ltd.—A meeting is to be held on September 16th at 56, Market Street, Bradford, to hear an account of the winding up from the liquidator, Mr. J. H. Haley.

Book Notices.—"Science Abstracts," Sections A and B. Vol. 15, Part 7. July 25th, 1912. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"Boiler Explosions, Collapses and Mishaps." By E. P. Rimmer. 1912. London: Constable & Co. Price 4s. 6d. net.

"*Proceedings* of the Engineering Association of New South Wales." Vol. XXV. Sydney, N.S.W.: The Association.

"Modern Illumination." By Henry C. Horstmann and Victor H. Tousley. 1912. London: The American Book Supply Co., Ltd. Price 8s. 6d. net.

"*Journal* of the Municipal School of Technology, Manchester." Vol. V. Manchester: The School.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 7. July, 1912. New York: The Society. Price $1.

"The Chart of the Elements." 1912. London: The Metallic Compositions Co.

"Growing Crops and Plants by Electricity." By E. C. Dudgeon. London: S. Rentell & Co., Ltd. 1912. Price 1s. net.

Trade Announcements.—Mr. G. B. Bowell, inventor of the "Silent" as well as of older forms of electric clocks, is at the end of this month giving up the active management of the Silent Electric Clock Co.'s Works, which he has controlled during the past four years. Mr. Bowell, who will continue to act as consulting engineer to the Silent Co., is commencing business as consulting engineer and advisory expert at Margate. The Silent Co., which will continue in business at Goswell Road, will be registered as a limited company, and Mr. A. Gilbey Gold will be on the board.

The Brimsdown Lamp Works, Ltd., have recently taken over an additional suite of offices with increased telephone accommodation at Kingsway House, London, W.C., and all communications should be addressed there. The new telephone No. is "7904 Gerrard" (two lines).

The British L.M. Ericsson Manufacturing Co., Ltd., announce that their London address will be altered from August 30th to Old Serjeants' Inn, Chancery Lane, London, W.C.

Mr. F. Bescoby, electrician, of 22, Grove Street, Retford, has taken his son into partnership, and the business will be carried on under the style of F. Bescoby & Son.

The Sandycroft Foundry Co., Ltd., announce that in future the title of the firm will be "Sandycroft, Ltd." They have made this alteration owing to the confusion of ideas resulting from the use of the former title, which led many people to imagine that they were makers of iron castings and heavy engineering work only, whereas, as our readers know, they have been making electrical machinery, starters, motors and generators, both D.C. and A.C., for mining and all industrial purposes, for the past 12 years.

Messrs. Lloyd Wise & Co., consulting engineers and chartered patent agents, have removed to their new offices, 10, New Court, Lincoln's Inn, London, W.C.

According to an Australian exchange, a company entitled Ramsay Sharp & Co., Ltd., has been registered in Sydney as electric lamp manufacturers, with a capital of £20,000 in £1 shares. The directors are H. W. Ramsay Sharp and R. Burgin (joint managing).

The same contemporary announces that the Lawrence and Hanson Electrical Co., Ltd., have been appointed agents in New South Wales for the Sterling Telephone and Electric Co., Ltd., London.

The Schniewindt Electric Co., 40-41, Staniforth Street, Birmingham, has been formed to take over the manufacture in this country of the specialities previously manufactured by Mr. Schniewindt, Neuenrade, Westphalia. The above premises are fitted up with new machinery for making his patent asbestos woven net resistances throughout, only British materials being used. The firm's other specialities are resistance wires, made by their German works, electric heating elements and electric heating and cooking apparatus. The new works are under the sole management of Mr. H. H. Cressall, who formerly acted as sole agent for the firm.

Catalogues and Lists.—Messrs. H. A. Jackson and Co., Caxton Works, Salford, Manchester.—Several illustrated lists, of several shapes and sizes, showing and giving prices of the following manufactures: The "Fourlite" shop fitting; "Warldin" iron-clad "Y1" type switches; electrical switch blocks; hand-beaten art metal luminous radiators and electric light fittings.

Westminster Electrical Testing Laboratories, York Street, Westminster, London, S.W.—Leaflet relating to tests of metal-filament lamps and charges for same.

Messrs. Ferranti, Ltd., Hollinwood. A brochure of 14 sheets illustrating in appropriate colouring their Ferranti electric fires and giving prices of same.

The Cromil Engineering Co., Ltd., Milburn House, Newcastle-on-Tyne.—As sole British agent for the International Acheson Graphite Co., of Niagara Falls, this firm has issued a new eight-page pamphlet giving particulars of Acheson graphite, graphite electrodes and paint, also the "Cromil" self-lubricating packing and pipe-jointing paste.

Messrs. Simplex Conduits, Ltd., Birmingham and London.—Mailing card No. 189, giving prices and brief information respecting the "Simplex" electric vacuum cleaner.

The St. Helens Cable and Rubber Co., Ltd., Warrington.—New 16-page list giving particulars and prices of their cab-tire sheathed cables, insulating tapes, gloves, rubber mats, &c. Also a copy of the St. Helens picture book, wherein there appear a number of interesting and humorous cartoons, with which most of our readers have been made familiar already by the firm's advertisements. Each picture is accompanied by appropriate verses. Copies of either of these publications will be forwarded on application.

The Brimsdown Lamp Works, Ltd., Kingsway House, London, W.C.—Advance copy of a 12-page price list of "Wirum" lamps for various candle-powers, voltages, and shapes, and including street lighting sizes, as well as candle, flame and tubular, and traction and train lighting lamps. Goliath holders lined with heavy metal are shown, and a 100-watt lamp, fitted with Canadian screw cap specially for export, is listed. A large inset sheet gives dimensioned diagrams of the lamps one-half their actual size. Copies may be obtained on application.

Messrs. R. H. Patterson & Co., Ltd., Forth Street Works, Newcastle-on-Tyne.—August catalogue of new and second-hand machinery.

A Manchester Rail Contract.—A contract for £11,000 worth of tramway rails led to a discussion in the Manchester City Council on Wednesday last week. The Tramways Committee proposed to accept a tender of a Sheffield firm, although that of an American firm, which had previously done much business with the Corporation, was £800 less. Councillor Bowie said they were throwing away £800 of the ratepayers' money. There appeared to be no difference in the quality, and he moved that the tender be let to the American firm. Alderman Bowes, chairman of the Committee, said he would take the matter back to his Committee for further consideration if the Council desired. The amendment was defeated. Councillor T. Fox said he was prejudiced in favour of British trade, and in Committee he voted for the Sheffield firm and took into consideration the fact that they could get quicker delivery from Sheffield. Alderman Walker said they were going to tell the people abroad that they would not give a contract there. They were going to make them retaliate on Manchester trade—a most serious thing. Finally, the Council sent the matter back to Committee, by 32 votes to 22.

A South African "Municipal Engineering Scandal."—*The South African Mining Journal* for July 13th, 1912, publishes the following:—"Winburg (O.F.S.) Municipality has, to say the least, a curious way of carrying out its civic duties. Its extraordinary methods are now exciting the ridicule of Johannesburg engineering firms because of a recent display of official bumbledom. Tenders, it appears, were lately invited for the supply of an electric lighting plant to the town, and a loan was contemplated from the Provincial Treasury to defray the cost. Several of the leading firms on the Rand put in competitive tenders, and most of them went to the expense of dispatching engineers to investigate the possibilities of the scheme. Tenders were duly opened, published, and adjudged. To the general surprise, however, though all the firms competing were of the highest standing, a tender other than the lowest was, for no ostensible reason, accepted. The accepted tender, indeed, was not nearly the lowest; in fact, there were a dozen below it, and repeated applications to the Town Clerk for an explanation of the slur thus cast on the plant offered at a lower price by the disappointed firms were met by a curt refusal to discuss the matter. The exact words were, 'the interest of the ratepayers guided the decision.' In the absence of a body such as the Home Local Government Board to investigate this extraordinary action on the part of the Mayor and Council of Winburg, it is highly desirable that the Administrator, Dr. Ramsbottom, take the necessary steps to remove the municipality in question from the stigma of the insinuations that are now being freely made against it. We are glad to notice that our contemporary, the *Friend*, has already taken the matter up; and, should the loan not yet be granted, it is to be hoped that the Administrator will in this case exercise even more than his usual strict supervision."

New Zealand.—The Customs authorities of New Zealand have lately given a decision to the effect that "electrical appliances, starting compensators, hand-operated, for alternating-current motors" are to be classified under No. 176 of the tariff, the duty on British manufactures being 20 per cent. and on foreign goods 30 per cent., *ad valorem*.

Electric Iron Records: Chapter III.—With reference to the records of endurance of domestic electric irons recently mentioned in these columns, Messrs. Eastman & Warne, of Acton Vale, W., send us a copy of a communication received from Messrs. Bowden, Higlett & Co., contractors, of Guildford, to the effect that factory irons installed in a client's workshop about four years ago have given very satisfactory results, only two having had to be repaired. "Thus in 24 iron-years there have been two failures only, an average of 12 years per iron. Since these are factory irons, run for, say, 50 hours per week, this is equivalent to a life of 120 years of a domestic iron that is but seldom used more than five hours per week."

LIGHTING and POWER NOTES.

Abyssinia.—An hydro-electric station has been built at Addis-Ababa, to supply the city with light and power. The Abyssinian Government is building a cartridge factory, which will also be supplied with current from the new station. The pressure at which the current is furnished to the city is 6,000 volts.—*La Lumière Electrique.*

Argentina.—Mr. M. Herlitzka advises that his firm has purchased the electric power houses and concessions for the cities of San Juan and Necochea. The capacity of the former is to be considerably increased by the utilisation of further hydraulic power, which will enable all the requirements of the city and suburbs for light and power to be met for many years. In Necochea, a new installation is being put down by Messrs. Siemens-Schuckert, which will considerably increase the output of the station.—*Review of the River Plate.*

Australian Farming.—At Gooramadda Park, Rutherglen (Vic.), there will be installed in October next an electrical equipment for the working of the whole of the station, containing an area of approximately 2,500 acres. The power plant will comprise two units, consisting of Babcock & Wilcox boilers, 220-H.P. Belliss engines directly connected to A.E.G. three-phase 3,300-volt 50-cycle generators. The principal motors will be operated at that voltage, and be directly connected to the pumps for the Nunan irrigation systems. All the ploughing, &c., sowing and reaping will be done by electric power, and the haulage of the lucerne and crops to the main stackyard by storage battery locomotives. Mr. F. J. Coote, late general manager of the Cassilis G.M. Co., is the consulting engineer.—*Mining and Engineering Review.*

The Sydney Municipal Council has agreed to a recommendation of its electrical engineer that legal advise should be obtained on the question of a future power station, remote from the city, with transmission lines, &c., and of obtaining Parliamentary sanction to such a scheme.

Braintree.—The question of electricity supply for the town is to be considered by the Roads and Lighting Committee, who will report on the matter at the next meeting of the Council.

Bredbury.—The U.D.C. has, subject to a payment of £1 1s. per annum, consented to Stockport T.C. supplying current from the tramways to a residence in the town; the Council has also asked Stockport Corporation to canvass the district to see what employers of labour are willing to take a supply of current.

Bacup.—Last week contracts were signed for a new weaving shed being erected at Bacup by Messrs. Hoyle Bros., of the Burnley district. The new shed will be named the Olive Mills, they will accommodate 400 looms and will be driven by electricity

Canadaian Farming.—The Ontario Hydro-Electric Commission has been demonstrating in the Niagara district the possibility of farming by electricity. The Commission purposes to order two portable threshing outfits which will tour the country this autumn, giving demonstrations of electric power for threshing, corn cutting and ploughing. During last year the Hon. Adam Beck, chairman of the Electricity Commission, together with several of his experts, studied electrical methods in Great Britain and Europe, with the object of ascertaining how far electricity could be applied to the work on the farm. The result of their researches is shown by the fact that they are now demonstrating to the farmers the advantages of electric power for the heaviest work on the farm. The movement, however, is capable of great extension, and the object of the Commission is to take advantage of everything that science offers in order to make the lot of the farmer easier.

Canary Islands.—The port, the quays, and the town of Las Palmas are lighted by electricity. The electricity supply station belongs to a Belgian company, and supplies 800 incandescent lamps for public lighting, and 39 arc lamps, whilst, at the same time, it is estimated that there are 15,000 incandescent lamps in use by private persons. There are 58 motors with a total H.P. of 250; public lighting consumes on the average 14,000 KW.-hours a month, and the private service 15,000 KW.-hours.

Cheam.—The Parish Council has decided, upon the recommendation of the Lighting Committee, to adopt electricity for the lighting of the street lamps, the opinion being that it would result in a small saving as compared with gas lighting.

Cheltenham.—The B. of G. has appointed a Committee to consider the question of lighting the workhouse premises by electricity. The board is advised that it will be much cheaper to substitute electricity for gas, as after a certain number of units are consumed the price per unit goes as low as 2d.

Continental Notes.—GERMANY.—Gueden, in Hanover, has decided on the installation of an electric service, and has given the contract for the local distribution network to the Siemens-Schuckertwerke for the sum of £12,500.

ITALY.—Our contemporary, *Elettricita*, of Milan, indicates that there is every prospect of a considerable reduction in the existing taxation of electricity in respect of the quantity used for domestic heating and cooking, and it further adds that it is even possible that electricity used in this way may be exempt from taxation altogether. The question, therefore, of electrical heating assumes greater importance, and the Italian technical factories will soon feel the necessity of turning their attention to the practical construction of suitable apparatus.

NORWAY.—The Arendals Fossekomgrani, which was formed some time ago for the purpose of erecting a large electrical iron and steel works, as well as a works for the mauufacture of carborundum, has, according to *Teknisk Ugeblad*, just obtained the Government's concession for a transmission line from the waterfall of Böilefas to the works, with a branch line to the carborundum works. The total amount of electrical energy to be transmitted over this line will vary between 20,000 and 30,000 H.P.

The Tyssefaldene Electrical Works, which are situated in the south-western part of the country, and from which energy is supplied to various large industrial undertakings, among others the Hardanger Electrical Iron and Steel Works, have recently placed an order with the Norwegian representatives of the Westinghouse Co., for two three-phase generators of 13,500 H.P. each. Large extensions of the works have been decided on, and the above order is in connection with these extensions. The works have previously ordered the whole apparatus, which is now being installed from the same firm. The proposed extensions are going to be completed in the course of next summer.

LUXEMBURG.—La Compagnie Luxembourgeoise d'Electricité is the name of a new company which has just been formed in Brussels with a capital of £8,000.

BELGIUM.—The T.C. of Liége is considering the question of expropriating the electric concession, granted in 1908, to the Compagnie Internationale d'Electricité and the A.E.G. Union Electrique. The concession was only for 10 years, the T.C. reserving the right of expropriation in any one of the last five working years.—*La Lumiere Electrique.*

SPAIN.—Although the electric light has already made its entry into the capital of Spain, it is only to a limited extent, and the municipal authorities have now decided upon its general introduction. Tenders are being invited for a concession for 15 years for the erection and working of a complete public service. For this purpose the city is divided into four zones, and tenderers have the option of taking one or more, or the whole of the zones. Two-thirds of the installation is to be completed by March 1st, 1914, and the whole is to be in full working order by July 21st of that year.—*Electron.*

RUSSIA.—The municipal authorities of Lemsal (Livland) are at present considering the question of establishing a central electric lighting station in the town.

Egypt.—A scheme to utilise the water-power of the Nile at the Assouan dam is mooted, a German society, of which the Deutsche Orient Bank is a member, having applied to the Government for a concession The volume of water passing through the sluices of the dam is reckoned at 32,000 tons per minute, and its conversion into electrical energy would afford means for stimulating the whole of the present and immediately future husbandry and industrial interests of the country.—*Elek. und Masch.*

Greenock.—The report of the Corporation deputation which had an interview with the B. of T. in connection with the proposed order for the supply of electricity to Port Glasgow power users paves the way, for a mutual settlement between the authorities of the two burghs. It is stated that the Board would look favourably on an application by Greenock for a provisional order for a general supply to Port Glasgow, backed by the consent of this burgh, but it was also agreed on the part of the Board officials that, in order to allow the supply to be given immediately to the power users, the simplest way to protect the Greenock Corporation interests would be for Port Glasgow T.C. to give an undertaking that, during the period of 30 years, it would not sanction an application by another authorised undertaker to exercise its powers.

Harrogate.—At the T.C. on the 12th inst., the Electric Lighting Committee recommended that £200 be set aside out of the past year's electricity profits for the development of electric heating and cookery. Alderman Chippendale moved an amendment that the recommendation be deleted. He said there had been a profit of £282 more than was estimated, and he thought the balance should go to the relief of the rates. Mr. J. H. Lofthouse said all progressive electrical undertakings were seriously considering cooking and heating by electricity. In the estimates for the past year £450 was allowed from the electricity undertaking for the relief of the rates. He believed a scheme could be devised, and the Committee wanted the money to carry it out, to earn more money in the future. The amendment was seconded, and on a vote being taken 10 voted for the amendment and 13 for the minutes, which were therefore confirmed.

Heywood.—The Albert New Mill Co. has accepted the terms of the Corporation in connection with a supply of electricity to its mill.

Mr. A. A. Day, manager of the Bolton Electricity and Tramways Department, has written accepting the terms offered by the Corporation for reporting on the general condition of the latter's electricity undertaking.

Horwich.—The Bolton T.C. has applied for the permission of the U.D.C. to supply electricity to a residence being erected in Fall Birch Lane, by Mr. Darbyshire. The Council has decided to ask why previous applications for current from inhabitants of the town have been refused by the Bolton Corporation.

Japan.—The Kinugawa Hydraulic-Electric Co. has just raised a loan of £100,000, with the object of considerably extending its plant.

It is reported from Tokio that negotiations are in hand in connection with the formation of a company to establish an electricity supply station at New Wiju.

Lanark.—On account of the increased demand for current, additions have been made by the County Council to the electric supply station at Cambuslang. In addition to the capacity of the station being doubled and its arrangements modernised, the feeder cables supplying the district have also been doubled.

Leigh.—At a meeting of the T.C. held on the 7th inst., a letter was read from the South Lancs. Tramway Co., in which it made application for the sanction of the Council to the supply of electricity to a local works. It was resolved that the Council be recommended to give its sanction subject to the company entering into an agreement to discontinue such supply on receiving six months' notice from the Council to do so.

Manchester.—Last year the Corporation electricity department generated 124,294,843 units, 93,682,940 units being sold —approximately 64 millions for private purposes and 30 millions for traction. Over 20 million units were used in distribution or otherwise not accounted for, this large amount, however, only representing 16 per cent. of the generated units. The maximum load recorded was 42,000 KW., 10,550 KW. being for traction supply. The total revenue for the year amounted to £436,317, while the gross surplus was £220,422, from which interest, sinking fund and loan repayment, &c., and a transfer to renewals (£21,835), absorbed £192,103, leaving a net surplus of £28,319, as compared with £27,573 in the previous year. The result would have been better but for the coal strike and breakdown of certain economical generating plant which arrested the downward trend of cost of production. The renewals suspense account now amounts to £182,735, and the outstanding mortgage debt to £1,900,000; the reserve fund had dwindled away to nothing, and it is pointed out in the report that the renewals account is considerably below the proper standard.

Newcastle Emlyn.—The U.D.C. has accepted the offer of the E.L. company to light the public lamps and the town clock for £47 per annum, provided the company keeps the lamps in repair.

Newcastle-under-Lyme.—A L.G.B. inquiry was held on Tuesday, last week, into the application of the T.C. for permission to borrow £6,600 for additional generating plant. It is proposed, on the advice of Messrs. Lacey & Sillar, to install two 135-KW. Diesel sets. The proposal is, however, meeting vigorous opposition locally, because it is felt that the installatian of oil engines will deprive the Corporation gas department of its most valuable consumer—engines running on town gas being at present used.

The Committee stated that consideration of figures placed at its disposal by various engineers led to the conclusion that gas would have to be supplied at 5d. per 1,000 cb. ft. in order to compete with the Diesel engine.

New Zealand. The Government has given an option of license to the Whangarei B.C. to utilise the water-power derivable from the Wairua Falls, in the extreme north of the North Island, for the production of electricity for lighting the borough and for sale to consumers as either light or power. Mr. Vernon Reed, M.P., acting on behalf of a new cement company which has a capital of £170,000, has entered into an agreement with the Council to take from a minimum of 500 H.P. to a maximum of 66 per cent of the total available power for a period of 25 years. This agreement is of course, subject to the sanction of the ratepayers to the loan necessary to carry out the work.—*Australian Mining Standard.*

The Christchurch City Council has unanimously adopted the provisional agreement arrived at with the Public Works Department respecting the charges to be paid to the Government for power from Lake Coleridge. The Council is to pay £8 13s. 4d. per KW.-year for 300 KW., and £5 per additional KW.-year for all in excess. It also agrees to take a minimum of 500 KW., and the department will guarantee to supply up to 4,500 KW. when required. Notice has, however, been given of a motion to appoint an expert electrical engineer to go through the scheme and report before entering on the expenditure estimated at £100,000.

Norden (near Rochdale).—The U.D.C. has accepted the tender of Mr. John Buttery for the supply of electricity to the new lamps at Red Lumb at 4d. per unit, and decided that an agreement be entered into for five years.

Northampton.—The E.L. and Power Co., Ltd., has reduced the general lighting tariff from 5d. per unit to 4½d., and the alternative sliding scale from 6d. and 3d., to 6d. and 2d. Both are subject to a 5 per cent. cash discount.

Oulton Broad.—The B. of T. has informed the U.D.C. that the latter cannot divest itself of its powers, duties and liabilities under the E.L. order. The Council had asked to be relieved of the liability of carrying out the order, as it could not dispose of it to a private company.

Portrush.—Mr. R. B. Leach, consulting engineer, has been appointed to prepare a report on the scheme for electrically lighting the town, and, in the event of his scheme being accepted, to be engineer to the undertaking from its commencement to its completion.

Radcliffe.—The U.D.C. has applied to the B. of T. for permission to erect overhead lines for the transmission of energy at a pressure of 6,600 volts from the Bury boundary to the Pioneer Mills, and another line from Bolton Road to Countess Lane and Turks Road. In this case the voltage will be 200.

Romford.—The U.D.C. has asked Mr. W. C. C. Hawtayne, Mr. W. T. Pressland and the County of London Electric Supply Co., who are applying for prov. orders for electric supply, for particulars of their schemes for consideration.

Rothesay.—The new electric light installation in the esplanade gardens at Rothesay was recently switched on by the Marchioness of Bute. Energy is supplied to the Corporation by the Rothesay Tramways Co., the total cost being about £650. The installation consists of 2,500 lamps, which produce a very fine effect.

St. Helens.—The extensions to the Corporation electricity supply works have been completed, and the new plant was set in operation by the Mayor, who is also the chairman of the Electricity Committee, on Wednesday, last week. Among the new plant is a 2,000-KW. turbo-alternator, made and installed by Messrs. Dick, Kerr & Co., consisting of a high-pressure impulse-type Bergmann steam turbine, direct-coupled to a three-phase alternator running at 3,000 R.P.M., and generating electricity at a pressure of 6,000 volts, 50 periods. The turbine exhausts into a low-level jet-type condensing plant, the latter maintaining a vacuum of 27½ in., and manufactured and supplied by the Mirrlees-Watson Co. The condensers are fitted with extraction pumps of the centrifugal type and an Edwards three-throw air pump, motor-driven. Extra-H.T. switchgear has been supplied by Messrs. Ferranti, and includes a Brown-Boveri pressure regulator. Boiler house equipment includes a Babcock & Wilcox water-tube boiler of 4,780 sq. ft. heating surface, capable of evaporating continuously 18,000 lb. of water per hour, the boiler being fitted with an underfeed stoker. Coal-handling plant has been installed, consisting of a chain and bucket-type elevator feeding into an overhead bunker, with a capacity of 20 tons. The whole of the boiler house contract has been carried out by Messrs. Babcock & Wilcock. The British Westinghouse Co. is supplying an additional rotary converter of 800-KW. capacity, and when installed it will be possible to generate the greater portion of the current used for tramways, lighting and power with the turbine plant, leaving the reciprocating plant to run on the peak load and for emergencies.

The Higher Education Committee has decided to apply for a loan of £1,000 for the equipment of a mechanical engineering and electrical laboratory at the Gamble Institute.

The Corporation, on the application of the electricity Committee, proposes to ask the L.G.B. for leave to borrow £5,000 spent in excess of the loans for electricity purposes.

Salford.—At the T.C. on the 7th inst. a good deal of discussion ensued on a proposal which foreshadowed an expenditure of £250,000 to £500,000, upon recommendations adopted by the Electricity Committee, as follows:—(*a*) That it is imperative that a new electricity generating station be provided with the least possible delay; (*b*) That a scheme be prepared, including the acquisition of land for a proposed generating station, erection of the requisite plant, provision of cables, and all other matters for the equipment of a new station. It was pointed out that it will be impracticable after the instalment of the two new turbine generators to accommodate further plant in the existing electricity station, and the Electricity Committee's recommendations were passed.

Judging by the remarks made, it is evident that Salford Councillors are not deficient in humour. Thus, Ald. Jackson had seen petrol tramcars running at Morecambe, and naturally concluded that their adoption in Salford would greatly relieve the generating station and thus avoid the costly new scheme proposed. Ald. Phillips, as chairman of the Gas Committee, can be excused for doubting the soundness of the proposed extension scheme. Ald. Hulton, as chairman of the Cleansing Committee, apparently wished to come to the rescue with steam from the refuse destructors—all this, when one prospective new consumer is prepared to guarantee a minimum consumption of 3,000,000 units per annum.

Swansea.—The Board of Guardians' Building Committee has decided to bring up a comprehensive scheme for lighting the workhouse with electricity.

Tipton.—The Shropshire, Worcestershire and Staffs. Electric Power Co. has informed the U.D.C. that it intends applying for a prov. order for electric supply in the district, and also for Smethwick, Oldbury and Rowley Regis.

West Wickham.—The West Kent Electric Co. has informed the Bromley R.D.C. that it intends laying mains from the boundary of Bromley Town to West Wickham, *viâ* Hayes.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation Tramway manager, in a report regarding fares, &c., states that, generally speaking, the car fares in the city are much lower than in other towns of similar size, whilst the penny fares give a greater distance than the majority of the largest towns in the country. Submitting the accounts for the past year, Mr. J. A. Smith, convener of the Tramway Committee, said the total revenue was £77,180, an increase of £3,710 over the previous year. Working expenses were £40,969 an increase of £1,294. The surplus for the year was £11,158, an increase of £3,554. With this surplus they had placed £6,762 to the renewal account which had been deficient by this amount, and the remainder, £4,396, was carried forward to a reserve account. Previous to this year they had always had to put the whole of their surplus into the renewal account, but this year for the first time they had more than sufficient money for their renewal account and had been able to start a reserve account. The accounts were adopted.

Ashton-under-Lyne.—A deadlock has arisen between the Ashton Corporation and the Hurst District Council with regard to the renewal of the agreement for the lease to the Corporation of the tramway in the urban district. The expiring agreement has been in operation for 10 years, and under its terms Ashton, it is stated, has lost from £10,000 to £15,000. Ashton now asks that Hurst, under the new agreement, should pay interest, sinking fund, rates, and a fixed sum for renewals. This would represent an increased rate for Hurst of 10d. in the £. The District Council has resolutely refused to accept these terms, and it has threatened that unless better conditions are offered, the tramways in the Hurst area will be closed as from to-day. Hurst is willing to pay the interest and sinking fund equal to a rate of 7½d. in the £. It is possible that the B. of T. will be asked to appoint an arbitrator.

Australia.—The special committee of the South Melbourne City Council has reported unanimously in favour of the permanent tramway, at an estimated cost of £60,000. The Melbourne City Council will be approached and asked to complete the connection (two or three chains) between the South Melbourne boundary and Prince's Bridge.—*Australian Mining Standard.*

The recommendation of the sub-committee of the Melbourne Harbour Trust respecting the inauguration of a tramway service between Spencer Street and the Victoria Dock has been adopted. The alternative schemes are as follows:—(1) Electric tram on rails from Spencer Street to Victoria Dock entrance; (2) electric railless cars; (3) electric omnibus; (4) petrol omnibus. It was also proposed that the Commissioners should have the option of purchasing the entire plant and rolling stock at any date after the expiry of 12 months, plus 10 per cent.

Belfast.—The Postmaster-General has pointed out that the tramway extensions will necessitate considerable alterations to the telegraph wires and poles, and the provision of guard wires at various points, the cost of which would devolve upon the Corporation. The engineer considers that this will cost about £545. A sub-Committee has been appointed to consider the question of a suitable site for the proposed electrical sub-station.

Brazil.—The Rio de Janeiro Tramway, Light and Power Co., Ltd., has recently acquired the tramway system in the suburb of Jacarepagua, which connects with the terminus of the company's Cascadura line. Work is at present in hand in electrifying the newly-acquired system, which has a length of about 11 miles.

Brighton Railway Electrification.—Speaking at the ordinary general meeting of the company, held recently, the chairman mentioned that the electrified services had continued to be emminently satisfactory, and that since the opening of the services in December, 1909, nearly 14 million additional passengers had been carried on the sections electrified. The directors are understood to be giving immediate attention to further extensions.

Burnley.—The T.C. has decided to fall in with the tramway manager's suggestion to fix an additional series of 1½d. fares. The town clerk reported that the extension scheme of the tramway to Harle Syke had been submitted to the B. of T. with a a request that the official inspection should take place as soon after the 12th inst. as possible. It was decided to ask permission from the Board to run a goods wagon attached to the front of the cars travelling on the Harle Syke extension so as to facilitate the conveyance of milk and other goods.

On August 8th there was a satisfactory preliminary run on the Harle Syke extension at Burnley, a couple of cars fitted with the special trucks being run over the lines. All is now ready for the Board of Trade inspection, which was expected to take place some time this week.

Canadian 'Bus Regulations.—In view of the uneasiness created in certain tramway circles by wholesale motor-'bus competition, also the proposals which have been made for curtailing this competition (and which have been generally derided in the daily papers), it is of interest to note that the Montreal City Council has just issued a new by-law, which defines the streets in which the "auto-'bus" shall run, the speed of the vehicles, the fares to be charged, and the frequency of the service. Thus the 'buses are restricted to certain routes, and amongst the other regulations to be observed, they must run all the year round, without interruption, at intervals of not more than five minutes during busy hours and ten minutes at less busy times.

Chile.—The plan for the construction of an electric railway from Santiago to Valparaiso has been approved. The new railway will be completed in ten years' time.

Continental Notes.—Germany.—A hitch has taken place in the proceedings connected with the construction of the prejected express line from Gesundbrunnen to Newköln, which the A.E.G. is to build for the Berlin T.C. The Minister of Public Works has refused to sanction the route planned owing, he contends, to the inconvenience of its traversing certain crossing points of existing and projected underground lines. The crossing in the Konigstrasse offers the greatest difficulty. It is suggested to divert the line towards the east—to the Alexanderplatz neighbourhood. As the contract between the company and the city is signed, the proposed modification of the course will necessitate fresh negotiations between the two parties.—*Elektrotechnisder Nachrichten.*

After lengthy negotiations with the Prussian Government and the authorities of Hamburg, the Alsterbahn Gesellschaft has secured the permission to build its line from Ohlsdorf to a junction with the Hamburg-Ohlsdorf suburban line. The line will be electrically worked, and will serve the beautiful district of the Alster Valley, one side of which river is Prussian and the other side Hamburg territory.—*Elek. u Maschinenbau.*

The final decision as to the electrification of the Berlin Stadtbahn is to be come to by the Landtag in its autumn session. Meanwhile, in order to make as prompt a beginning as possible, preliminary works are being speeded up, so that the conversion may be taken in hand at the beginning of 1913. The more ample material required by the Landtag is partly prepared. The Administration remains of the conviction that the conversion can be no longer delayed.—*Elektrotechnische Nachschrift.*

Turkey.—An understanding has been arrived at between the Smyrna Tramway Co. and the Minister for Public Works for the electrification of the tramways of the city.—*La Lumière Electrique.*

Russia.—A syndicate has been formed in the Russian capital for the extension of the St. Petersburg tramway system. The capital is £3,600,000, and the principals in the operation are the firm of Kolomenski, the Siemens & Halske Co., and the Westinghouse Co.

Switzerland.—The report of the Government Committee of inquiry into the question of the conversion of the Swiss State railways to electric traction states that water powers would be required which would yield from 1,200,000,000 to 1,500,000,000 h.p.-hours on the turbine shafts per annum. A list of the available sources shows that sufficient water-power could be obtained for the purpose without any special difficulties arising. It is estimated that the expenditure on the transformation of the St. Gothard railway would amount to £2,700,000 and the working of the traffic would cost £402,000 per annum and be considerably cheaper than steam locomotion. The system which is considered to be the best for the Swiss railways is the single-phase method at about 15 periods and 15,000 volts.

Italy.—It is understood that the question of introducing electric traction on the St. Gothard lines will not reach the stage of completion before 1914. The administration of the Swiss Federal Railways, before deciding important matters in connection with the work, is awaiting the results of the system of electric traction on the Loetschberg Railway, and this will not commence working until next May.

The Briante Electric Tramway Co., whose headquarters are at Monza, has undertaken the construction of the last stretch of line that goes from Meda to the end of Cantu. It is hoped to inaugurate the new section of the line during next October; several steel bridges have had to be constructed in connection with the work. The total cost of the work is estimated at 700,000 liras (£28,000).

France.—According to the *Morning Post*, the first of the single-coach electric trains to run between the Invalides Station, Paris, and Versailles, has been tested, a speed of 53 miles an hour being obtained. Eight similar one-coach trains are to be provided.

Belgium.—Good progress is being made with the establishment of the electric tramway system in the town of Louvain; all the lines—which have a length of about eight miles—are now laid, and one route has just been opened for traffic. The necessary electrical energy is being supplied from the generating station of the Société de l'Electricité du Nord de la Belgique.

Norway.—It is reported from Bergen that there has recently been held a meeting for the discussion of the building of an electrically-driven cable railway from the town to the top of Flöifjeldet, which is a mountain situated on the northern side of the town. The railway will run partly through a tunnel and partly in the air. In connection with this project, it is also intended to build a hotel for the tourists on the mountain. The total capital expenditure for both projects is estimated at about £40,000 to be divided equally between them. The plans and estimates have been laid before the directors of the Tourist Association, who have approved of them, and an application for the Government concession is going to be submitted in the near future.

Falkirk.—At an extraordinary general meeting of the Falkirk Electric Construction Syndicate at Larbert, it was decided not to increase the capital for carrying out the tramway extension scheme from Falkirk to Grangemouth.

Farnworth.—The local D.C. is co-operating with the Little Hulton D.C. in trying to persuade the South Lancashire Tramways Co. to construct tramways from Little Hulton to Farnworth.

Glasgow.—Bailie Pratt has given notice of the following motion to be moved at the next meeting of the Tramways Committee:—"That it be remitted to a special sub-committee to consider and report as to the desirability and practicability of the tramways department providing cottage dwellings to be rented by workmen in the service of the department."

It has been decided by the Corporation Tramways Committee to recommend to the T.C., without prejudice, that, as from December 10th last (the date when the extended halfpenny stage came into operation) the annual premium payable under the Corporation's third-party insurance policy with the Excess Insurance Co. be increased by 12½ per cent. in lieu of 10 per cent., as recommended earlier.

In connection with the celebrations of the centenary of the first call at Glasgow of the steamship *Comet*—the progenitor of steamship navigation—the Corporation decided that specially decorated cars should traverse the principal tramway routes of the city. Contracts for the decorations have now been fixed, the successful offerers being Messrs. Wylie and Lockhead, and Mr. Claude Hamilton.

London-Southend Electrification.—The Purchase Bill for the Southend line was referred to at the half-yearly meeting of the Midland Co., when it was indicated that the directors were satisfied that to develop the line properly it would have to be electrified, and that money spent for that would be profitably spent.

Middlesex.—The figures contained in the fifth annual report of the Light Railways Committee of the Middlesex C.C., just issued, are indicative of very substantial progress; 57 miles of tramways are in use (which are leased to and worked by the Metropolitan Electric Tramways, Ltd.), and the County Council, under the terms of the lease, takes 45 per cent. of the profits, its share this year amounting to £3,765. Traffic receipts totalled £460,500, an increase of some £67,000 on the previous year, but the average earnings per car-mile, 10½d., were a little lower. As a set-off, however, there was a slight decrease in the working expenses per car-mile, the profits approximating 3½d. per car-mile. The Council's loan debt to March 31st, 1912 (less discount on and expenses of the issue of County stock), amounted to £1,939,544; 90 millions of passengers were carried, being an increase of over 23 millions.

Oldham.—The question of ½d. tramway fares was discussed by the T.C. recently. Councillor Dunkerley said that the system had been adopted in Manchester, Glasgow and other places, but it would not suit Oldham owing to the short stages into which the routes were divided up. The Council confirmed the decision of the Tramways Committee not to introduce ½d. fares.

Salford.—During the past year there have been nearly 49 million passengers carried on the Corporation cars, and nearly 6 million car-miles were covered. The receipts were £253,315, the average receipts being 10·46d. per mile, or nearly ¼d. more than the earnings in 1903, when the average was 10·25d. There was a gross profit of £97,813, which added to £5,157 from investments, made an available balance of £102,971. This has been absorbed by the payment of £29,425 to local authorities for running powers, &c., £45,816 to interest and sinking fund, £9,509 to depreciation and renewals fund, and £160 for repairs. A sum of £18,000 was contributed to the relief of the rates, and is £8,000 more than was contributed to the rates in 1903. The stock of cars at the end of the year was 200, and there are 75 miles of lines worked by the Corporation, 25 miles being leased and 40¼ owned outright by the Corporation; 2½ are worked jointly with Manchester Corporation, and on the remaining nine running powers are possessed.

South Shields.—A long discussion took place at the last meeting of the T.C. on the question of extending the tramways to Horton village. . The Tramway Committee recommended that the motion be postponed for 12 months but Mr. Anderson, vice-chairman of the Tramways Committee, proposed that the Committee be instructed to take steps to obtain the necessary powers for carrying the tramways to Horton, and that the proposal be submitted to the rural authorities. The amendment was rejected on a vote

South-Western Railway Electrification.—At the recent half-yearly meeting of the South-Western Co., the chairman said that the electrification of the suburban lines had been receiving attention, and the necessary plans and estimates were being prepared. They had called in Sir Alexander Kennedy to advise, but the matter was not ready yet to place before the shareholders. They were satisfied the proposal was one they would be able to confidently place before the shareholders in the near future. The scheme being worked out contemplated such a service of trains to all the principal towns in the Thames Valley as would give entire satisfaction and leave no room for a competing line.

U.S.A.—A recent issue of *The Motor* contains statistics of the motor-car industry in the States. It appears that including certain States where figures were estimated, the total registrations were 860,000 approximately. During the year ending June 30th, 1912, there were 252,569 motor-cars produced in the States, and this included 6,000 electric pleasure cars and 1,000 electric commercial cars.

It is reported that the Banker's Express from Boston, hauled by a 90-ton electric locomotive, left the track in the centre of the tunnel leading into New York city. According to our account the live-rail was broken and much violent arcing occurred before the train was brought to a standstill, one luggage van catching fire and burning. The passengers were rescued through an opening in the tunnel roof.

West Hartlepool.—A special meeting of the T.C. was held on the 9th inst. to consider a report of the Tramways Committee recommending the acquisition by the Corporation of that portion of the West Hartlepool and Hartlepool route, which is in the former borough, and of the Seaton-Carew section, which were constructed under the West Hartlepool Light Railway Order of 1897. The Committee reported that no applications had been received in response to the advertisements for the leasing and working of the tramways. The Committee also recommended that such of the tramway staff as had applied to be taken over on the same terms and conditions as their appointments under the company, be taken over by the Corporation. It was further recommended that the Tramway Co. be asked to submit terms for the sale of that portion of the West Hartlepool aad Hartlepool route as lies within the borough of Harlepool, and the Corporation of that borough be asked whether it concurs in such a sale. The report was adopted.

TELEGRAPH and TELEPHONE NOTES.

American Wireless.—According to a lengthy statement in the *Financial Times* of the 13th inst., the final papers were signed on the 3rd ult., by which the physical assets and patents of the United Wireless Telegraph Co., of U.S.A., were turned over to the Reorganisation Committee appointed in connection with that company's affairs, and they have since been sold to the Marconi Wireless Telegraph Co., of America, for 140,000 $5 shares of that undertaking.

Australia.—In connection with the wireless telegraph station recently set up for the Commonwealth Government, the Australasian Wireless Co, states that tests have been going on for several weeks, and that they have proved more than satisfactory. With 70 H.P., the wireless plant has not only succeeded in establishing communication with stations or ships 1,250 miles distant, but has established communication at 2,920 miles. It is considered quite probable that communication may be established at night time between Sydney and San Francisco—a distance of about 6,000 miles.

Compulsory Wireless on Ships.—In connection with the recommendations as to wireless equipments on British ships, arising out of the *Titantic* inquiry, the *Financial News* says the Governments of Canada, the United States, New Zealand, and Italy, have for some time insisted upon the equipment, and on August 1st last all Spanish merchant vessels carrying passengers or mails had to be fitted with the apparatus, while from January 1st next no passenger will be allowed to embark at Spanish ports on any ship which is not similarly provided. A compulsory regulation has come into force in Uruguay, and all ships not complying with it will be refused dispatch. Then on October 1st a German law on the subject also takes effect, and involves vessels which have 75 people on board, including crew, as well as cargo boats carrying at least 60 persons, though steamers trading in the North Sea, the Baltic, the Mediterranean, and the Black Sea, are exempted.

German Cable Subsidy.—It was stated at the recent meeting of the German South American Telegraph Co. that the Imperial Post Office had decided to grant an annual subsidy of £42,500 for the proposed cable extension from Teneriffe to Duala, in the Cameroons. The subsidy is for a period of 40 years, and is to be increased to £45,750, on the introduction of duplex working.

Germany.—A new company has just been formed in Berlin, with a capital of £65,000, and the title the A.G. Deutsche Sudsee Gesellschaft für Drahtlose Telegraphie, to link up the German Colonial Possessions in Oceana by means of wireless telegraphy with the telegraph stations of the Deutsch-Niederlandische Telegraphen Gesellschaft.

Liberian Wireless Developments.—In Monrovia, the capital of the negro republic of Liberia, two wireless stations have lately been opened to public traffic. One of the stations belongs to the French West Africa Telegraph Administration, and the other to the Deutsch-Südamerikanische Telegraphgesellschaft, of Cologne, and is an annex to their telegraph station there. The latter station is concerned only with the exchange of telegrams with ships at sea, whereas the French station, in addition, exchanges communications with the existing, and will later on with the projected stations in the neighbouring French possessions.—*Zeit für Schwachstromtechnik.*

Marconi v. Fessenden.—The Marconi Co. informs us that it has received a Marconigram from its patent lawyers in New York advising that the Examiner of Interferences has awarded all priority to Mr. Marconi, disallowing the claims of Fessenden, in respect of synchronously operated spark-gaps.

Post Office Engineers.—In the *London Gazette* of July 30th, the Civil Service Commissioners published the regulations respecting open competitive examinations for the situation of assistant engineer in the Engineer-in-Chief's Department of the General Post Office. The limits of age for this situation are 21 and 24. Candidates must satisfy the Commissioners that they have had at least two years' training in an engineering works or an engineering school, or partly in a works and partly in a school, and must pass an examination, which is open to all British subjects, with certain restrictions. A fee of £3 is charged for admission to the examination.

Proposed Atlantic Weather Bureau.—Prof. Moore, head of the Meteorological Office, Washington, proposes that a median line shall be established through the North Atlantic, and all ships fitted with wireless apparatus, sailing on either side of it, will be required to take a daily weather observation. The idea is that vessels on the eastward half of the ocean should relay these reports to London and Paris, and those westward of the line to Washington. By a close comparison of the messages it will be possible to estimate the track and speed of storms, to make up a weather chart for cabling to each side of the Atlantic every day, and to warn navigators when special precautions are necessary.

Russia.—It is intended to erect a second telephone line between St. Petersburg and Moscow. The new line will be a double one, and its cost is estimated at about £21,100.—*Der Elektrotechniker.*

Spanish Telegraph Statistics.—The telegraphic network of Spain in 1910, according to statistics just published, had an extent of 42,934,974 km., 87 stations with a continuous service were in existence, 341 with a day service, and 1,474 stations with a limited and special service. The number of instruments in use was 1,884, of which 1,440 were Morse, 249 Hughes, and 195 of other types. The receipts of the interior service totalled 8,192,853 pesetas, and of the international service 3,484,384 pesetas. Telephone receipts totalled 1,142,448 pesetas. The cities of Madrid, Barcelona, Valencia and Corunna, in the order named, were the chief clients. In the previous five years, the network increased by 12,988,213 km. of lines, the stations by 193, the instruments by 234, and the receipts from both telegraphs and telephones by 1,733,420 pesetas.—*Elektron.*

Submarine Signalling.—The *Daily News* states that there are now 122 submarine signal stations in use or being installed, and that nearly 900 ships are equipped with the Submarine Signal Co.'s receiving apparatus.

Telephony in Japan.—Telephonic communication has recently been established between the summit of the well-known mountain Fuji and Gotemba and Omiya.

The Bergen Wireless Station.—This station has been opened to public use. It is one of the most powerful stations in Europe, its range extending as far as the North Cape and over the North Sea as far as Iceland and the Atlantic Ocean.—*Zeit für Schwachstromtechnik.*

Trunk Telephone Rates.—The P.M.G. recently intimated in a Parliamentary reply to Mr. Fiennes, that he had been able to arrange for the use of telephone trunk lines during the less busy hours of the day under monthly contracts for daily periods of 15 minutes or more, on payment at the following rates :—

For the first or second quarter-hour period, three-quarters of the ordinary rates, according to the time occupied.

For the third and fourth quarter-hour periods, one-half of the ordinary rates.

For each additional quarter-hour period, one quarter of the ordinary rates.

The time for which such arrangements can be made necessarily depends upon the demands of the ordinary trunk service, but as a rule special contracts can be accepted for the use of lines before 9 or 9.30 a.m., between 1 and 2 p.m., and after 4.30 or 5 p.m.

For long periods, of not less than six hours between 5 p.m. and 6 a.m., still more favourable rates of charge are in force, based on the actual length of the line used. The rates are as follows:—

For six hours' use, £2 10s. per mile per annum; and for twelve hours' use, £3 10s. per mile per annum.

For periods of between six and twelve hours the charge is as for six hours, with an addition of 5s. per mile per annum up to a maximum of £3 10s.

Wireless Stations in Panama.—The United States Government intend to expend $1,000,000 in constructing wireless stations on the Isthmus of Panama. An arrangement has been entered into with the Government of Panama whereby all private companies are precluded from erecting wireless stations in Panama.—*Zeit. für Schwachstromtechnik.*

Wireless Telegraphy.—A wireless connection right across South America has been established by the Telefunken Co. between Lima, on the West Coast, and Para, on the East. The distance is 2,100 miles over primeval forests and the transmission bridges over the high Andes. Messages dispatched from Lima proceed direct to Manaos, on the Amazon River, and thence to Para.

The Compagnie Générale Radiotélégraphique has received the order to equip the whole of the fleet of the Compagnie Sub-Atlantique with wireless plant. Eight steamers will be fitted on the "musical spark" system.—*Journal des Postes.*

Wireless telegraph experiments are being carried out by the Western Telegraph Engineers of the West Lancs. Division of Territorials at the top of Blackpool Tower, the first military station to be constructed upon the top of a tower in this country, and they have been attended with gratifying success. Capt. Coulston, R.F.A., is in command of the wireless company.

The tests that the Colombo wireless station has been undergoing for some time have been completed, and have proved very satisfactory. The record for the longest distance wireless messages ever sent in the East was created by the Colombo station last week, when they spoke to Sabang, Sumatra, 1,007 miles away.—*Indian Engineering.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—August 28th. Common-battery and automatic switchboards, for Newton, Glebe and Balmain, for the Postmaster-General's department. See "Official Notices" July 26th.

September 25th.—Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

September 3rd.—Six 60-k.v.a. transformers, for the Melbourne City Council. See "Official Notices" to-day.

Melbourne.—September 17th. One fuel economiser, for the Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" to-day.

Western Australia.—November 5th. One common-battery automatic switchboard, one common-battery semi-automatic switchboard, one common-battery manual switchboard and equipment, for the P.M.G.'s department, Perth.

Austria.—Vienna.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Batley.—August 23rd. High-tension cables, for the Corporation. See "Official Notices" August 2nd.

Bedwas.—September 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Belgium.—September 3rd. The Société Nationale des Chemins de Fer, of Brussels (14, Rue de la Science), is inviting tenders for (1) the supply and installation of the electrical equipment of a transformer sub-station at Dieghem, in connection with the Brussels-Haecht light electric railway; (2) the supply of the copper rail bonds required by the company during the year ending October 1st, 1913; and (3) the supply of the bronze wire required for overhead conductors during the same period. The bronze wire required is round in section, and 53, 64 and 80·2 mm. in diameter.

Bradford.—August 28th. One 300-kw. and one 1,500-kw. rotary converter, for the Corporation. See "Official Notices" to-day.

Costa Rica.—December 9th. Tenders will be received for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

France.—October 8th. The French State Railway authorities in Paris are inviting tenders for the supply of the current necessary for the electrical operation of the State railway system in the Paris district. Particulars may be obtained from, and tenders are to be sent to, Le Directeur des Chemins de Fer de l'Etat, 20, Rue de Rome, Paris.

Hungary.—Besztercebanya.—August 24th. Tenders are invited for the supply of a 500-h.p. crude-oil engine with accessories, a three-phase generator and a switchboard with connections. Deposit 5 per cent. Particulars (5 kronen), Ingenieur Tibor Szeberenyi, Josef-utea 12, Budapest VIII.

The municipal authorities of Varpalota have just invited tenders for the concession for the establishment and working of a central electric lighting station in the town during a period of 50 years.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" August 9th.

London.—L.C.C.—August 23rd. Electric lighting, bells and telephones at the County Secondary School, Plumstead, S.E. See "Official Notices" August 9th.

Lewisham.—The Infirmary Committee of the Guardians have decided to obtain tenders for the installation of electric light in the operating room.

Manchester.—September 10th. One 12,000-kw. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" August 9th.

August 28th.—Electric lighting fittings at Atherton Street Schools, Deansgate, for the Education Committee. The Offices, Deansgate. (Returnable deposit £1 1s.)

New Zealand.—September 5th. 100 prepayment "shilling-in-the-slot" wattmeters, for the Wellington Corporation electric lighting department. A copy of specification may be seen at the Board of Trade Commercial Intelligence Department, London, E.C.

Rochdale.—August 28th. The Electricity Department is inviting tenders for 50,000 tons of best coal. T. Banbury Ball, Gas and Electricity Works, Dane Street, Rochdale.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Roumania.—August 20th. The municipal authorities of Turgu-Ocna (Bacau) are inviting tenders for the establishment of a central electric lighting station in the town.

The municipal authorities of Botoshani are about to invite tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

South Africa.—September 11th. Durban Corporation. One-ton electric storage battery vehicle. A statement on the matter can be seen at the Board of Trade C.I. Department, London, E.C.

Spain.—September 1st. The municipal authorities of Algeciras are inviting tenders for the concession for the electric lighting of the town. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Algeciras.

Torquay.—September 2nd. One 1,000-kw. single-phase turbo-alternator, condensing plant and switchgear, for the T.C. See "Official Notices" to-day.

Witney.—The U.D.C. is inviting tenders for (*a*) suction gas plant and accessories, including vertical high-speed 75-kw. engine and d.c. dynamo; (*b*) battery booster; (*c*) switchboard; (*d*) cables. Specifications, &c., from May & Hawes, consulting engineers, Caxton House, S.W. Deposit £1 1s., returnable.

CLOSED.

Atherton.—The U.D.C. has accepted the tender of the British Westinghouse Co., Ltd., for one 250-K.V.A. transformer.

Australia.—The following contracts have recently been placed, according to the *Australian Mining Standard*:—

South Australia.—Supply and Tender Board.

1¼ miles telephone cable for £307.—Todd & Samuel.

Sydney.—Postmaster-General's department.

Various distributing boxes, &c.—Western Electric Co. (Australia), Ltd.
4,500 cable clamps, each pattern "A" and "B."—Boehme & Owen.
17,850 ft. piping, wrought iron, galvanised, £819.—T. McPherson & Son.

Adelaide.—Postmaster-General's department.—

Two switchboards, magneto wall pattern, 25 lines, at £12 16s. 3d. each; two switchboards, magneto, non-multiple, [illegible] lines, at £26 each; three switchboards, magneto, non-multiple, 100 lines, at £87 each.—J. Bartram & Son Pty., Ltd.

Brisbane.—Postmaster-General's department.—

Four drums, each 1,000 ft. of lead covered cable, £70.—W. T. Henley's Telegraph Works Co., Ltd.

Melbourne.—Postmaster-General's department.

10,000 glazed earthenware conduits, 6-ducts, at 2s. 10d. each, £1,417; [illegible] glazed earthenware conduits, 1 duct, at 1s. 10d. each, £[illegible].—Hoffman Patent Steam Brick Co., Ltd.
500 three position switching keys at 6s. 3d. each, £156; 3,000 condensers, 2-microfarad, at 1s. 9d. each, £262.—J. Bartram & Son Pty., Ltd.
120 miles tinned copper wire, rubber insulated, cotton covered, at £2 per mile, £240; 400 common battery wall telephones, at 35s. 9d. each, £715.—British General Electric Co., Ltd.
1,500 glazed earthenware conduits, 4-ducts, at 1s. 10d. each, £137.—Hoffman Patent Steam Brick Co., Ltd.

Brisbane.—Postmaster-General's department.

5 tons wire, galvanised steel, 3-strands, No. 16 S.W.G., at £[illegible] per ton.—Noyes Bros. (Sydney), Ltd.

Sydney.—Postmaster-General's department.—

36 tons bolts at £18 15s.—T. McPherson & Son.

The *Australian Mining and Engineering Review* states that the tender of the British Aluminium Co., Ltd. at £340, has been accepted for 3 tons, 12 cwt. of bare hard-drawn aluminium cables by the Melbourne City Council.

The Sydney Council has ordered fibre conduit (£479), an electric pulley block (£162), and underground cables (£5,[illegible]) from Noyes Bros. (Sydney), Ltd.; also underground cables (£785) from B. I. and Helsby Cables, Ltd.; underground cables (£2,042) from W. T. Henley's Co., and underground cables from the Western Electric Co., Ltd., at £560.

Barrow-in-Furness.—The T.C. has accepted the tender of Messrs. Wm. Gradwell & Co., Ltd., for extensions to the Electricity Works buildings, at £983.

Bootle.—Further tenders as follows have been accepted by the Corporation in connection with the erection of the new electricity supply works in Marsh Lane and Hawthorne Road:—

Babcock & Wilcox, Ltd.—Steam piping, £155.
J. Smith, Ltd.—Overhead cranes, £310.
Kennicott Water Softener Co.—Water-softening plant, £300.
W. and T. Avery, Ltd.—A weighbridge with 16 ft. × 8 ft. plate, £78.
Mellows & Co.—For glazing the roofs of the engine house and boiler-house £575.

Glasgow.—The Tramways Committee recommends the T.C.'s acceptance of the following:—

Armature coils..	Malleable Steel Castings Co.
Special track work	Lorain Steel Co.
Rails and fishplates	Lorain Steel Co.
Copper strip	Chas. Henderson & Co.

Hereford.—The T.C. has accepted the tender of Messrs. Wm. Cory & Co., Ltd., for 2,000 tons of best Cannock rough small coal for the electricity works, at 11s. per ton.

London.—Mr. F. R. Garrod, of Golder's Green, N.W., has obtained the contract for electric lighting, power, signs, &c., at the new Arcade, 78, Uxbridge Road, W., for the British Arcades, Ltd., "Funland," of Edgware Road.

Salford.—The T.C. has accepted the following tenders:—

Sharples, Hill & Co.—Alteration to electric light at Royal Technical Institute, £34.
H. G. Mabbs.—Motor starters, £400.
W. Hodgson & Sons, Manchester.—20-ton weighbridge for coal-conveying plant, £82.

Sheffield.—The tender of the British Electric Transformer Co., Ltd., has been accepted by the T.C. for a biennial supply of transformers and switchgear. The tender of Abbott & Bannister, at £6,750, has further been accepted for carrying out extensions at the Neepsend power house.

Walsall.—The T.C. has accepted the tender of the General Electric Co., Ltd., in lieu of that of the British Westinghouse Co., Ltd., at £198, for the supply of a new switchboard.

Wigan.—The Tramways Committee has accepted the tender of Messrs. Webster & Winstanley, at £2,640, for the supply of British Standard No. 3 steel rails to the Sandberg Silicon process for tramway loops.

NOTES.

A Minister of Commerce.—For some years past there has been a strong feeling in commercial circles that a Minister of Commerce should be appointed. The matter has been referred to in these columns from time to time. It is now understood that the Prime Minister has asked the Association of Chambers of Commerce of the United Kingdom to embody its proposals in a memorial to be presented to him. The Association, it is stated, has asked Sir. F. F. Adam, a member of the Commercial Intelligence Committee of the Board of Trade, to draft the memorial.

Will.—According to a Swansea paper, the late Mr. S. Mansel Jones, electrical engineer, who died in May last, left estate of the gross value of £1,435, with net personalty sworn at £27.

Australian Factories.—A Reuter dispatch from Melbourne, appearing in the *Birmingham Daily Post*, says that the Victorian statistics report for 1911 shows that the number of factories in the State of Victoria is 5,126, employing an aggregate of 113,000 hands, compared with 4,873 factories in the preceding year, employing 102,000 hands. Male employés constitute 65·7 per cent. of the total number. Their wages amounted to £7,358,000 during the year, females receiving £1,553,000, making a yearly average of £106 12s. 4d. and £41 3s. 3d. for men and women respectively. Wages constituted 21·4 per cent. of the value of the output.

Fatality.—According to a Glasgow paper, Edward Kerr, labourer, Buchanan Street, Coatbridge, while engaged at an electric crane within the British Tube Works, received an electric shock, and death was instantaneous.

Athletics.—The London Electric Railways Institute and Athletic Association, which has a membership of 750, held its first annual sports on Saturday, August 3rd, at the Paddock, North End Road, Hampstead.

Educational Note.—University College.—We have received a copy of the "Handbook of the Faculty of Engineering," at the University College, Gower Street, for the forthcoming session. Dr. J. A. Fleming, the Dean, is head of the Electrical Engineering Department, with Mr. W. C. Clinton, B.Sc., as assistant professor, Mr. E. Kilburn Scott as lecturer, and Mr. G. B. Dyke, B.Sc., as assistant. The first term of the session opens on September 30th. Intending students should communicate with the Provost (T. Gregory Foster, Ph.D.), at the College, as early as possible.

Concealed Lighting at St. Mary's Church, Warwick.—St. Mary's Church, Warwick, is a very fine old building in the perpendicular style, of which only the sanctuary and chancel are at present equipped with the electric light. The installation, which was carried out by Mr. Alexander Wylie, Warwick, to the design and specification of the British Thomson-Houston Co., is on the concealed lighting system. Batteries of reflectors—some Mazdalux and some prismatic glass—are attached to the east side of projections, such as the pillars supporting the chancel arch, and the side of the window recesses. Each battery of reflectors (there are four in the choir stalls and four in the sanctuary, containing in all 30 Mazda lamps) is so disposed as to concentrate the light in the required direction. The length of the chancel is 73 ft., and the 30 Mazda lamps give an approximately uniform horizontal illumination of 2 foot-candles. This method of lighting gives uniform horizontal illumination—it renders visible the beautiful roof tracery—and no fittings can be seen by the congregation. The installation was designed by the B.T.-H. Co.'s illuminating engineering department.

Centre of Area.—An American correspondent writes as follows:—For good working a power station should be located at the centre of the area and the feeding points as near as possible to the centre of their respective local areas. We know that physical conditions seldom allow of such ideal happenings, but when necessary, a novel way to find the centre of the area is to outline the district on a piece of paper, then go over the outline with water using a small brush for the purpose. Now fill up the area with water and float the paper on a bowl of water, the water area should be filled up by squeezing a small wet rag on it until the area is as deep as possible without the water running out of bounds. When all is prepared fix a pin with the point dipping into the water, that is, on the paper, but not touching the paper; no matter where you put the point of the pin the paper will shift around until the centre of area locates itself right under the pin point.

The Extraction of Nitrogen.—The representatives of certain Canadian and Spanish interests have recently been in negotiation at Christiania with the Hydro-Elektriske Aktieselskab, which owns the large nitrate works at Notodden, in regard to the establishment of branch factories in Canada and Spain. It is said that the negotiations have led to the decision to erect works in the vicinity of Montreal and Barcelona to produce according to the Eyde-Birkeland process, and the Norwegian company will have a financial interest in the undertakings.

Plant Wanted for Calgary.—It is stated in yesterday's *Standard* that Mr. A. G. Graves, the City Commissioner of Calgary, Alberta, will visit London during the early part of September. "During his stay he is anxious to get into touch with the manufacturers of large-unit gas engines to be used for electric light generating purposes and power by gas, as there is a possibility of the City of Calgary adopting this type of power if it be proved beneficial." His address will be care of High Commissioner for Canada, 17, Victoria Street, London, S.W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. J. P. Kemp, the resident engineer of the Summer Lane Station, who is resigning his appointment at the end of this month to take up the post of chief engineer of the Para Electric Railways and Lighting Co., Ltd., was entertained by the staff and workmen of the Birmingham Corporation Electric Supply Department at the White Horse Hotel, Birmingham, on Monday, August 12th, and was presented with an illuminated copy of a resolution of congratulation passed by the Birmingham Electric Supply Committee, a gold cigarette case, suitably incribed, from the staff and workmen of the whole department, and a silver cigarette case, subscribed for by the workmen of the Social Club. Mr. Kemp was also handed a jewelled pendant for Mrs. Kemp. Mr. Chattock, who made the presentation, called attention to the fact that Mr. Kemp had been resident engineer at Summer Lane Station since its opening, and that the great developments which had taken place in the 6½ years had raised the capacity of the station from 11,500 to 26,500 kw. On behalf of the whole staff, he congratulated Mr. Kemp on the appointment he had obtained, and wished him success and happiness in his new and responsible position. Mr. Kemp suitably replied.

Mr. G. Parr, assistant accountant, in connection with the Marylebone electricity supply undertaking, and Mr. A. McKichan, consumers' accounts clerk, left on Saturday last, by the *Kingfauns Castle*, for South Africa, to take up appointments with the Victoria Falls and Transvaal Power Co., Ltd. On the Thursday previous to their departure, Mr. Parr was presented by his colleagues with a pair of binoculars, an attaché case, and a cheque, and Mr. McKichan with a gold watch, suitably inscribed, the presentations being made by Mr. E. J. Jennings, secretary and accountant of the department.

The *Australian Mining and Engineering Review* states that Mr. A. T. Twiss, recently associated with Siemens Bros. Dynamo Works, Ltd., in Victoria, has been appointed electrical engineer to the Zeehan municipal electric supply.

The Horsham U.D.C. have appointed Mr. Chubb, second assistant engineer, as chief assistant engineer at the electricity works, his salary being increased to £120 per annum. Mr. Eric Sendall has been appointed second assistant engineer.

Tramway Officials.—At a meeting of the West Hartlepool Corporation on the 13th inst., Mr. C. Burgess, of Wigan, was appointed tramways manager at a salary of £200 per annum. There were 52 applicants for the position.

General.—A fortnight ago we published a paragraph in this column, on the authority of one of our usual provincial news correspondents, stating that Mr. John Hesketh, of Australia, had been as recently as that week paying a visit to Blackpool, where he was years ago borough electrical engineer. As a matter of fact, however, Mr. Hesketh was at that time on the seas on his return to the scenes of his Australian activities. From the *Australian Mining Standard* received by this week's mail, it appears that he was expected back in Melbourne in the third week of last month. We have investigated the matter at Blackpool, and find that information to the same effect as was passed on by our correspondent appeared in a Blackpool newspaper on July 26th—a week later than Mr. Hesketh's arrival in Australia! It remains for us to do one of two things—either to congratulate Mr. Hesketh on his supernatural powers, which on occasion must be extremely convenient to a busy Government official, or to wonder how the report gained such belated currency at Blackpool. Reluctantly we must, we suppose, choose the latter alternative.

We are sure that a very large number of our readers, and especially those associated with electricity supply affairs, will join with us in an expression of deep sympathy with Mr. E. Cunliffe Owen, secretary of the Metropolitan Electric Supply Co., on the death of his elder son, Francis Edward, which has just occurred, at the age of 27 years, after an illness extending over some two years, and accompanied by intense suffering.

Mr. G. D. Seaton has joined the staff of Messrs. Richardsons, Westgarth & Co., Ltd., and will represent them in the Manchester district, where he will act as sales agent for their land specialities.

Indian Engineering states that with the departure of Mr. T. Roberts, telegraph superintendent, on leave home preparatory to retirement, the Madras and Southern Mahratta Railway Co. have, it is believed, centralised the executive control of the telegraph department under Mr. H. H. L. Prendergast, their electrical engineer at Arkonam, with Mr. R. C. C. Yates, as first assistant electrical engineer at a salary of Rs. 500-700 per mensem. The electrical department has been strengthened by the recent appointment from home of an assistant electrical engineer.

On 15th inst., at Cornhill, Biggar, the marriage was solemnised of Mr. James Caldwell, M.I.E.E., eldest son of Thomas Caldwell, Rockfield, Paisley, to Blanche, youngest daughter of Mr. James Young, J.P., Cornhill, Biggar.

Obituary.—The death has occurred at Capstones, New Mills, of Mr. F. Burks, managing director of the High Peak Electric Works, New Mills. He was 54 years of age.

NEW COMPANIES REGISTERED.

South American Railless Traction Co., Ltd. (123,567).—This company was registered on August 1st, with a capital of £2,000 in 1,800 preferred shares of £1 each and 4,000 ordinary shares of 1s. each, to carry on in South America or elsewhere the business of engineers, electricians, suppliers of electricity and gas for light, heat or motive power, manufacturers of locomotives, engines, rolling stock and conveyances, cables, wires, lines, accumulators and works, whether for railway, tramway, road, field or other traffic or purposes, and rails and railway and tramway plant and apparatus, &c. The subscribers (with one share each) are:—F. Jackson, Hurstbourne, Elgin Road, Croydon, clerk; H. Boger, 74, Compayne Gardens, West Hampstead, N.W., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

British Electric Equipment Co., Ltd. (123,576).—This company was registered on August 2nd, with a capital of £3,000 in £1 shares, to carry on the business of mining and electrical engineers, electricians, suppliers of electricity, &c., and to adopt an agreement with M. M. Gillespie and M. Beales. The subscribers are:—M. M. Gillespie, Amberley House, Norfolk Street, W.C., engineer, 100 shares; M. Beales, Amberley House, Norfolk Street, W.C., engineer, 100 shares; E. H. Wiley, 30, Duke Street, St. James', S.W., solicitor, one share. Private company. The number of directors is not to be less than two or more than five; the first are M. M. Gillespie (chairman) and M. Beales; qualification, £100. Registered office, Amberley House, Norfolk Street, W.C.

Kerswell, Faulkner & Hamlyn, Ltd. (123,636).—This company was registered on August 7th, with a capital of £6,000 in £1 shares, to carry on the business of manufacturers of electric fittings and appliances, metal workers, tool makers, founders, machinists, mechanical and electrical engineers, iron and steel converters and smiths, &c., and to adopt an agreement with H. H. Kerswell and S. W. Hamlyn. The subscribers (with 667 shares each) are:—H. H. Kerswell, 6, Adelaide Road, South Hampstead, manufacturer; J. H. Faulkner, 31, Langland Gardens, Hampstead, N.W., salesman; S. W. Hamlyn, 85, Parchmore Road, Thornton Heath, manufacturer. Private company. The number of directors is not to be less than two or more than three; the first are H. H. Kerswell, J. H. Faulkner and S. W. Hamlyn (all permanent); qualification, £500; remuneration as fixed by the company. Registered office, Hanway Street Works, Hanway Street, Tottenham Court Road, W.

Gledhill-Brook Time Recorders, Ltd. (123,602).—This company was registered on August 3rd, with a capital of £10,000 in £1 shares, to take over the business of manufacturers of time-recording machines of all kinds, and the patent rights formerly belonging to the Stockall Brook Time Recorders, Ltd., of Huddersfield, and to adopt an agreement with G. H. Gledhill & Sons, Ltd. The subscribers (with one share each) are:—G. H. Gledhill, Dessingham, Skircoat, Halifax, cash register manufacturer; A. H. Gledhill, 22, Ventnor Terrace, Saville Park, Halifax, cash register manufacturer. Private company. The number of directors is not to less than two or more than seven; the first are G. H. Gledhill (chairman, subject to holding 1,000 shares); A. H. Gledhill (managing director, subject to holding 1,000 shares); G. Gledhill (secretary, subject to holding 250 shares); and E. Hollingworth and F. Brook; qualification, £250; solicitor, E. Booth, 7, Harrison Road, Halifax. Registered office, 43, Market Street, Huddersfield.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

The Marquess of Winchester (chairman) presided on Thursday, August 8th, at Salisbury House, E.C., over the annual general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 187), said he might fairly claim that it rendered a good account, not only of the past year's operations, but gave every indication of a continuation of the steady progress which had been the feature of the company's business since its inception. The share capital had now all been issued and stood at £3,000,000. The first mortgage debenture capital also had all been issued and stood at £3,000,000, so that the total share and debenture capital issued at the date of the accounts figured at £6,000,000. During the current year the creation of £2,000,000 second mortgage debentures had been authorised and £1,000,000 issued. The creditors amounted to £210,562, and included debenture interest for the half-year to December 31st, 1911, contractors' accounts London and South Africa £42,539, income-tax due in respect of previous year's profits and the balance represented accounts open at the end of the year. The next item, the contractors' retention account of £86,198, also appeared on the other side of the balance-sheet and represented on the one side the money due to the contractors on the completion of their work, and on the other side the amount at the bank kept in reserve against this liability. On the other side of the balance-sheet the leases and concessions and purchase of original undertaking were brought into the accounts at £1,629,006, which was £14,763 less than last year, the difference being accounted for by sales of some of the unused plant, transfer of amounts from this account to the expenditure on new stations, and by £10,785 which had been written off as depreciation. Expenditure on and in connection with new stations stood in the present balance-sheet at £1,398,789, and it was clearly shown in the balance-sheet how the amount was made up as compared with the figure at which this account stood at December 31st, 1910. Since the accounts for the year 1910 were before them they had paid up all the capital they held in the Rand Mines Power Supply Co., Ltd., and the 500,000 shares in that company now stood in the balance-sheet at £500,000. They had also purchased on account of, and handed over to, the Rand Mines Power Supply Co., Ltd., plant amounting to £1,840,228, under their agreement with that company which was secured as to £1,500,000 by a mortgage bond, and by an undertaking to execute a further bond for the balance, which bond would be executed this month. Of the expenditure on plant and machinery there was an item of £64,630 which had not been allocated. This represented the plant and machinery required in the carrying on of the business, but up to the time of the closing of the accounts the costs of this plant and machinery had not been finally allocated to the different stations, therefore it appeared in the balance-sheet under a separate heading. The machinery consisted for the most part of standard apparatus for the sub stations, and of spares purchased in connection with the plant already in operation, and would be charged in due course to the station or sub-stations in which it was ultimately employed. The debtors amounted to £92,427, and ample provision had been made for any doubtful debts. The cash amounted to £788,683. The various other items in the balance-sheet, such as stores, furniture and equipment, livestock, vehicles, and harness, preliminary expenses, had been brought into the balance-sheet after liberal depreciation had been written off. Turning to the profit and loss account, the year's work recorded the very satisfactory profit of £323,094, to which had to be added the balance of £37,850 remaining from last year's profit and loss account after payment of the dividend declared at the last annual meeting. This profit had been dealt with as follows:—The interest on debentures and income-tax thereon for the year 1911 absorbed £124,736, and they had written off depreciation amounting to £61,264, and the balance of £137,093 had been carried to the balance-sheet and added to the amount brought forward from the year 1910, thus increasing the balance to the credit of profit and loss account to the sum of £174,943. Out of the balance they paid on June 14th last a dividend on the preference shares issued up to December 31st, 1910, which payment absorbed £129,199, leaving £45,744 to be carried forward to the current year. The dividend declared covered a period of 14½ months at the rate of 6 per cent. per annum, which made the dividend on the preference shares paid up in full to the end of 1910. He had in previous years dealt with the nature and scope of the business, so that there was no need to dwell at any great length on the obligations which they had undertaken for the supply of electricity to the Victoria Falls and Transvaal Power Co.'s consumers, and electricity and compressed air to the consumers of the Rand Mines Power Supply Co., Ltd. The demands which have been made by consumers of both companies for the supply of power to which they were respectively entitled, necessitated that additional capital should be raised in order to supply the demands notified. After much careful consideration they came to the conclusion that the most advantageous way was to raise this further capital by the issue of second mortgage debentures. On April 22nd last the shareholders sanctioned the proposal to create 2,000,000 5½ per cent. second mortgage debentures, of which the issue of 1,000,000 had already been made. The progress of the business had been of such a character that even were they not under the obligation to provide further plant to meet the increasing demands on the capacity of their stations, they would be thoroughly justified in doing so by the return which had been made on the capital represented by plant already brought into commission, and in this respect in referring them to the sum of £323,093—the profit for the year—he would like to emphasise the fact that this profit had been earned although plant representing an expenditure of considerably over £1,000,000 had not been brought into commission at the time to which the accounts referred. During the past year the immense power station at Rosherville was brought into full operation, both for the supply of electricity and compressed air, and the sale of power by the two undertakings on the Rand was now one of the largest in the world, being exceeded as far as he was aware by few other enterprises. The new station at Vereeniging was already being doubled, and there were now four sets each of 15,000 H.P. being installed there. The first two sets and accompanying boilers should be ready to supply power during next month and the two extension sets which were already on the site, would be available early next year. Excepting that again as in the past they had been hampered in their work by unlooked for delays during the past year, due to the stoppage of manufacturing during the recent coal strike, and delays in shipping due to dock strikes, he was pleased to be able to report that the erection of this large station had otherwise been most rapidly carried out. The progress of the construction of the transmission line had been very seriously delayed by the causes he had mentioned owing to their being unable to obtain the necessary insulators. During his recent visit he had the opportunity of thoroughly inspecting the plant in successful operation. When they first started up the earlier plants at Brakpan and Simmer Pan for the company, they met with certain difficulties due to lightning and other causes, but during his visit he saw these two stations running continuously without interruption regulated and controlled. At Rosherville, the biggest by far of the stations which had been erected for the Rand Mines Power Supply Co., and which only came partly into commercial use at the beginning of last year, they experienced similar troubles during the lightning season, whereas the stations at Brakpan and Simmer Pan continued without fault or interruption. In an undertaking where the use of machinery whose output far exceeded the normal standards of manufacturers, however much ingenuity and thought was expended in the construction of the plant, nothing could ensure them, when first putting stations into commercial service, against temporary interruptions of supply, and reliability could only be ensured through experience gained in actual operation. The Rosherville plant of the Rand Mines Power Supply Co., Ltd., station proved no exception. On his arrival in Johannesburg last November on the business of the company and of the Rand Mines Power Supply Co., he was faced with claims for a considerable amount on the latter company under the penalty clauses of its contract with the Rand Mines, Ltd. In the course of negotiations for this settlement, it became evident that the result of experience showed, that however carefully the original contract had been drafted, there were certain alterations which would prove of mutual benefit to the consumers and suppliers, and he was glad to be able to inform them that he found that the representatives of the Rand Mines, Ltd., were quite prepared to recognise the difficulties which had been met, and that they appreciated the manner in which the responsibilities of the undertaking had been carried out. He would like to testify to the manner in which the representatives of the Rand Mines, Ltd., met him in the somewhat difficult negotiations which resulted in the drawing up of a new contract, which, while preserving all the rights which had been obtained under the old contract, would not only largely increase the margin of security of supply to the industry, but would simplify the conditions of many of the clauses and give greater security to the consumers. This new contract had not yet finally been agreed, but the points requiring adjustment were receiving immediate attention, and he hoped before long that the only questions still open would be satisfactorily arranged. The results obtained from the sales of energy in the form of compressed air on a system such as they had installed, and which had not, so far as he knew, been previously adopted, had come up to their estimate, but there was this drawback that the capital expenditure for the installation of the machinery necessary to generate a unit of air involved a higher ratio of capital expenditure than that for the machinery necessary to generate a unit of electricity. The results of this method of distribution of energy had met with the approval of the consumers of the Rand Mines Power Supply Co., and demands for energy in this form had largely increased since the original contract was obtained. The past year had been a most strenuous one for the management in South Africa and the engineering staff, and he could not conclude without acknowledging the great assistance which they accorded him when in South Africa in carrying through the negotiations for the new Rand Mines, Ltd., contract, and for the zeal and energy which they had always displayed in the company's interests.

Mr. A. Brakhan seconded the motion, and pointed out that as good results had been obtained with only a part of their plant in operation, it must be evident that when the full plant now in course of construction, or being arranged for, was installed, it would ensure a satisfactory and profitable future for the company.

Mr. Ellison said he understood that the power from the Victoria Falls had not yet been touched, but that all the electricity was being generated from coal. When was it propose to tap that source of income, or were they under penalty if they did not utilise that concession? The amount of depreciation included the buildings, plant, &c., and seemed to be very small, considering the value of the plant. He suggested that in future there should be a separation of the items. He thought he was right in estimating a probable profit of £420,000 to £430,000 in the current year, so that the preference shareholders would get their dividend, and he would like to know what hope there was for the long-suffering ordinary shareholders. If they went on as they were going, it seemed to him the ordinary shareholders might hope to get a dividend in 1914.

The Chairman said they incurred no liability for not making use of the Victoria Falls concession. Obviously to harness such an undertaking as the Zambesi River would not be a remunerative investment unless they had a large sale for power, and they were awaiting developments in the country before attempting to do so. The board would consider the suggestion as to the depreciation account but he was quite satisfied that the shareholders' interests were being most carefully safeguarded in that direction. They maintained the plant at the highest state of efficiency, and made liberal provision for depreciation. If he was asked about the dividend in 1914, he hoped to be able to give further information on the subject; but at the moment he had no wish to prejudice the position of the board by making any statement that day.

The report was then adopted, and the retiring members of the board and the auditors re-elected.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Empire District Electric Co.—Fully-paid scrip for 1,500,000 dols. first mortgage 5 per cent. sinking fund gold bonds.

Hadfield's Steel Foundry Co., Ltd.—Further issue of 100,000 ordinary shares of £1 each, fully paid.

And to allow the following securities to be quoted in the Official List:—

American Telephone and Telegraph Co.—25,000,000 dols. additional collateral trust 4 per cent. bonds of 1,000 dols. each Nos. 28,000 to 53,000).

Toronto Power Co.—Further issue of £800,000 4½ per cent. consolidated guaranteed debenture stock.

The Committee has ordered the undermentioned to be quoted in the Official List:—

Georgia Light, Power and Railways.—2,230,000 dols. first lien 5 per cent. 30-year gold bonds of 1,000 dols. each, Nos. 1 to 2,230; and 62,645 common shares of 100 dols. each, fully paid.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Birmingham Electrical Case Co., Ltd.
British-Bitumen, Ltd.
Cyclops Asbestos Co. (Liverpool), Ltd.
General Power Development Co., Ltd.
Hooghly River Electric Power Co., Ltd.
London Electric Hot Air Baths (Greville's System), Ltd.
North-Eastern Electrical Stores, Ltd.
North Lancashire Electrical Treatment Co., Ltd.
Pyrenees Electrical Society, Ltd.
Railway and Tramway Development Co., Ltd.
Universal Electrical Supply, Ltd.
Variable Electric Lamp Syndicate, Ltd.
Werner-Stuart Steam Generator Syndicate, Ltd.
Wireless Telephony (Entertainments) Co., Ltd.

La Plata Electric Tramways Co., Ltd.

The directors in their report for 1911, say that owing to the discovery that the company's accountant in La Plata had made false entries in the books and had defrauded the company, the directors requested Messrs. Nordaby, Brewster & Co., who are now acting as the company's auditors in La Plata, to make an exhaustive examination of the books for the past two years. They report that they found numerous omissions and false entries, and that as on December 31st last the total defalcations amounted to £7,787. They also report that further defalcations, applicable to the year 1912, amounting to £2,081, have been discovered. The frauds occur on both sides of the accounts. Miscellaneous receipts have been kept back, and fictitious invoices presented for payment. The directors are at a loss to understand how these frauds, continued over so many months, can have been overlooked by the manager and the company's late auditors in La Plata who have countersigned the monthly and annual accounts sent to London. The directors are much concerned at these discoveries, and are using all possible means to ascertain the facts. Mr. Hamilton, the chairman of the company, is on his way to La Plata, holding full powers to act. The accounts presented are based on the accounts as corrected after the examination, and represent the state of affairs as at December 31st, 1911. The traffic receipts, £48,948, have been up to the original estimate. The working expenses are 68 per cent., and have been affected by two causes, viz., disturbance of traffic owing to paving operations, and the partial use of horse traction. The electric working expenses are 63 per cent. The horse traction section is conducted at a loss. The balance of profit for the year is £14,673, less £7,787 loss by defalcations; interest aborbs £1,500; £5,352 has been distributed in interim dividend on preference shares, and £23 remains. The defalcations since December 31st, 1911, will have to be dealt with in the next account. The following is a comparison of the traffics for the two years ending December 31st, 1910, and December 31st, 1911:—

	Passengers carried.	Receipts.
1910	3,564,576	£34,483
1911	5,228,355	£48,948

The route to Ensenada is practically complete, except at the crossing of the railway. These crossings are being constructed by the railway company at this (the tramway) company's cost.

Mr. W. W. Western presided on August 8th at River Plate House, E.C., over the third annual general meeting of the above company, and in moving the adoption of the above report, he said he would divide his remarks into two portions—first, as regarded the accounts of the year, and secondly, regarding the circumstances under which the company had sustained heavy losses. Traffic receipts amounted to £48,900, and miscellaneous receipts to £700. The traffic receipts were already in excess of the original estimates, and the comparison was all the more satisfactory because the original estimate was for the completed line, whilst, as a matter of fact, they were still working with one section not electrified. The uncompleted section was that connecting the town with the port of Ensenada. The old horse line followed the bank of the harbour canal and commanded hardly any intermediate traffic. The substituted line ran along a paved road, along which buildings were being erected which would give a substantial intermediate traffic in addition to the normal traffic between the town and the docks. The necessity for obtaining an Act of Congress, and difficulties with regard to the crossing of the railways, had delayed proceedings, but according to the latest advices, the line was practically finished saving the railway crossings. So far as they understood, it would take about a month to complete the crossings. Extensive paving operations carried out by the municipal authorities had interfered with the traffic and also affected their expenses ratio. Their original estimate of expenses was 65 per cent., but the actual rate was 68 per cent. An analysis of the account, however, showed the rate for the electric tramway to be 63 per cent. As the work was still uncompleted, they had not dealt with depreciation, but they recognised that as a charge which could not be neglected. The traffic receipts for the current year were somewhat in excess of the corresponding period, but he was disappointed that they did not show a substantial increase. Their local director attributed it to the effect of the electrification of the municipal horse line, and possibly he was correct, but in view of the rapid growth of the town coupled with their possession of the best routes, he (the chairman) did not fear for the future. It was a matter of very great concern to the directors that so large a proportion of the profits had been swept away by the fraud of an employé, and it was a matter of still greater concern to them to find the frauds continued over a considerable length of time without discovery. Proceeding to explain the company's system of control at La Plata, the chairman said they had M. Boutell as local director, who acted as intermediary between the company and the authorities, and advised the board on questions of policy, but who did not interfere with details of working. The manager, Mr. Dore, was the manager of the old horse tramways, and he did the routine work, and referred to the local director in cases of difficulty. Two years ago, their accountant resigned his position, and the local director found a man on the spot, Mr. Allan, whose credentials were satisfactory, and he was appointed. Outside there was what was locally called the stationmaster. The tramway conductors got out way bills showing the tickets issued, &c., and each day paid their takings to the stationmaster, whose duty it was to pay them into the bank. It was the manager's duty to see that the amount paid into the bank tallied with the way bills. The company's payments were made from another bank and cheques were signed by the manager or director and countersigned by the accountant, and before the cheque was signed the accountant had to produce the corresponding merchant's invoice or other document to be marked by the manager. There were local auditors, whose duty it was to examine the cash accounts, and monthly accounts were sent to the London office, from which the company's books were made up. Up to 1911, Messrs. Fowler and Co. audited for the company locally, but from that date Messrs. Nordaby, Brewster & Co., who were in close touch with the company's London auditors, had done the work. The board were on the point of sending out the balance-sheet when they received a telegram, stating that frauds had been discovered. They at once instructed Messrs. Nordaby, Brewster & Co. to make a strict examination of the accounts for the past two years, and it came as a terrible blow to the board to learn that frauds amounting to nearly £10,000 had been going on over a period of nearly two years. The accountant had obtained money from the stationmaster and had manipulated his books, and had also retained money due to suppliers and produced duplicate invoices and got cheques. It was incomprehensible to the board how the frauds escaped the notice of the manager, and how he and the auditor signed monthly sheets without discovering the discrepancies between them and the actual balance in the bank. Mr. Woodrow, the secretary, was now in La Plata, and Mr. Hamilton, the chairman, was on the high seas, with full power to act, and would remain in La Plata to make arrangements for protecting the company's interests. Referring next to a note in the auditors' certificate regarding the value of stores, the chairman said that that had relation to a quantity of old material valued at £1,200 or £1,300, and he could not say what the true value of it was. As regarded the procedure that day, he suggested that they might either formally adopt the report and call another meeting when Mr. Hamilton came back, or else adjourn the present sitting.

Mr. Harmood Banner, M.P., seconded the motion, and also expressed regret at the frauds which had occurred.

Replying to a question, the Chairman said that an application was at once made for a warrant for the arrest of the accountant, but apparently they did things in a different manner in that country, and the Judge was holding an inquiry not only into the actual losses of the company, but with regard to who was responsible for allowing them to be robbed, but he had not communicated anything to them.

A long discussion took place, principally with regard to the advisability of getting auditors for the company who were actually represented by a branch in Buenos Ayres, and eventually the meeting was adjourned till a date to be fixed after the return of Mr. Hamilton.

Perth Electric Tramways, Ltd. (W.A.).

The directors' report shows that, for the year ended December, 1911, there was a profit of £37,893, which is an appreciable increase over any former year and compares favourably with the year 1910, which was adversely affected by the strike of conductors and motormen. The directors have already distributed an interim dividend of 2½ per cent. on the ordinary shares, and now recommend the payment of a further 2½ per cent., making 5 per cent. for the year. After making this payment and distributing the dividend on the preference shares, and interest and sinking fund on the first and second debentures, there remains a balance of £9,742. The directors recommend that £9,000 of such amount should be placed to cash reserve fund, bringing such fund up to £19,741, leaving £742 to be carried forward. As stated in the circular issued in June, the directors have signed a provisional contract for the sale of the undertaking to the Government of the State of Western Australia for £475,000, which agreement is conditional (amongst other things) on the Government obtaining certain consents from the various municipal authorities from whom the company's concessions are held. As the Perth City Council refused to give its consent, the Government took the necessary steps to bring in an Act of Parliament enabling them to purchase the tramways without the consent of the Perth City Council, and the Bill is now before Parliament. There seems to be no doubt that the Bill will, in due course, become law, and after an intimation has been received that the Bill has been passed by the Western Australian Parliament, the necessary meetings of shareholders will be called, and the agreement submitted for confirmation. The latest information received is that the Bill has passed the second reading and is now in the Committee stage. The amount of the first debenture stock redeemed in respect of the year under review is £5,050 at a cost of £5,207. The directors record their appreciation of the services of Mr. Somerset and his staff during the year.

Mr. H. J. Somerset, the manager and engineer, in his report, says that during the year 1911 no new construction work was carried out. The trams travelled 1,230,910 miles, as against 1,011,510 miles in 1910. The total receipts were £86,528, as against £68,455 in 1910, an increase of £18,073. The total Perth expenses in 1911 were £45,441, as against £38,479 in 1910, an increase of £6,962. The excess of receipts over expenditure was therefore £11,111 greater than in 1910. The earnings per car-mile were 16·87d. in 1911, as against 16·24d. in 1910; while the expenses were 8·85d., as against 9·13d. in 1910. The expenses per cent. of earnings in 1911 were 52·47 per cent., as against 56·21 per cent. in 1910. The mileage constructed is 30 miles 11 chains.

South Metropolitan Electric Light and Power Co., Ltd.—**The transfer book and register will be closed from August 19th to 31st inclusive, for the preparation of warrants for dividends payable on 31st inst.**

Manaos Tramways and Light Co., Ltd.

The directors in their third annual report for the year ended April 30th, 1912, state that during the year both the tramway and lighting sections of the business improved. The tramway receipts amounted to £109,718 and the lighting to £35,603, against £105,867 and £33,595 respectively for the previous year. The number of passengers carried has increased by 234,000, and four large cars are being put into service to cope with the increased business. The public lighting has been increased by the addition of the 23 arc lamps, the company now supplying electricity for 345 arc lamps, and with every likelihood of a further increase being necessary in the near future. In the private lighting section 584 new customers have been secured, increasing the number of 16-c.p. lamps by 1,969, and making the total number of lamps now connected 15,065. The property has been maintained in first-class condition and is well equipped, every care having been taken to place the company in a position to meet the demands of the public. Up to the present time the company has confined its operations to electric traction and lighting, but it is now actively engaged negotiating for the sale of power to the various works in Manaos. The result of the company's operation for the year is a profit of £34,828, which compares with £30,431 for the previous year. After providing for London expenses, &c., and debenture interest amounting to £18,510, there remains a balance of £16,319, plus £3,509 brought forward, making £19,828, which the directors recommend should be dealt with in the following manner:—To contingencies reserve, making a total to the credit of this account of £10,000, £2,500; to renewals reserve, making a total to the credit of this account of £15,000, £5,000; dividend on £300,000 ordinary shares at rate of £3 per cent. per annum, £9,000; to be carried forward £3,328. The meeting is to be held in London on August 20th.

Underground Electric Railways Co. of London, Ltd.

The directors in their report for the June half-year, state that the net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £208,666, plus amount receivable under guarantee on Metropolitan District Railway assented first preference stock £2,687, making £211,352, less interest charges on £1,730,000 4½ per cent bonds of 1933 remaining outstanding, and expenses of redemption of £1,088,700, redeemed January 15th, 1912, which absorbed £43,447, leaving a surplus of £167,906. This amount will be applied as follows:—In payment, on September 2nd, 1912, of interest at the rate of 6 per cent. per annum on £1,181,981 6 per cent. first cumulative income debenture stock for the June six months, £35,459; interest at the rate of 4 per cent. per annum plus income-tax on £6,110,031 6 per cent. income bonds of 1948 for the June six months, £129,771; balance carried forward, £2,676. The income from investments for the half-year shows an increase of £101,877 over that for the corresponding half-year of 1911. Included in this amount is the income from the company's holdings in the London General Omnibus Co., Ltd., which appears for the first time in the revenue account, and, therefore, prevents a true comparison. By reason of the sale of the power house undertaking to the Metropolitan District and London Electric Railways Joint Committee, as of January 1st, 1912, the income from the operation of that undertaking disappears from the revenue account, as does the charge for interest on the securities redeemed with the proceeds of such sale.

The traffic and working expenses of the railway companies and of the London United Tramways, Ltd., have been adversely affected by the general labour unrest during the half-year. The Metropolitan District Railway Co. has paid in respect of the half-year a dividend at the rate of 2 per cent. per annum on its 5 per cent. second preference stock, on which no payment was made for the corresponding period last year. The London Electric Railway Co. has paid dividends at the same rates in respect of this half-year as in the corresponding half-year. The construction of the Paddington and Charing Cross extensions is proceeding satisfactorily. The Bills promoted by the Metropolitan District Railway Co., the London Electric Railway Co., the Edgware and Hampstead Railway Co., and the London United Tramways, Ltd., the main provisions of which were explained at the last meeting, received Royal Assent on August 7th.

The directors proceed to give particulars of the scheme for the fusion of the interests of the company and the London General Omnibus Co., Ltd., and the progress that has been made with it.

The item stocks, shares and other property stands in the books at £13,518,642, and consists of stocks and shares in associated companies, as well as of lands and buildings. The increase of £2,529,956 in the figure shown in the balance-sheet, as compared with the corresponding figure (£10,988,686) at December 31st, 1911, results mainly from the acquisition of the ordinary stock of the London General Omnibus Co., Ltd., acquired under the scheme, and from expenditures in connection with the Edgware and Hampstead Railway. The new capital items appearing in the balance-sheet are the first cumulative income debenture stock the "A" ordinary shares, and an addition to the 6 per cent. income bonds of 1948, which securities were issued in exchange for the ordinary stock of the old London General Omnibus Co., Ltd., under the terms of the scheme. The item of calls unpaid (in course of collection) has been reduced during the half-year from £111,477 to £7,477. As a result of the sale of the power house undertaking, material improvement in the position of the company is shown in the balance-sheet. The 4 per cent. first power house debentures, amounting to £1,000,000, have been paid off, and the 4½ per cent. bonds of 1933 have been reduced by the redemption of £1,088,700 (leaving the amount now outstanding £1,730,000), and, in addition, certain suspense items have been either reduced or entirely written off.

Paisley District Tramways Co.

The result of the half year's working to June 30th, 1912, is as follows: Revenue £28,697, expenses £18,046, leaving £10,651, less extra cost electrical energy due to coal strike £316, general interest £274, interest on debentures £1,600, and debenture sinking fund £750, leaving £7,711 plus £2,559 brought forward. The balance is £10,271, which is to be disposed of thus: £1,500 to general reserve account; £3,750 to dividend on £150,000 cumulative 5 per cent. preference shares for the half-year; £1,000 to preference share sinking fund; £2,025 to dividend at the rate of 2½ per cent. per annum on the ordinary shares for the half-year; carrying forward £1,996. The traffic receipts show an increase of £2,359, compared with the receipts for the corresponding half-year of 1911. Owing to the increasing traffic four additional cars have been ordered and will be put into service shortly. The expenses were £3,363 in excess of the expenses for the first half of 1911. This increase is to a considerable extent in connection with the maintenance of the permanent way, necessitated largely by the increasing heavy commercial motor traffic. The dividends will be paid on 23rd inst.

Half year ended	Miles open.	Passengers carried	Traffic receipts.	Average fare.	Car mileage.	No. of cars.
Dec., 1910	[illegible]	5,756,773	£24,773	1·03d.	511,731	50
June, 1911 ..	17·98	6,009,072	£26,121	1·04d.	559,021	56
Dec., 1911	17·98	[illegible]	[illegible]	1·06d.	[illegible]	56
June, 1912	17·98	[illegible]	£28,180	1·04d.	[illegible]	56

The American General Electric.—The New York correspondent of the *Times*, writing on July 26th on the subject of Business in the United States," states that General Electric stock advanced vigorously, the reason being an announcement that stockholders would be given a 30 per cent. stock dividend. The dividend, he goes on to state, was not wholly unexpected, but it is "one of the largest 'melons' received by stockholders of any Corporation for a long time . . . . The company's stockholders will meet on August 29th to vote upon the proposed increase in the capital stock from $80,000,000 to $105,000,000. After such increase there will be paid to stockholders of record December 31st, 1912, out of the surplus earnings of the company, a dividend of $30 per share, payable in stock of the company at par. Such dividend is to recoup stockholders in part for dividends passed or reduced in the years after 1893. For the future financial needs of the company it is proposed to issue debentures from time to time, and for this purpose the directors have authorised an issue of debentures limited to $60,000,000 bearing 5 per cent. interest or less."

Falkirk Electric Construction Syndicate, Ltd.—An extraordinary general meeting has been held to consider a resolution that the capital be increased for the purpose of carrying out the scheme for the extension of the Falkirk tramways to Grangemouth. The resolution was moved by Mr. G. M. Brown, chairman of the board of directors, who presided. A direct negative was moved and seconded by Mr. A. W. Tait and Mr. George Balfour respectively, and after a vote this became the finding of the meeting. The effect of the decision is that the extension of the tramways to Grangemouth will be delayed.

Paignton Electric Light Co., Ltd.—The annual meeting was held on Wednesday last week. During the year £6,967 was expended on capital account, chiefly on new mains, cables and machinery. The trading showed a profit of £847, less £306 for depreciation, leaving a gross profit of £541. The sale of electricity increased during the year from £822 to £1,667. The destructor showed a profit of £142, and the tarring department of £239. Since December 31st new condensing plant has been installed, at a cost of £1,200.

Continental.—France.—The balance-sheet of the Compagnie Continentale Edison, of Paris, for the last financial year shows a profit of £154,420, as compared with only £134,708 in the preceding 12 months.

Switzerland.—The report of Messrs. Brown, Boveri & Co., of Baden, for the last financial year shows a net profit of £97,772, as compared with only £92,001 in the preceding 12 months. The dividend is being maintained at 7 per cent.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum for the half-year ended July 31st, payable less income-tax on August 31st.

Claud Hamilton, Ltd.—The directors' report for the year ended April 30th a net profit, including £2,060 brought forward, of £6,964. After writing down property account by £500, a dividend of 10 per cent. is declared, carrying forward £2,698.

Electric Supply Co. of Victoria, Ltd.—The directors have declared a dividend of 6 per cent. on the preference shares on account of arrears.

Para Electric Railways and Lighting Co., Ltd.—The directors announce an interim dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year.

Liverpool District Lighting Co., Ltd.—The directors have declared an interim dividend of 2 per cent.

Tyneside Electrical Development Co., Ltd.—The directors have declared an interim dividend of 5 per cent.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, August 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£24 15	..
a Lead, Nitrate	„	£26 10	..
a „ White Sugar	„	£25 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3⅓d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3⅛d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7¼d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b „ Wire, in ton lots	„	£102	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	⅝d. inc.
c „ Tube (brazed)	„	11¼d.	¼d. inc.
c „ „ (solid drawn)	„	10d.	¼d. inc.
c „ Wire, basis	„	9⅜d.	⅜d. inc.
c Copper Tubes (brazed)	„	1/0¼d.	¼d. inc.
c „ „ (solid drawn)	„	11¾d.	¼d. inc.
g „ Bars (best selected)	per ton	£95	.
g „ Sheet	„	£95	..
g „ Rod	„	£95	..
d „ (Electrolytic) Bars	„	£82	10s. inc.
d „ „ Sheets	„	£100	10s. inc.
d „ „ Rods	„	£88 10s.	10s. inc.
d „ „ H.C. Wire	per lb.	10⅜d.	⅛d. dec.
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/7	..
h Gutta-percha, fine	„	6/6 to 8/6	..
h India-rubber, Para fine	„	5/-	1d. inc.
i Iron Pig (Cleveland warrants)	per ton	61/-	2 4 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£19 15 to £20	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	5s. dec.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£210 to £211	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

Calgary Power Co.—The directors report that a commencement was made with the delivery of power on May 1st, 1911, but only on a very limited scale. Subsequently, however, a full service was undertaken, and the accounts now presented show a total of $81,318 in respect of gross earnings for the eight months from May 1st to December 31st, 1911, including dividend on investment. The net earnings totalled $61,600, and, after deducting interest charges, amounting to $47,600, there remains a surplus of $14,000 to be carried forward. Construction work is now being rapidly completed, with the exception of the storage reservoir and second transmission line, but the latter will probably be finished before the coming winter season, while the reservoir dam has already been handed over by the contractors, and the directors confidently expect that a sufficient quantity of water will be stored for use during the low stage of the river this year, thereby materially increasing the capacity of the plant and ensuring a more reliable service.

STOCKS AND SHARES.

Tuesday Evening.

ALTHOUGH the Stock Exchange usually expects to drag through the holiday season with little to disturb the tenor of its dulness, the present month has proved an exception to general custom, and quite a distinct revival of speculative interest has been witnessed in many departments. This is chiefly to be accounted for by the extremely low levels to which the majority of stocks had fallen, owing to the over-speculation in the earlier part of the year, and the consequent ease with which they rose when the re-investment of the half-yearly dividends began to take place.

As our lists of last week very clearly proved, most of the concerns connected with the electrical industry did not share in this depreciation, but are, on the contrary, considerably better since the beginning of the year. Therefore, it is only natural to find that the stocks and shares which we quote, do not supply any very decided tendency except in the case of those in the Home Railway market, where prices have been subjected to the influences referred to in the previous paragraph.

Undoubtedly the railway stocks have been the most interesting, and some really good advances have been scored. After creeping up steadily throughout last week, prices became almost buoyant on Monday. Large lines of stocks were bought which, it was said in the Stock Exchange, were on behalf of the syndicates who forced prices up in the spring. Chief attention, as usual among electrical railways, was paid to Metropolitans and Districts, which, after their continued dulness, had come back to a level giving ample margin for recovery. The former jumped 3¾ to 57, and Districts, with a three points rise, managed to climb over 40 again. Opinion is divided as to the staying power of these stocks, the sharpness of the appreciation leading to the fear that an equally quick reaction may follow. City and South London, though by no means a bad market, did little more than recover the point they lost last week. Profit-taking after the rise which followed the opening of the extension to Liverpool Street led to a fall of a point, to 76, in Central London Ordinary. There is still some fear expressed that the extra passengers carried will not justify the expenditure, as it is thought that the end of the journey for the majority will still be the Bank Station.

Though Underground Electric Railway 6 per cent. Income bonds have shared in the general improvement, with a rise of three points to 91, they were not directly influenced by the report, issued on Monday evening, which was very much according to market expectations. Any true comparison with the results of last year is impossible owing to the inclusion of the income derived from holdings in the London General Omnibus Company, but the payment of a dividend of 4 per cent. on the 6 per cent. Income bonds (compared with 1½ per cent. a year ago) and a carry forward of £2,700 shows that satisfactory progress has been made. The chief cause of the increased revenue is, of course, due to the acquisition of the omnibus stock, but it is interesting to note that the payment of 2 per cent. on District Railway second Preference, as against nothing, meant £13,800 extra for the Underground Company.

English electricity supply shares have not displayed any great activity of late, though what movements there have been are generally in an upward direction. On top of their recent rise, County of London Preference have put on another ⅛ to 12⅛, while Brompton and Kensington Ordinary and Westminster Ordinary have gained equal amounts to 8⅞ and 8⅝ respectively. Amongst English tramways, the only movement that calls for special mention is a drop of ⅛ in London United Tramways Preference to 5⅛, and except for recoveries in India-Rubber and Gutta-Percha, Babcock and Wilcox and Edison & Swan "A" shares, there is nothing of particular interest in the manufacturing division.

The Latin-Canadian group has shown some disposition towards recovery after the falls which naturally followed the large advances. Mexico Tramways have been very active, dropping back at one time, but at the lower level support was forthcoming with a result that a further rise of two points to 128½ was scored by the Common and half that amount by the 5 per cent. bonds. Rio de Janeiro Tramways improved at one time, but the rise was not maintained. Monterey Light and Power Debenture have been in some request, and Canadian General Electric Common have also advanced. Sao Paulo First Debenture declined a point to 106.

The issues of the British Columbia Electric Railway have been bought fairly extensively, and the Deferred, Preferred and 5 per cent. Preference have each gained a point, but Anglo-Argentine Tramways First Preference fell back $\frac{1}{16}$ to 5¼.

Chief interest in the Telegraph market has been centred upon Marconi shares, which have slumped rather severely. It was, of course, according to Stock Exchange custom to put down the price when the details of the deal with the Government were made public, on the idea that there was "nothing more to go for"; but the decline has been aided by some uneasiness caused by the postponement of the House of Commons' debate on the subject, and also by vague talk of improved patents which would have a serious effect on the prospects of the company. The Ordinary were at one time down to 4¼, and Americans and Canadians have also been flat. Speculation in National Telephone Deferred is not on such a large scale as hitherto, the disposition being to await the resumption of the arbitration proceedings in the autumn. The price has improved, however, to 144. Reuter's have been very dull, falling 15s. to 10½, on sales by holders wishing to exchange into the new shares. Any further drop on this account is not to be expected, as, allowing for dividend, the values at present prices now approximate. Among other changes in this department may be noted small rises in Eastern Telegraph and Eastern Extension.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	9¾—10¼		5 2 4
Do. 4½ % Pref.	10	4½	4½	9 —10		4 10 0
Do. Second 6 % Pref.	10	6	6	10½ - 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8 — 9¼	+ ¼	5 9 7
Do. 7 % Cum. Pref.	5	7	7	7¾— 8¼	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½— 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4⅞	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾— 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4½— 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	7	8	17 - 19½	..	4 2 1
Do. 6 % Cum. Pref.	10	6	6	13½ - 15½	..	3 17 5
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	5	6	11¼ - 11¾	..	5 2 2
Do. 6 % Pref.	10	6	6	11¾— 12½	+ ¼	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅛— ⅜		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾— 5¾	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95 xd	..	4 14 9
Hove	5	9	9	7¾ — 8		5 12 6
Kensington & Knightsbridge, Ord	5	9	9	7½— 7¾	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1½ - 1⅝	..	4 0 8
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3½— 4	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	+ ½	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4⅝— 4⅞ xd	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5⅞— 6⅝	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 - 8¾ xd	..	5 14 3
Do. 7 % Pref.	5	7	7	6¾— 7¼ xd	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 5
Smithfield Markets, Ord.	5	Nil	2	1⅝— 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½	.	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	.	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/16— 1 3/16	..	5 17 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	5	..	½— ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½— 3	..	3 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord.	5	10	10	8⅝— 8⅞	+ ⅛	5 12 8
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5½	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝— 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7½— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5¼ — 5 7/16	— 1/16	4 11 1
Calgary Power, 1st Mort. Bds.	100	5	5	96— 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7†	114 —119	+1	5 17 8
Do. 7 % Pref.	$100	7	7	120 —121	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	8†	13/16— 15/16	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	99 —101	..	4 19 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— ¼	..	Nil
Do. 6 % Pref.	1	6	6	11/16— ¾	..	8 6 0
Kaministiquia Power, 5% G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1⅞— 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	93 — 96	..	4 3 4
Do. 7 % Cum. Pref.	$100	7	7	109 —112	+1	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½— 98½ xd	— ½	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88½— 90½	+ ½	5 10 6
Montreal, Lt., H. and Power	$100	7	8	238 —243 xd	.	3 5 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	152 —157	+1	3 3 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½— 101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½— 92½	..	5 8 1
Victoria Falls Power, Pref.	1	Nil	11⅞d.	½— 1 1/32	+ 3/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½—107½	.	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7½— 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½— 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	149 —151	..	5 6 0
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph	Stock	8¾	8	67½— 69½ xd	..	5 7 11
Do. 6 % Pref.	Do.	6	6	113 —114 xd	+ ¾	5 5 3
Do. Def.	Do.	30/-	30/-	26¼— 26¾	— ¼	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½—104½	..	4 16 2
Chili Telephone	5	7	..	7½— 7¾	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½— 84½	+ ½	4 14 8
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅜— 7⅝ xd	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128½—131½	+ ½	5 6 5
Do. 3½ % Pref. Stock	Do.	3½	3½	77½— 79½	+ ½	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	98½—100½	..	3 19 7
Eastern Extension	10	7	5†	13 — 13½	+ ⅛	5 3 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4
Great Northern Telegraph	10	18	18	28¾— 29¼	..	6 3 1
Indo-European Telegraph	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	4⅜— 4½	—11/16	4 6 7
Do. 7 % Cum. Partic. Pref.	1	16	17	3 13/16— 3 15/16	— 3/16	4 11 2
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	13/16— 15/16	..	5 6 8
National Telephone Def.	Stock	6	6	143 —145	+1	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100—101	+ ½	4 9 1
Oriental Telep. and Elec.	1	8	8	1 23/32— 1 27/32	+ 1/16	4 6 9
Do. 6 % Cum. Pref.	1	6	6	1 3/32— 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	10¼— 10¾	— ¾	3 14 5
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7 3/16— 7 7/16 xd	..	5 7 7
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 11 0
West Coast of America	2½	2½	2½	1 5/16— 1 9/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	½	2½— 2¾	..	1 16 4
Do. 6 % Cum. 1st Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾— 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17
Western Telegraph, Ltd.	10	7	6†	12⅞— 13⅜	..	5 4
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	[illegible]	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	97 — 100	..	5 0 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	75 — 77	-1	3 17 11
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	2	73 — 75	..	2 13 4
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3
City & South London, Ord. ..	100	1½	1⅝	34 — 35 xd	+ 1½	4 12 10
Do. 5 % Pref., 1891	100	5	5	106 — 108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 — 104 xd	..	4 16 2
Do. Do. 1901	100	5	5	102 — 104 xd	..	4 16 2
Do. Do. 1903	100	5	5	101 — 103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10¼ — 11¼ xd	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅞ — 2⅛	..	Nil
Hastings Trams, 6 % Pref. ..	1	Nil	6	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4⅞ — 5⅜	— ⅛	..
Do. 4 % Deb.	100	4	4	73 — 77	..	5 4 0

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Metropolitan Railway Consol. ..	100	1⅜	1⅞	56¾ — 57¼	+3½	3 5 6
Do. Surplus Lands	100	2¾	2⅞	66 — 68	—1	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	85 87	..	4 0 6
Metropolitan District Ord. ..	100	Nil	Nil	40½ — 41	+3	Nil
Do. 6 % Deb.	100	6	6	141 — 143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 — 101	..	3 19 3
Do. 4½ % First Pref.	100	3¼	4½	91 — 93	+1	4 17 10
Do. 3½ % Gtd.	100	3½	3½	74 — 76 xd	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	.	5 6 8
Do. Def.	1	Nil	..	3/16 — ¼	..	Nil
Do. 5 % Pref.	1	5	5	27/32 — 31/32	..	5 4 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	99 — 102	+1	4 19 0
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	9/16 — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4¼	..	Nil
Do. "A"	1/-	..	..	⅝ — 11/16	..	..
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	1	1½†	90 — 92	+3	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5⅛ — 5⅜	— 1/16	5 2 4
Do. 2nd Pref.	5	5	5½	4 13/16 — 5 1/16	..	5 6 0
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	99½ — 101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 — 103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 — 104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	+ 1	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½ — 103½	+ 1	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	136 — 141	+ 1	5 13 6
Do. Pref. Ord.	100	6	6	116 — 121 xd	+ 1	4 19 2
Do. 5 % Pref.	100	5	5	107½ — 110½	+ 1	4 10 6
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ — 102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 — 105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 — 104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6⅛ — 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	+ 1/16	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5 9/16 — 5 13/16	..	4 10 6
Do. 4 % Deb.	100	5	5	99 — 102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 — 103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
La Plata Elec. Trms, Ord. ..	1	..	..	½ — ¾	..	..
Do. Pref.	1	6	6	25/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 — 102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	103 — 105	..	4 15 2
Mexico Trams Com.	$100	7	7	127 — 130	+2	5 7 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	101 — 103	+1	4 17 1
Do. 6 % Bonds	100	6	6	102½ — 104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7¼ — 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 — 102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16 — 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 — 102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	150 — 153	..	3 5 4
Do. 1st Mort. 5 % Bonds ..	..	5	5	102¾ — 103¾	..	4 16 5
Do. 5 % Mort. Bonds ..	100	5	5	99¾ — 100¾	..	4 19 8
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	260 — 265	..	3 15 6
Do. 5 % 1st Deb.	$500	5	5	105 — 107	—1	4 13 6
Singapore Trams, 5 % Deb. ..	100	5	5	82½ — 85½	..	5 17 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video ..	5	6	7	5½ — 6	..	5 16 8
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 — 103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 — 106	..	4 4 11

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Aron, Ord.	1	Nil	6	⅝ — ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3 1/16 — 3 5/16	+ 1/16	8 3 0
Do. Pref.	1	6	6	1⅜ — 1⅝	..	4 0 0
British Aluminium, Ord. ..	1	..	..	1/16 — 3/16	..	..
Do. 6 % Cum. Pref.	1	..	..	⅜ — ⅝	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	5¾ — 6¼ xd	..	4 11 1
Do. Deb...	100	4½	4½	101 — 103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	3	Nil	..	7/16 — 11/16	..	Nil
Do. Deb...	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	102 — 105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- — 3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¼ — 11	..	6 16 4
Do. Pref.	5	5	5	[illegible]	..	4 14 1
Do. Deb...	100	4½	4½	99 — 101	+ ½	4 9 1
Castner-Kellner	1	17½	20	3⅝ — 3¾	..	5 6 8
Do. Deb...	100	4½	4½	102 — 105 xd	..	4 5 9

NAME.	Stock or Share.	Dividends for 1910.	1911.	Closing Quotations Aug. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid ..	5	Nil	..	1/32 — 1/16	+ ⅛	Nil
Do. fully paid	5	Nil	..	1⅞ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	¾ — 1 xd	..	7 10 0
Do. Pref.	2	7	7	1⅞ — 2 xd	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 1
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾	..	5 16 8
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 0
Do. Deb...	100	4½	4½	102 — 104	..	4 6 7
India-Rubber, G. & T.	10	10	..	9 — 10	+ ¾	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	32½ — 34½	..	6 16 6
Do. Deb...	100	4	4	97 — 99	— 1	4 0 10
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	⅜ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

ELECTRICAL APPLICATIONS OF REINFORCED CONCRETE.

The following article (abstracted from one by P. Lecler in *L'Ind. Electrique*), is solely concerned with the following applications of reinforced concrete work in the electrical field: (1) Partitions and partition work for switchboards; (2) conduits, boxes and tanks; (3) reinforcement of wooden poles *in situ*, without disturbing the lines carried by the poles.

Partitions and Cellular Work for Switchboards.—High-tension switchboards are almost exclusively built on the cellular principle, and reinforced concrete has become a most popular material for their construction. The available space is often very restricted so that it becomes important to make the walls of the cells as thin as possible while still completely covering the reinforcement with concrete.

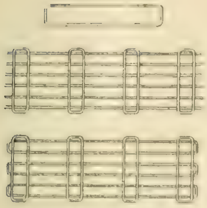


Fig. 1.

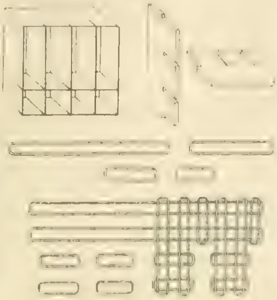


Fig. 2.

The reinforcing members may be composed of small iron sections, cut up and built together as required, or of expanded metal lattice cut to form panels of the same size as the cell walls. In either case, skilled labour is required, and it is a difficult matter to obtain thin and quite flat panels in which the structural steel is conveniently placed, particularly if the panels are of large size. In the case of switchboards having several tiers of superposed compartments, it is difficult and almost impossible to make the panels in advance. The skeleton must first be erected and then covered with cement—a costly and difficult operation, which may be considerably simplified by using rectangular frameworks, such as are shown in fig. 1. These frames are machine made, of standard dimensions, and are delivered at the works ready for use. Sets of the frames may be used in conjunction with straight bars, or with other frames of various sizes, as indicated in the upper and lower parts of fig. 1. The latter construction is obviously the more rigid, and is less liable to deformation during erection.

The use of these frameworks is specially advantageous in the construction of such a board as that illustrated in fig. 2. The various panels fit into each other in a manner exactly similar to that employed by carpenters, and the most complex boards can be built up from panels completed in advance.

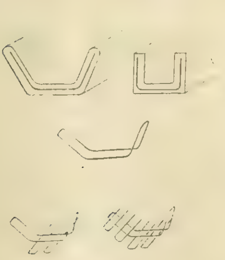


Fig. 3.

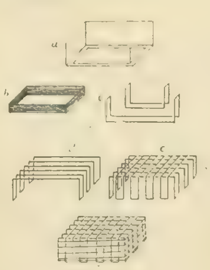


Fig. 4.

Conduits, Boxes, Tanks, &c.—The frames which compose the reinforcement of the above structures may be applied to almost any other case. For instance, the skeletons of ducts may be formed by longitudinal bottom, and side frames carried by similar, but shorter, frames, twice bent at 90° or a larger angle. The successive stages in the erection are shown in fig. 3, and it is hardly necessary to point out that the ends of the longitudinal frames must be staggered to secure uniform shear strength throughout.

By combining two sets of frames bent twice at right angles and tying the whole by means of a square or rectangular spiral (see fig. 4), the skeleton of a box or tank may be formed by the successive stages shown.

So far, no mention has been made of the means by which the component frames are tied together. Ordinary annealed iron wire may be used for this purpose, but this process, which has hitherto been exclusively employed, requires—despite its primitiveness—considerable skill in application, if good results are to be secured. It was quite a reasonable method when skilled workers had, in any case, to be employed for the fitting and erection of the skeletons, but when ready-made frames, requiring a minimum of skill in erection are employed, it is necessary to evolve a form of ligature which shall be as easily applied.

The "Centrator" clips shown in fig. 5 are formed from steel wire and are almost instantaneously attached by the stages shown in fig. 6. The clip is placed round one rod N at D and the limb D B, which spans the second rod M, is bent down so that the hook B engages under N after which, the joint is completed and tightened by bending down and straining the end F.

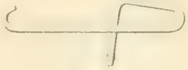


Fig. 5.

Reinforcement of Poles.—It is well known that a large percentage of pole replacements are undertaken solely on account of serious rotting at the ground level, the remainder of the pole being quite fit for years' more service. Such replacements are specially objectionable by the interruption of service they involve, and, during recent years, numerous successful means have been devised for strengthening the damaged sections of poles by reinforced concrete. The method employing spiked stirrup-irons spanning the site of the rotted wood (the latter being chopped or scraped away), and filled round with cement, has already been described in these columns. Another method—rather more elaborate, and designed to be applied as a preventative of ground rotting—is shown in fig. 7; the left-hand view shows the skeleton ready for cementing, and the right-hand view shows the completed job. The reinforcing member, which can be fitted without any disarrangement of lines carried by the pole, comprises a helix H, and bars or rectangular frames B—in number and size sufficient to resist the bending moment to which the pole is subject. The helix is of springy steel wire, wound to a diameter slightly greater than that of the pole; to place it on the pole, it is held in a horizontal position near the latter (see fig. 8), and the end A is sprung on to the pole as shown. By turning A round the pole in the sense shown by the arrow on P, meanwhile turning the disengaged portion of the helix in the sense shown by the arrow *f*, the whole of the coil can be rapidly worked on to the pole. The longitudinal members should preferably be rectangular frames, as shown at fig. 7, B, in which case the ends are screwed to the post as indicated. To complete the whole operation, a two-part mould is placed round the skeleton and a quick-setting cement is run in.

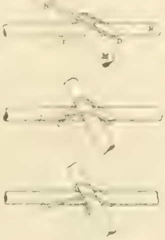


Fig. 6.

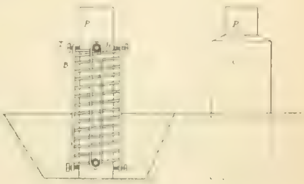


Fig. 7.

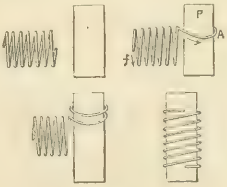


Fig. 8.

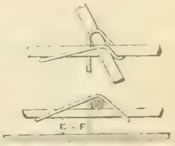


Fig. 9.

There are two difficulties to contend with in the above process. On the one hand, it is difficult to ensure, even with the co-operation of a good workman, that the mould is placed concentrically with the post and remains so during the pouring and setting; while, on the other hand, there is a great tendency for the coils of the spiral to sag, leaving much too wide a pitch between the upper turns. When using ordinary iron binding wire for the joints between helix and vertical bars or frames, these difficulties are quite serious, but by using special clips, such as shown in fig. 9, and leaving the tail F projecting, a minimum thickness of cement equal to the length E is automatically ensured. Again, by using stiff waved-wire for spacing purposes (see fig. 10), holding it in place by the same clips as are used for connecting the main members of the reinforcement, uniform pitch is ensured between turns of the helix. Under the most unfavourable conditions possible, the ends of one or more sets of wires F will lie flush with the surface of the concrete when set, and, even if the latter is not painted or coated, the worst that can happen is the appearance of a small patch of rust round the projecting metal.

As shown by fig. 7, the use of rectangular frames, instead of straight bars. provides an easy means of attaching the reinforcement to the pole. Further, the frames stiffen the helix and reduce the risk of their deformation during erection; this advantage is specially important in the case of large helices, such as are used for pipes, well rings, and so on. Fig. 11 shows a skeleton built up from a circular helix, and also one using a rectangular helix; vertical stiffening frames and spacing wires are used, and the whole is bound together with clips similar to those shown in figs. 5 and 9.

Conclusions.—The special object of the above methods of construction is to reduce to a minimum the difficulties of fitting and erecting reinforced concrete work—particularly of those classes most used in electrical applications.

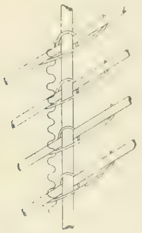


Fig. 10.

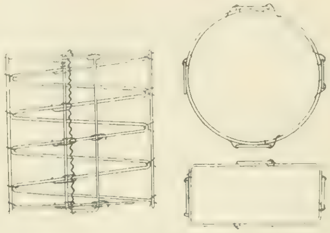


Fig. 11.

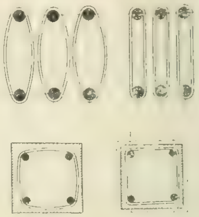


Fig. 12.

The reinforcing members may be broadly divided into two categories—first, the principal bars, forming the greater part of the weight of the whole and requiring little or no manipulation after leaving the manufacturer's works; and secondly, relatively light pieces, such as stirrup irons, helices, and so on. The latter need skilled labour in their manufacture and should preferably be made to standard gauge, and delivered ready for immediate use. The cost of carriage on such ready-made goods is more than compensated by the lower cost and greater accuracy of their manufacture by firms specialising in their production. The accuracy of form of machine-made members enables smaller and lighter designs, with the same spacing of the main bars and an equal thickness of cement over the outer metal; this point is well illustrated by fig. 12.

Finally, the regularity of the skeleton enables great accuracy in the dimensions of the completed partition, box or other part, and entirely avoids the necessity for surface layers of cement which, owing to their coefficient of contraction being greater than that of reinforced concrete, are either broken themselves (during setting), or seriously injure the enclosed structure. (M. Maynard, at the Copenhagen Congress in 1910, stated that this effect had often been observed in connection with beams and similar structures.)

THE MELBOURNE RAILWAY ELECTRIFICATION.

The Melbourne correspondent of the *Railway Gazette* recently discussed the specifications—published in the local papers—for the proposed suburban electrification scheme.

Some extracts from his letter are published below:—It was arranged that tenders should be invited, so that reliable information might be available to enable the relative advantages of the direct-current and single-phase alternating-current systems of electric traction to be definitely appraised. The comparison of the two systems will be facilitated, too, by the fact that tenderers are being invited to quote for the maintenance of the train equipments, which constitutes an important factor in the variation in the operating costs between the direct and alternating-current systems.

The specification for the power station buildings, boiler-house equipment and plant, sets out as general conditions that the normal steam consumption of each generating set may be taken as 240,000 lb. of steam per hour; the plant is to be designed for a normal continuous output of 720,000 lb. per hour; the boiler house equipment shall generate and supply steam at 210 lb. pressure per square inch above the atmosphere, and at a normal temperature of 600° F., to the turbines and auxiliary plant at the power station and extensions.

The power station is proposed to be located on Crown land at Yarraville, and connected by rail with the Williamstown line, and also provided with facilities for obtaining coal by water, thus affording alternative means of obtaining fuel supplies. The water for the condensing plant is to be obtained from the river.

For the purposes of the calculations, it is assumed that the whole of the power required for railway purposes will be generated at the Yarraville power house, and tenderers are invited to quote for the supply of four generating sets of 20,000-KW. each, or alternatively six sets of 10,000-KW. each, with the necessary accessories and boiler and condensing plant to suit. This plant is common to both systems of traction, as it is proposed that in either case three-phase current be produced and transmitted to the distributing points at a voltage of 20,000. The equipment thus provided differs from that recommended by Mr. Merz in his report of 1908 in that the latter provided for eight generating sets of 3,750 KW. each, or a total of 30,000 KW., from which power was to be transmitted at a voltage of 12,000. It is proposed in the case of the single-phase system that the power be conducted to the trains by overhead conductors operating at from 10,000 to 11,000 volts, and that under the direct-current system the power be also conveyed to the trains by an overhead conductor operating at from 1,300 to 1,550 volts, with an average of 1,450 volts. The original recommendation of Mr. Merz provided for a direct-current system, with a third, or conductor, rail operating at 800 volts, and the change to an overhead conductor with the higher average voltage of 1,450, indicates the advance which has taken place in the development of the direct-current system since that time.

The trains are still proposed to be worked on the multiple-unit system, and the specifications provide that the equipment must admit of 10 cars—five motor-cars and five trailers—being attached together if circumstances render it necessary to so increase the size of the trains. The number of cars provided for in Mr. Merz's previous report was 496, and tenders are now invited for the equipments for 950 cars.

The average speed, including stoppages, of the trains under electric traction was previously fixed by Mr. Merz at 20 miles per hour, but it is now proposed that an increase be made to the average rate of about 21 miles per hour, and an illustration of the increase in speed which is proposed, as compared with steam, may be obtained from the particulars given to tenderers by Mr. Merz in respect of the times of stopping trains on the lines from Flinders Street to Sandringham, and Flinders Street to Essendon. Thus:—

	Electric traction. Former.	Electric traction. Present.	Steam traction.
Flinders Street to Sandringham ...	31 min.	30 min.	40 min.
Flinders Street to Essendon ...	18½ „	17½ „	23 „

The lighting of the cars will be by electricity, and electric power will also be used to operate the Westinghouse air brake.

Tilmanstone Colliery.—At the meeting of the Snowdown Colliery, Ltd., held at Dover, on Friday, 2nd inst., the chairman, Mr. Arthur Barr, said, according to the report in the *Financial Times*:—"Perhaps you would like to know the latest from Tilmanstone. . . . . The principal thing we have been waiting for has been the switchboard, an immense machine which weighs a good many tons, I am told, although I have never seen it myself. It takes six months to make one. It arrived from Berlin on Saturday and is down No. 3 shaft at the present moment, and Mr. Metzger told me that in 10 days' time it would be all wired up and ready for work. The three new horizontal permanent pumps are also down the pit and are being fitted. That is a very short job. The rising mains to take the water are now actually fitted in the shaft and in duplicate. Mr. Wroe tells me that he will be pumping by the end of this month of August."

Accident.—A correspondent writes:—"A remarkable escape from death from electrical shock is reported from Birmingham, where Albert Davis, a boy 11 years of age, came in contact with a cable carrying current at 6,000 volts, and was not killed. Davis had been playing with another boy at a spot between Salford Bridge and the storm water pumping station. Here the wires conveying current to the works are carried under the River Tame, and come into the open at a terminal pole which is surrounded by a brick wall 6 or 7 ft. high, and coped with broken glass laid in cement. Thus closed in, the cables are on the Drainage Board's private property. The boys scaled this wall, and obtained access to a ladder some 30 ft. high. They then got into a cage where the terminal wires are protected. Davis caught hold of one and received a terrible shock, which knocked him backwards. Sparks flew in all directions from his body, he was burned about the arms, hands and neck, while his body generally was much discoloured. He was removed to the local hospital, where he soon showed signs of recovery."

ITALIAN EXPORTS OF ELECTRICAL GOODS.

THE following statement shows the exports of electrical and similar goods from Italy during the year 1910 as compared with 1909, and should be of interest in view of the expansion of the Italian electrical and engineering industry. Notes of increases or decreases as compared with the previous year are given, and it will be noted that although the trade is comparatively small, the increases proportionately are large:—

Boilers.

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Portugal	—	44,000	+ 44,000
,, Egypt	71,000	103,000	+ 32,000
,, Argentina	70,000	179,000	+ 109,000
,, Brazil	6,000	15,000	+ 9,000
,, Uruguay	62,000	90,000	+ 28,000
,, Other countries ...	119,000	70,000	— 49,000
Total ...	328,000	501,000	+ 173,000

Steam engines, semi fixed (with boilers attached), hot air, compressed air, gas, petrol, &c., motors.

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Portugal	22,000	136,000	+ 114,000
,, Roumania	—	122,000	+ 122,000
,, Egypt	48,000	214,000	+ 166,000
,, Argentina	237,000	593,000	+ 356,000
,, Turkey	8,000	155,000	+ 147,000
,, Other countries ...	126,000	360,000	+ 234,000
Total ...	441,000	1,580,000	+ 1,139,000

Dynamo-electric machines weighing more than 1,000 kg.

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To France	28,000	26,000	— 2,000
,, China	8,000	21,000	+ 13,000
,, India and Straits Settlements	23,000	49,000	+ 26,000
,, Argentina	94,000	305,000	+ 211,000
,, Other countries ...	126,000	56,000	— 70,000
Total ...	279,000	457,000	+ 178,000

Ditto, less than 1,000 kg.—

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Austria	18,000	20,000	+ 2,000
,, France	19,000	23,000	+ 4,000
,, Germany	12,000	21,000	+ 9,000
,, Switzerland	10,000	14,000	+ 4,000
,, Other countries ...	57,000	61,000	+ 4,000
Total ...	116,000	139,000	+ 23,000

Machinery not specified in the statistics (excludes agricultural, textile, printing, &c.).—

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Austria	141,000	179,000	+ 38,000
,, France	272,000	257,000	— 15,000
,, Russia	56,000	195,000	+ 139,000
,, Switzerland	166,000	217,000	+ 51,000
,, Germany	349,000	687,000	+ 338,000
,, Algeria	33,000	111,000	+ 78,000
,, Argentina	235,000	370,000	+ 135,000
,, Brazil	81,000	147,000	+ 66,000
,, Other countries ...	587,000	613,000	+ 26,000
Total ...	1,920,000	2,776,000	+ 856,000

Electric accumulators and parts thereof.—

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Austria		40,000	+ 40,000
,, Argentina	-	19,000	+ 19,000
,, Other countries ...	13,000	12,000	— 1,000
Total ...	13,000	71,000	+ 58,000

Parts of dynamo-electric machines and transformers.—

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Germany	24,000	14,000	— 10,000
,, Spain	5,000	11,000	+ 6,000
,, Switzerland	31,000	6,000	- 25,000
,, Argentina	1,000	14,000	+ 13,000
,, Brazil	1,000	16,000	+ 15,000
,, Other countries ...	39,000	36,000	— 3,000
Total ...	101,000	97,000	— 4,000

Electrical apparatus.—

	1909. Lire.	1910. Lire.	Increase or decrease. Lire.
To Austria	3,000	15,000	+ 12,000
,, Germany	12,000	24,000	+ 12,000
,, Argentina	2,000	13,000	+ 11,000
,, Switzerland	7,000	3,000	— 4,000
,, Other countries ...	9,000	17,000	+ 8,000
Total ...	33,000	72,000	+ 39,000

Incandescent lamps.

	1909-10. Lire.	1910-11. Lire.	Increase or decrease. Lire.
To Austria	28,000	10,000	— 18,000
,, Germany	36,000	39,000	+ 3,000
,, Other countries ...	17,000	30,000	+ 13,000
Total ...	81,000	79,000	— 2,000

25 lire = £1.

MECHANICAL TROUBLES WITH TRAMCAR BRAKE GEARS.

It may be said without fear of contradiction that the brake equipment of a tramcar is one of the most important parts of the mechanism, inasmuch as should there be any failure to operate in emergency, the consequences in damage to life and property might be enormous. Hence it is an important part of the duties of the maintenance staff of a tramway authority to keep the brake gears in good working condition.

The principal causes of failure in connection with such gears are dirt and wear. The component parts are very largely exposed to the action of dust, water, and in some cases oil, so that there is every chance for the formation of a heavy sticky coating of extraneous dust and dirt, having the tendency to clog the parts, and also in the case of gritty dust to cause undue wear. Hence actual cleaning, as opposed to the theoretical kind of thing which the ordinary cleaner puts into the work, if not closely watched, is absolutely necessary, and it is also essential that very frequently the component parts should be examined in detail to see whether wear is so far advanced that renewal or repair is necessary.

Quite a typical case can be observed occasionally in connection with the brake handles when these are fitted with a ratchet and spring. The action of the spring is, of course, to hold the top half of the ratchet into the bottom half, while, at the same time, giving the necessary release. If, however, care is not taken periodically to clean out the recess at the top of the brake staff, dirt will find its way into it and clog it up, stopping the action of the spring. The result of this is that the handle can be moved in either direction without turning the brake staff, and should this occur while the car is on an incline the danger will be at once obvious.

The effect of wear is most easily seen in connection with the ratchet and dog which are used for the control of the brake staff, by means of the driver's foot, inasmuch as this is placed in a position where it is bound to be covered with any grit which happens to get on to the footboard, and hence there is, owing to the constant rubbing action, great wear on the dog and on the ratchet wheel. A case occurred on one tramcar in which the dog itself got so worn that it did not hold into the ratchet when the driver's foot was applied, with the result that for a moment there was quite an exciting time until the alternative brakes could be got into action. After this it became a point of rule to see that the dogs were removed as soon as they showed any undue signs of wear, and to see that the ratchet wheels themselves were kept up to a state of proper efficiency.

Another instance of wear occurred on a tramcar equipment which shows the necessity for careful examination at the depôt before the car goes out on the road, inasmuch as in this case the defect could not very easily be observed by the driver. Owing to the fact that the pin on the floating lever of the brake had become somewhat worn, and also as under the continued vibrations of the car this pin came out of the floating lever while the car was on one of its journeys, the lever dropped, throwing the hand brake entirely out of gear. Reliance had, therefore, to be placed on the alternative brakes, until the car could be run over a pit at the depôt, and the lever fixed again. Part of the car overhaul should consist of the careful examination of all pins and fastenings to see that undue wear has not taken place, and to see that the safety devices such as split pins, &c., are not missing.

On one occasion a car had to be pulled up suddenly on an emergency, and the driver, who was equipped with more muscle than judgment, managed to apply his hand brake with such vigour that the pull rod was actually pulled over the staff at the rear end, the chain hanging loose. The result of this was that the pull rod had to be sawn in two in order to let off the brake again, and the only satisfaction which the driver got out of the incident was that he had demonstrated his muscular strength. The incident, however, shows the inadvisability of allowing much play on the brake movement, and also that the whole travel of the brake should be taken up by an ample length of chain without the possibility of allowing the rod itself to come into contact with the staff.

These are a few simple points which will probably appeal to those who are interested in maintaining car equipments, and the subject has been limited to parts of the equipment which are very often treated as a matter of course and almost subsidiary portions, inasmuch as the mechanical arrangement of the parts is so absurdly obvious. However, even in the simplest and plainest portion of the car equipment, care and judgment are necessary in the overhaul and maintenance of the parts.

RULES FOR ELECTRIC OPERATING STAFFS.

[Communicated.]

During the past few years the attention of electricity supply engineers has been directed more to the external, or business-getting, than to the internal organisation, considered from a technical point of view, of the works. This, of course, is only intended to be a general statement, inasmuch as there are, of course, very many instances where engineers have been thoroughly impressed with the importance of maintaining a definite technical organisation, but the position has been rather forced upon the electric industry of going after fresh business, to the partial exclusion of other activities, partly on account of the fact that the metal-filament lamp made it necessary, on its introduction, to bring up the drop in load as quickly as possible, and partly also because there has been a boom in what may be described as commercial methods. At the same time, without at all disparaging this side of the work, it may be necessary now and again to remember the old themes in order to realise that electrical works will not run automatically or at haphazard.

Presumably, the younger generation of electrical engineers are passing through the electricity supply undertaking systems for the purpose of gaining experience, although it must be admitted that many of them are staying there because they cannot get an opening into any other branch. For general all-round responsibility on the part of the junior engineers of the undertaking, there is, perhaps, no finer field of training than the medium-sized generating station and mains system. The large installations, such as supply big cities, specialise the departments to such an extent that all-round experience is practically impossible, while the very small undertakings are, of course, only useful for initial experience. This being the case, it is not surprising that in the medium-sized undertakings there are a large number of keen engineers who are there to gain experience and who possess previous experience and a fair share of common-sense. As this may be taken as the average product of the electrical engineering profession, it is interesting to inquire into the methods of organisation of such plant with respect to the duties of the staff. The medium-sized undertaking occupies a more than usually interesting position in this respect, as, on the one hand, sufficiently precise instructions must be given to avoid overlapping or neglect of duties in the various departments, and on the other, such organisation must not be carried to a point where red-tapism becomes ridiculous.

The rules governing the operation of generating plant and mains in any station are more or less local in character, depending on the plant used and the system adopted, but in general characteristics they are, or should be, of the same tendency. One would, therefore, expect to find in most medium-sized stations sets of rules laid down which would be more or less the counterpart of each other. As a matter of fact, this is not the case.

Inquiry among a considerable number of electrical supply undertakings has revealed the fact that some chief engineers have made no standard rules; others make them, but regard them as private, and it is only a small proportion that have really standardised to such an extent that any comparison could be made, with the object of formulating anything like the standard requirements for the regulating of the operating staffs of such stations.

Dealing first of all with the first class, there is, of course, a good deal to be said in favour of the avoidance of a stringent set of rules. In the medium-sized plant, the engineers employed have, presumably, previous experience, and have ordinary initiative and common-sense. If it were attempted to saddle them with too many rules, two things would happen. First, there would be a tendency to confuse them at a critical time, or to badger them afterwards for non-adherence to rules which, although in themselves excellent, might not have applied to the particular case. The second result would probably be that some engineers would lose self-respect through being bound down too tightly, and would not do their best in an emergency. For these reasons, a good many chief engineers are of the opinion that a good operating engineer in time of emergency must work "off his own bat," and on this account no regulations are laid down. The only thing which can be said against the above position is that there is a distinct difference between routine operation and emergency work, and by a clear understanding of what routine is, and adherence to it, many emergencies could be avoided. Hence, it would seem advisable to have certain standard rules clearly enunciated and presented to the operating engineers.

This brings us to the position of the next class of chief engineers, who formulate rules but regard them as private documents. Obviously, in some instances, this is necessary. It would not do to reveal to all and sundry the eccentricities of behaviour of some of the plant installed in generating stations or on mains, by publishing rules which arise from the necessity of humouring such plant; but apart from this, there does not seem to be any reason why, for the benefit of the whole community and for the avoidance of eccentricity, standard rules should not be laid down and published. We are living to-day in an age of standardisation, and it goes almost without saying that operating costs would be materially reduced if in general terms the engineer from one plant could pick up his duties at another without having to unlearn a good deal of special regulation which he had already acquired. The case is analogous to engineering on board ship. The nearer the plant and regulations governing it conform to standard practice, the quicker the engineer picks up his duties. For this reason it must be fairly stated that the practice which is adopted in some electrical undertakings by the chief of issuing orders on sheets of foolscap, to be placed in an instruction book which has to be read periodically by the engineers in charge and mains engineers in order to refresh their memories, is not a perfect way of doing things. In such collections of orders it will not be improbable that regulations bearing on a certain subject contradict themselves at different dates, thus reducing the whole arrangement to confusion. We are, therefore, again brought to the point that the formulation of a standard set of regulations for operation is necessary.

Bearing in mind, therefore, that while giving ample play to the resource and initiative of the operating engineers, some form of general system of working should be laid down so as to avoid the interference of one department with the operations of another, the question arises as to the points which may best be included in such a scheme of rules. Briefly speaking, they may be summarised under two heads. First, the routine operations, not of an obvious character, which are necessary in order to maintain the plant in an efficient condition. For example, in a wisely-conducted station the plant should be subjected to regular periods of overhaul and inspection, these periods being determined not arbitrarily, but by considerations of the length of running, which, by experience of a particular part of the plant, can be allowed without thorough overhaul. This system is simply following out methods which have been found advisable on railways and other large undertakings involving running plant. The writer believes that similar systems are also being adopted in connection with colliery undertakings possessing mechanical and electrical appliances, which have to be periodically inspected for safety and efficiency. A clear set of rules regarding such matters as, for example, valve drill—that is to say, the opening and closing of valves upon a steam or water system in order to detect any leakages, and to perfect the staff with a view to rapid operation in case of emergency—is a thing which could readily be formulated, and similar matters will suggest themselves to those in charge of electricity supply plants. Such rules are necessary, and need not be made absurd. For example, every shift engineer knows how to parallel one unit with another, or how to keep a check on the cells of a battery, and such matters need not appear in routine regulations. There are, however, many other things which in some stations are not noted at all, and which in others are scribbled down in the form of orders on loose sheets of paper by the chief, which could be carefully tabulated and made into a permanent record.

(*To be concluded.*)

Hadfield's Steel Foundry Co., Ltd.—The directors announce an interim dividend of 1s. per share, free of tax, on the ordinary shares.

NATIONAL INSURANCE ACT, 1911.

Umpire's Decisions under Unemployment Section of Act.

By JOS. J. H. STANSFIELD, F.C.I.S.

Sec. 84 of the National Insurance Act, 1911, states that every workman employed in any of the trades mentioned in the Sixth Schedule to the Act must be insured under the Unemployment Section of the Act.

The Sixth Schedule reads as follows :—List of Insured Trades . . . relating to Unemployment Insurance.

1. Building : that is to say, the construction, alteration, repair, decoration or demolition of buildings, including the manufacture of any fittings of wood of a kind commonly made in builders' workshops or yards.

2. Construction of works : that is to say, the construction, reconstruction or alteration of railroads, docks, harbours, canals, embankments, bridges, piers or other works of construction.

3. Shipbuilding : that is to say, the construction, alteration, repair or decoration of ships, boats or other craft by persons not being usually members of a ship's crew, including the manufacture of any fittings of wood of a kind commonly made in a shipbuilding yard.

4. Mechanical engineering, including the manufacture of ordnance and firearms.

5. Ironfounding, whether included under the foregoing headings or not.

6. Construction of vehicles : that is to say, the construction, repair or decoration of vehicles.

7. Sawmilling (including machine woodwork) carried on in connection with any insured trade, or of a kind commonly so carried on.

It will be noted that neither electrical engineering nor the supply of electricity are included in the schedule, but it must not, therefore, be assumed that the electrical industry is exempt from the provisions of this part of the Act, for it must be borne in mind, in the first place, that under Sec. 107 (2) of the Act, "in determining any question as to whether a workman is, or has been, employed in an insured trade or not, regard shall be had to the nature of the work in which the workman is engaged, rather than to the business of the employer by whom he is employed," and, in the second place, the ramifications of the electrical industry are of such an increasingly extensive character, that the schedule touches both employers and employed more or less in all its sections.

In deciding whether a workman is insured or not many doubtful points arise, and to solve such difficulties an umpire was appointed under the provisions of Sec. 89 of the Act, and up to August 1st last over 700 decisions have been advertised in the *Board of Trade Journal*. An inspection will show that many of these directly or indirectly affect those engaged in the electrical industry.

Only "workmen" are insurable under the unemployment part of the Act, and workman is defined by Sec. 107 (1) to mean "any person of the age of 16 or upwards employed wholly or mainly by way of manual labour," and a decision as to inclusion or exclusion in the first place turns on the words "wholly or mainly by way of manual labour."

Similar words are to be found in the Workmen's Compensation Acts, and there have been many decisions on the matter. A difficulty arises because many persons are employed in employments which involve both manual and other forms of labour. The question is one of fact, the principal rule to determine the matter being to see whether manual labour is the general duty of the employé, or only incidental and subsidiary to other more important mental duties, and the distinction between manual labour and manual work must also not be overlooked.

In deciding the points submitted by the representatives of the many industries, the umpire has endeavoured throughout to avoid inconsistencies, but being bound by the schedule he has in many cases been forced into decisions which lead to inconsistent results.

This is well shown in the decision on the laying and jointing of mains and services, and the erection of overhead lines, such work coming, in the opinion of the umpire, within the meaning of the words "other works of construction" in the second section of the schedule. These are as follows :—Workmen *are* included when jointing new cables, but *not* included when jointing cables for the purposes of repair, or taking branches from mains in consumers' premises ; workmen *are* included who are employed in underground mains, &c., where the cost is chargeable to capital account, whilst workmen are exempt who are repairing such mains, the cost of which is chargeable to revenue account.

In new work or large extensions workmen are usually engaged specially for the work, whilst repair work and services are carried out by the permanent staff, and a dividing line is thus roughly drawn which has not been lost sight of in making decisions ; but this is not an invariable rule, and the average workmen will hardly appreciate why contributions are deducted one week and he is exempt the next, for whilst such distinctions may be well founded in law they seem to be far from common sense.

However this may be, the Act must be obeyed, and it is hoped that the following list of inclusions and exemptions may be of assistance to all concerned ; but before proceeding further it will be well to state that the word "workman" includes both male and female, and the following workmen are excluded in all cases :—(1) Persons under 16 ; (2) indentured apprentices ; and (3) foremen or gangers who are not wholly or mainly employed by way of manual labour.

The list is divided so as to distinguish between (1) mechanical engineering, which is closely allied to electrical manufacturing ; (2) electrical engineering ; (3) manufacture and laying of cables, the erection of overhead lines and street lighting ; (4) generation and supply of electricity ; (5) tramways ; (6) buildings ; and (7) works of construction. The letters and numbers refer to the umpire's decisions.

Mechanical Engineering. Contributions *are* payable in respect of workmen employed in or as :—

1. Fitters, turners or finishers, erectors, millwrights, planers, borers, slotters, screwers, shapers, iron sawyers, grinders (iron and steel), glazers, millers, polishers, buffers and drillers (machine), machinemen (others than those specified), drillers (hand), smiths, smiths' strikers, toolsmiths and toolmakers (A. 20).

2. Coremakers, casters, moulders, dressers, polishers, finishers and fitters, their helpers and labourers engaged in the manufacture of brass, white metal, gun-metal or other copper alloys (A. 23).

3. Goods hoists attendants (A. 50).

4. Wheelwrights (A. 85).

5. Cranemen (hand or power), enginemen and firemen (stationary engines), and boilermen (A 86).

6. Sheet metal workers ; manufacture of copper fittings and appliances (coppersmiths, &c.) (A. 88).

7. Making boilers for generating steam for power or heating (A. 315).

8. Labourers and general shop labourers (A. 319).

9. Saw hammerers and sharpeners, knife, tool and cutter grinders, gas-fitters, oilers of shafting, lime washers, gas producer men, pump fitters, belt attendants and strap piecers, pattern makers, press tool makers, machinery testers manually employed, and machinery painters (A. 337).

10. Engine testers (bench test prior to erection in chassis) and car testers (after erection) manually employed (A. 341).

11. Manufacture of forgings for mechanical and vehicle building establishments (A. 372).

12. Boiler and steam pipe coverers and applying non-conducting material to steam boilers and pipes (A. 574).

Contributions *are not* payable in respect of the following :—

1. Timekeepers, watchmen, storekeepers, draughtsmen, tracers, gatemen, weighmen, passenger hoist attendants, closet and office attendants, commissionaires, clerks, typists and office errand boys (B. 50).

2. Manufacture of flexible metallic tubing in cold rolling process or cold galvanising under electric process, in joining up lengths of india-rubber and picking out foreign matter from asbestos thread and in corrugating ribbon metal and forming it into metallic tubing (B. 184).

3. Rolling, drawing, annealing and pickling seamless steel tubes (B. 200).

4. Storekeepers' assistants (B. 285).

5. General labourers in packing and warehouse department (B. 286).

6. Manufacture of tubes from strips and solids and wholly or mainly engaged in grinding (B. 295).

7. Manufacture of non-conducting composition for boilers and steam pipes (B. 296).

8. Making steel welded barrels, drums and tanks not forming part of the structure of buildings, vehicles, machinery or works (B. 308).

9. Making picks, hammers, shovels, &c. (not being iron founding), and wooden handles for such tools (B. 310).

10. Workmen in steel works—working boiler-feed pumps, boiler firers, coal elevator men, hydraulic engine men, men in charge of engines producing power, and switchboard attendants, men at hydraulic presses, rolling mills, and furnaces, and cranemen (B. 541).

Electrical Engineering.—Contributions *are* payable in respect of workmen engaged in, or as—

1. Installation and maintenance of electrical machinery and conductors; manufacture and assembling of main switchboard parts and the erection of main switchboards, including rheostats, controllers, contactors, and brush gear (excluding the winding of coils in all cases); manufacture of parts of commutators and collectors; toolmakers making tools for use in connection with the manufacture of any of the before-mentioned instruments or apparatus (A. 280).

2. Toolmakers employed in the tool department of electrical engineers making tools for telephone apparatus manufacture (A. 342).

3. Toolmakers and machine setters manufacturing electric light accessories (A. 343).

4. Testers of machinery wholly or mainly manually employed (A. 346).

5. Manufacture of steel and metal balls for bearings and ball and roller bearings (A. 353).

6. Painting machines finished by erectors (A. 356).

7. Construction, reconstruction, or alteration of electrolytic plant. In the opinion of the umpire "alteration" refers to work which involves a substantial change or variation in the original design (A. 374).

8. Wiremen engaged in wiring for electric lighting and bells in buildings (A. 194).

9. Manufacture and assembling of main switchboard parts, electrician and wiremen running wire tubing, &c., to buildings (A. 516).

10. Electrical wiremen installing electric light or bells on ships (A. 695).

Contributions *are not* payable in respect of the following :—

1. Manufacture of accumulators and electrical batteries (B. 4 and 5).

2. Casting and finishing electric light fittings in brass or other copper alloy in connection with buildings, ships and vehicles (B. 49).

3. Joinery, sawmilling and wood-turning in connection with electric light fittings and accessories (B. 344).

4. Slate and metal enamellers and lacquerers of brass or other metals in connection with electric light fittings (B. 345).

5. Repairing electrolytic plant not being machinery (B. 373).

6. Softening a compound (made of asbestos and gum) on hot plates, and placing same in dies and moulds, which are closed or opened by machinery for electrical insulating material makers (B 109).

7. Storekeepers, shop-cleaners and odd men (B. 137).

8. Dismantling electric meters (B. 190-8).

9. Manufacture of telephone and telegraphic instruments and apparatus (B. 80-1).

10. Clerks, lady typists, storekeepers, assistants and canvassers (B. 140).

11. Packers, examiners or viewers of goods, goods carriers, and window cleaners (B. 364).

12. Preparation and repair of removable electric stoves (B. 190-5).

13. Making and assembling electric meters and arc lamps, including quartz and silica and glow lamps (B. 288).

14. Armature and coil winding, including the assembling and insulation of commutators and collectors, whether mica or other insulators (B. 288).

15. Manufacture of silk shades for electric light fittings, &c., cutting and sewing silk on to wire frames, and making wire frames (B. 413).

16. Installation of telephones (B. 426).

17. Telephone wiring and repairs (B. 471).

18. Adapting gas and candle fittings for electric light (B. 515-4).

19. Making parts and assembling magnetos and repairing same; making switches and cut-outs for motors (B. 518).

20. Making scientific instruments (other than tool makers) for wireless telegraphs or engaged in the maintenance and upkeep of machinery or buildings, superintending and assisting in superintending in the erection of stations (not manually employed) (B 528).

21. Manufacture of switchboards, switches and lamps for electric lighting or motor-cars and making switch-boxes (B. 530).

22. Making fuses from cut tubes made of fibre, &c., and filling same (B. 626).

23. Making and assembling metal parts of sparking plugs with porcelain and other insulators (B. 665).

Cables, Overhead Lines and Street Lighting.—Contributions are payable in respect of :—

1. Jointing new cables in electricity and tramway departments (191-4).

2. Work wholly or mainly in connection with overhead, third rail, conduit, surface contact or cable equipments of railroads, tramways, light railways or electric power supply, the cost of which is usually chargeable to capital account (A. 191-6). *Note*—this does not include services.

3. Manufacture and assembling of parts of electrical distribution appliances such as feeder boxes and pillars, joint, network and service boxes, &c., in the mechanical engineering department of a cable and construction company (A. 679).

Contributions *are not* payable in respect of :—

1. Manufacture of electric cables (B. 80).

2. Setting up poles to be used solely for electric lamps for street lighting purposes (B. 190-3).

3. Repairing and maintaining overhead third rail conduit, surface contact or cable equipments of railroads, tramways, light railways or electric power supply, the cost of which is usually chargeable to revenue account (B. 190-4).

4. Making lamp irons and bolts for erection of lamp pillars (B. 190-7).

5. Repairing electric controllers for lighting and extinguishing lamps (B. 190-9).

6. Laying services (B. 190-10A).

7. Laying mains, the cost of which is usually chargeable to revenue account (B. 190-10B).

8. Jointing cables for repairing or taking branches from mains in consumers' premises (B. 190-15).

9. Finishing and assembling cable accessories for underground and for use in consumers' premises (B. 190-17).

10. Draughtsmen (B. 264).

11. Labourers unloading cable (B 515-3).

12. Painting street lamps (B. 547).

13. Handling, preparing and creosoting telegraph poles and other timber (B. 650).

14. Wood machinists making arms for telegraph and telephone poles and cabinets, casing and covers for electric light wires, cabinet work for telephones, packing cases, &c. (B 687).

Note.—The Board of Trade propose to make a general order exempting drivers and attendants of any vehicle and stablemen or other workmen employed in tending horses or cleaning any vehicle.

Generation and Supply of Electrical Energy.—Contributions *are* payable in respect of—

1. Pipe fitters maintaining and up-keeping steam pipe lines (A. 258-2).

2. Electricians employed by dyers and cleaners in the fixing and upkeep of electric lighting plant (A. 326).

3. Electricians employed by flour millers wholly or mainly in the maintenance and repair of electrical machinery and conductors (A. 330), and in the electric wiring for buildings (A. 193).

4. Smiths and mechanics and their labourers engaged

wholly or mainly in the maintenance and upkeep of machinery (A. 58).

5. Cranemen employed in repairing shops in electricity and tramway departments engaged wholly or mainly in lifting materials for repairs of machinery (A. 191-1).

6. Carpenters engaged in constructional woodwork and general repairs to buildings, engine fitters, labourers, moulders, moulders' mates, machinists attending to machine tools, painters, plumbers and mates, timbermen and scaffolders (A. 265).

Contributions *are not* payable in respect of—

1. Switchboard, motor-generator and battery attendants, installation and arc lamp testers and meter readers (B. 10).

2. Dynamo and electric motor attendants not wholly or mainly engaged in the maintenance and upkeep of machinery (B. 24-5).

3. Repairing railway sidings (B. 190-11).

4. Repairing electric meters (B. 190-16).

5. Ash cleaners, boys (porterage and general cleaning), coal trimmers, labourers and measurers, condenser attendants, dynamo cleaners, engine drivers and cleaners, foremen, greasers, gate and timekeepers, instrument and meter testers and calibrators, inspectors, loco. drivers, lamp trimmers, regulators (switchboard and battery attendants), storekeepers and assistants, shop boys, shift engineers, substation attendants, transformers and dynamo attendants, water softener attendants, water and pump attendants, box inspectors, camp boys, chauffeurs, installation inspectors, street lighting attendants, yardmen, clerks, canvassers, collectors, chefs, messroom attendants, lavatory attendants, carmen, draughtsmen, lightermen, lift attendants, office cleaners, typists, telephone girls, window cleaners, and chemists (B. 264).

6. Cleaning lights on roofs of works; washing of motor-cars (B. 165).

7. Motor tire repairers, petrol storekeepers and caretakers (B. 172).

8. Cleaning, overhauling, repair, and general maintenance of arc and incandescent lamps, carpenters and assistants making removable meter brackets, fuse hands, boiler cleaners and wiremen fitting up temporary wires and appliances in showrooms, making joints and carrying out experiments and tests,(B. 455).

9. Crane attendants, coal labourers, coal meterers and firemen (B. 488).

10. Scaling stationary boilers, economisers, &c., by hand or by pneumatic tools (B. 556).

11. Smelting refractory ores by electricity (B. 696).

Tramways.—Contributions *are* payable in respect of—

1. Bricklayers, slaters and labourers of each, employed by a tramway company, engaged wholly or mainly in the construction, alteration, repair and decoration or demolition of buildings (A. 26).

2. Wholly or mainly employed in the construction, reconstruction or alteration of tramway lines (A. 221).

Contributions *are not* payable in respect of—

1. Repairing tramway lines and repairing a working tramway line (A. 220).

Buildings.—Contributions *are* payable in respect of—

1. Bricklayers, carpenters, joiners, plumbers, painters, scaffolders' plasterers, and the labourers of each engaged, wholly or mainly, in the construction, alteration, repair, decoration or demolition of buildings (A. 54).

2. Whitewashers and decorators (Note to B. 364).

Works of Construction.—Contributions *are* payable in respect of—

1. Workmen employed by a firm of contractors who are engaged in generating and distributing electrical power for the purposes of works of construction (A. 393).

In some cases the decisions of the Umpire refer to a local authority or a company, or to some specified trade, but they may be taken to apply *mutatis mutandis* to any of these; and when the above are considered in conjunction with the Schedule, it will be found that the above list is fairly exhaustive, but should any difficulty be found, or should no decision have been given, application should be made to the Umpire. The address to which all applications should be made is 47, Victoria Street, Westminster, London, S.W.

BOILER SETTINGS.

By EDWARD INGHAM, A.M.I.M.E.

Whilst, generally speaking, almost every attention is given nowadays to the design and arrangement of the steam plant at electric generating stations, there is one matter, viz., the setting of the boilers, which certainly does not always receive the careful consideration which its importance demands. As a result, not only is the efficiency of working less than it might be, but the "wear and tear" of the boilers is increased, not infrequently to a very considerable extent.

In order that the maximum of efficiency and the minimum of "wear and tear" may be obtained from a steam boiler, it is absolutely necessary that the boiler be set properly. Hence a few remarks on this important, though somewhat neglected subject, will, it is hoped, be of use.

The first consideration is, of course, the selection of a suitable site. Low and damp situations should as far as possible be avoided, because, as every engineer knows, there is nothing more liable to cause rapid deterioration of steam boilers than external dampness, particularly if the setting is in any way defective. It sometimes happens that the site is below the level of a canal or at the foot of a hill, so that water can drain downwards into the foundations. If then the latter are below the level of the drains, the setting will be constantly damp, and severe external wasting is then very liable to be set up. Under such circumstances, a good concrete foundation should be provided, and should there be any likelihood of moisture passing through the walls of the setting, it is a good plan to extend the concrete bed at the sides up to the outside ground level. Another effectual expedient, when the foundations are below the level of the drains, is to dig a well in the vicinity of the boilers, suitable arrangements being made for draining the water which collects in the foundations into this well. The well would, of course, require to be emptied from time to time of its water.

The thickness of the concrete, which material, by the way, is the best on which to build the setting, depends on the nature of the foundation, and may, indeed, be anything from 9 in. to 24 in. A usual thickness for clay, say, or ordinary firm earth, is 12 in.

One of the principal sources of loss in the working of steam boilders is radiation of heat from the hot surfaces. In the case of exposed surfaces this is usnally prevented to a large extent by means of non-conducting porous composition. Some provision against loss from radiation should, however, also be made in the walls of the setting by means of an air cavity. As is well known, air is one of the best insulators or non-conductors of heat, and if therefore an air space is built into the walls, the loss from radiation may be reduced very considerably. The makers of the well-known and deservedly popular Poulton setting, in addition to providing an air space in the walls, also provide one underneath the boilers by means of special anti-radiation serrated bricks, with the object of preventing radiation through the foundations. The importance of this additional air space is well illustrated by the following:—"At a large electric lighting and power station, where a range of 10 boilers is installed, the temperature of the clay underneath the concrete, 10 ft. below the bottom of the boilers, was found to be as much as 280° F. The boilers were worked night and day, and were provided with forced draught arrangements. An immense mass of material was thus maintained at this high temperature day and night by a direct waste of valuable heat."

In order to provide, say, a 2-in. cavity in each of the side walls, more space is required, and at electric power stations, where large ranges of boilers are concerned, and where space is frequently a most important consideration, this becomes a serious item. In such cases, special serrated bricks are of great use, as by their adoption much saving in ground space may be made.

As a further preventive against radiation losses, the brick walls may, if it is thought worth the extra expense, be carried up to the boiler tops, and then roofed over so as to form a hot air chamber.

This question of preventing heat radiation losses is always an important one, but at electric generating stations this is especially the case, because at such places, the boilers may be worked for only a short time each day, and the loss then becomes a serious item.

The practice of facing the front walls of the setting with white enamelled bricks is one which is to be recommended. Although this entails additional expense (the cost of the enamelled bricks being many times that of ordinary bricks), the extra expense will be more than compensated for in other ways. The boiler house is made to look bright and cheerful, and as a result, the men in charge of the plant take a keener interest in maintaining the general upkeep and condition of the boilers and setting.

Probably the most important consideration in the setting of steam boilers is the extent to which the boiler plates are hidden or covered by those parts of the setting which are in actual contact with the plates. At one time, it was quite common to make the seatings and flue covers of Lancashire boilers of great width, often as much as 12 or even 18 in. wide at the parts in contact with the plates. Such wide bearing surfaces as this are extremely objectionable, because not only is much useful heating surface lost, but a large area of plate is covered over, and hence complete inspection of the boiler cannot be made. Further, external corrosion is especially liable to occur at parts covered by brickwork, and unless, therefore, the plates are bared frequently, the wasting may proceed undetected until the condition of the boiler becomes dangerous. Nowadays, the bearing surfaces are made much narrower than formerly, but even now, considerable improvement might, in the majority of cases, be made. Thus the thickness of the seating blocks at their bearing edges is generally about 3 in., but as a matter of fact, a thickness of one-half this, viz., 1½ in. is ample—in fact, much more than sufficient to support the heaviest Lancashire boiler even when filled with water.

Every part of the setting which is in contact with the boiler plates should be reduced to the absolute minimum; it seems absurd to adopt 3-in. bearing surfaces, as is generally done at the present time, when a width of 1 in. is sufficient. In the "Poulton" setting, all parts which come in contact with the boiler plates are made of a rounded form, so that there is practically no surface of plate covered over. In this way a maximum of heating surface is obtained, whilst every part of the boiler, so far as the setting is concerned, is open to inspection. With the ordinary type of setting it is generally necessary to plough through the seatings and flue covers occasionally, especially at the seams, in order that a thorough inspection may be made. This ploughing may be avoided by cutting away a portion of the upper part of the seating blocks where these are crossed by the ring seams, and fitting into the openings thus made loose pieces of fireclay; the loose pieces can then be readily removed at any time for inspection purposes.

A good form of setting is made by the Adjustable Cover and Boiler Block Co., who keep the width of all bearing surfaces small, and construct the flue covers so that these may be readily lifted, thus allowing the plates to be fully inspected at any time. In some instances the ordinary flat-topped seating blocks and flue covers are fitted with a piece of asbestos rope, the boiler being made to rest on the rope, and not on the block. In this case no heating surface is lost, and the asbestos forms an effectual means for preventing air leakage into the flues.

Special attention should be given to the size of the flues, which must be made large enough to permit of a man readily passing through them for cleaning and inspection purposes. The side flues of Lancashire boilers should be not less than 9 in. wide at the narrowest part, but 12 in. is preferable. The bottom flue is usually made about 2 ft. 6 in. deep and about half the diameter of the boiler in width.

Seating blocks and flue covers should be made of specially prepared fireclay blocks, whilst all parts of the flues which are exposed to the action of the hot furnace gases should be lined with a good quality of firebrick, the lining being well keyed in. With water-tube boilers (the type now most used in power stations), the question of using firebricks of high heat-resisting qualities, is one of great importance. This is especially the case where machine stoking and forced draught are employed. Under such circumstances, an intense heat, almost equal to that in a reverberatory furnace or a puddling furnace is obtained, and in one instance with which the writer is acquainted, the heat was so intense that the cast-iron soot doors and frames at the back end of the boiler actually melted, and when the boiler was laid off for cleaning, the melted metal hung down like icicles. Such intense heat as this naturally has a destructive effect on the fire-brick arches, especially of water-tube boilers settings, and for such purposes any but the very highest quality of fire-brick is quite useless.

Good fire-bricks, in addition to being capable of withstanding high temperatures without becoming fused or disintegrated, are good non-conductors of heat, and hence a refractory fire-brick lining also serves to prevent to a large extent, loss of heat by radiation through the setting. Good fire-bricks seem to acquire a glazed surface after exposure to high temperatures, and thus reflect back the heat of the furnace, for, as is well known, bright surfaces have a tendency to reflect heat.

Fireclay, and not mortar, should be used for the jointing material, especially for such parts of the setting as are exposed to the hot gases, or come into contact with the boiler plates. Mortar, like ordinary brickwork, is porous, and readily absorbs moisture, so tending to set up external corrosion of the boiler plates, and it also quickly breaks up. This is not the case with fireclay, which is, therefore, much more suitable as a jointing material.

Other points requiring attention in the building of the setting are the avoidance of cavities and chambers in which explosive mixtures might collect and the doing away, as far as possible, with local contractions, sharp bends, &c., in the flues. No part of the flues should be less in sectional area than the area of the throat of the chimney, which is usually not less than one-eighth the area of the fire-grate.

A boiler will often work satisfactorily, even when the flues are cramped and restricted, so long as it is only required to work at comparatively low power. When, however, extensions of the steam plant are made, and the boiler is called upon to develop its full power, it is unable to do so. The results of this may be very serious, for it is generally a difficult matter to remedy the evil; hence the importance of building the flues of ample capacity in the first instance.

In Lancashire boilers a mistake sometimes made is to build the firebridges too high. Such a mistake is liable to seriously cripple the draught, and in one or two instances which have come under the writer's notice it has been impossible to maintain steam in consequence. The removal of one or two layers of bricks has entirely remedied the evil. Generally speaking, a distance of not less than 10 in. should be left between the tops of the bridges and the furnace crowns at the middle.

In conclusion, the importance of entrusting the work only to men who have had special experience in boiler setting cannot be too strongly urged. Defective brickwork is a constant source of annoyance and expense, and is one of the most fruitful sources of low efficiency in the working of steam boilers. If the work is indifferently carried out, short-circuiting of the flue gases from one flue to another, and various other troubles, are liable to be experienced.

Defective setting no doubt explains why boilers built to exactly the same specifications, and by the same firm, often give such widely different results when put to work, even though they may be working under apparently identical conditions.

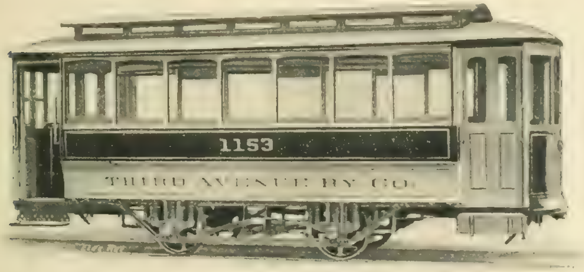
Explosives in Coal Mines Order.—The following notice is issued from the Home Office:—"The question having been raised whether the words 'magneto-electrical apparatus' as used in the Order of May 21st last include what is known as a 'dynamo exploder,' *i.e.*, an electrical firing apparatus consisting of an armature rotating in a permanent (non-electrical) magnetic field, as well as the form in which an armature rotates in a field formed by an electromagnet, the Secretary of State wishes it to be generally known that it was intended to include apparatus of both kinds, and he is advised that the phrase used does, in fact, include apparatus of both kinds.

"With regard to the requirement in Clause 2 (*h*) of the Order that every electrical firing apparatus shall be provided with a push button, an internal arrangement by which the firing contact is automatically made at the end of the travel of the handle, and on the release of the handle is immediately broken, performs the same function as a push button, and will be admitted as complying with the requirement in the Order as to the provision of a push button."

AN INTERESTING STORAGE BATTERY CAR.

The problem of the storage battery car has nowadays received a renewed amount of attention on account of the possibilities which are being afforded by the lighter types of storage batteries which are now available, and in the United States considerable practical experience has already been gained in the construction and operation of such cars, which can with advantage be studied by engineers on this side of the Atlantic. It is, therefore, of interest to discuss briefly the storage-battery cars which are now being used by the Third Avenue Railroad of New York City, inasmuch as these operate over some of the lines which were previously served by horse cars; altogether over 60 cars have been put into commission for this purpose. The development was not made in a hurry, inasmuch as the initial number of battery cars in use was only five on this particular line, so that it can be said that the first cars, at any rate, operated so satisfactorily as to justify the extension of the experiment to the large scale now indicated. In fact, it may be said without much fear of contradiction that the matter has progressed from the experimental stage into one of practical working operation.

Fig. 1 shows the general external appearance of these cars, which are built by the J. C. Brill Co., of Philadelphia. The trucks are designed to allow the batteries to be placed under the body if desired, and whereas in the earlier type chain gearing was adopted, in the later cars ordinary railway motor gearing has been employed. The motor equipment consists of two 4½-h.p. General Electric motors furnished with axle bearings, the gears eliminating all maintenance trouble due to the driving mechanism, and taking up perceptibly less space than the chain drives formerly used. Cast-steel wheels are used with anti-friction journal bearings. The new cars have a length over the vestibules of 26 ft. 1½ in., the body being 18 ft. long. The width overall is 7 ft. 6 in., and the length over the sill is 6 ft. 5½ in. The height to the sills is 2 ft. 5½ in., and the height from the sills to the roof is 8 ft. 2½ in. The longitudinal seats accommodate 30 passengers, and each of the new cars is equipped by the Electric Storage Battery Co., with Hycap-Exide batteries having a rating of 420 ampere-hours. These batteries are supplied under a maintenance guarantee of five years, during which period the output has not to fall below 75 per cent. of the original rating. The future progress of these cars, especially with regard to the maintenance of the battery and the cost per car-mile, will be watched with considerable interest on this side, and it is to be hoped that further figures will be available after greater running experience has been obtained.



New York Storage Battery Car.

Electric Cheese.—A Dutch farmer claims to be able, by passing a current through them, to mature cheeses in 24 hours. The process has hitherto been very slow.

ENGINEERING AND MATHEMATICS.

[Communicated.]

Those responsible for the design of machinery are practically unanimous in their desire to avoid mathematics and complex formulæ; it is only the inexperienced student who endeavours to apply such means where simpler methods would be quicker and equally satisfactory.

If the data at our disposal were accurate, it would be possible to use formulæ giving precise results, but, unfortunately, the measurements, weights and quality of the materials used in the construction of machinery are only approximate, hence the prediction of exact results from any given combination is impossible. On his first acquaintance with *electrical* apparatus, the novice is inclined to assume that a knowledge of theory is sufficient to enable him to design a dynamo or motor. This assumption is entirely erroneous, and it is doubtful whether any other class of machinery demands so much experienced judgment for its successful design. It is impossible to obtain homogeneous materials; the iron or steel for the magnets will vary in quality, the armatures often differ slightly with different consignments of disks, the gauge of wire and the thickness of the insulation are never exactly to specification, and many other factors enter into the calculations, for which allowances based upon practical experience have to be made. Such being the case, it would be a waste of time to complicate the calculations for the sake of ensuring extreme accuracy, when the results are certain to be vitiated by faulty data; hence simple formulæ are used by practical designers, which give only approximately correct figures for output, efficiency, temperature rise, &c.

To professors and others whose calling involves the investigation of the principles underlying the design of machinery, a good knowledge of mathematics is essential; also the mathematical training of engineering students should include the study of more complex problems than they are likely to meet with in after experience, but the professors should endeavour to simplify their calculations and formulæ so as to make them suitable for commercial application, whilst students should not attempt to advertise their attainments in the columns of the technical press or before the members of the engineering institutions.

Text-books, in which practical problems are treated by the aid of complex formulæ have a very limited application. The practical designer will not look at them, and the student is likely to waste time puzzling out problems which could be presented in a much simpler and more useful form. These strictures also apply to articles and papers of a similar nature, some of which, in all probability, are never read by anyone.

It is astonishing how unwilling are the readers of technical papers to use their brains over any article which is difficult to understand, and this attitude extends to some extent to the editorial staff. Some years ago, the writer came across an article which, although it involved no considerable knowledge of mathematics, was necessarily of a complex nature owing to the subject dealt with. This article appeared in one of the leading engineering journals (not the Electrical Review), and by reason of a misunderstanding with the editor over certain additions, parts of it were reduced to absolute nonsense. The subject was apparently not understood by the editor, or his assistant who presumably perused it, otherwise publication must have been postponed pending revision. As regards the readers of the aforesaid journal, reference to the "Correspondence" columns indicates that many of them are quick enough to point out mistakes when opportunity occurs, yet in this instance no letter to the editor was forthcoming.

It is to be feared that articles of this nature are sometimes accepted on the strength of the writer's reputation, and this course would appear to be a safe one where the subject has been treated in a manner difficult to understand.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,519. "Apparatus for measuring the electric conductivity of liquids." M. Coplans. July 29th.

17,583. "Electrical welding apparatus." Dunlop Pneumatic Tyre Co., Ltd. and F. J. Keegan. July 29th.

17,618. "Manufacture of electric pig iron." V. Stobie. July 30th.

17,623. "Electrical conduit fittings." L. G. Byng and T. Taylor. July 30th.

17,634. "Electrically operated time-limit detonator for use in blasting and such like operations." W. R. Ash, C. Dalley and W. S. Toplis. July 30th.

17,651. "Electromagnets." H. Leitner. July 30th.

17,663. "Electrodes for use in arc lamps." A. A. Low. July 30th. (Complete).

17,678. "Electrodes for use in arc lamps." A. A. Low. July 30th. (Complete).

17,680. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 30th.

17,701. "Method of producing conducting films upon the surfaces of electrical apparatus." L. D. Reay. July 31st.

17,749. "Method of and apparatus for electric welding." R. Haddan. (Cleveland Welding and Manufacturing Co., United States.) July 31st. (Complete.)

17,752. "Electric hand apparatus for producing light." W. E. Lake. (Fabrique Internationale D'Appareils a Magneto S.A. (F.I.A.M.), Switzerland). July 31st.

17,779. "Electric striking gear." H. Campiche. (Convention date, August 1st, 1911, Switzerland.) July 31st. (Complete.)

17,805. "Electrically-actuated automatic door-operating appliances." J. J. Reynolds and P. C. Larmuth. August 1st.

17,836. "Electrolytes for use in electrometallurgy." N. H. M. Dekker. August 1st. (Complete.)

17,837. "Heating apparatus." R. Weaving and Ferranti, Ltd. August 1st.

17,838. "Self-regulating dynamo-electric machines." C. A. Vandervell and A. H. Midgley. August 1st.

17,840. "Process and apparatus for the electrical separation of bodies in suspension from electrically insulating fluids, more particularly gases." E. Moller. August 1st. (Complete.)

17,850. "Portable electric hand-lamps." A. H. Hunt. August 1st. (Complete.)

17,858. "Automatic telephone exchange switches and controlling circuits therefor." Western Electric Co., Ltd. (Western Electric Co., United States.) August 1st. (Complete.)

17,864. "Insulating boots and shoes." J. H. C. Brooking and St. Helen's Cable and Rubber Co., Ltd. August 1st.

17,871. "Electric accumulator." S. F. Thompson and E. R. Thompson. August 2nd.

17,918. "Fire-alarm apparatus and circuit arrangements." A. C. Brown and G. A. Edwards. August 2nd.

17,942. "Magnetic speedometers." J. K. Stewart. August 2nd. (Complete.)

17,951. "Production of artificial resinous substances." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 2nd.

17,952. "Method of separating magnetic from non-magnetic powdery materials, such as iron, sands, and the like." S. L. Elborne and R. Godsal. August 2nd.

17,955. "Telegraphic relays." A. Muirhead and F. L. Muirhead. August 2nd. (Complete.)

17,978. "Telegraph receiving apparatus adapted to split up incoming signals into their components, and to actuate a transmitter or analogous device, or to perforate a tape according to either the Wheatstone, cable, or other systems of working." A. Fraser, K. L. Wood and Eastern Telegraph Co., Ltd. August 3rd.

17,980. "Resistances." J. Roothaan and Ferranti, Ltd. August 3rd.

18 013. "Electrical driving of ring-spinning and doubling frames." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) August 3rd. (Complete.)

18,017. "Electric heaters." H. H. Grundy. August 3rd. (Complete.)

18,025. "Electrical generating set." J. A. Rey. August 3rd. (Complete.)

[Correction.—The number of the patent for "Recording instruments and the like" (Evershed & Vignoles, Ltd., and G. W. Binstead), appearing in this column of our last issue, should be 17,226, not 17,214, as printed.]

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Accumulator. K. R. Smith. 13,758. June 9th. (December 8th, 1911.)

Traction Electromagnets. H. W. Lake. (D. L. Lindquist.) 16,374. July 15th.

Spark Plugs. J. W. Mackenzie. (Champion Ignition Co.) 16,438. July 17th.

Electric Lifts. W. H. Scott. 16,532. July 18th.

Covering of Electric Conductors with Plastic Material and Apparatus therefor. W. S. Smith and A. D. Shuter. 16,542. July 18th.

Apparatus for Recording Telephone Calls. C. C. Chapman and A. Grimsley. 16,553. July 18th.

Manufacture of Electric Accumulator Electrodes, and Means for Use therein. R. Pape. 17,132. July 26th. (Patent of Addition not granted.)

Electric Switching Devices. H. S. Hatfield. 17,286. July 28th.

Method for Timing Telephone Calls. T. Doddrell. 17,635. August 3rd.

Electric Power Transmission Devices. H. Kleinschmidt. 18,051. August 9th.

Electrical Ignition Apparatus for Internal-combustion Engines. A. H. Midgley and C. A. Vandervell. 21,441. September 28th.

Electric Fuse. R. C. Hall. 22,844. October 17th.

Long Tubular Metallic-Filament Electric Lamps. H. E. Angold and J. F. Poynter. 24,250. November 1st.

Mica and such like Insulators and Screens, and the Manufacture of the same. W. McLoughlin. 27,759. December 11th.

Electro-osmotic Processes. Ges. für Elektro-Osmose. 28,185. December 14th. (September 28th, 1911.)

Electricity-controlling Switches. Soc. H. Lapipe and C. Wittmann. 28,711. December 20th. (December 20th, 1910.)

Electrically-operated Valves for Gas Conduits. W. Thiem. 29,140. December 27th. (June 17th, 1911.)

1912.

Combined Percussion and Electric Primers for Quick-Firing Guns. Soc. Anon. John Cockerill and E. Ternström. 9,283. April 19th. (Addition to 4,990 of 1912.)

Electrolytic Process for Cleaning Metal Articles. Langbein Peanhauser Werke Akt.-Ges. 9,609. April 23rd. (April 25th, 1911.)

Electric-Signalling Apparatus. V. H. Street. 9,936. April 26th.

Arc Lamps. C. Weber. 10,737. May 6th. (May 5th, 1911.)

Protective Arrangements for Use in Connection with Electrolytic Valves or Polarisation Cells. G. Liebe. 11,366. May 13th. (May 31st, 1911.)

Apparatus for the Electro-osmose Method. Ges. für Elektro-Osmose. 725. January 9th. (October 2nd, 1911.)

Stabilising Voltaic Arcs. C. E. Guye. 804. January 10th. (January 10th, 1911.)

Manufacture of Electric Incandescent Lamps. Deutsche Gasgluhlicht Akt.-Ges. (Auer-Ges.) 874. January 11th. (May 11th, 1911.)

Cooling Arrangements for Dynamo-Electric Machinery. Siemens Bros. Dynamo Works, Ltd. (Siemens & Schuckertwerke Ges.) 3,106. February 7th.

Electrical Warp Stop-Motions for Looms. D. Schatz. 3,114. February 7th.

Electric Incandescent Lamps. Deutsch Gasgluhlicht Akt.-Ges. (Auer-Ges.) 3,840. February 15th. (November 4th, 1911.)

Apparatus for Controlling and Recording the Consumption of Electrical Energy. H. Gottschalk. 4,791. February 26th.

Electric Signal or Indicator for Taximeter Cabs or other similar Public Vehicles. P. T. Hillman. 5,534. March 5th.

Press-Button Electric Switches. H. Wischhusen and A. Hepke. 7,795. March 30th. (April 1st, 1911.)

Telephonic Head Gear. E. A. Graham. 10,041. April 27th.

Bulbs for Electric Glow-Lamps. H. Gethe and Gluhlampenfabrik Hansa Ges. 10,346. May 1st.

Sparking Plugs. C. E. Johnson. 11,311. May 13th.

Wind Power and Electricity.—The problem of how to derive a supply of electrical energy from the wind has always had a certain fascination for electrical engineers. Unfortunately, although at first sight it does not seem a difficult matter to devise some system of wind vanes coupled with a generator and a storage battery which would work well and cheaply, there are many difficulties of a practical nature in the way. Some intermediate storage system must be used with a view to obtaining a constant source of power no matter what may be the fluctuations of the wind, the point being that such storage device should come between the wind vanes and the dynamo, instead of between the dynamo and the distribution system, as would at first sight appear desirable. A recent patent is for a system of generating electricity in which a petrol engine is used in conjunction with a wind motor. Both these prime-movers are designed to work on the same shaft, and they are connected together by means of a clutch. The load is taken up by the engine, and the windmill, as soon as the wind serves, adds its power to the shaft. Should the wind rise above a certain predetermined velocity, the wind vanes commence to take charge, as it were, and speed up the engine. A centrifugal governor then cuts out the ignition, thus shutting off the engine power. Should the wind drop, the ignition circuit is opened automatically, and the engine again takes the load. In this case it is difficult to see what advantage is derived from the use of the windmill. It would seem a far better arrangement if the governor, instead of working on the ignition, worked on the engine throttle and controlled the supply of vapour. The windmill and engine would then work in parallel when the wind power was insufficient to drive the generator by itself, and there would be a considerable saving in paraffin or petrol.

As an illustration of a storage method a plant may be mentioned in which power from a windmill is combined with water power in the following manner:—A 14-ft. windmill is coupled by gearing to a large plunger pump, which draws water from a pond and delivers it to a tank of large capacity; the water, when power is desired, is allowed to flow through a small turbine, of $\frac{1}{2}$-H.P. capacity, which is direct-coupled to a $\frac{1}{4}$-H.P. dynamo. The current from this, which is generated at 25 volts, is used to charge up an 11-cell storage battery, which is capable of supplying 20 8-C.P. metal-filament lamps for three hours, according to a statement made by the firm who installed the plant.

By means of certain automatic hydraulic devices, practically all the energy which the windmill can produce is stored up, and it is stated that with the equipment mentioned sufficient electricity for winter use can be obtained by allowing the windmill to work for an average of five hours per day. Of course, during the summer months less electricity is used for lighting purposes, and an average of two hours' run per day is amply sufficient.

THE

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THE ART OF OBTAINING TENDERS.

THE form of public requests for tenders varies considerably. It is not uninstructive to study these variations and to consider the legal effect of such advertisements. In former days those who invited tenders were wont to do so in some such form as this :—

> The County Council invites tenders for the construction of about 1,000 yards of tramway in certain streets in this district. Plans and specifications may be seen at ———, and copies of the quantities and forms of tender may be obtained at the same place. Sealed tenders must be delivered at ———, by 12 o'clock noon on ———. The Council do not bind themselves to accept the lowest or any tender.

Many changes have been made in this simple form during recent years. For instance, it has become customary to enforce payment of a deposit of from £1 to £5 on receipt of the papers, which deposit is returned on receipt of a *bonâ fide* tender. Sometimes it is stated that with regard to the deposit it "will be forfeited should the contractor not send in a *bonâ fide* tender or afterwards withdraw his tender." In order to obtain a further measure of protection against persons who ask for copies of the paper out of pure curiosity, it is sometimes provided that any tender which is made must remain open for 30 days. One of the most striking features of the latter-day request for tenders is the appearance of the following paragraph :—

> The contractor will be bound to pay to all workmen (except a reasonable number of legally-bound apprentices) wages at rates not less, and to observe hours of labour not greater, than those set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract.

The following form is sometimes used :—

> The successful contractor or contractors will be required to employ, to the satisfaction of the surveyor, local labour (if available) in the execution of the works.

Dealing in the first place with the ordinary form, the importance of obtaining copies of the plans and specifications, and of studying them carefully, lies in the fact that mistakes are made that cannot afterwards be rectified. In a recent Scotch case the defender offered to execute work for the pursuers for the lump sum of £859. His offer was accepted. He afterwards found that, owing to an error in calculation made by his son, the offer was £86 less than it would have been. In an action for damages for breach of contract, the defendant having contended that this mistake released him from his contract, the Court held that he was not released (the mistake having arisen through no fault of the pursuers), and that the pursuers were entitled to damages.

Compliance with the provision that a tender must be sent in by a certain time is also essential, as there is no obligation upon the local authority to consider those which come in too late. Time is of the essence of the contract in this respect. The proviso that the Council do not bind themselves to accept the lowest or any tender is in reality mere surplusage, as no obligation to accept any tender is implied even when the words are omitted. It is, however, a very useful warning to those who are unacquainted with the law. In cases where there is an undertaking to accept the lowest tender, the meaning of this term may have to be considered. It seems that a tender to the effect that, "I offer £100 less than any other builder who makes you a tender," would not be the lowest tender. In South Hetton Coal Co. *v.* Haswell, &c., the owner of certain coal mines proposed to receive sealed tenders from two parties who were competing for the purchase of the mines, and undertook to accept the highest net money tender. One of the competitors offered such a sum as would exceed by £200 the amount offered by the other. It was held that a tender in this form did not answer the description of "the highest net money tender."

The provision that a tender must remain open for 30 days, is of considerable importance, and a contractor should walk warily before he sends in a tender in response to an advertisement which contains this clause. The law is that a tender can be withdrawn at any time before acceptance, and the waiver of this privilege may be a serious matter. Suppose, for example, that a man were to discover on the day after he sent in his tender that he had made a serious mistake. If the advertisement had contained no clause similar to the above, he might withdraw it, and possibly tender anew. The clause which provides that certain rates of wages must be paid, is one which must be carefully watched, and pains must be taken to study the list of wages which is provided by the Council, or the Trade Union rate of wages which is enforced in the district. The provision that local labour must be employed, may also be a pitfall for the unwary.

MUNICIPAL STRABISMUS.

Municipal bodies suffer from a considerable number of ailments, some of which are corrected by local opinion, and some by the astringent action of the Board of Trade. We venture to diagnose a complaint which is by no means new, and which is in very young persons frequently cured by corporal punishment. We refer to strabismus, or the unhappy habit of squinting. It has been said that truth in its beauty can be best beheld by him who has the single eye for its excellence: it is when the view becomes binocular that confusion is apt to ensue.

It is not the first time that we have referred to that unhappy Act of Parliament which, promoted by æsthetic persons, limits the activities of those who wish to advertise. Whether it is in itself a wise Act we are not going to discuss at present, beyond pointing out the fact that two classes of people who are perfectly willing to advance the prosperity of the country are hit by its operations. These are: the electric sign manufacturer who has probably sunk thousands of pounds in what is admitted to be the best advertising medium of the present day, and the large advertiser who is quite willing to spend money on electric signs if he has secured tenure, and if he can get a decent show for his money. Looked at from a commonsense standpoint, it would seem that anything that would help a trading concern to pay larger rates would be hailed with delight by Parliamentary and Municipal bodies, and that advertising would therefore be given every chance. We know differently, however, so we must let that point go.

But there is an anomaly which needs some explanation. It is admitted that municipal bodies have a power to charge a rental for a sign or advertisement projecting more than a certain distance over a roadway. Whether they are wise in exerting that power is another story. And we also know that the electric arc lamp suspended outside a shop front is a most powerful means of drawing attention. We are also aware that not a hundred miles from St. Paul's Cathedral the authorities, far from welcoming this augmentation of street lighting, have, in their wisdom, compelled the placing of screens round such lamps, so that all light except that falling into windows or on the immediate pavement, is blocked. There comes, however, a piece of news from what we have always considered the progressive city of Newcastle-upon-Tyne, which, if correct, seems to indicate an amazing state of complexity in the local by-laws.

We understand that, if an enterprising tradesman in that city wishes to put his name on the globe of the arc lamp outside his shop, he may do so at the rate of about 5s. or 6s. per annum. Apart from the point as to whether a municipality should have powers to charge in this way, it seems a very stringent interpretation of æsthetic ideals, inasmuch as the lettering shuts out no view and does no damage to the passing public. The beauty of the position is heightened when we remember that on arc lamps and globes turned out by more than one prominent firm, and which, we presume, are freely hung in the streets of Newcastle, the name of the manufacturer is prominently displayed. The only logical conclusion to which we can come, if the above facts are correct, is that the powers that be must look with favour on any advertising which is done to benefit a firm outside the municipality, but wish to repress any attempt at advertising which would put a tradesman in the town in a position to pay better rates.

Another interesting feature of the subject, we understand, is that if a massive gold block letter sign is placed outside the premises and on the wall of a business house, the rental charged for this display is quite unimportant; but that if electric lamps are fixed on or recessed into this same sign, the rental immediately rises to a considerable figure. This unsolicited testimonial of the value of electric advertising is rather extraordinary, and might without further explanation be held to indicate a policy of exclusion of the electric sign.

That this is a case of municipal strabismus seems to be confirmed by the consideration that if an electricity supply undertaking were owned by any municipality, it would, in order to justify the existence of an electrical department, have to do its best to sell current wherever possible, and vexatious restrictions would in all probability be removed.

The Bray Explosion.

The letter of Mr. E. A. Wood, published on page 248 of our last issue, reached us too late for comment to be made then, but it shows pretty conclusively that the explanation given in our leader on this matter was fairly correct. Mr. Wood, however, realises that trouble may arise from excess of oil at the cylinder and from excess of cylinder pressure above the blast receiver pressure, and that these faults may occur even with air; that no special excess of oxygen is required. This being so, it is even more necessary that there should be a reflux valve in the air blast pipe in order that there shall be no possibility of back flow or the driving back and spraying of plugs of oil into this large mass of air in the receiver. Nor should it be possible for the cylinder air to get back to the fuel valve, there to cause combustion of the oil at that point. In Mr. Wood's instance the blast air vessel was probably saved by the blowing out of the safety valve bodily before the pressure rose too high in the receiver. Had the receiver contained air richer in oxygen there would not have been time to blow out the safety valve. The pressure would have risen so quickly that the receiver would have burst before the safety valve could move off, so that probably the root cause at Bray was oxygen; but, all the same, whether oxygen or mere oil excess caused the trouble, both causes may probably be rendered inoperative by the simple mechanical device named. It is possible that the safest form of such a valve is the loosely-hinged flap with restrained opening, and not the mushroom valve. Or a caged ball would probably be fairly certain in automatic closing.

Indian Contract Grievances.

Two letters appear in our "Correspondence" columns this week on a matter of public interest relating to Indian Government contracts. Already it has been ventilated in this journal, but seemingly without the desired effect. It is to be hoped that the present protest will be more successful. The public has the right to demand that its representatives in high places shall act in the interests of the public and not favour private parties without the amplest justification for so doing. It is important that all public contract transactions should be perfectly open and above-board, and it is for the Press, both technical and lay, and for manufacturers and traders, to agitate until some definite action is taken adopting a procedure or policy which shall remove the suspicion which now appears to exist in the minds of some. It is profoundly regrettable when circumstances require a repetition of a complaint of this kind, and it is not calculated to inspire confidence at home in the conduct of public departments in India. Anything in the nature of secrecy is bound to excite curiosity and suspicion, and in connection with public contracting it calls for the strongest possible condemnation. The motives influencing those responsible for placing the contracts may be of the purest, but the best of intentions are of no avail if they be shrouded in mystery. The only correct way is to follow the principle of open tendering and publication of prices and reasons for recommendations when these are not readily apparent. Several years ago we received a complaint that orders for a Japanese Government department did not come home to England because one high official was not aware of the ability and capacity of British electrical manufacturers. In Australia recently the Government of Victoria has put its foot down upon the procedure of sending orders in a certain direction for no other reason than that the habit of so doing has been acquired. It may be that the state of things reported from one part of India is due to prejudice or to habit, and probably some organised action will require to be taken by all the firms interested in the Indian electrical and engineering trade. Naturally enough, for obvious reasons, a single firm, or even two or three, will not care to take isolated action. We trust that the necessity for any further protest will be obviated by a consideration of the whole subject, both by the India Office at home and by those who have authority to give out orders in India.

Railway Companies' Accounts.

As is well known, the accounts of railway companies are in statutory form, and have been published half-yearly since 1868. On January 1st, 1913, however, the Railway Companies' (Accounts and Returns) Act, 1911, which is the result of the recommendations of the Committee appointed by the Board of Trade in 1906, comes into operation. It will probably be remembered that the Committee was not unanimous in its recommendations, Messrs. Ackworth, Paish and Peel being in favour of ton-mile in preference to the existing train-mile statistics, whilst Sir Charles Owens and Messrs. Bailey and Whitelaw were against the introduction of the new element. The former stated that the statistics of ton-mileage and passenger mileage stood, in their judgment, on the same footing as the other accounts and statistics, and should equally be made statutory, whilst the latter urged that the train-mile was a much more trustworthy and constant factor than the ton-mile could possibly be, and that much more exhaustive information in the accounts had been agreed to in order to make the train-mile as accurate as possible in relation to both receipts and expenditure, which alone would involve the companies in very considerable additional expenditure. The ton-mile theory is as interesting as the proposed new car-mile method of calculation for comparative purposes.

There are one or two notable features in the new Act to which we may give brief notice. Under the new law no railway company need prepare or submit to its auditors and shareholders statements of account or balance-sheets, nor hold a general meeting more than once a year except in the case of a company which is under statutory obligation to prepare half-yearly accounts in connection with guarantees of dividend under statutory provisions. The directors may, if it appears to them that the profits of the company are sufficient, declare and pay an interim dividend for the first half-year, notwithstanding the fact that the accounts have not been audited for the half-year and that none have been submitted to the shareholders.

The new Act is likely to mean much additional labour, as the new accounts are greatly increased both in number and volume, and the statistical returns total 24, against the present statutory requirement of 3.

Provision is made in the "Receipts and Expenditure on Capital Account" statement for "electric power stations, &c.," whilst discounts on shares and debenture stocks require to be distinctly recorded.

Electrical Cooking.

Elsewhere in this issue we are able to publish some interesting particulars regarding the working of the Queen's Head Electric Restaurant at Earl's Court Exhibition, the results in connection with which have given satisfaction equally to the caterers and electrical interests concerned.

We take it that the information now published will be amplified at a later date, and that fully detailed test results relating to the various types of apparatus in use will be made available to those engaged in developing the electrical cooking business.

The practicability of electrical cooking is, of course, beyond dispute at the present day—indeed, the fact that as many as 1,700 meals a day are being served in the Queen's Head Restaurant somewhat discounts any criticism on that point. Moreover, we believe that very satisfactory results are being obtained in numerous instances in regard to which nothing is published. A case in point is a Felixstowe hotel, where, under the direction of Mr. Napier Prentice, of the Suffolk Electricity Co., electric cooking on a fairly large scale—with apparatus of Mr. Prentice's own design—has proved very successful from the proprietor's point of view—which, after all, is the main thing.

The successful application of electricity for cooking on a large scale will undoubtedly lead to a wider recognition of its possibilities for domestic purposes. In this direction, however, the problem is a much more difficult and mainly financial one, calling for most skilful handling if it is to be solved.

An interesting development, which we may hope is the beginning of effective co-operation between the manufacturer, central station man, and contractor, for the purpose of pushing the electric cooking and heating business, is contained in the announcement of the General Electric Co., Ltd., to engineer and contractor clients, of its intention to allow consumers a seven-days' free trial of its smaller heating apparatus, such as toasters, kettles, water boilers, flat-irons, &c. Unless the average consumer in this country is extraordinarily different from his American cousin, the free trial arrangement should lead to a greatly extended sale of the smaller class of apparatus, and if the scheme is developed into something of a much more comprehensive character, as we gather is the intention, possibly of the larger apparatus as well. The seductiveness of the free-trial period in one American town, can be gathered from the fact that a 90 days' educational campaign, with from 10 to 30 days' free trial, resulted in over 1,000 irons per month being sold, and comparably good results were obtained in the case of other small apparatus.

SOME INCONSISTENCIES IN AMERICAN LIGHTING PRACTICE.

By AN ENGLISHMAN IN AMERICA.

At the outset I must utter a word of warning as to the general deductions which may be drawn from a perusal of this short article. I propose to utter a protest against some of the inconsistencies which are to be seen every day in American street lighting; but it must not be inferred from this that I am of the class of Englishmen who can see little in American engineering practice superior to British, and who rate the bulk of American enterprise as froth without the substance. On the contrary, I am a great admirer of the *esprit de corps*, the enthusiasm, and the methods of the members of the American electrical profession; and can assure Englishmen who know little of the American electrical men that they will find in the latter many good points which might profitably be copied in the pursuit of their professional duties at home. At times, however, the fact does forcibly strike one that some of these American schemes, while showing many of the qualities of meritorious performance, possess all the elements of the ridiculous. I propose to name a few instances, and have selected street lighting as the example of American electrical activity to be pilloried.

The Illuminating Engineering Society of America is a flourishing institution, and is doing invaluable work. Its meetings are well attended; and the general calibre of its rank-and-file member is on a high plane as regards technical ability, general intelligence, and practical good sense. The scope of its activities is, I imagine, well understood in England, and reports of its work are received there with probably as much interest as those of the English association in this country. Many of its members would be capable of presenting valuable expert testimony at any conference on subjects such as the conservation of vision, and efficiency of house lighting, and so on; but just now much of the attention of the Society is being devoted to street-lighting matters, and particularly to the subject of ornamental lighting.

About a year ago, a report published by a special committee of the National Electric Light Association, organised for the purpose of studying the question of how much bad been done in regard to decorative street lighting, pronounced that there was really nothing in the street-lighting systems of the country which could be called ornamental. As a matter of fact, however, even while the examination was being conducted and the report prepared, considerable activity was being shown on the part of several different manufacturers, both of the lamps and the poles; and these energies were redoubled after the publication of the report. Street standards for tungsten clusters are now to be seen in countless cities in all the States of the Union, some of which are hideous in their over-elaboration, some of which combine a really artistic ornamentation with substantial construction.

Meanwhile, the arc-lamp designers have been busy. The luminous magnetite lamp, the development of which has been directed and fostered by the genius of Steinmetz, provides a beautiful white light of high intensity. The lamp was marketed for a number of years before the ingenuity of the designers succeeded in producing an arrangement of the operating mechanism which would admit of the lamp being mounted on top of a suitable standard for street lighting. The necessary design of lamp was in time produced, while it was a comparatively easy matter to draw up specifications for a simple but ornate standard upon which the lamp might be mounted. The resulting combination provides a unit, of the 4-ampere and the 6·6-ampere rating, probably superior for street-lighting purposes to anything else which has yet been produced, as regards exceptionally high efficiency, low maintenance charges, quality of the light and general appearance, whether by day or night. It is at this point that we may applaud the persistence and the skill of the American manufacturer, who, in this instance, as in nearly all other instances, has proved his ability to produce the goods.

One then logically expects to see the excellent achievement duly crowned and receiving a fit setting as its reward. One sees nothing of the kind, and one's admiration is nearly turned to ridicule. New Haven opens its great White Way, in which this really beautiful lamp is used as the source of light. The papers are full of it; New Haven is *en fête*. The striking of the first arc on its streets is regarded by many as a milestone in the exterior lighting business. It may well be. But how about the setting and the general decorative effect? This is the point: What is the use of evolving a beautiful lighting unit, one of whose main virtues is that it is as pleasing by daylight as at night, when it has to stand, cheek by jowl, with an unsightly wooden pole making an angle of possibly 80° with the thoroughfare, with cross-arms equally ugly and equally off centre, and burdened with lighting and power mains strung with varying sags up and down the street? One of the first things which strikes the Englishman in this country is the manner in which lighting mains and trolley wires are supported, even in the business districts of the cities; and he thanks Heaven that, whatever its faults, the municipality at home is scoring heavily in one direction at least when it insists on trolley cables being hung in a decent manner. In this country the designer performs his full share by facing his problem squarely and designing the required lamp. The advantages which might accrue from his labours are largely thrown away; but the citizens of New Haven are still happy in the delusion that they have beautified their city.

The other matter upon which I wish to touch is the electric advertising sign business, and the general over-illumination of the business districts of a city; taking up the position that it is foolish to provide super-sunlight values on the main street of a town, when the residential quarter, and even the side streets turning out of the main thoroughfares, are illuminated in a manner which, on the score of insufficiency of light, would not be tolerated in an English country town. I have more than once been told the old tale of the Britisher being escorted down Broadway by a New Yorker. His attention was directed to a dazzling sign lit up with many hundreds of 8-c.p. lamps. "Yes, but doesn't it make the thing beastly conspicuous?" I thoroughly appreciate the fact that if an Englishman in America deplores the sign vogue, he will meet with nothing but good-humoured ridicule. But so far I have learnt nothing which will dispose me favourably towards it. There is nearly everything to be said against it, and little in its favour. The weightiest fact against the sign is that it is unsightly—to use no stronger term. Even when carried out on a grand scale, as along Broadway, it represents in its general effect a number of light sources unsymmetrically arranged and distributed, and, therefore, unnatural; carried out on a cheap scale, this unnaturalness is increased and the sparseness accentuated, until the effect is sometimes hideously garish and harsh. If it is these things at night, it is incomparably worse in bright daylight. Another fact against it is that it is (theoretically) a business-getting illumination, and is, therefore, extinguished at an early hour of the night. The regular street illumination is reduced often to a negligible value since the evening illumination is provided by the signs; so that when the signs are cut off the business area is left considerably under-illuminated.

No one will deny that the sign is a business-getter, since abundant figures are forthcoming to prove the assertion. The reservation must be made, however, that it is so only when its use is not general. If there are five restaurants along a street, or five department stores, and one of them erects an attractive sign over its door, it may be assumed that, other things being equal, that store or restaurant will attract more business than any of the others. If—as is usually the case—all the others follow suit, the relative position becomes just the same as it was originally, with the difference that all the stores are paying more money to the central station, and are flooding the street with an objectionable superabundance of light. I do not believe those who argue that the ultimate spending capacity of the whole population is increased. People spend only as much as they have to. If they exceed that rate, the fact can certainly not be taken as a sign of health. The argument that the sign business provides a heavy station load remains in its favour. In most industrial towns, this load comes off the peak, and is therefore a desirable load. But central stations are run by individuals who are citizens first and engineers afterwards; and they may not be disposed to go after a load which, while putting money in their pockets, is rendering their city an eyesore to the stranger as to the native.

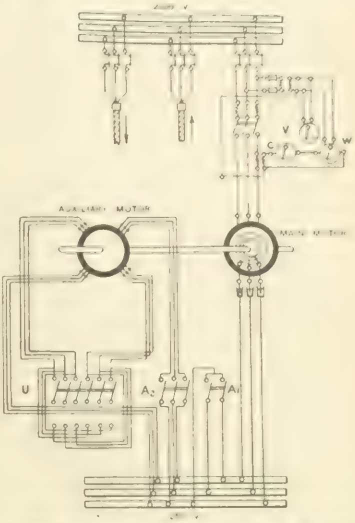
While, however, we may or may not admit the advantages of the sign system, how is it reasonable to cultivate the sign business in the down-town districts, while the illumination of all parts of the cities, except just the business area, is scarcely better than it was 50 years ago? England is way ahead of America in this respect at least; and, in my judgment, it does not matter whether the lighting is done by gas or by electricity. The aim should be the provision of a certain minimum candle-power per square foot at any point on any street, to be obtained by the most efficient illuminant which can be found; and it seems to me absurd that merchants should squander vast sums of money in their attempts to beautify the commercial area ("beautify" = over-illuminate), when their way home of an evening leads them along streets the contour of whose ill-paved sidewalks is revealed to them only on rare occasions. It must, in justice to the American municipality, be said that usually this problem is a difficult one, owing to the fact that many of the streets in the up-town districts in the smaller cities are lined each side with trees, whose function it is to render these streets endurable and beautiful during the blazing midsummer weather. The density of their foliage renders difficult the execution of any efficient scheme for lighting by night. Low-power incandescent lamps at short intervals seem the most hopeful solution. Arc lamps at long intervals are much cheaper, and are therefore adopted, but it is obvious that the system is entirely unsuited to these conditions, and that in such towns it represents nearly a reversion to mediæval conditions of highway lighting.

ADVANTAGES OF THREE-PHASE CASCADE MOTORS.

The general principle of the Cascade connection of three-phase motors is very well known. Instead of controlling the speed of the main motor by ohmic rotor resistance, the slip energy is efficiently utilised in a second smaller three-phase machine mechanically coupled to the first. If the main motor has p_1 pairs of poles, its synchronous speed, on a supply of f cycles per second, is $(60 . f/p_1)$ R.P.M. and the synchronous speed of the combination of the main machine with an auxiliary motor of p_2 pairs of poles is $(60 . f/(p_1 + p_2))$. As shown below, it is an easy matter to arrange three values of p_2, thus providing four definite speed steps. By using other than a 1 : 1 speed ratio between the main and auxiliary motor shafts, other definite speed steps can be secured, making a total of at least seven without involving an inconvenient equipment.

Various modifications of the simple Cascade connection have been devised to enable continuous speed variation and high power factor. A commutator auxiliary machine is employed, and the energy recovered from the rotor circuit of the main motor may be yielded directly as mechanical energy (Kramer) or indirectly by means of a three-phase D.C. converter on the main motor shaft (Linsenmann), or it may be yielded as electrical energy directly in the Heyland system or indirectly through a three-phase motor-generator, back to the supply network (Scherbius). As shown below, the efficiency of such control systems is very considerably lower than that obtainable by simple Cascade control. The cost of the commutating auxiliary machine is about twice that of the squirrel cage auxiliary used in the system described below, and the operating and maintenance costs are correspondingly higher.

The only justification for the use of the modified Cascade systems—in industrial networks where the lower power-factor of the simple control is not serious—is the continuous-speed control obtained. In many cases this is a most important consideration, but, in other applications, it carries no weight at all. For instance, a colliery fan has to be driven at constant speed for very long periods, with an occasional shut down for an hour or two for inspection and cleaning. The fan is installed when the workings are commenced, and is proportioned to supply ultimately a much greater volume of air than is at first required. For months or years, the fan must be run at reduced speed, its R.P.M. being slightly increased from time to time as the workings expand. Four or seven definite speed steps would admirably meet the requirements; efficient, but not continuous, speed regulation is desirable, and absolute reliability is imperative. The simple cascade system of control fulfills all these desiderata, and the following paragraphs describe the equipment and performance of the Werne Colliery (Osnabruck),* where a fan delivering 11,000 cbm/min. against 300 mm. (water) pressure is driven at 250 R.P.M. by a 1,200-H.P., 24-pole, 50-cycle, slip-ring induction motor coupled through 1 : 1 belting (space forbidding direct mechanical coupling) to a cage-wound auxiliary motor the stator of which has two windings, one with eight poles, the other with four or two according to connections (see fig. 2). The synchronous speed of the main motor is 250 R.P.M., and Cascade speeds of 231, 214 and 188 R.P.M. are available, using the respective connections indicated in fig. 1.



250 r.p.m., A₁ closed; 231 r.p.m. [illegible]; 214 r.p.m. [illegible]; 188 r.p.m., [illegible]

FIG. 1.

The main motor is connected to the 2,000-volt mains through the necessary measuring instruments. The liquid starter has a split neutral, closed by the switch A₁, and the connection of the main rotor to the auxiliary motor is through the switch A₂ and the reversing switch U). (See also fig. 2.)

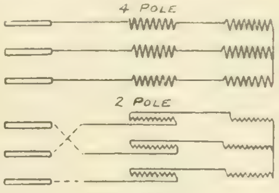


FIG. 2.

It is usual to provide slip rings on the auxiliary motor, and if the present arrangement is adopted the resistance in circuit acts as a primary starter and the auxiliary stator voltage is reduced. If the starter is not switched out at the correct moment (preferably indicated by a tachometer on the motor shaft) there is a danger that the Cascade will not be established, but the additional care required in starting is fully compensated by the elimination of slip rings on the auxiliary machine and the losses and upkeep involved by the latter; (in the present case a phase-wound rotor would need two windings and 12 slip rings, seriously reducing the simplicity and reliability of the installation).

Test Data; Efficiency; Power Factor.—The output and efficiency of the fan and motors, individually, and as a whole, are shown in fig. 3 herewith, the synchronous speeds of the main motor and of the three cascade steps being marked by broken ordinates. On comparing the efficiency and power factor of the present control system with the corresponding data for other systems and over a range of speed regulation from 8 per cent. to 26 per cent., the following results are obtained:—

System.	Main motor.		Speed regulation 8 and 26 % respectively.	
	H.P.	R.P.M.	Efficiency %.	Power factor %
Present; see fig. 1 ...	1,200	250	94—92	0·77—0·62
Do. with simple slip regulator	1,200	250	89—72	0·89—0·80
Linsenmann, D.C. ...	1,150	270	92—90	1·00—0·98
Heyland frequency changer	950	300	90—84	1·00—0·98
Scherbius, three-phase ...	1,000	363	90—83	1·00—0·98

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* See also Glückauf 48, pp. 949-955.

These figures, referring to actual installations, show the marked superiority of the simple over the modified Cascade systems as regards efficiency, and also its marked inferiority as regards power factor.

In general, high power factor is a most important consideration in industrial power supply, but there are cases—the present among them—where the low power factor is of minor importance. The horse-power required to drive a fan varies approximately with the (speed)^3, so that, as the speed falls, the current supplied falls below the full speed value, despite the lower power factor of the load; hence larger mains are not required by reason of the low power factor at reduced output. The effect of the latter on the generator capacity required depends upon the extent and nature of the remaining load carried. In the present installation the average day load is 1,800 KW. at a power factor of 0·8. The fan, now running at very low output, requires 323 KW. at 0·57 power factor, and were the power factor of its demand unity, the power factor of the whole installation would average 0·9. The fan load has thus no serious effect on the losses in the mains and the losses in the fan circuit, due to low power factor, are more than offset by the high efficiency of the simple Cascade control. As the output of the fan increases, its power factor and the general advantages of the system employed will increase. There are many other cases in which the use of simple Cascade control offers similar advantages.

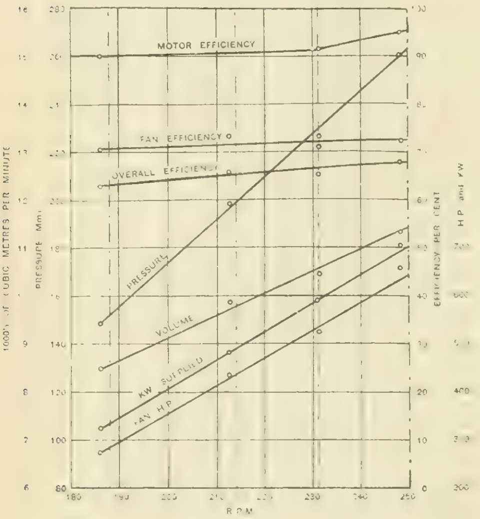


Fig. 3.

WATER-POWER AND LEGAL RIGHTS.

(FROM A LEGAL CORRESPONDENT.)

Although we have not in the United Kingdom a very large amount of power running to waste in streams and canals that might be usefully employed, there are a number of places where the hydro-electric mind finds falls to interest it. The writer, looking at the matter entirely from the legal point of view, desires to consider a few aspects of the question.

It is necessary to consider, in the first place, the legal rights of one who has access to a flowing river. It is manifest that if a man has a river so flowing through his land that he owns the banks on either side, he can use the water as he pleases, subject to the rights of riparian owners lower down. Even if he were to so use the flowing water, that it nearly all passed through his tail race, the lower owners could not object unless the position was complicated by the fact that the water was polluted. Nor would there be the smallest objection in law to the owner above described erecting a dam on his property, which was capable of impounding all the water of the stream. Such water could be applied to any purposes which commended themselves to the landowner. In the nature of things, he would be compelled to provide a by-pass for the release of flood water.

The erection of a dam, and reasonable use of the impounded water, may be complicated by the Acts which have been passed to check the pollution of rivers. When polluted water flows into a dam the matter held in suspension must sink to the bottom. In the result it may become necessary to clean out the dam from time to time. This point is dealt with a little lower down.

It was decided in Miner *v.* Gilmour (12 Moo.P.C. 131) that every riparian proprietor has a right to the reasonable use of the water flowing past his land, for his domestic purposes, and for his cattle, and this without regard to the effect which such use may have, in case of a deficiency, upon proprietors lower down. He has also the right to the use of the water for any other purpose, provided he does not thereby interfere with the rights of other proprietors either above or below him. Upon this authority, a riparian owner would clearly be entitled to use and replace water for the purpose of a mill, but he may also consume a reasonable quantity of water. Thus he may by means of water-wheels and machinery erected by him for that purpose, pump up water from a natural stream flowing past his land to a reservoir, and convey it thence by pipes to his dwelling house. He may even send water to another estate at a distance from the stream, and there apply the water to his domestic and other necessary purposes of utility, provided he takes only a reasonable quantity with reference to the size of the stream and the rights of his neighbour; but he has no right to take more water by means of the wheels and machinery than he would have a right to take otherwise.

Again, a railway company may use water to supply their locomotives. In a case tried some years ago, the Great Northern Railway Co., whose line crossed a stream in the immediate neighbourhood of one of their stations, took water therefrom for supplying their engines and for the general purposes of the station. In an action brought by a millowner lower down the stream, it appeared that the abstraction did no damage in wet weather, and never shortened the working of the mill for more than two or three minutes a day. In these circumstances it was held that the company, as riparian owners, were entitled to take a reasonable quantity of water for their own purposes, and that in this case the quantity was reasonable.

As a general rule, the Rivers Pollution Acts do not apply to or affect the lawful exercise of any rights of compounding or diverting water. The meaning of these words were considered in a recent case (Ribble River Committee *v.* Halliwell, 1899, 2 Q.B. 385). In that case, the owner of a dam was proceeded against for allowing solid matter to enter a stream. For many years prior to the passing of the Rivers Pollution Prevention Act, 1876, he had lawfully exercised the rights of diverting and impounding in a reservoir, water from the stream for the purposes of his business. The water so diverted contained vegetable matter discharged into the stream by paper mills higher up the stream. While the water was impounded, this vegetable matter settled at the bottom of the reservoir, and after two or three days it became putrid. The reservoir was flushed out once a week (on Saturdays after the mill was stopped) by opening sluice gates into the stream and allowing the water from the stream to flow through the reservoir and out again into the stream, carrying with it the putrid deposit at the bottom of the reservoir. The effluent water as it went into the stream contained 97·6 per cent. of water and 2·4 per cent. of solid matter in suspension. In proceedings taken against the mill-owner under Sec. 10 of the Rivers Pollution Prevention Act, 1876, for having, contrary to the provisions of Sec. 2, caused to be put or carried into the stream, so as to pollute its waters, "putrid solid matters," it was held by a majority of the Court of Appeal that, assuming that the matter at the bottom of the reservoir was "solid matter," the mill-owner was not liable to be proceeded against under the Act, for at the time the effluent from the reservoir entered the stream the solid matter was "in suspension in water." It was further held that, assuming that what was put into the stream was "solid matter" within Sec. 2, the mill-owner was protected by Sec. 17 of the Act, which provides that the Act "shall not apply to or affect the lawful exercise of any rights of impounding or diverting water."

In a later case, the proprietors of a dam in order to clean it out turned the whole waters of the river into the dam, while men with spades conveyed the mud and deposit into the current as it flowed through the dam, and by this operation the mud, sludge, and deposit in the dam became admixed with water and were carried in suspension to the outlet from the dam into the river below the mill, rendering the river muddy and turbid for a considerable distance. The effluent, as it went from the dam into the river, consisted of over 99½ per cent. of liquids, and less than ½ per cent. of solids. It was held, on the authority of the Ribble River Committee *v.* Halliwell (*supra*), that the respondents had committed no offence against Sec. 5 of the Act, either in unlawfully causing to be put, or in knowingly permitting to be carried, into the river, the mud sludge and deposit from the dam, as the stuff sent out into the river being in a liquid state, and containing less than ½ per cent. of solid matter, could not then be described as mud, sludge and deposit, and that it was immaterial that it may have been so in the dam before the operation of cleaning began.

These cases make it plain that the owner of a river has but little to fear from the River Pollution Acts if he finds it necessary to impound water for the purpose of generating electricity.

The next question to be considered is: What use, for power purposes, can be made of a navigable river? It was stated in an old case that a navigable river is a public highway, navigable by all her Majesty's subjects in a reasonable manner and for a reasonable purpose. Being a public highway, all persons have a right to come there in ships, and to unload, moor, and stay there as long as they please; but if they abuse that right, so as to work a private injury (as, for instance, to interrupt the enjoyment of a private fishery), they are liable to an action.

Having regard to this definition, it is clear that a member of the public who has the right to use a navigable river merely as such, could make no use of it for power purposes. For instance, were there a stream in Great Britain having a current of velocity similar to that of the Mississippi, it would not be legitimate to do what they sometimes do in that river, namely, anchor a vessel in mid-stream and use the current to rotate the paddles to drive a floating mill. As to the rights of riparian owners on a navigable river, it has been held that there is no distinction in principle between riparian rights on the banks of navigable or tidal, and on those of non-navigable, rivers. In the former case, however, there must be no interference with the public right of navigation; and in order to give rise to riparian rights, the land must be in actual daily contact with the stream, laterally or vertically.

Assuming that there is no question as to the existence of riparian rights, the question might arise whether the proposed annexation of water for power purposes would interfere with the navigation. In the case of a non-tidal navigable river having no locks, the establishment of a low-level turbine or an ordinary waterwheel might involve a substantial diminution of the volume of water passing along the fairway. In that case, it is apprehended that there might be an interference with the navigation.

The navigable non-tidal rivers, however, are so few in number that the solution of the question regarding them cannot be of any practical importance.

It is next proposed to consider whether and to what extent canal water can be used. Some of the Acts which authorised the making of the canals with which the country is intersected made incidental reference to the use of water for power purposes. For instance, in Blakemore *v.* Glamorgan Canal Co. (2 C.M. & R. 133), it appeared that, by a Canal Act, a company was restricted from any alterations of its canal after the expiration of two years. By the same Act, a proprietor of a mill near the lower part of the canal was entitled to all the surplus water of it. It was held that the erection of a steam engine after the expiration of two years, to pump water into the upper part of the canal, by which the carrying power of the canal was increased and the surplus water diminished by the enlarged trade, was an injury to the millowner for which he was entitled to damages. Where a millowner has the right to use the surplus water of a canal, this means that he is entitled to use all the water which is not for the ordinary purpose of a canal. Thus, where a statute directed that a millowner should be entitled to receive the surplus water by a weir above a certain lock, which the company were bound to keep watertight, it was held that it was to be inferred that the company should not have the right of passing any water through the lock, though necessary to the lower part of the canal, except that which passed when barges were lowered through the lock.

It may be also pointed out in this connection that a company incorporated for the purpose of making and maintaining a canal, and having powers under its Act to take water for the purpose of supplying the canal, cannot by user acquire a prescriptive right to take the water for any other purpose.

Where rights are reserved to millowners as against a canal company the remedy for infringement of those rights is often to be found not in an action at law, but in proceedings for compensation under the compensation clauses. So in Redler *v.* Great Western Railway Co., 96 L.T. 98, a company was authorised by Act of Parliament to construct a canal and cut to be supplied with water from a river, and the proprietors were empowered to do anything "which they shall think requisite and necessary or convenient for . . . . maintaining and using the said canal and cut . . . . doing as little damage as may be," and making compensation as provided by the Act. A later Act authorise the construction of a tidal basin and entrances in connection with the canal, and extended the powers conferred by the earlier Act to such additional works. The proprietors of the canal drew water from the river, through the canal, to scour out silt which was deposited in the tidal basin and entrances and tended to choke them, and by so doing interfered with the supply of water to mills situated on the river. It was held that they were justified under the powers contained in the Act in so using the water, and that the remedy of the millowners was under the compensation clauses.

Those who are riparian owners along a canal cannot, of course, assert any right to the use of the water. In fact, for any person to take water without permission would be a trespass, if not something worse.

Canadian Farming.—According to the *Standard*, the Hydro-Electric Power Commission will be able to furnish the individual agriculturist with a constant 2-H.P. service for $24 per year, which will enable him to do his milking, chop his feed, light his farm, and perform many of the house and general farm duties. For heavier work like threshing and ploughing, it is proposed to send about the country motor-wagons, with the assistance of which a cable can be connected with the transmission line at any point, and be tied up to the threshing machine that will turn over 24 acres each day.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

(*Continued from page* [illegible].)

The following is the third instalment of definitions of electrical terms adopted by the British Electrotechnical Committee:—

Note.—Words printed in SMALL CAPITALS are already explained or will be explained later.

Master Controller or Pilot Controller.—A controller used in the MULTIPLE-UNIT SYSTEM of electrification. It does not act directly on the current supplied to the motors, but works electromagnetic or other switches called CONTACTORS. These contactors control the motors.

Maximum-Demand System.—A system for assessing the payment to be made for a supply of electrical energy, composed of two parts: (1) a sum depending on the maximum power supplied during a certain period; and (2) a sum proportional to the energy supplied during that period.

Meg-Mega.—A prefix signifying one million times—*e.g.*, megohm, one million ohms; megavolt, one million volts.

Messenger.—A name used in America for a wire or cable from which electric wires or cables are hung. Called in railway work a CATENARY, in telephone and telegraph work a SUSPENDING WIRE.

Mho.—The unit of CONDUCTANCE. The reciprocal of the OHM. The conductance of a circuit the resistance of which is one ohm.

Micro-.—A prefix signifying one millionth part; *e.g.*, microampere, one millionth of an ampere; microfarad, one millionth of a farad.

Micron.—One millionth of a metre; *i.e.*, one thousandth of a millimetre.

Microphone.—A device employed at the transmitting end of a telephone circuit, consisting of a contact or system of contacts such that the resistance is altered by the impact of the sound waves.

Middle Wire.—The conductor of a THREE-WIRE SYSTEM of supply the potential of which is intermediate between those of the other two. Sometimes called the intermediate or neutral.

Mil.—One thousandth of an inch.

Mil or Circular.—A unit used in America, the area of a circle of which the diameter is one thousandth of an inch.

Milli-.—A prefix signifying one thousandth part; *e.g.*, milliampere, one thousandth of an ampere.

Milker.—A dynamo used for charging individual cells forming a portion of a battery of ACCUMULATORS. Sometimes called MILKING BOOSTER.

Mirror Galvanometer.—A galvanometer having a mirror attached to the moving part. A beam of light reflected from the mirror is used as a pointer, or the image of a scale is observed in the mirror by means of a telescope.

Moment.—(*a*) Of a force. The effectiveness of a force to produce rotation about a point. The product of the magnitude of the force and the length of the perpendicular let fall on its line of action from the point.

(*b*) Of a couple. The product of the magnitude of one of the two equal forces and the arm or perpendicular distance between them.

(*c*) Of a magnet. The product of the strength of one of the poles of a magnet and the distance between them.

Morse Alphabet.—A signalling code in which two different signals, arranged in groups of one or more, are used to represent a letter, figure or symbol.

Motor.—A machine for converting electrical energy into mechanical energy.

Motor Generator.—A machine consisting of a DYNAMO or ALTERNATOR driven by an electric MOTOR, either in the form of two distinct parts coupled together, or having the armature windings on a common core and revolving in a common field. Sometimes called a dynamotor, a term not recommended.

Motor Transformer.—A term not recommended. See TRANSFORMER.

Mouse Mill.—A special continuous-current motor used for running paper strip though a SYPHON recorder.

Moving Coil Instrument.—A measuring instrument, the indication of which depends on the torque exerted by a magnetic field on a coil through which the current to be measured passes.

Multicellular.—Voltmeter or electrometer. An instrument in which several pairs of quadrants act on several NEEDLES mounted on one axis.

Multiphase.—Synonym for POLYPHASE.

Multiple Arc.—Synonym for connection if PARALLEL. A term not recommended.

Multiple Board.—A form of telephone switchboard.

Multiple Unit System.—A system of electric traction, in which two or more cars are units in themselves and have their own motors, controlled by electromagnetic or other switches called CONTACTORS. When the cars are coupled together as a train, the contactors can all be worked from a single MASTER CONTROLLER.

Multiplex Telegraphy.—A telegraphic system in which several messages, generally more than two, in either direction can be transmitted on one circuit at the same time.

Multipolar Generator or Motor.—A DYNAMO, ALTERNATOR or MOTOR having more than one pair of magnetic poles.

Mutual Induction. See INDUCTION, MUTUAL.

Needle. A name originally applied to the moving magnet of a mariner's compass, later to the similar magnet of a galvanometer, and to the paddle-shaped moving conductor of a quadrant electrometer.

Needle Astatic.—See ASTATIC.

Negative.—Of the two POLES of any source of electricity, that one is called negative which corresponds as far as the direction of the current in the external circuit is concerned, to the zinc plate of a Daniell cell.

Network.—A number of conductors interconnected for the distribution of electrical energy in a supply system.

Neutral.—(*a*) In a THREE-WIRE SYSTEM of supply, the MIDDLE WIRE is sometimes called the neutral or intermediate.

(*b*) The point of junction of the conductor of a STAR-connected polyphase system of alternate-current working. See PHASE.

(*c*) Points on a dynamo commutator. Those points between which there is a maximum electromotive force when the dynamo is running on open circuit.

Nominal Horse-Power.—An obsolete mode of describing the output of a steam engine in terms of certain of its dimensions.

Non-Inductive.—(*a*) *Circuit.*—A circuit so arranged that its self-induction is practically negligible.

(*b*) *Winding.*—Two identical insulated conductors laid side by side, or twisted together, and so connected that a current traversing them in opposite directions generates no sensible magnetic field.

(*c*) *Load.*—A load such that its self-induction is practically negligible.

Ohm. (*a*) *True.*—The unit of resistance in the PRACTICAL SYSTEM of units. The value in the C.G.S. system is equal to 109 electromagnetic units.

(*b*) *International.*—The resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14·4521 grammes in mass, of a constant cross-sectional area, and of a length of 106·300 cm. (International Conference, 1908, the British Order in Council, January 10th, 1910.)

Ohmmeter.—An instrument for measuring electrical resistance by the deflection of a pointer over a scale.

Oil Transformer.—A TRANSFORMER immersed in oil.

Omnibus Bar.—See BUS-BAR.

Oscillation, Electric.—When a system or circuit possessing CAPACITY and SELF-INDUCTION is disturbed from its condition of electrical equilibrium, the currents flowing alternately in opposite directions with decreasing amplitude during the return to equilibrium are called electric oscillations.

Oscillating Circuit.—A circuit in which electrical OSCILLATIONS can freely take place.

Oscillator.—A conductor having effectively both SELF-INDUCTION and CAPACITY in which electric OSCILLATIONS can be set up.

Oscillograph.—An apparatus for observing or recording quickly varying currents or potential differences.

Outer.—The two conductors of a THREE WIRE SYSTEM between which there is a maximum voltage are called the outers.

A term not recommended as a synonym for the external conductor of a concentric cable.

Output.—A synonym for LOAD. The total power delivered at the shaft or at the terminals of a machine or apparatus. See RATED OUTPUT.

Over Compounding.—(*a*) of a generator. A generator is said to be over compounded when the potential difference between its terminals increases with the load.

(*b*) of a motor. A motor is said to be over-compounded when the speed increases with the load.

Over-load.—A load greater than the RATED LOAD.

Over-load Circuit Breaker.—An automatic switch which opens when a predetermined load is exceeded.

Parallel.—(*a*) Two or more systems of conductors are said to be in parallel in a circuit, when the current flowing in the circuit is divided between the two systems.

(*b*) Two or more systems of conductors, generators or motors, are said to be connected in parallel when the terminals of the same sign are electrically connected together.

Paramagnetic.—A substance of which the magnetic permeability is greater than unity (vacuum).

Paste (of an accumulator).—The active material of the plates or grids of an ACCUMULATOR. So called, as it is sometimes applied as a moist composition or paste.

Peltier Effect.—The liberation or absorption of heat which takes place in a heterogeneous circuit at the joint where an electric current passes from one material to another.

Period (Periodic Time).—Any varying quantity, which repeats its values regularly at equal time-intervals, is said to be periodic, and the time-interval of one repetition is called the periodic time or period.

Permanent Magnet.—A body, which having been magnetised, retains a substantial portion of its magnetism.

Permeability.—See MAGNETIC PERMEABILITY.

Permeance.—See MAGNETIC PERMEANCE.

Phase.—(1) (*a*) In an operation which occurs harmonically, the stage or state to which the operation has proceeded.

(*b*) In an operation which recurs harmonically, the fraction of the whole period which has elapsed, measured from some fixed origin.

(*c*) *Phase Difference.*—The difference of phase (usually reckoned in time or in angle) between two periodic quantities which vary harmonically and have the same frequency. See LAG.

(*d*) Each of the circuits of a polyphase apparatus is sometimes called a phase.

Single-phase.—A supply is said to be single-phase when it consists of a single alternating current.

Two-phase.—A supply is said to be two-phase when it consists of two alternating currents which are displaced with regard to one another by one-quarter of a period.

Three-phase.—A supply is said to be three-phase when it consists of three alternating currents displaced with regard to one another by one-third of a period.

Polyphase.—A supply is said to be polyphase when it consists of more than one alternating current displaced with regard to one another by equal periods.

Phase-angle.—The angle between two vectors representing two simple harmonic periodic quantities having the same frequency but differing in phase from one another; *e.g.*, the vectors representing alternating voltage and the current produced by it.

Extended Meaning.—The angle between any two vectors which represent quantities having the same fundamental frequency.

Phasemeter.—Apparatus for measuring the distance of phase between two periodic electric quantities of the same frequency.

Photoelectric Effects.—Any changes in the electrical properties of a body produced by the action of light, *e.g.*, generation of electromotive force, change of resistance, or loss of charge.

Piezoelectric Effect.—The production of electrification by mechanical pressure.

Pile.—(*a*) *Thermo-electric.*—A source of electrical energy due to the direct transformation of heat into electrical energy, generally consisting of a series of thermo-junctions.

(*b*) *Voltaic.*—An obsolete synonym for a BATTERY of CELLS.

Pilot Wire.—(*a*) A wire used for measuring the voltage at a distant part of a NETWORK.

(*b*) In a MULTIPLE UNIT SYSTEM, a wire used between the MASTER CONTROLLER and a CONTACTOR.

Plant.—A collective term including various machines, equipment and apparatus used together for any purpose.

Planté Plates.—ACCUMULATOR plates prepared by electrolytic action on lead in acid.

(Process invented by G. Planté.)

Plough.—An appliance for effecting a sliding electrical connection between the conductors of a CONDUIT SYSTEM and the electric equipment of a car.

Plug Contact.—A slightly conical or screwed metal plug for making electrical contact between two conductors, conducting bars or blocks, or between the bars or blocks and the plug.

Point (in wiring).—The termination of the wiring for attachment to the fitting for one or more lamps or other consuming devices.

Polarization.—A condition set up in a battery or electrolytic CELL as a result of the passage of a current, and which manifests itself by a back-electromotive force.

Polarity.—A quality of a body, in virtue of which certain characteristic properties are manifested at points called POLES.

Pole.—(*a*) OF A CELL. Synonym for the TERMINAL or the accessible part of an ELECTRODE.

(*b*) OF A MAGNET. Points towards which LINES of FORCE converge, or at which the resultant MAGNETIC FORCE may be considered to act.

(*c*) OF AN ARC. The extremity of each of the ELECTRODES between which the ARC burns.

Pole-Piece.—Any specially shaped piece of magnetic material forming a polar extension, and in the case of a GENERATOR or MOTOR, facing the ARMATURE.

Poly-phase.—See PHASE.

Positive.—Of the two POLES of any source of electricity, that one is called Positive which corresponds, as far as the direction of the current in the external circuit is concerned, to the copper plate of a Daniell cell.

Potential, Difference of.—(*a*) *Electric.* A difference of potential exists between any two points if energy is expended or acquired in moving a unit of electricity from one point to the other. In practice measured by a VOLTMETER.

(*b*) *Magnetic.* A difference of potential exists between any two points if energy is expended or acquired in moving a unit magnetic POLE from one point to the other.

Potentiometer.—An instrument for measuring electrical quantities depending in principle on balancing an unknown DIFFERENCE OF POTENTIAL against a known fall of potential obtained by the passage of a current through an adjustable resistance.

Power.—The rate of doing work. Units, the WATT, KILOWATT, and HORSE-POWER.

Power-Factor.—The ratio of the WATTS to the VOLT-AMPERES.

Practical Units.—Some of the UNITS of the centimetre-gramme-second or C.G.S. system are inconveniently large or small for practical purposes; and, therefore, certain PRACTICAL UNITS have been chosen, which are made some decimal multiple or sub-multiple of the corresponding units. Thus, the Ampere is one-tenth, and the Volt is 100 million times the c.g.s. unit (electromagnetic) of current, and the c.g.s. unit of Electromotive Force respectively.

Pressure. Often used as a synonym for Voltage, Electromotive Force, Difference of Potential.

Primary.—(*a*) Cell or Battery. See Cell in contradistinction to a Secondary Battery or an Accumulator.

(*b*) Of a Transformer. That winding of a Transformer to which electrical energy is supplied.

Pull-Off.—See Ear.

Pulsating Current or Pulsatory Current.—A uni-directional current which varies in some periodic or quasi-periodic manner.

Pyro-Electric Effect.—The Electrostatic Charge produced by heating a body (particularly the substance tourmaline).

Pyrometer.—An instrument for measuring temperatures higher than those measurable by an ordinary thermometer.

Quadrant Electrometer.—A measuring instrument consisting of a moving vane or Needle placed within or near four quadrants, the electrostatic forces between the fixed quadrants and the moving Needle producing the deflection.

Quadruplex Telegraphy.—The method in telegraphy in which four messages are sent simultaneously two in each direction.

Quantity.—(*a*) Of electricity. The product of current into time. Units, Coulomb and Ampere-hour.

(*b*) Obsolete term for the strength of a current as distinguished from the Intensity of the battery which furnishes the current.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Armearth" System of Cable Protection.

The General Electric Co., of 67, Queen Victoria Street, E.C., has recently introduced the "Armearth" system of cable protection, consisting of 12-ft. lengths of rolled grooved steel conduit, so designed that when the halves are bolted together they completely enclose the cable. Each length is half overlapped on to the opposite half, to which it is bolted, thus giving a large area of contact, and ensuring electrical continuity and mechanical strength; also the ends overlap 1½ in. The bolts are of special type, with eyes and square nuts, and can be tightened up without special tools; the eyes provide for suspending the conduit, which must be hung on edge. The conduit can be bent round large radius curves without trouble, and standard short bends can also be supplied. The "Armearth" system is particularly recommended for mines, as two men can easily erect it, and unarmoured cable can be used with it, saving about 25 per cent. on the cost of armoured cables.

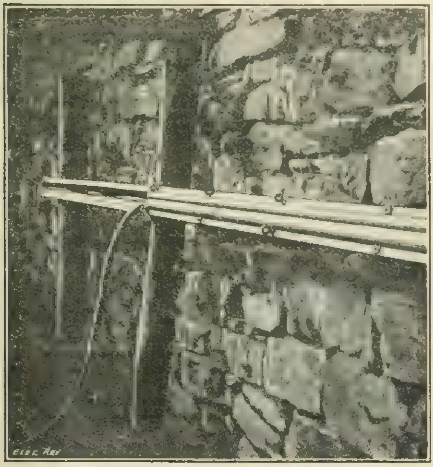


Fig. 1.—"Armearth" Cable Protection in a Mine.

Unarmoured cable is much easier and lighter to handle in the mine, where weight and size are limiting factors in the material used, and the "Armearth" protection is specially adapted for bringing existing unarmoured cable installations into line with the Revised Home Office Rules.

Sternol Oil Testing Machine.

The patents for a machine for testing oil have been acquired by the Stern, Sonneborn Oil Co., Ltd., of Royal London House, Finsbury Square, E.C., where they are willing to demonstrate its operation to readers. The machine is intended to reproduce the conditions obtaining in practice, as regards both pressure and temperature, and records the results on a chart. Provision is made for admitting high-pressure steam, saturated or superheated, up to a temperature of 850° F., into the chamber in which the oil is tested, so that cylinder oils can be tested under working conditions. The use of curved bearing surfaces has been abandoned in this instrument, on account of the difficulty in maintaining the conditions uniform, and instead the oil is tested between flat disks, which can be so shaped as to represent various types of bearing, and can be revolved at any desired speed, equivalent to relative speeds ranging from 5 to 25 ft. per second, while the pressure forcing them together can be varied from 1 to 750 lb. per sq. in.

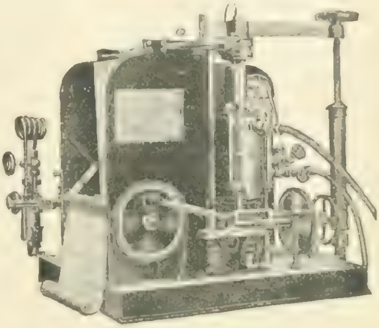


Fig. 2.—Sternol Patent Oil-Testing Machine.

The illustration, fig. 2, shows the complete machine from the front. It is stated that the experimental results obtained are not merely comparative, but absolute, and show with precision the merits of each sample, besides indicating the purpose for which it is most suitable.

"Wirum" Lamps.

In the new catalogue of the Brimsdown Lamp Works, Ltd., referred to last week, there is illustrated the "Wirum" 100-watt lamp, fitted with Canadian screw cap. This lamp is made specially for export purposes, and we illustrate it in fig. 3. In the same list the company gives full particulars respecting its special carton for lessening the probability of breakage of filaments in transit. The carton has no lid to be torn off, it has a gripping device at both ends, and there are two elliptical openings, one on either side, opposite each other, so that the filaments can be examined without removing the lamp.

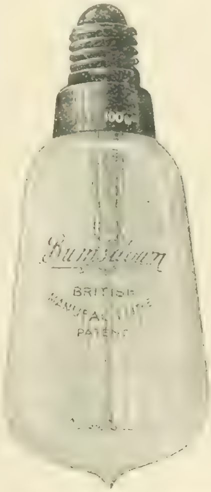


Fig. 3.—"Wirum" Lamp with Screw Cap.

A Submarine Lifting Magnet.

An interesting test has been carried out at the wharf of Messrs. Geo. Cohen & Sons, Regent's Canal Dock, where it was recently decided to recover from the dock alongside the wharf a large quantity of scrap-iron which had fallen in while loading and unloading barges.

Dredgers and divers had been unable to get this material up from the mud, but the difficulty was overcome by installing—on the advice of Mr. F. H. Preece, engineer, of 49, Queen Victoria Street, E.C.—a lifting magnet on a barge crane, as shown in the accompanying view, fig. 4, which has proved successful in lifting several tons of material per hour from a depth of 16 ft. of water. The magnet is of the Kramer type, supplied by the Witton-Kramer Electric Hoist Co., of Witton.

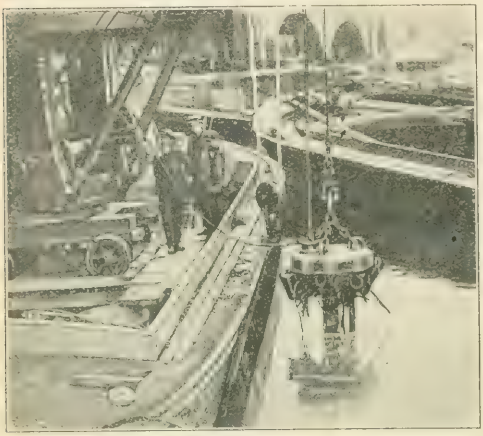


Fig. 4. Kramer Magnet Recovering Submerged Scrap Iron.

The "Klipton" Lamp.

A handy little device (for which patents are pending) is the "Klipton" electric lamp, which Messrs. Rose Bros., of 38, Beech Street, Barbican, E.C., are supplying.

It consists of a small dry battery, which can be placed in any convenient spot, and a length of flexible leading to a small lamp bracket carrying a metal lamp. The lamp bracket, however, is attached to an ordinary spring clip, which can be sprung on to the top or bottom of a book, on to any ledge or bar, near to the place where light is required. It should prove invaluable as an emergency light, which can be clipped to some near-by object, and leaves the user both hands free.

Safety Locks for Automatic Lifts.

Messrs. Smith, Major & Stevens, Ltd., of Abbey Works, Northampton, have introduced a safety lock for lifts, which is claimed to overcome the defects of previous so-called locks of this type, operating with the closing of the gate.

In the new patent lock the gate must first be completely closed, and till that is done nothing more can be effected. Next follows the latching of the gate, which must be completed before current can be given to the machine. Finally, current is given.

On opening the door, current is first cut off; then only can the gate be unlatched and finally opened. The device has also been further strengthened against wilful interference.

WIRELESS TELEGRAPHY AND SEARCHLIGHTS FOR ENSURING SAFETY AT SEA.

The report of the Merchant Shipping Advisory Committee on regulations for ensuring safety of life at sea has been published this week. It contains the following references to matters of interest to our readers:—

"The question of the installation of wireless telegraphic apparatus in merchant vessels has been considered by the Sub-Committee we appointed to deal with this question. Their report is as follows:—

"Having regard to its proved value, we are of opinion, that the time has now come when the State may reasonably prescribe the class or classes of vessels on which a wireless installation shall be compulsory, and the conditions which are to govern its use.

"Before proceeding to set out our recommendations, we think it desirable to review, briefly, the present position from the standpoint of the British shopowner who is prepared, without compulsion, to provide his vessels with radio-telegraphic installations. After passing under consideration the various types of installation which are at present in the market, we have been brought face to face with the fact that practically all British merchant vessels at present fitted with wireless telegraphy use installations under the control of Marconi's Wireless Telegraph Co. A few, but, so far as we can learn, not more than 20, British vessels have been supplied with installations by the Helsby Wireless Telegraph Co., or by Messrs. Siemens Bros., who are the agents for the Telefunken system in this country. On foreign vessels other systems—in particular the Telefunken system—appear to be largely used.

"In order to arrive at an opinion as to the present commercial position, we have taken evidence from Mr. Godfrey Isaacs, the managing director of the Marconi Co., Mr. F. Hird, representing Messrs. Siemens Bros., Lieut.-Col. J. Bernard, chairman of the Helsby Wireless Telegraph Co., and Mr. F. J. Chambers, chief engineer of the same company.

"The evidence makes it clear that the Marconi Co., relying mainly on their Patent No. 7,777, of 1900, and on the extended Lodge Patent No. 11,575, of 1897 (the rights of which they have acquired) claim what amounts to a monopoly in this country.

"This claim is disputed by Messrs. Siemens Bros., and by the Helsby Co., but both of those companies are desirous of obtaining from the Marconi Co. a licence to use the Lodge patent. The Marconi Co. are bound, under the extension of the Lodge patent, 'to grant licences to all who desire to make use of the protected invention, on such terms as a duly qualified arbitrator, to be nominated by the Board of Trade, shall think fair and reasonable'; and on the application of the Helsby Co. the terms upon which such a licence is to be granted are at present the subject of arbitration. But whatever may be the result of these proceedings, the Marconi Co. contend that the Lodge patent cannot be worked effectively without an infringement of their patent No. 7,777.

"The Marconi Co. who have been successful in such patent actions as have been concluded in this country, have, we understand, instituted legal proceedings to prevent the use of the Telefunken system, and in at least one of the actions they have joined as defendants the shipowners who have installed that system. On the other hand, we understand that Messrs. Siemens Brothers have instituted legal proceedings against the Marconi Co. in which they challenge the validity of the patent No. 7,777. We can express no opinion on the matters in dispute, but we have arrived at the conclusion that any British shipowner dealing with the Marconi Co.'s competitors will do so at the risk of costly litigation, and, further, that, as matters stand at present, any effective competition with the Marconi Co. in the supply of installations may be impracticable.

"In considering the present commercial position it must be further borne in mind that so long as the rival patents are held in only a few hands, there is risk of the competitors amalgamating or of pooling their commercial interests so as to obtain, on joint account, the best possible price for all their installations. This risk is emphasised by the fact that whilst the Telefunken system is at war with the Marconi system in this country, they are apparently working as an amalgamated company in Germany.

"It would, in our opinion, be impossible to require, by law, merchant vessels to be fitted with wireless telegraphic apparatus if thereby shipowners were delivered into the hands of a monopoly which could impose such terms as it pleased without stay or hindrance.

"Before Parliament can apply compulsion to any class of ship, it must therefore, in our opinion, first establish the conditions of a free market in the installations, or otherwise ensure their supply to merchant vessels at a reasonable commercial cost and under reasonable commercial conditions. This is a point to which we attach great importance, and the recommendations we are about to make are subject to such an arrangement being arrived at.

"We would, in relation to the questions we have been discussing, again emphasise the point that we have looked at the question of the installation of wireless telegraphy on merchant ships solely from the point of view of saving life.

"This is the only point of view which is relevant to our inquiry and, in our opinion, it is the only consideration which should govern legislative enactments on this subject. Shipowners themselves should be left to deal with the question of the installation of wireless telegraphy for commercial purposes, or for the convenience of passengers; and we fully recognise that in regard to installations for such purposes the wireless telegraphic companies are entitled to obtain from the shipowner the best terms their command of the market will secure to them.

"For the purpose of considering what compulsory requirements should be imposed, we have divided the merchant vessels into three classes:—

"1. Foreign-going vessels carrying passengers.

"2. Home trade vessels carrying passengers.

"3. Vessels not carrying passengers.

"In vessels of the first class, with many people on board, the installation of wireless telegraphy is, in our opinion, a necessity, and we therefore recommend that all foreign-going vessels, British and foreign, carrying passengers from or to the United Kingdom, and having on board 50 persons or more, including both passengers and crew, shall be required to be equipped with radio-telegraphic apparatus.

"With regard to vessels of the second class, another Sub-Committee is considering what requirements may properly be imposed on home trade vessels carrying passengers, and we feel that the Merchant Shipping Advisory Committee will wish to take into account the report of that Sub-Committee before deciding on the advice to be tendered to the Board of Trade as to the installation of wireless telegraphy on such vessels. We accordingly make no recommendation as to these vessels, subject to what is said below as regards the range of the apparatus and the number of operators to be carried on such of these vessels as shall be required to carry the installations.

"The position of the vessels in the third class which do not carry passengers requires careful consideration.

"Having regard to considerations (stated in the report), we are of opinion that if Parliament, in the interests of the community, compels any of the cargo vessels to carry wireless installations, the owners of such vessels should be reimbursed out of public funds for any expenditure imposed on them by complying with such compulsory requirements.

"If the community are not prepared to bear this expense, then in our opinion compulsion cannot be justly applied to this third class of vessel.

"As regards the range of the installations to be provided, we are of opinion that in the foreign trade an installation capable of a normal range by day of 100 miles oversea will be effective for life-saving purposes.

"The minimum range necessary for the home trade passenger vessels depends very largely upon the locality in which the vessel is trading. We understand that the Post Office have arranged, or are arranging, their stations round the coast of the United Kingdom on the principle that any ship off the coast will be in touch with one of the coast stations if she is fitted with wireless apparatus having a range of 100 miles. In the case of many home trade passenger vessels, which are always by the nature of their trade within easy reach of a coast station, a range of considerably less than 100 miles will be sufficient, and after careful consideration we recommend that home trade passenger vessels, to which wireless telegraphy may be compulsorily applied, should be required to be fitted with an apparatus having a range which is deemed by the Board of Trade to be sufficient having regard to the coast stations available, and the nature of the trade in which the vessel is engaged.

"In our opinion, the space occupied by the installations should not be added in calculating the tonnage for any purpose.

"We are further of opinion that in the case of all vessels compulsorily fitted with wireless telegraphy, the regular installation should be supplemented by some form of energy-transmitting apparatus employing accumulators or dry cells, or some other effective supplementary motive power, and capable of working for not less than four hours after the current supplied by the ship's engines has failed.

"Any compulsory provisions for the installation of wireless apparatus should, in our opinion, be preceded by a comprehensive review by the Post Office of their present system of receiving stations with a view of establishing such stations at every point, whether on the coast or on lightships or in lighthouses, at which they can be most effectively used for the preservation of life at sea. We have been informed that it is the intention of the War Office to abandon the military wireless stations in the Channel Islands, and that the Post Office do not see their way to open a wireless station in the Islands for ship and shore work unless they are guaranteed by the lines whose vessels trade in those waters a certain income. If the carrying of the installations on the passenger ships is to be made compulsory, the policy upon which such a demand was based must be entirely abandoned. The necessary receiving stations must be maintained as a national duty, and without regard to questions of commercial returns.

"At the present time the land stations are instructed, in the event of receiving messages of distress, to communicate at once with the coastguard and lifeboat stations nearest to the place of disaster, and with Lloyd's and the Underwriters' Associations at Liverpool and Glasgow, and, further, to use every other possible method of securing that prompt assistance is rendered to the distressed vessel.

"In order that the time expended in communicating the distress messages received may be reduced to a minimum, we recommend that every possible effort be made to establish, so far as is consistent with efficiency, the land stations at points in immediate touch with the ports from which the most effective assistance can be sent.

"We further hope that all possible steps will be taken to improve the system of land wireless stations in other parts of the world, with special reference to the desirability of providing means for a vessel in distress to communicate with the shore.

"It is in our opinion absolutely essential, in the interests of safety, that there shall be unimpeded intercommunication between ship and ship without regard to the particular system of radio-telegraphy adopted by the two vessels. We understand that, as a matter of fact, a distress message is always accepted, whatever may be the system by which it is transmitted, but the right of free intercommunication in regard to ice, derelicts, and other dangers is so important that we think that it should be placed beyond all doubt, and we hope that the Government will now see their way to adhere to the additional undertaking appended to the International Radio-telegraphic Convention of November, 1906.

"There remains the question of the efficient working of the installations.

"The period during which the installation should be in operation is a matter to which we have given very careful consideration, and we are of opinion that to make wireless telegraphy of the greatest possible use for saving life at sea, arrangements must be made to ensure that no signal of distress or danger within the range of the instrument will be missed.

"We have made inquiry whether it would be possible to dispense with constant attendance at the installation by means of some system of call by signal or bell. Although automatic devices of this kind have been invented, none of them have up to the present time been found reliable in practice, and, pending the introduction of a satisfactory device, we consider it essential that a permanent watch on the installation should be kept.

"We recommend that all foreign-going vessels compelled to be equipped with wireless apparatus should be required to carry one fully qualified operator, and in addition such assistants as will enable a constant watch to be maintained during the absence of the operator. Such assistants must possess sufficient experience to be able to recognise at once a distress or danger signal, but they need not be qualified either to receive or to send messages.

"From the life-saving point of view it is clearly not necessary for any vessel to keep open, throughout the 24 hours, a telegraph office for the receipt of either commercial or private messages, and, therefore, whilst the skilled operator is off duty it would be quite reasonable for the assistant on watch to ignore all but distress or danger calls.

"The qualifications required from a skilled operator are already definitely laid down by the International Regulations.

"In the case of the assistants, we are informed that no great amount of skill is necessary. Their sole duty will be to listen for a distress or danger signal, and, in the event of such a signal being received, to summon the operator to the installation. We are advised that the training required in order to secure the efficient performance of this duty is not considerable, and that it would not be beyond the capacity of any reasonably intelligent member of the ship's company. In this connection it has been suggested, and we think the suggestion a good one, that training ships and schools for the Mercantile Marine should be encouraged to give a preliminary training in wireless telegraphy to the boys under their charge, so as to fit them to discharge the duties of an assistant to the skilled operator.

"In the case of home trade passenger vessels, we do not think that assistants will be necessary.

"Finally, it should, in our opinion, be impressed upon all concerned that the operator should be under the captain's control, and that every message transmitted and received by the operator (other than private messages to or from passengers sent whilst the installation is being worked under the captain's orders for the sending of such messages) should be transmitted and received under the control of the captain."

The extent to which wireless telegraphy should be compulsorily fitted in home trade passenger vessels is dealt with by the Home Trade Passenger Vessels Sub-Committee, and the recommendations made by the majority of that Sub-Committee on this question have been adopted by the General Committee, as under :—

"4. *Wireless Telegraphy and Submarine Signalling.*

"Among those most competent to judge and who have had actual experience of its working, there is a strong belief in the usefulness of wireless telegraphy as a means of life-saving. Several owners engaged in the cross-channel trade have already adopted wireless telegraphy and its use is gradually being extended to other companies. Its general adoption, however, is hindered by the present want of suitable shore stations and by the cost of the apparatus. There is practically no revenue from passengers' messages to set against the outlay, and the installation must be regarded as exclusively for life-saving purposes. Another matter which militates against the extension of the system is that, under present regulations, the wireless cabin is added to the net measurement of the ship, on which port dues have to be paid. As these vessels when on service incur dues in two ports, at least, every 24 hours, this means a considerable extra tax for carrying a wireless installation. Submarine signalling apparatus seems, so far as the Sub-Committee can discover, to be used only by one or two fleets. It is will spoken of by those using it, but is still largely in the experimental stage."

In regard to searchlights, the Committee say that they have considered the question of the provision and use of these in large passenger vessels, and, in arriving at their conclusions, they have had the assistance of information supplied by the Admiralty.

"It is possible that a searchlight would be of value in certain circumstances—for instance, in picking up an unlighted buoy, rock, land, iceberg or icefield, in passing through a canal, or for salvage purposes.

"On the other hand, the use of searchlights would be attended by many disadvantages, such as the following :—

"1. Dazzling the observers on board the ship making use of the lights, especially if the lights are badly placed.

"2. General danger to navigation owing to the blinding effect on those on board other vessels and to the possibility of the navigation lights of the vessel exhibiting the searchlight being obscured.

"3. Temptation to make land, buoys, &c., by placing too much reliance on picking up the marks by means of the searchlight.

"4. False security when in the vicinity of ice or other dangers.

"5. The danger of searchlights being mistaken for powerful electric lights from lighthouses, especially in thick or hazy weather, and of searchlights having the effect of screening shore lights from passing vessels.

"The disadvantages of searchlights seem to us so greatly to outweigh their advantages that their adoption in the mercantile marine would, in our opinion, be most inadvisable."

A reservation by Mr. Trevisa Clarke is appended to the report. He mentions, among other things, that "improved means for lifting and lowering a full complement of boats (the majority being in protected positions) by means of electric cranes placed inboard and by a single wire fall and bridle, the cranes being actuated by a special electric generating plant with independent internal combustion engines, situated at the highest available point above the water line (this plant would also be available for lighting and wireless telegraphy), are fully illustrated in plans and explanatory statements," which he sent to the secretary.

The plans, &c., illustrating this proposal are to be placed before the Special Committee.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Re Contracts in India.

I wrote with reference to the above subject in 1910, and you were good enough to publish my letter in your issue of April 22nd of that year. More than two years have elapsed since then, but the method of placing contracts by the Electrical Department of the Government of Bombay has gone from bad to worse, and as one instance of many, I will cite the contract for the illumination of Bombay in honour of His Majesty the King's visit. This contract was placed without any tenders whatever being called for, and the value of this alone was Rs.1,20,000 (£8,000), while inquiries as "Please let us have your lowest quotation for three metal-filament lamps, one batten holder and one flat-type switch," the total cost of which amounts to only a few rupees (more than the value of which is spent in stationery and postage), are sent round to all firms. Why this should be done when, in contracts amounting to lakhs of rupees, no tenders are called for, and the contracts are simply placed with any firm the Department chooses to select, without, apparently, any reference being made to Government, is surely strange. All have to pay heavy taxes and have the right to make a bid, and tenders should be called for through the medium of the public Press, and the results published, as is done by other Government Departments, municipalities and Native States.

As this matter concerns the electrical department only, I think it is one the Institution of Electrical Engineers, as a body, should take up and inquire into closely, as I feel certain the Civils and Mechanicals would never permit such a scandal to continue to the detriment of their professional dignity.

Thanking you in anticipation of your giving this question the greatest publicity.

One Interested.

Bombay, *August 3rd*, 1912.

A year or two ago a letter appeared in your journal drawing attention to the method adopted of giving out electrical contracts of the Bombay Government; since then matters have become worse, and now all electrical works for the Bombay Government are given to one firm in Bombay without tenders being invited from other well-known electrical firms. As this is not only unfair to the public paying Government taxes, but is liable to lead to corrupt practices, I would ask the assistance of your paper in the matter.

You may make such use of this letter as you think fit.

N. M. Marshall.

Bombay, *August 3rd*, 1912.

The Propulsion of Ships.

Referring to the leading article on the "Propulsion of Ships" in your last issue, I would beg to point out that among the advantages of the electro-mechanical system are the following:—

1. The prime motive power can be distributed in three, four, or—if need be—a dozen parts of the vessel; consequently, better and more convenient disposition of weight than in a steam-propelled vessel can be obtained; and in the case of warships vulnerability is reduced.

2. Avoidance of large and untried sizes of internal combustion engines, with no loss of fuel economy. Up to 500 or even 1,000 H.P. these engines are reliable; above 2,000 H.P. they do not at present inspire the sense of reliability essential in a warship.

3. No complication in coupling engines to screws.

4. Handling of propelling power, including reversing and alteration of speed, can be under immediate control of bridge, almost as simply as a tramcar is controlled by the motorman.

I called the Admiralty's attention to the foregoing two years ago, and was informed that these advantages were well known to it, so let us hope they will soon be materialised.

Francis K. Cassels.

Eastbourne, *August 19th*, 1912.

HOUSE LIGHTING BY STORAGE BATTERIES.

By H. R. TAUNTON.

Some little time ago there appeared a note in the technical Press anent an experiment in house lighting by means of portable storage batteries in the "West Side Home of a Chicago Citizen." Two 6-volt batteries were in use, each of 60 ampere-hour capacity. One supplied current, we were told, for 14 6-volt metal lamps of from 2 to 10 C.P. Assuming an average of 6 C.P. each, and that, taking one hour with another, half this brilliant illumination would be alight during lighting hours, it is clear that the battery would need recharging at the end of about 8½ hours' use—a long winter's night. Moreover, this remarkable battery was called upon to work a gas lighter, and "burglar alarms, call bells, electric fans and electric cigar-lighters"! To calculate how long the "juice" would last while running a 12-in. fan, lighting cigars, and alarming burglars with a blaze of 2-C.P. lamps, were too far beyond the decimal point for any but a Yankee electrician. He, nothing daunted by the technical difficulties of the problem, gives the answer as a month. "One or other of the batteries is recharged once a fortnight at a cost of 15 cents." It sounds cheap until one works it out at something like 1s. 9d. per unit consumed. Over here we would think that rather expensive; but then a unit evidently doesn't hustle so far in England as it does in Chicago!

The other battery had a no less strenuous existence. It worked a vacuum cleaner, a sewing machine, a massage vibrator, and a table fountain—all at 7½d. a month. We are not told what happens while the battery is round at the station being recharged. Presumably they have to miss massaging or the table fountain, or, perhaps, they switch on to the other battery. But that would be sheer cruelty—unless, maybe, they cut out the 2-C.P. electrolier in the banqueting hall.

There are certain conflicting improbabilities in the report as it reached us, which makes it suspect. The best way to look at it is as an intelligent and stimulating anticipation of possible developments in the near future. Three factors only are necessary in order to make such a scheme of lighting practical: lamps of high efficiency, low charging rates, and accumulators with a high ratio of capacity to weight. The first we have: the 1 watt per candle of a 25-volt metal lamp is good enough for the present purpose. As for the second, most undertakings could well afford to charge batteries as a day load at three farthings, or a penny a unit. Take, for instance, a small provincial station, with a large number of small private residences within a 5-mile radius—too far and too scattered to make it worth while to run mains to them. These might want anything from 20 to 50 lights—full-blooded 16's and 25's, not 2 C.P.'s, such as satisfy the Chicago "West Sider." They would not think of undertaking the expense and trouble of putting down and running their own plant, so perforce they have to be content with oil or candles. But if they could hire accumulators of 120 to 500 ampere-hour capacity, and have them periodically recharged, they would not grudge even the statutory maximum of 8d. a unit, including hire of battery; a figure which would allow a margin of at least 7d. a unit for interest, depreciation and working expenses. Alternatively, of course, and perhaps preferably, an annual charge could be made for battery hire, additional to the flat rate per unit.

The third factor—a suitable battery—appears at first sight unattainable. The ordinary lead accumulator is too heavy and too messy to be easily handled. Assuming a minimum practical voltage of 25, 14 cells would be required. Open glass boxes would be out of the question, and lead-lined wood boxes of the smallest capacity mentioned above—120 ampere-hours—would weigh something like 60 lb. per cell, or 7½ cwt. for the complete battery, which would occupy about 8 cb. ft. of space. To transport such a mass to and from the station at short intervals would hardly be a practical proposition; and it would be out of the question where a battery of, say, 300 ampere-hours was concerned.

We are not, however, limited to the ordinary type of accumulator, which, as in the example above cited, has only a capacity of from 4 to 6 watt-hours per lb. in the small sizes under consideration. There are cells on the market which will give up to 15 watt-hours per lb. at best, and can give, say, 10 watt-hours per lb. without difficulty. Such cells have been brought to a high state of efficiency in connection with ignition and motor-car lighting. The Edison cell, too, is sufficiently a commercial fact to be worth consideration, and its ratio of capacity to weight is, if anything, higher than that of the best lead cells. The high-efficiency lead cell, however, will do all that we now require of it, and although its life is necessarily short, its low first cost gives it an advantage as compared with the present high price of the Edison cell.

We can then count on the use of a lightly-built lead cell giving 10 watt-hours per pound. Let us take a typical case: a small country house, five miles from a provincial town, and installed with, say, 20 25-watt, 25-volt lamps. In practice, it would only be very occasionally that more than a third of these would be alight at once, and the average proportion in use continuously would be considerably less. It would be safe to calculate that during the eight-hour evenings of midwinter 800 watt-hours would be the maximum consumption. A battery then of about 3,000 watt-hours capacity would require recharging twice a week in winter, and about twice a month in summer.

This, at 25 volts, would mean a battery of 14 cells of 120 ampere-hours' capacity, weighing little more than 2½ cwt. High efficiency batteries are usually mounted in celluloid. or ebonite boxes, and are sealed. There would consequently be no splashing of acid. They are considerably smaller than the ordinary type, and this particular battery, mounted and connected up in a light teak crate, would not occupy more than about 1¼ cb. ft.

It would certainly not be a difficult matter to transport such a battery. It might, for instance, be mounted on a small trolley, well sprung and running on rubber-tired castor wheels, like a porter's truck. It could thus be hauled by one man to and from the station, or several could be attached as trailers to a horse or motor-vehicle, which would be necessary, in any case, for the larger sizes.

Whatever means of transport were adopted, each battery would have its own wheeled trolley, on which it would permanently remain. On the trolley, too, might be fixed a suitable switchboard. This need not comprise more than an ammeter, voltmeter, a pair of tubular cut-outs, and a four-way battery switch—one side only, which would be used for charging at the station and discharging at the house. A pair of flexible leads would complete the outfit.

On arrival at the house, the battery on its trolley would be wheeled into any convenient out-house, shed or lean-to, where the company's meter and cut-outs would be fixed, with a pair of terminals to which the flexible leads could be readily connected. The same man or vehicle that brought the battery would, of course, remove the discharged battery, which would be taken back to the station.

It would obviously be needful to have two batteries to each installation, to ensure continuity of service. If there were a number of installations having the same size battery, a less proportion would suffice, so long as there were always sufficient fully-charged batteries at the station to meet the possible demand.

A difficulty, of course, would be to ensure that a charged battery would be requisitioned at least a day before the one in use was fully discharged, otherwise the life of the batteries, short as it is, would be considerably reduced. The difficulty is not insuperable. An obvious basis for some precautionary regulation or device is the fact that the last stop of the battery switch would not be needed until the battery was near the end of its tether.

From the practical standpoint, then, such a scheme is at least feasible. The only question is, would it pay? Take as a test case the example cited above: a house requiring a 120-ampere-hour battery.

Depreciation at 20 per cent. per annum on two batteries (the maximum proportion) costing, say, £14 each	£5	12	0
Depreciation at 5 per cent. per annum on trolleys and switchboards, costing say, £7 10s. each .	0	15	0
Interest at 5 per cent. per annum, on, say, £43 ...	2	3	0
Labourer's time transporting battery to and from station—average, say, two hours a week or a total of 104 hours at 8d.	3	9	4
Charging cost, 750 units, at, say, ¾d.	2	6	10
	£14	6	2
Consumer pays for, say, 500 units at 8d.	£16	13	4

This shows a profit of about ¾d. a unit, after allowing for a fair interest on the capital outlay. The profit on larger sizes would be approximately *pro rata*, and where there were a number of batteries in use it would be greater.

Of course, 8d. a unit is a heavy price to pay, and a small country house might be able to get the light cheaper by installing, for instance, a small petrol-electric plant. But the present scheme is suggested for the thousands who are unable or unwilling to face the necessary initial outlay of putting down an independent plant, yet would cheerfully meet a fairly heavy annual outlay, if thereby they could discard their ancestral candlesticks in favour of the luxury of electric light.

If the figures quoted will stand the test of experience, there is no reason why a scheme on these lines should not be initiated by provincial supply companies for the benefit of householders beyond the limits of their mains, to the improvement of their stagnant day loads. There is no need to await the advent of the ideal cell. Naturally, however, every improvement in the capacity and cheapness of accumulators will simplify the problem. The day may yet come when the "juice-man" will hang the daily battery on the garden gate beside the matutinal milkcan.

ARTIFICIAL GRAPHITE AND ELECTROLYTIC PROCESSES.

By FRANCIS H. DAVIES, A.M.I.E.E.

In the Electrical Review of July 15th, 1910, the writer gave some particulars of the manner in which artificial graphite is produced in the electric furnace at the works of the International Acheson Graphite Co., of Niagara. Without going into the details of the process, it may be mentioned here that anthracite coal containing a fairly high percentage of ash is the raw material. This is treated in large electric resistance furnaces of 2,000-kw. capacity at a temperature of approximately 7,000° F., and the graphite thus formed is then ground and variously treated to suit it for the numerous useful purposes it fulfills. As was mentioned in the previous article, a large proportion of the output is used for lubricating purposes, paint making, dry battery filling, &c., but there is another important and growing sphere for artificial graphite in the manufacture of electrodes and other articles used in electrolytic processes. For many purposes graphite electrodes of this class have been found superior to crude retort and manufactured amorphous carbons. In the manufacture of chlorine and caustic alkilies, the chlorination of gold ores, the electrolytic decomposition of chloride solutions and the recovery of nickel, zinc, &c., graphite anodes have been found to possess a life of from two to four times that of crude retort carbons and from four to seven times that of amorphous carbons made from mixtures of pitch, powdered coke, lampblack, &c. In other processes, such as the deposition of metals from sulphate solutions, the oxidation of chromic acid solutions and the manufacture of chlorates, in all of which the anode is exposed to greater oxidising action, the difference in the longevity of graphite and amorphous carbon is not so great, but it is still very appreciable and in favour of the former.

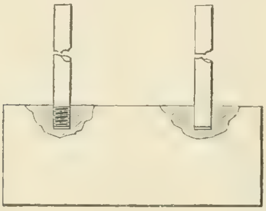


Fig. 1.—Slab Electrode with Graphite Leading-in Rods.

An objection to the use of graphite electrodes in certain industries lies in the colouring of the solution. Owing to this effect, they are not employed in connection with gold or silver electro-plating in cyanide solutions where it is necessary that the plated surface should be clearly visible during the operation. This difficulty, however, does not arise in the ordinary course of electrolytic processes, and the sphere for graphite electrodes is, therefore, a large one, as in many respects they possess undoubted advantages.

An important feature of the artificial graphite electrode which makes for economy in several directions is the ease with which this substance may be worked and machined. In consequence, it is possible to effect considerable saving, not only in actual materials, but by a convenience of arrangement which is not feasible with electrodes of a type that do not possess this quality. A class of electrode which exemplifies one of the principal advantages claimed for the graphite article is shown in fig. 1. Electrical connection with the electrode or slab is made by means of any desired number of graphite leading-in rods which may be either screwed or driven in as shown. The first method is rendered possible by the ease with which artificial graphite takes a thread, differing greatly in this respect from amorphous carbon. Where the rod is driven in it is given a slight taper and made to fit tightly. There is a particular advantage in this arrangement in the case of electrolytic cells from which it is desired to collect gases, and which must, therefore, be kept effectively sealed. Connection can conveniently only be made to the ordinary slab anode by casting around it a head of suitable non-corroding metal, or, as an alternative, by allowing the end of the slab to project through the cover of the cell. Common to both these methods is the disadvantage that the electrode area above the surface of the electrolyte is wasted, and in the latter case there is also the difficulty of making the joint gas-tight. The cast lug is comparatively expensive, and it is furthermore apt to develop a faulty state of contact owing to the effect of corrosion at the joint. In an electrode of the type shown in fig. 1, the maximum use per unit of surface is made of the slab, and when it is worn out the leading-in rods may be used over again. There is no difficulty in making a gas-tight joint round circular rods of small diameter, and no deterioration of contact; thus, none of the objections to the simple slab electrode are present. With the ordinary electric furnace electrode, there is considerable waste owing to the difficulty of using up the stubs. This source of loss, however, does not exist where the artificial graphite electrode is in use, as owing to the ease and cheapness with which it may be machined, short pieces can be jointed in the manner shown in fig. 2. The stub having been used up as near as possible to the metal holder, the latter is taken off, the stub screwed into the tapped end of a new electrode (the shoulders being faced to make a tight fit), and the metal holder affixed to the latter as shown. It is preferred to use a tapered thread, as this is found to be the strongest form with graphite. The brass collar which actually grips the thread, is also tapered externally, and to this the clamp or holder is attached. By a modification of the above method, continuous feeding and joining up of the electrodes can be arranged for, thus obviating the necessity for shutting down the furnace for renewal. It is found that an 8-in. diameter electrode of this type will carry over 5,000 amperes without heating at the joints, and in the case of 6-in. electrodes, 4,500 amperes and even higher currents give no trouble in this respect. This point is of material importance as it is generally assumed that a 6-in. amorphous carbon electrode should not be loaded to a greater extent than 1,500 amperes. Turning to the question of cost: according to the makers the inclusive cost of machining both ends of a 6-in. electrode is about 50 cents, and in the case of an 8-in. electrode 60 cents. These figures cover labour, cost of tool steel, and repairs.

In machining, about 3 in. of the length is lost, and the value of this is put at 59 cents. for a 6-in. and 97 cents for an 8-in. electrode. The total cost for a joint under American conditions is, therefore, \$1.09 and \$1.57 for the 6 in. and 8-in. sizes, representing 11·5 per cent. and 10 per cent. respectively of the cost of the electrodes themselves in 48-in. lengths. Owing to its higher conductivity the weight of an artificial graphite electrode suitable for any given current is rather less than half that of the amorphous carbon article, but as its price is higher the net result is an approximately equal cost. It is claimed, however, for the graphite electrode that it possesses a much longer life, and there is in addition the possibility of effecting appreciable economy by utilising the short ends.

An interesting example of the use of artificial graphite electrodes is that of the well-known Acker process in which a fused electrolyte and a fused lead cathode are used in the production of chlorine and caustic soda. The form of the graphite anode is shown in fig. 3. The lower face of the bottom block which is grooved to allow the gases to escape is the actual operative part of the electrode, and carries a working current of 2,250 amperes. There are several of these blocks side by side in each cell, and two graphite rods 5 in. in diameter are screwed into each, and act as leading-in rods from the metal cap. This latter is of cast-iron screwed on to the top of the rods and connected by brass bars which form the terminal. To protect them from oxidation the graphite rods are encased in tile pipes as shown, and the space between the latter and the cast-iron cap is made air-tight by cementing with a suitable fireclay mixture.

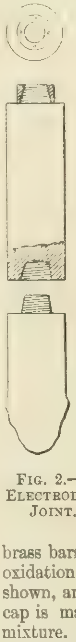


Fig. 2.—Electrode Joint.

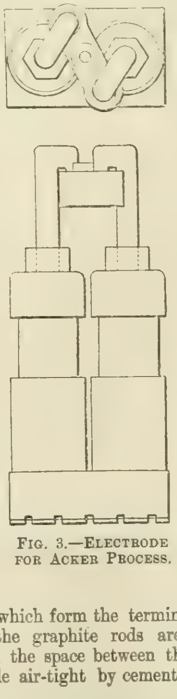


Fig. 3.—Electrode for Acker Process.

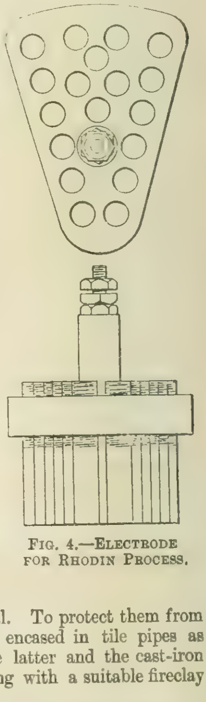


Fig. 4.—Electrode for Rhodin Process.

In the Rhodin process special graphite anodes of the form shown in fig. 4 are used. This electrode consists of a triangular graphite block, which, fitting the anode comparatively tightly, acts as a cover. A number of 1¼-in. graphite rods are screwed into the block, and by this arrangement they may be lowered as their ends become disintegrated. It is to the use of artificial graphite electrodes of high conductivity that Mr. Rhodin attributes the possibility of passing a current of 800-1,000 amperes through a cell of only 3 ft. diameter, as is done in his process. The high conductivity of artificial graphite (four times that of ordinary carbon) is an important point, but it is not the only one that tells in its favour for electrolytic work. Its adaptability, arising from the fact that it can be readily machined, is obviously a good feature, and, in addition, its high degree of purity and resistance to oxidising and disintegrating action are particularly important. It appears to be very largely used in America for electrochemical processes, and to some extent in Great Britain and Europe.

BUSINESS NOTES.

Dissolutions and Liquidations.—THE BRIDGWATER CONSTRUCTION CO., LTD., 453, Holloway Road, N., electrical, &c., engineers.—A meeting of the creditors and shareholders of this company was held last week at the Board of Trade Offices, Carey Street, Lincoln's Inn, W.C. The winding-up order was made on April 17th upon a creditor's petition, and accounts had been lodged showing unsecured debts, £983; preferential claims, £89; and loans on debenture bonds, £1,291; making a total indebtedness of £2,363. The assets are valued at £454, and the accounts, with the contributories, disclose a deficiency of £3,159. Mr. W. J. Warley, Official Receiver, reports that the company, which is stated to have been promoted by Mr. Samuel Bridgwater and Miss Florence Bridgwater, was incorporated as a private company on May 26th, 1909, with a nominal capital of £1,250, divided into shares of £1 each; its objects were to acquire and carry on the business of constructional, electrical and hydraulic engineers and ironfounders, formerly carried on by Miss Bridgwater at 453, Holloway Road, N. By an agreement dated June 15th, 1909, the company agreed to purchase from Miss Bridgwater (1) all the plant, machinery, stock, fixtures and chattels at 453, Holloway Road; (2) all existing contracts, subject to liabilities affecting the same; and (3) the goodwill of the business. The consideration, therefore, was £2,498, to be satisfied by the allotment to the vendor of 1,248 fully-paid shares of £1 each, and 25 debentures of £50 each. The shares and debentures were allotted on July 7th, 1909. Mr. Bridgwater states that the working capital was obtained from amounts received from time to time on the company's contracts and from the realisation of certain book debts taken over from the vendor. No accounts were prepared showing the results of the past trading of the vendor's business. Mr. Bridgwater states that the purchase price of £2,498 was based on a valuation made by himself, but he has been unable to produce such valuation. A list of the plant, machinery, fixtures, &c., prepared at the date of the sale amounting to £1,675, has been produced; the balance of £823 is stated to have been the value of the goodwill and lease, the whole of which has been written off. No auditors were appointed, and no accounts showing the company's position were ever prepared, but according to the deficiency account a trading profit of £5,041 had been made from the date of the company's formation to the date of the appointment of the Receiver for the debenture-holder. The company was not, however, able to meet its liabilities owing, it is stated, to its capital being locked-up in contracts in course of completion. Several judgments were obtained against the company by creditors, and in April last, owing to execution being levied on its premises, Miss Bridgwater commenced a debenture action, and on April 16th the Court appointed Mr. R. F. W. Fincham, chartered accountant, of 3, Warwick Court, Holborn, W.C., Receiver for the debenture-holder. The Receiver reports that he is now completing the contracts in hand and realising the assets, but he does not anticipate that any surplus will accrue for the benefit of the unsecured creditors. The failure of the company is attributed by Samuel Bridgwater to insufficient working capital to carry out the contracts in hand, and to pressure by creditors.

SYLVERLYTE (1909), LTD.—Creditors must send particulars of their debts, &c., to Mr. F. P. Baxter, 13, Sise Lane, E.C., the liquidator, by September 25th.

WORSLEY & PAGE, LTD.—A meeting of creditors is to be held on August 23rd (to-day) at the office of the liquidator, Mr. A. S. Brewis, 36, Spring Gardens, Manchester.

By way of correction of a notice which appeared in our last issue respecting the firm of DIGBY & BIGGS, we have to state that Mr. Arthur C. Heap was never a partner in that firm, but on the dissolution of partnership between Messrs. C. W. V. Biggs and W. Pollard Digby, Mr. Heap joined the latter, and the business will, as stated, be carried on by these two gentlemen jointly, under the style of Heap & Digby.

Meter Approved.—The B. of T. has approved of the Mordey-Fricker A.C. single-phase two-wire energy meter, A.C.E. type, deposited by the Mordey-Fricker Electricity Meter Co., Ltd.

Engineering Exhibition.—The International Engineering and Machinery Exhibition to open at Olympia on October 4th, is being organised by the Machine Tool and Engineering Association, Ltd, and it will, as far as possible, follow the idea of a large engineering workshop. Among the exhibitors will be Messrs. Vickers, Ltd., Messrs. Alfred Herbert, Ltd., and Messrs. Tangyes, Ltd.

Bankruptcy Proceedings.—JOHN WILLIAM GARSDEN (trading as J. W. Garsden & Co.), electrical engineer, 24, Preston New Road, Blackburn.—The following are creditors herein :—

Baldwin	£15	"Bankers"	£382
The Beaton Metal Co.	32	Maudsleys, Ltd.	25
The D.P. Battery Co.	26	National Gas Engine Co.	102
Edison & Swan	104	Pollard, James, Ltd	37
United Electric Co.	20	Pulvo Co.	16
Gorse, A. D.	78	Simpson, Mrs. Ann	1,183
Glover, W. T., & Co.	60	Sutton, C. A., & Co.	122
Mackintosh, C., & Co.	41	Sterling Telephone Co.	45

THOMAS PARKER, engineer, 66, Friar Stile Road, Richmond, late 44, Mortlake Road, Kew Gardens, Surrey.—The adjourned public examination of the above-named debtor was held at the Court House, Wandsworth, last week. The examination was adjourned.

W. F. FLINT, electrical engineer, Hull.—First and final dividend, 2s. 10d. in the £, payable August 26th at offices of Buckley and Hall, Union and Smith's Bank Chambers, Silver Street, Hull.

Book Notices.—"National Insurance Questions and their Answers." By Gilbert Stone, B.A., LL.B. London: Butterworth & Co. 1s. net.—The author has succeeded in making a both interesting and instructive book, which we can imagine proving of service to both employers and employés. The author has endeavoured to explain many points in regard to this very complicated piece of legislation by taking a host of hypothetical questions so framed as to make them, and the answers made thereto, of general application and use. The several divisions in Part I, each of which has a number of sections, are as follows:—(A) Insured persons; (B) Duties; (C) Contributions; (D) Benefits; (E) Special classes of persons; (F) Miscellaneous points. Part II is devoted to Unemployment Insurance.

"Electric Lighting." By W. S. Franklin. London: Macmillan and Co., Ltd. 1912. Price 10s. 6d. net.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 6. June, 1912. Chicago: The Society. Price 50 cents.

"Iron and Steel Institute" Charter, Bye-laws and List of Members." London: The Institute. 1912. Price 1s.

"*Journal* of the American Society of Mechanical Engineers." August, 1912. New York: The Society. Price 35 cents.

"*Economic Protection of India-Rubber.*" Paris: Bureau de Reseignements du Brésil a Paris, 59, rue de Richelieu. Gratis.—This is a pamphlet, of 48 pp., containing a translation into English of the law recently passed by the Brazilian Parliament on the economic protection of india-rubber and of the regulation of public administration in respect thereto. Particulars will be found herein of the advantages offered to all who interest themselves in the cultivation of india-rubber, or in kindred industries, in Brazil. At the end of the pamphlet there is a list of instruments and materials destined for use in the rubber industry, &c., that are exempted from importation duties.

New "Wotan" Lamp.—MESSRS. SIEMENS BROTHERS DYNAMO WORKS, LTD., of Dalston, are manufacturing, and have placed on the market, an entirely new grade of "Wotan" lamp, suitable for burning in series or parallel, and supplied in voltages from 90-130, and consuming only 7 watts giving 5 C.P. The great filament strength has been retained, and the filament is so thin that it is described as microscopic.

Southport Exhibition.—It is proposed to hold an Electrical Exhibition at Southport, from October 3rd to 12th, in the Cambridge Hall. We are asked to state that there are two or three spaces to let. Particulars may be had from the secretary, Mr. Albert Maund, 13, Corporation Street.

Free Trial Scheme for Electric Cooking Apparatus.—THE GENERAL ELECTRIC CO., LTD., which has been engaged in the manufacture of electric heating and cooking appliances for the past 18 years, has now made arrangements by means of which contractors and central station engineers can give their customers a seven-day free trial of G.E.C. electric kettles, breakfast cookers, toasters, water boilers and electric flat-irons. Suitable leaflets have been prepared describing the scheme and allowing space for printing the name of the actual contractor, or supply station, and special trial terms are allowed for any orders placed in connection with the free trial offer. Full particulars can be obtained on application to the company.

Trade Announcements.—Owing to increased business, MESSRS. W. H. WILLCOX & Co., Ltd., have taken a building adjoining their main warehouses, 32, 34 and 36, Southwark Street, viz., 38, and are removing there on August 27th. Their registered offices will in future be at 38.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., announce that Messrs. Downes & Davies, of 1-3, Stanley Street, Liverpool, have ceased to represent them in Lancashire and Yorkshire. Until further representation in the district has been arranged, all orders should be directed to the head office at Stafford Works, Rea Street South, Birmingham.

MESSRS. J. C. FULLER & SON, LTD., of Wick Lane, Old Ford Road, Bow, E., announce the reorganisation of their works and the laying out of new forming and assembling shops to cope with the increasing demand for their patent Block accumulators for automobile, railway and lighting service.

For Sale.—The buildings, machinery, plant and goodwill of the business of Messrs. Connolly Bros., Ltd., Blackley, Manchester, are offered for sale by tender as a going concern. See our advertisement pages in this issue.

Aluminium Prices in 1913.—It is stated that the International Aluminium Syndicate has now fixed the sale price for the opening of business for 1913 on the basis of 80 marks per cwt. (£80 per ton), with the usual extras for certain sizes and qualities. At the same time only a portion of the output for next year is to be offered for sale at first, as the opinion prevails in interested circles that the production will scarcely be able to satisfy the greatly increasing consumption. Nevertheless, it is asserted that moderation has been observed in the fixing of prices, in order not to hamper the large development taking place in the industries which work up aluminium into highly-finished articles.

Prices Advance.—Owing to the continued increase in the price of raw materials, the British Prometheus Co., Ltd., announce to the trade an increase of 10 per cent. in their trade prices from September 1st next.

Turret Clocks.—The Silent Electric Clock Co. are erecting four large turret dials for the Hovis Bread Co. on their new mills at Vauxhall Bridge. Each dial is 9 ft. 6 in. diameter.

Private Arrangements.—Nathaniel John Kethro Holder, electrical engineer, trading as Price & Co., 21, Shooter's Hill, Cowes, Isle of Wight.—A circular has been issued to the creditors herein by Mr. W. C. Black, I.A., of High Street, Newport, Isle of Wight, which states that the debtor suspended payment on the 7th inst. With the concurrence of the principal trade creditors, Mr. Black has prepared a statement of the debtor's affairs, which shows unsecured liabilities of £116, all of which are due to trade creditors. There is a deficiency of £89. It appears that the debtor started trading in November, 1911, at 16, High Street, Newport, and 21, Shooter's Hill, Cowes, in partnership with a Mr. S. H. Douglas. The latter had previously traded alone. No inventory was made of the assets taken over by the partnership. The business was continued up to May of the present year, when a dissolution took place by mutual consent. Mr. Douglas then retired, and the debtor took over the assets and agreed to discharge the liabilities. No accounts were prepared when the partnership was dissolved. Early last month the debtor sold his Newport business to a man who had previously been in his employ. The sale price of the business was £29, of which £15 15s. represented arrears of wages. The balance of the purchase price was used in paying creditors. A deed of assignment has been executed, to which creditors are asked to assent.

Manufacturing in Canada.—A company established at St. Catherine's, Ontario, with a capital of $1,000,000 (about £205,500), has been incorporated under a Dominion charter, with a view to extending its operations of manufacturing electric motors, dynamos, transformers, switches, &c., as well as to manufacture and deal in all kinds of metal.—*Board of Trade Journal.*

Catalogues and Lists.—The Fahnestock Electric Co., 129, Patchen Avenue, Brooklyn, N.Y.—Catalogue illustrating and pricing the Fahnestock spring-binding post for batteries, telegraph, signal, and other electrical work.

Messrs. Ross & Co., 62, Robertson Street, Glasgow.—Two new catalogues. One of 32 pp. gives wholesale prices of "Rosa" pocket lamps, torches, hand lamps, induction coils, and many other novelties and specialities. The other list (84 pp.) contains illustrations and prices of a variety of electric bells, telephones and accessories therefor.

The National Time Recorder Co., 5, Blackfriars Road, London, E.C.—20-page catalogue giving full particulars, with illustrations, of their time recorders and the purposes for which they are being employed in offices, works, &c.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester. —Pamphlet illustrating and describing their Whipcord braided flexible cables for mines and workshops, and showing them in use in a large ordnance factory.

The St. Helens Cable and Rubber Co., Ltd., Warrington.—30-page pamphlet, with a serviceable cover, containing a copy of the new rules concerning electricity in mines, as published in March last by the Home Office, together with the company's own condensed version of same. A page of useful cable notes is also given. Copies will be forwarded to any interested reader on application.

Messrs. Brolt, Ltd., Princip Street, Birmingham.—Catalogue of 20 pages containing a fully illustrated description of their Brolt dynamo set for motor-car lighting.

Electrochemical Schemes in Norway.—A scheme is being promoted at Christiania for the formation of a company to work a new process for the extraction of nitrogen from the atmosphere. The share capital is stated, on the one hand, to be £549,000, whilst, on the other, it is assumed that it will be much greater, having regard to the circumstance that the undertaking, according to Mr. Eyde, will be of large dimensions if it is brought to a successful issue. The process relates to the utilisation of the method devised by Herr Serpek, which has been tested on a small scale in France. An application has been made to the Government of Norway by R. Blackstad for a concession to use the water-power of the Aura and the lakes formed by the latter in the north of the Gudbrandsdal Mountains. The available power ranges from a minimum of 197,000 h.p. to a maximum of 230,000 h.p., and would be used for electrochemical purposes, the total expenditure being estimated at £2,800,000

Consular Notes.—Spain.—The British Consul at Barcelona reports that a Marconi station has been put up near the mouth of the River Llobregat, which flows into the sea about 5 miles to the west of Barcelona. The station is situated between the mouth of the river and the village of Prat de Llobregat, which is some 5 miles inland. Another station has also been put up at Soller, a small town in the Island of Mallorca. The tariff is, for messages between towns in the Peninsula, 4·50 pesetas per 10 words and 45 centimos for each additional word, and the same from the Peninsula to the Canary Islands and the Balearic Islands, or *vice versa.* For messages sent from ships: from Spanish vessels, 7·50 pesetas per 10 words and 75 centimos for each additional word; from ships of other nationalities, 8·50 francs for the first 10 words and 85 centimos for each additional word. In both cases (Spanish vessels as well as foreign) the appropriate charge for the use of any of the landlines is additional. A Marconigram from the Peninsula or the Balearic Islands to New York costs 11·38 francs per 10 words, as against 16 francs by cable, thus effecting a saving of 4·62 francs on every 10 words. From the Canary Islands to New York the cost is 19·18 francs per 10 words, as against 22 francs by cable, or a saving of 2·82 francs on every 10 words. A station was also being erected at Alicante, in the Consular district of Barcelona.

United States.—The British Consul at Chicago reports that that town is one of the leading markets in the United States for electrical goods and supplies. In 1911 the estimated value of these goods manufactured in Chicago amounted to about £10,000,000, an increase of 5 per cent. over 1910. An even greater output is predicted for 1912, as the largest factory has increased its capacity, and several eastern houses also report good advance sales, as well as those in the great west served by Chicago. The feature of the year was an increased number of customers with a decrease in volume per customer. The decrease in the large volume was due to the general industrial depression and lack of inclination to invest capital in new plants. This depression, however, was much less severely felt in Chicago, it is stated, than in the Eastern States. The increase in small orders was due to the installation of electrical apparatus by small business houses and industries, and by large builders. Reports indicate a steady increase in the western business and further prospective advances in that in the south-west and south-east territory.

France.—The British Consul at Lyons reports that the most important development in the electro-metallurgical industry in his district during 1911 related to the production of aluminium and its by-products, the French manufacturers of which have formed themselves into a company called L'Aluminium Francais, with a share and debenture capital amounting to 17,000,000 fr. (£680,000). The most interesting part of the combination lies in the fact that the new company has acquired the exclusive rights all over the world in the Serpek process of aluminium manufacture, hitherto vested in the Nitride Co. (Société des Nitrures), who had in 1910 bought up the rights and plant (at Mulhausen) of the Swiss holders of the patent and had established experimental works in the valley of the Arc, near St. Jean de Maurienne.

Large works utilising 40,000 h.p. are about to be established by the Aluminium combine for the purpose of manufacturing under this process. The alumina thus obtained will be used by the various aluminium works grouped together in the new organisation, and it is intended to carry on the production of the metal on a larger scale than ever, and to extend its use by all possible means. The company is also said to contemplate the erection of rolling and drawing works near Chambéry. It is calculated that, given sufficient water-power, the cost of the manufacture of alumina will be reduced, thanks to the valuable by-product of sulphate of ammonia, from 200 fr. to 50 fr. per ton, a net saving of 150 fr. per ton, or 300 fr. per ton of aluminium.

The Consul understands that the United States rights have been conceded to a subsidiary company with large financial resources, and that licences will probably be granted by the parent company for working the patent in other foreign countries. The production of ferro-alloys and patent steels in the electric furnace grows apace in this district, there now being 12 factories engaged in this branch of the industry. The well-known works at Ugines (Savoie) for working the Paul Girod processes of producing electric steels of great resistance have lately turned their attention to armaments, and have supplied shells to the French and Russian navies.

The output of the various products of the electro-chemical industry grows yearly—the chief articles produced being carbide of calcium, carborundum, chlorates, explosives, phosphorus and sodium. The Nitrogene Co. with works at Briancon, is still experimenting with the manufacture of nitric acid by the Pauling electrical process, which consists of direct oxidisation by means of electric discharges.

Porto Rico.—The British Consul in Porto Rico reports that the concession held by the West India and Panama Telegraph Co. expires during the coming year, and will not be renewed, as the Government wishes to encourage competition in the service. As an immediate consequence the following rates have been reduced:—Havana, from 2s. 6d. to 1s. 10½d. per word; Canada, Nova Scotia, and New Brunswick, from 3s. 1½d. to 2s. 4d.; New York and Brooklyn, from 3s. 1½d. to 2s. 1d.; U.S.A. East of Mississippi, from 3s. 1½d. to 2s. 2½d.; West of Mississippi, from 3s. 4½d. to 2s. 5½d. and 2s. 7d. The rate to the United Kingdom, France, Germany, Holland, and Belgium, remains at 4s. 2d., as heretofore.

China.—The British Vice-Consul at Changsha reports that the electric light works, after many delays, at length began working on June 2nd, of 1911, the current for the first fortnight being supplied free of charge, and thereafter at the rate of 10 c. (about

2½d.) per unit. It can hardly be pronounced a success, only some 3,000 points in all having been installed, the light is poor, breakdowns are of frequent occurrence, and the management is wasteful and extravagant. Enterprises conducted in this manner can hardly compete seriously with kerosene oil, which it is the avowed aim of the company to do.

The British Vice-Consul at Hangchow reports that electric light has at last made its appearance in the city, but the plant is not capable of supplying light to more than a comparatively small portion of the city.

LIGHTING and POWER NOTES.

Aberdare.—A L.G.B. inquiry was held on August 14th respecting the application of the U.D.C. for a loan of £12,000 for the extension of the electricity undertaking. There was no opposition.

Acton.—Mr. S. Lord, accountant to the U.D.C., in his seventh annual report and abstract of accounts, issued this week, says that the electricity undertaking was, under the provisions of the Metropolitan Electric Supply Co. (Acton District) Act, 1911, transferred to the Metropolitan Electric Supply Co., Ltd., as from April 1st, 1911. As several financial matters connected with the transfer are still awaiting settlement, the accounts presented are in the nature of "suspense accounts." Under this heading items of expenditure total £5,773, represented by wages and materials, mortgage debt, and amounts written off as irrecoverable. The income shows that the actual cash received from the company during the year was £3,894. Bank interest and amounts standing to the Council's credit on sundry accounts left a balance, at March 31st, of £829. The balance-sheet shows total liabilities £60,750. Assets and outlay include £54,973, the transfer of capital assets (suspense) account, cash in hands of treasurer, £4,947, and the balance of £829 in revenue (suspense) account. A sum of £2,500 received from the company as part consideration money for the transfer of the undertaking was credited to the district fund during the year.

Afghanistan.—News from Kabul states that the estimates and plans for the electrical installation at Jabal Siraj, north-east of the capital, have been prepared, and the work is to be begun immediately. Water power will be used, and 400 Afghan sappers and miners are to be employed in making the necessary channel. Four stations will be built between Kabul and the head works. The project is in charge of Mr. Jewett, who has received instructions to carry out the works.

Argentina.—The Municipality of Florencio Varela (Buenos Ayres) have accepted the tender of Sr. Ramiro Giostro for an electric light station for public and private lighting. The cost of the station is to be $250,000. Public lighting is to be by means of 10-ampere lamps, at a cost of $26 per month; private lighting 40 cents per KW., and power 25 cents.

The Municipality of Curuzu Cuatia (Corrientes) has signed a contract with Mr. Iturriaga for the erection of an electric light station.

The Comisión de Fomento of Vera (Santa Fe) have applied to Government for permission to call for tenders for an electric light station.—*Review of the River Plate.*

Ashton-under-Lyne.—The electrical engineer to the Corporation has been authorised to arrange for the conversion from gas to electric light of 50 lamps in the principal streets.

An agreement has been entered into between the Corporation and Messrs. John Hill & Son, Ltd., for the supply of electrical energy.

Australia.—Under the New South Wales Industrial Act, a large number of Boards have been appointed to deal with disputes. Board No. 6 has to do with makers, fitters, repairers, and installers of electrical apparatus and installations, and persons employed in the maintenance of electrical apparatus and installations or in running electrical plant, excepting those in the employment of the Chief Commissioner for Railways and Tramways, the Metropolitan Board of Water Supply and Sewerage, the Hunter River District Board of Water Supply and Sewerage, those working electrical coal-cutting machines in coal mines.

Bolivia.—According to the local Press, Senor Juan M. Canovas is making surveys for the establishment of a plant to generate electric energy by hydraulic power. The objects of the power station are stated to be the supply of electric light to the North and South Yungas districts and the working of the Yungas forests. It is proposed to extend the electric tramway from La Paz to the Yungas, in order to facilitate the transportation of timber.—*Board of Trade Journal.*

Bolton.—The L.G.B. has sanctioned the borrowing by the Corporation of £20,000 for electric lighting purposes.

Brazil.—At the commencement of the present year, the central station of the Rio de Janeiro Tramways, Light and Power Co., Ltd., was supplying current to electric motors, aggregating 51,064 H.P. (36,221 H.P.), 288,985 incandescent lamps (173,417), 7,523 arc lamps (5,253), and 1,709 electric fans (1,475). The figures in brackets represent the corresponding numbers at the beginning of the previous year.

Cheam (Surrey).—The P.C. has decided to use electricity in place of gas in such streets as are provided with electric cable.

Chesterfield.—The T.C. has received from the L.G.B. sanction to a loan of £7,000 for the following purposes:—Building extensions at the electricity works, £1,650; additions to plant, £5,350

The price of current for heating and cooking in the case of lighting customers has been reduced to 1d. per unit.

China.—The westerly Chinese province of Sechuan, through which flows the Yangtse River, possesses numerous waterfalls suitable for the generation of electricity. It possesses also mineral wealth in the shape of salt, natural gas, petroleum, iron, copper and lead, which only await capital and technical skill for their realisation. A step in their development is contemplated by the German Orient Bank, of Hamburg, which has made application for concessions to construct generating stations and build a network of electric railways from the capital Tchingtoofoo to Yunnan, Hupeh and Shansi. The provisional capital is already equipped with an excellent mint and arsenal, the outcome of German enterprise.—*Elek. u. Masch.*

Continental Notes.—Norway.—A firm near Larvik is harnessing the Hogstadfos Falls and the erection of the line for transmitting the power to Larvik has already been begun. Constructional work is to be finished by the spring of next year, when it is hoped that 8,000 H.P. will be available.

A company has also received Government permission to make the necessary expropriations for the laying of an electric cable from the Böilefos Falls, in the Nidelven River, to Vindholmen, near Arendal, with a branch to Staknes, for transmitting electrical energy, equivalent to from 20,000 to 30,000 H.P., for the electrical smelting of iron and steel, &c.—*Board of Trade Journal.*

Austria.—The construction of the new generating station on the Wottawa River, which is projected by the T.C. of Bergreichenstein, has been entrusted to the Vienna branch of Brown, Boveri and Co. It will be built on the Vinzenzsäge, at a cost of £10,000, and the current transmitted underground for the intervening distance of 7 km. The station will form a part of the great scheme to cost £1,400,000 projected on the Wottawa River by the Böhmerwald Electricitäts Gesellschaft, in conjunction with the Union Bank and the International Electricitäts Gesellschaft, of Vienna.—*Der Elektrotechniker.*

The Bohemian Landesculturrat, recognising the importance of supplying the agricultural industry with electricity for light and power purposes, has instructed the Provincial Committee to institute an inquiry among representatives of the agricultural interests regarding the erection and maintenance of power stations, by co-operative societies or otherwise, the probable call for current and other details.—*Zeit. Ostr. Ing. u. Architekten Vereines.*

Schemes have been deposited both by the State Railway Department and by the firm of P. Hagyi Rioto & Co., of Vienna, for the utilisation of the water-power of the Faggenbeck, in the Kaunser Valley. The former proposes to appropriate only the falls on the river from Talboden to near Pruth, to provide current for working the State Railways, while the latter proposes utilising the whole of the falls by the construction of five weirs in connection with a large power station to supply current for industrial purposes.

Germany.—A very comprehensive electrical exhibition is to be held at Krefeld this autumn. The use of electricity in minor and large industries, households, restaurants and hotels, in husbandry, the dairy, waterworks, irrigation, &c., will be practically demonstrated. The participation of many leading German firms is announced, and most of the available room is already let.

The city of Ulm, in Wurtemberg, is to have a central power station, the River Argen being used to provide hydro-electric power. A chief and secondary station are to be built, near Steinenbach and Sattel respectively, at an estimated cost of £500,000. Some 12,000 H.P. will be obtained.—*Elektrotech. Zeitschr.*

France.—The recent establishment of a power station at Hyeres, in the Department of the Var, is having the best results. Not only are neighbouring communes applying for concessions, but the great Creusot establishment has become a client to the extent of 300 H.P. —*La Revue Pratique d'Electricite.*

Holland.—The Dutch Government has decided to improve the harbours of Sourabaya and Macassar, in the Dutch East Indies, and has allotted a sum of 48,000,000 gulden for the purpose. The new quays and other works which will be built will be equipped with the electric light, and electrically-worked cranes and other appliances will be installed.—*Elek. und Maschinenbau.*

Darton (near Barnsley).—Councillor Hanby has given notice of his intention to propose at the next meeting of the U.D.C. that the question of the electric lighting of the township be discussed.

Dundee.—A report by Mr. Harry Richardson, the Corporation electrical engineer, on the proposal to still further extend the undertaking at a cost of about £50,000, has been submitted to the Electricity Committee and adopted. It was agreed to ask for tenders. In his report Mr. Richardson pointed out that increased business which had taken place, and which would probably be added to in the immediate future, rendered it necessary to proceed with an extension of the plant immediately. Having regard to the fact that from 10 to 12 months were required for the delivery of new machinery, which time might be further extended by industrial unrest, the order should be placed as early as possible. The engineer further explained that he proposed to put in a new generating set of about double the capacity of either the existing ones at Carolina Port, and to allow space for a further set. All the necessary boilers, switchgear, auxiliaries and accommodation required for the extension would, of course, have to be proceeded with also, and he estimated the cost of the extension at £49,000. The town clerk explained that the department had received from the Scottish Office fresh borrowing powers to the extent of £68,000, and this had been obtained without any expense whatever—not even a deputation to London. Mr. J. M. Nairn, convener of the Committee, said that if they did not make such provision as was suggested, they would find themselves in the position of having to refuse to take on consumers.

Ealing.—The annual report of Mr. J. D. Knight, borough electrical engineer, covers the seventeenth year of working of the undertaking, and shows that the past year's trading has been very successful. The output was nearly 70,000 units in advance of the previous year, the number sold totalling 1,573,968, and the income has increased in an even greater ratio, the total for the year being £28,348, an advance of £1,302. The capital outlay during the year amounted to £6 354. Out of the year's revenue, a sum of £8,510 has been allocated to the repayment of loan capital, the repayments to date totalling £72,399, equivalent to 33·8 per cent. of the borrowed capital of the undertaking. Charges for interest, £5,029, were also defrayed out of the year's revenue. The gross profit for the year was £15,792, equal to 7⅝ per cent. on the total loan capital. From the gross profit, charges for interest and sinking fund payments, audit fees, contributions to bad debts, reserve and loan redemption fund, &c., amounting in all to £14,474, were paid, leaving the net profit on the year's working £1,317. A substantial reduction is shown in the cost per unit. Whereas, last year every unit sold cost 3·974d., this year the cost has only been 3·938, nearly 1 per cent. reduction, and represents a saving of £240. The number of consumers increased to 4,550. A feature of the year was the large number of old houses and shops—totalling 82—which have installed electricity. This represents nearly 21½ per cent. of the consumers added during the year, and shows that property owners are recognising that money spent on an electrical installation is fully recouped in the enhanced letting value of houses.

Fermoy, Co. Cork.—At a meeting of the Urban Council on the 17th inst., the chairman said he had received a communication from a firm offering to carry out an electric lighting scheme for the town. He took it on himself to write and say that the Council was prepared to give the firm every facility for the installation of the proposed scheme for electric lighting.

Greenock.—The Electricity Committee has decided that they cannot undertake to give a supply to the power users in Port Glasgow, unless the Port Glasgow T.C. is willing to furnish a guarantee not to sanction an application by any other competent authority to enter Port Glasgow for a period of 30 years. Port Glasgow Electricity Committee recommends that the Council do not give the guarantee asked for. The deadlock is to regretted, as the shipbuilders in Port Glasgow desire a supply of electricity.

The Electricity Committee recommend that Mr. J. A. Robertson, their engineer, be granted an honorarium of £50. The surplus of £5,255 shown in the accounts of the department for the past year will be allocated as follows:—£3,000 to reserve fund (double the amount required by the B. of T.), £2,000 to the relief of burgh rates, and £225 to be carried forward to next year's account.

Honiton.—The B. of G. on Saturday last, decided to accept the offer of the Devon E.L. Co. to install the electric light at the workhouse for £35, and to supply current at 4d. per unit. The Gas Co.'s tender was £54 and 4s. 2d. per 1,000 cb. ft.

India.—The municipal authorities of Kurrachee are meditating large harbour improvement works and the installation of up-to-date goods handling appliances.

Kingswood.—With reference to the proposed revocation of the E.L. Order, 1904, held by the Kingswood Electric Supply Co., to which reference was made in a recent issue of the Electrical Review, the B. of T. has extended the order until the end of the current year.

Liverpool.—A Special Committee has been appointed to investigate the position of the Corporation electrical undertaking, and the staff arrangements necessary in view of the retirement of Mr. Bromley Holmes, the consulting electrical engineer.

Lossiemouth.—A special meeting of the T.C. has discussed the lighting of the town by electricity. A report by Mr. J. Alex. Bell, city electrical engineer, Aberdeen, on the schemes of electric lighting companies which had previously been submitted to the Council, was considered. After consideration, the Council resolved to proceed with a scheme for lighting the town by electric light, provided the cost of the scheme does not exceed a certain figure, and Mr. Bell was appointed engineer, on certain conditions, to prepare plans and specifications with the view of offers being taken for the execution of the works.

Peterboro'.—The annual report of the Corporation Electricity Works has just been issued. For the year ending March 31st last, 892,934 units were generated. During 12 years, deficits paid from the District Fund of the city have amounted to £7,547, but, for some years past, the works have shown a considerable balance to the good. A bad break in the record of success was incurred in 1909-10, an expensive arbitration with the tramway company running away with £1,583 from the rates. Another arbitration is now pending

Rochdale.—The Gas and Electricity Committee has decided, on the Works Sub-Committee's recommendation, to supply electricity in bulk to the Milnrow district.

St. Mellons.—The South Wales Electrical Power Distribution Co. has informed the R.D.C. that it intends applying to the B. of T. for a prov. order for electricity supply for the parishes of Bedwas and Machen Upper. The Council has asked the company for its proposed scale of charges for current.

Surbiton.—Messrs. Callender's have agreed with the U.D.C. to pay interest and sinking fund charges at the rate of 6¼ per cent. per annum in regard to legal expenses and fees which were not included in the loans sanctioned for electric lighting.

Wakefield.—The T.C. has decided not to support the Bill seeking powers for local authorities to provide electrical fittings and to undertake wiring work.

Weardale.—A scheme for supplying electricity to Wolsingham, Frosterley and Stanhope, has been submitted to the R.D.C. by Mr. A. Martin, of Wolsingham, but the Council has decided to take no steps in the matter.

Whitehaven.—The T.C. has sanctioned the purchase of of an electrical cooking outfit, the electrical engineer having expressed the opinion that there is a large field for hiring out such utensils, as cooking by electricity can be done with more satisfactory results and more economically than with any other form of heating.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyme.—As the result of an interview, the threat by the Hurst Council to close the tramway in its district has been withdrawn. The truce will last for one month. The 10 years' agreement between the two authorities expired on the 16th inst.

Australia.—The Hobart Electric Tramway Co. (Tas.) has accepted the Hobart Council's offer for the purchase of the tramways; the price offered was £210,000. A Bill to obtain the necessary authority from Parliament to borrow the money had been drafted in anticipation of the acceptance of the offer. It has not yet been decided by the City Council whether the money shall be obtained from the Government under the Local Government Act or borrowed from the general public by means of debentures.

Chile.—Plans submitted by Don Horacio Valdés for the construction of an electric railway between Santiago and Penaflor have been approved. Three years are allowed for carrying out the work.

Continental Notes.—Sweden.—Since the exhaustive trials made some years ago near Stockholm with electric traction, the question of the electrification of the State railways has been an order of the day. Those trials led, at the time, to the proposals for the electrification of the southern network, and to the conversion of the frontier railway. There can be no doubt, however, that the present Swedish Government will wait the results of experience from the working of the lines now in hand before proceeding with the larger schemes. This is shown by the admission of the Minister for the Home Department in Parliament recently, and also by the fact that no plans for large electric conversions have been drawn up. In the course of reference to the Tomteboda-Wartan line which is being electrically worked, the Minister observed that it afforded no data as to the cost of rolling stock. Nevertheless, electric working for local traffic was a solved problem. Electric working on an extended scale was, moreover, a necessity for Sweden, as thereby she would become independent of foreign coal, and her own sources of power would be better utilised. A surplus would also remain for appropriation for other purposes. Experience in other countries showed that electrification in some cases was advantageous; in other cases not so. In no case, however, were the circumstances exactly comparable with those in Sweden; whence it followed that they must obtain their own experience. Electrification could not, therefore, be considered until data regarding the extent of the country's water resources were obtained, and extensive tests over lengthened periods carried out. The frontier railway, when completed, would supply conclusive data. Furthermore, the results of the building of the northern internal line, with its branch to the main line, must be awaited. Lastly, the Minister declared that at the present time it remained to be considered whether various local lines were being electrified as quickly as was desirable. On the supposition that their electrical working was remunerative, plans for their conversion would shortly be prepared.—*Elektro. und Maschinenbau.*

Spain.—The Municipal Council of Cartagena has granted a concession for the establishment of an electric tramway in Cartagena which shall also supply that city with electric light and power. The concession is for 40 years, at the expiration of which period the city has an option on the purchase of the plant at 80 per cent. of its value at that time. The concession is granted on condition that the concessionaire negotiates a loan of £80,000 in favour of the municipality; failure to negotiate this loan voids the concession.—*Financier.*

(*Continued on page* 303.)

THE QUEEN'S HEAD ELECTRIC RESTAURANT.

Some few months ago the electrical Press was privileged to inspect the equipment of the Queen's Head Electric Restaurant, which forms such a prominent feature of the "Shakespeare's England" Exhibition at Earl's Court this year.

Through the courtesy of Mr. R. S. Downe, of the Brompton and Kensington Electricity Supply Co., the hon. manager of this restaurant, we were able to give a general description of the apparatus then installed, and he has kindly placed at our disposal further information based on experience gained during the period in which the restaurant has been in daily use.

It may be remembered that the catering is in the hands of the London Home Delicacies Association, of 9, New Bond Street, W., and that the electric restaurant was fitted up by arrangement with the British Electrical and Allied Manufacturers' Association, and the Electric Supply Publicity Committee.

The equipment was supplied by the following firms:—Messrs. The Electric and Ordnance Accessories Co., Ltd.; Ferranti, Ltd.; General Electric Co., Ltd.; T. & J. Jackson, Ltd.; Purcell & Nobbs; Siemens Bros. Dynamo Works; and Bertram Thomas. A detailed list of the apparatus supplied by these firms appeared in our pages at the time.

The manufacturers supplied apparatus from stock, mostly of the domestic type, and although this apparatus worked satisfactorily, it was found that it was not suitable for restaurant purposes, owing to its not being capable of meeting the large simultaneous demands for grills, &c.

To meet this difficulty the Publicity Committee supplemented the equipment with several pieces of special restaurant apparatus which have proved to be capable of meeting the sudden rushes in the restaurant, and have given every satisfaction to the chefs both as regards convenience, cleanliness and quality of cooking.

The principal additions have been a combined griller, toaster and hot cupboard of the following dimensions:—5 ft. 6 in. wide, 6 ft. high, and 1 ft. 10 in. back to front, comprising two grilling compartments 21 in. × 18 in., giving a total grilling space of 5¼ sq. ft. Between the grills there is a centre chamber, forming a hot cupboard, and over this a tier of hot cupboards, with sliding doors, running the full length, and a heating space under the grill, fitted with grids. The grilling elements are sub-divided into six sections, each of 2,500 watts, each section being controlled by an Admiralty pattern pull-and-push switch.

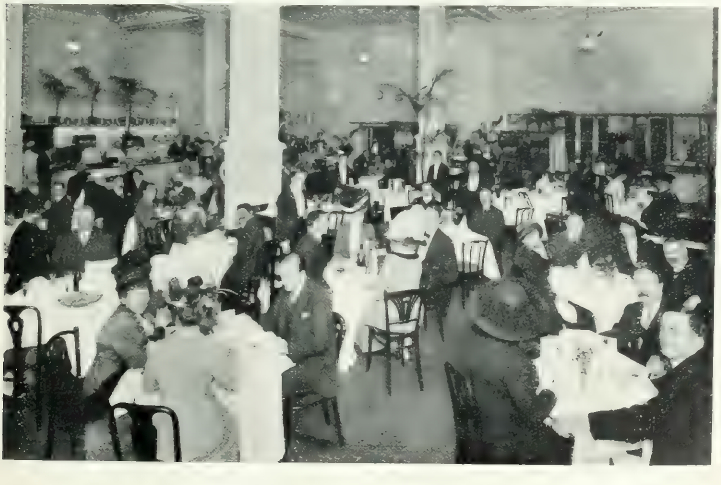


Fig. 2.—General View of Interior of Restaurant.

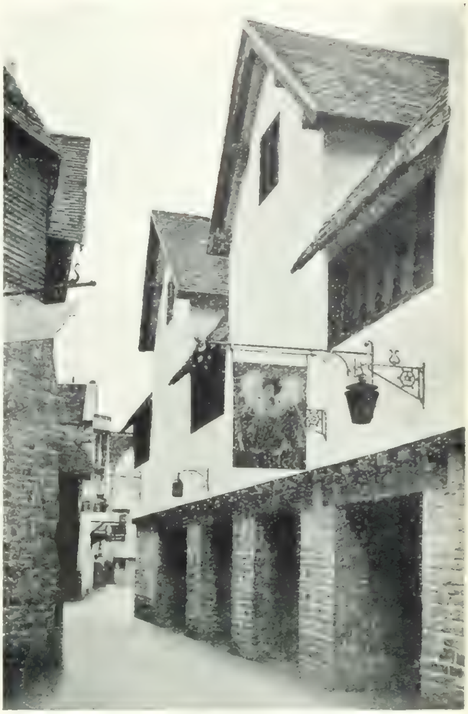


Fig. 1. The Queen's Head Electric Restaurant Earl's Court.

There has been a big demand for grills in the restaurant, and the following is typical of the demand made each evening between 7.30 and 9.30:—

Rump steaks, 24; fillet steaks, 12; loin chops, 20; chump chops, 8; cutlets, 46; kidneys, 20; tournadoes, 18; ham, 4; sausages, 12; salmon steaks, 17; soles, 3—making a total of 184.

Current supplied to each half of the grill, and to all pieces of apparatus in use is metered, the current consumption on the grill working out at between a quarter and a third of a unit per grill, according to the demand.

It must be borne in mind that a grill varies between a porter-house steak and two devilled kidneys. The consistent excellence of the grilling has been much commented upon, and the uniform temperature conditions greatly appreciated by the chefs.

A vegetable steamer has also been added having a capacity of 160 lb. of potatoes per hour, or an equivalent amount of puddings and fish. The overall dimensions of this steamer are 4 ft. 10 in. high, 1 ft. 9 in. wide, and

2 ft. 4 in. back to front. It contains five wire vegetable baskets, each 20 in. × 13½ in. × 3 in. deep, and is fitted with an automatic supply system which keeps the steam generator supplied with water automatically.

The cooking is done under a pressure of steam varying from ·5 to ·75 lb. per sq. in., and the steamer has a maximum loading of 5 KW., arranged in two heats.

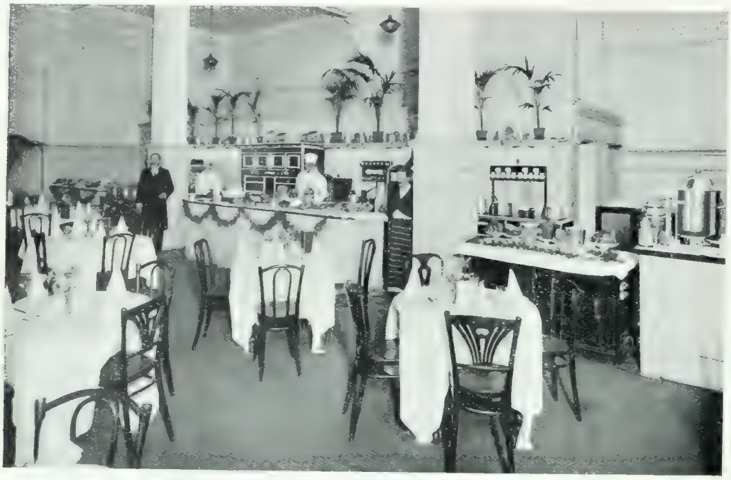


Fig. 3.—View of the Electrical Cooking Apparatus at One End of the Restaurant.

In practice it is found that 2½ KW. is sufficient to keep the apparatus working at full capacity.

A restaurant type Bain Marie has also been added, containing six vegetable containers and four sauce pots, heated by an open type water bath. The size of this apparatus is 64 in. long, 34 in. high, 22 in. back to front, and it has been found of sufficient capacity for the whole of the vegetables and sauces required in the restaurant.

One carving table has been found capable of handling all the joints required for the restaurant, and the hot cupboards underneath have had a sufficient capacity for heating all the plates and dishes required.

The fish fryer has been worked very hard since it was installed at the opening of the Exhibition, and the chef is very satisfied with its behaviour. The articles cooked have been so numerous it has been difficult to keep account of them, but it has dealt with the whole of the fish fried and potatoes.

Practically all the roasting has been done in an Eclipse oven of boarding house size, and a Bertram Thomas oven, No. 2 size. To give some idea of what can be cooked in two ovens, the following articles were roasted to meet a Saturday's demand :—Two sirloins of beef, one fore-rib of beef, 50 to 60 lb. of beef, one whole lamb, eight ducks, 10 chickens and six or seven large fruit tarts.

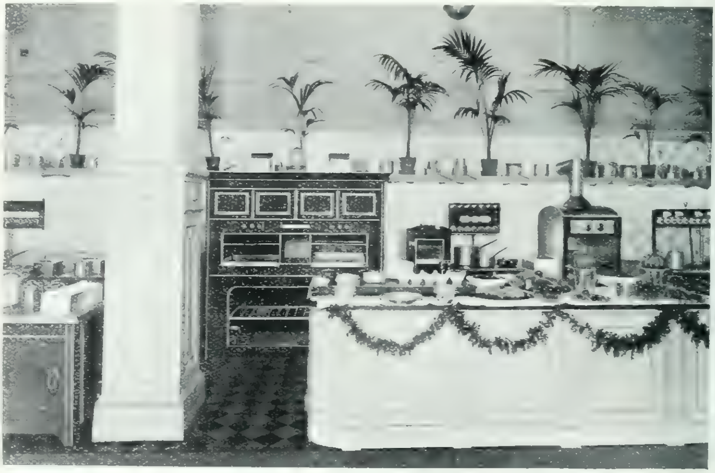


Fig. 4.—The Large Electric Grill, Queen's Head Restaurant.

Both these ovens have worked splendidly since the opening of the Exhibition, and are in daily use.

The large ham boiler has given no trouble, and three York hams are being regularly cooked in about five to six hours.

The small grills supplied by Messrs. Purcell & Nobbs, Messrs. T. & J. Jackson and the General Electric Co. worked exceedingly well, and since being replaced by the large grill are being used for making toast and grilling fish.

In the views some of the apparatus is clearly shown, but several pieces are hidden by the counters.

The Eclipse hot water urns and the Siemens café-au-lait have been working daily, and occasionally have served 150 teas in one and a half hours; these urns would be greatly improved if the filling was carried out automatically.

In addition to the main cooking equipment, the manufacturers have supplied a large assortment of electrical accessories, which have been shown working, and have created considerable interest, at the Information Bureau in the restaurant; a large amount of literature dealing with the electrical accessories has been distributed amongst the customers.

The electrical cooking equipment is the largest which has so far been got together, and the chefs who have been working it have been very pleased with the comfortable conditions under which cooking has been carried out. Practically all the cooking has been done in the restaurant itself, and as the atmosphere has remained quite fresh, this points to the fact that with attention to the ventilation, cooking may be carried out on a considerable scale by electricity in places where it has not previously been possible.

The number of meals served in the restaurant works out approximately at 1,200 luncheons and dinners, and 500 teas per week, making an average total of 1,700 meals, while the units metered at the apparatus are some 1,500 per week.

ELECTRIC FARM EXHIBIT IN AMERICA.

A RECENT issue of our trans-Atlantic contemporary, the *Electrical Review and Western Electrician*, contains a very good account of a portable exhibit of electrical farming machinery and appliances, which has been got together by the Edison Electric Illuminating Co., of Boston.

Some months ago the superintendent of this company inspired his associates with the practicability of an enterprise of this sort, and we gather that, for six weeks prior to the present month, the attendance of potential users — not including mere sightseers—averaged about 100 a day.

FIG. 5.—DEMONSTRATION TABLE AND INFORMATION BUREAU FOR SMALL APPARATUS QUEEN'S HEAD RESTAURANT (page 300).

The exhibit, or "The Farm," as it is termed, consists of some 40 large pieces of apparatus and farming tools, together with 30 or 40 of the ordinary and smaller appliances, in a big tent, 60 × 106 ft. in size. All the apparatus is practical for use and for economic service on the average farm. Each appliance is plainly marked with its name, the manufacturer, its price, and the cost of operation. The price is retail, and includes the machine, its motor, and everything ready for actual service on the farm. In the front of the tent, display signs have been placed, to add some of the drawing effect of the high-class circus. The tent is lighted by 500-watt Mazda lamps inside and by luminous arcs outside.

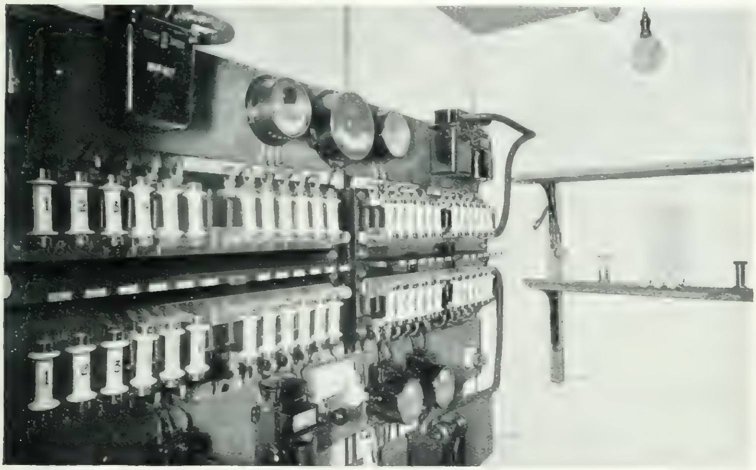


FIG. 6.—THE DISTRIBUTION BOARD CONTROLLING THE COOKING CIRCUITS. QUEEN'S HEAD RESTAURANT (page 300).

Two electric trucks, one of 2-ton capacity by the General Motor Truck Co.; and another of 700-lb. capacity manufactured by the Walker Vehicle Co., are used in connection with the farm for hauling material to and fro. A special feature of the truck service has been the demonstrations for the neighbouring farmers. Wherever the farmers have shown interest in the truck, the vehicle suited to the service has been sent out to haul loads on the farm. From time to time material has been carried from farms into town, or *vice versâ*. The result has been that many of the farmers have now a practical knowledge of the working efficiency of an electric truck on the farm, and are considering its adoption.

A partial list of the apparatus shown on the farm is as follows:—Cider mill, vegetable cutter, electrobator, electric brooder and bone cutter, milk tester, milking machine and vacuum-cleaner outfit, butter churn, cream separator, bottle-washing machine, grindstone, horse clipper, forge blower, circular saw, wood saw, wood splitter, portable breast drill, furnace blower, meat chopper, oat crusher, electric pump for farm storage supply system and irrigation, pumping jack for attachment to windmill outfits, motor-operated sewing machine, vegetable peeler, battery-charging rectifier outfit, icecream freezer, corn sheller, clover cutter, feed grinder, friction windlass, ensilage cutter, hay unloader, electric kitchenette, washing machine, flat-irons, and electric household utensils, as well as buffing and grinding outfits, and all electric appliances for use in a carpenter or repair shop.

The authoritative tests of the efficiency of some of the important pieces of apparatus at the farm show the following results:—

Clover Cutter.—0·5-H.P. motor; rate per hour, 41 lb. of finely cut clover; KW.-hours per 100 lb., 0·870; average H.P., 0·48.

Milking Machine.—Capacity, 10 machines, 20 cows; 3-H.P. motor; tests, eight machines used, 90 cows milked; give 432 quarts milk; rate per hour, 91 cows; KW. per hour, 0·019; average H.P., 2·3.

Corn Sheller.—Capacity, 26·5 bushels Flint corn per hour; KW.-hours per bushel, 0·0278; average H.P., 0·98.

Washing Machine.—Capacity, six sheets per washer-full;

0·125-H.P. motor: rate per hour, six washer-fulls: KW.-hours per washer-full, 0·0232; average H.P., 0·187.

Feed Grinder.—Capacity, 6·2 bushels per hour with 5-H.P. motor; grinding shelled Flint corn fine; rate per hour, 6·02 bushels; KW.-hours per bushel, 0·710: average H.P., 5·9. Grinding Flint ear corn fine, 4 bushels per hour; 5-H.P. motor; KW.-hours per bushel, 0·888; average H.P., 4·7. Grinding Flint corn and oats, half and half, 4·6 bushels per hour; KW.-hours per bushel, 0·821: average H.P., 5·08.

Oat Crusher.—Capacity, 50·5 bushels per hour; 2-H.P. motor; KW.-hours per bushel, 10·5: average H.P., 3·04.

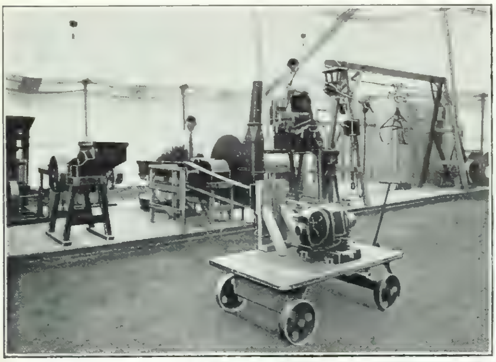
Ensilage Cutter.—Capacity, 2·6 tons of rye per hour: 10-H.P. motor, KW.-hours per ton, 3·11: average H.P., 11·3.

Electric Trucks used at the Farm Exhibition.

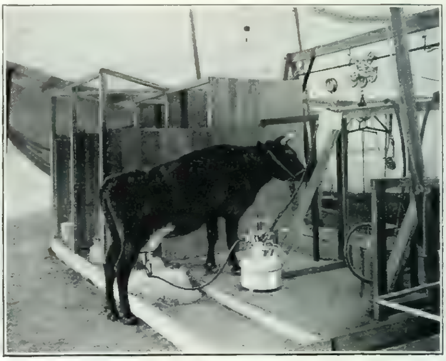
The farm is equipped with a motor on a portable truck, which can be moved from place to place and connected up with any piece of apparatus. This shows the practicability of portable electric power on the farm.

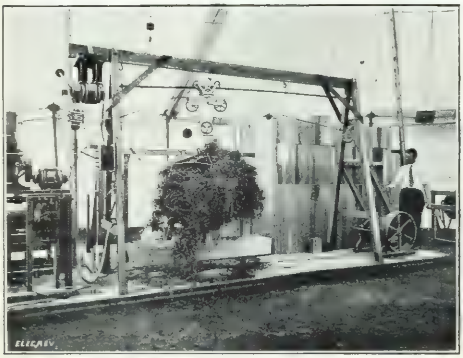
The milking tests prove very attractive for the people, and there is always a crowd at the evening milking time.

Portable Truck with Feed Cutters, Grinders, &c.

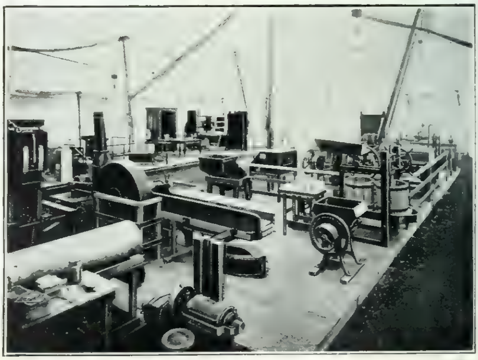


Cow with Electric Milking Apparatus.





Electric Hay Unloader in Use.



Farm Exhibits in Foreground and Home Section in the Distance.

Electric Farm Exhibit in America.

Practical milking demonstrations have been given at large near-by dairy farms, to the great satisfaction of dairymen.

The exhibit, we gather, is resulting in excellent business, and purchases of apparatus are directly traceable to the inspiration gained by visitors; it is to be moved to various towns during the summer, having, in the first instance, been located near Boston.

Although American and English farming methods differ considerably, and English farming is not generally accounted a very lucrative undertaking, there is good reason for supposing that considerable scope exists in this country for electrical farming developments in certain districts—indeed, we have in mind a charming rural area in this country centring on an old cathedral city where, through the enterprise of the electrical engineer, many local farms have been supplied with electricity by cheap pole lines, and are using both electric light and power for various purposes.

It is also well known that great progress has been made in Germany, which country is one of our best customers for steam ploughing tackle, in the introduction of electric ploughing, as well as in the minor applications of electricity to farm work, while reference to our columns last week shows that both in Australia and Canada developments along the same lines are being made.

In conclusion, we have to thank our contemporary for the illustrations which appear on this page.

TRAMWAY and RAILWAY NOTES.

(*Continued from page 298.*)

France.—The trials to which we referred last week, with a new combined electric locomotive and passenger coach intended for the French State railway line between the Invalides station (Paris) and Versailles, were made with a coach which runs on a couple of four-wheel bogies, and is entirely constructed of iron and steel, with the object of obviating any risk of fire. It contains not only the driver's portion, but also first and second-class passenger compartments and a luggage department, so that during the slack period it can be used as a complete unit, while at the busy times, trailer-cars can be added. The electrical equipment comprises two 250-H.P. motors, which will enable the machine to attain a speed of 50 miles per hour on the level, and from 34 to 38 M.P.H. on the gradients. The coach, which can be driven from either end, has a total length of nearly 74 ft.

The Compagniè Generale d'Omnibus, which runs a large fleet of petrol motor-'buses in Paris, is reported to be about to make some trials of a new electrically-propelled omnibus.

A scheme for the electrification of six railway lines radiating from Valenciennes is being promoted, viz.: Valenciennes to St. Amand, Condé, Bonsecours, Hergnies, Denain, and Blanc Misseron.

Dewsbury.—The recent action of the Yorkshire (Heavy Woollen District) Electric Tramways Co. in establishing a general increase in tramfares on its system has called forth, as might have been expected, quite a storm of protest on all hands. The latest expression of disapproval is a resolution of the General Purposes Committee of the Dewsbury T.C., who, in addition to protesting against the increases in passenger fares, instructed the town clerk to ask the Batley Corporation and the District Councils of Birstall, Heckmondwike, Cleckheaton and Gomersal to take similar action. At the meeting last week at which this resolution was passed, a letter was read which had been received from Huddersfield Corporation with reference to the proposal to extend the Huddersfield tramways from Cooper Bridge, through Mirfield and to a point within the borough of Dewsbury, and was referred to a special committee.

Dundee.—The attention of the Corporation Tramways Committee was directed by a communication from the Municipal Tramways Association to the fact that the Post Office authorities were seeking to place bare telephone wires over trolley wires, and to call upon local authorities to erect guard wires to protect these. The Association had approached the Postmaster-General with a request that he should receive a deputation on the subject, but no reply had been received, and it was suggested in these circumstances that Dundee Corporation and other authorities in the event of a request being made to them to have guard wires erected, should refuse until the point in dispute had been settled. The manager supported the proposal, and the Committee agreed.

It has been suggested to make use of tramway poles for street lighting purposes. On the opinion being expressed that the B. of T. would disallow gas-pipes being attached to electric standards, it was pointed out that they might be led up the outside of the standards, and properly insulated. The Corporation Lighting Committee is to have a report on the matter from a Special Committee.

Huddersfield.—Members of the Huddersfield Tramways Committee, accompanied by the tramways manager and surveyor to the Huddersfield Corporation, together with the surveyor to the Mirfield U.D.C., have made an inspection of the proposed Mirfield tramway route.

The Dewsbury Corporation has appointed a special committee to consider and report upon the proposal of the Huddersfield Corporation to extend its tramway system into the boundary of Dewsbury.

The Elland District Council has also received a communication from the Corporation, asking whether the offer of the Council made some time ago to subsidise the tramways to the extent of £100 per annum for a certain period, still holds good, seeing that the Corporation now proposes to obtain Parliamentary powers to extend its system to Elland. The District Council has decided, before definitely replying to ascertain what steps other authorities are taking in the districts which the Corporation proposes to touch by its extended system.

The Linthwaite U.D.C. has consented to an extension of the Huddersfield tramways from the terminus at Linthwaite to the boundary at Slaithwaite.

Keighley.—A recommendation has been made that a scheme be prepared for a system of railless trolley vehicles between the tramway terminus at Ingrow and the junction of Haworth Road and Hebden Road, and to obtain tenders for the necessary equipment.

L. & Y. Electrical Services.—This company has been experimenting recently with a new type of electric locomotive, which it is proposed to use for hauling goods traffic on the electrified lines. Tests have been carried out between Marsh Lane and Aintree, the new locomotive drawing about 700 tons up this gradient. If the present experiments are entirely satisfactory, larger engines of the same type will be provided, chiefly for use in connection with the goods traffic between the Liverpool docks and local stations.

New Zealand.—The Board of Management of the Wellington City Tramway services have issued a lengthy report on the subject of losses incurred in working the cars. Recommendations are made to shorten some of the 1d. fare sections, to withdraw concessions which favour distant places, to limit scholars' tickets to those under the age of 17, to institute a minimum 3d. fare on Sundays and to issue blocks of 14 1d. tickets for 1s.

South Africa.—The ratepayers of Bloemfontein have agreed to borrow £80,000 for the flotation of a scheme to provide a system of railless traction. A poll, however, was demanded by the opponents of the scheme.

Widnes.—At a T.C. meeting recently it was reported that there had been a loss on the motor-'bus service for the past three months of £560, and a reduction in the passengers carried of 96,000 compared with last year. The clerk said the actual loss on the running was £285, and the total was made up by interest, &c., because the Government forced them to pay the money back in five years.

TELEGRAPH and TELEPHONE NOTES.

Australian Wireless Notes.—According to the *Standard*, the final settlement of the wireless dispute has been delayed by the illness of the Postmaster-General, the Hon. Charles E. Frazer. It will be recalled that the Commonwealth Government had expressed its willingness to pay a fair price to the Marconi Co. for the use of patents said to have been infringed in the system adopted by the Federal Post Office. The local representatives of the company have offered to accept £50,000 for the Marconi rights involved.

Mr. J. C. Balsillie has been testing for the Commonwealth authorities the radio-telegraphic installations at Adelaide, Brisbane, Hobart, and Melbourne, which are on the point of being taken over by the Australian Postmaster-General. At Adelaide and Brisbane the installations are of a hybrid character, a ground wire system being used in conjunction with masts 140 ft. high. The effect of the combination is said to reduce the marked difference between the day and night ranges of communication. At Melbourne, where the mast is 185 ft. high, the day range is 400 miles, as against 1,500 miles at night.

France.—For the convenience of the French commercial world, the wireless telegraph station at Bordeaux has now been opened for the tranmission of ordinary private messages.

French Telephones.—The Administration des Postes et Telegraphes have decided on the establishment of telephone and telegraph lines in 57 towns and townships throughout France. The following 12 cities have also decided to set up or extend their municipal telephone and telegraph. systems:—Caen, Rouen, Honfleur, Troyes, Laval, Deauville, Marizy, Levallois, Montagnac, Malakhoff (Seine), Casteljalous and Beauville.—*Revue Pratique de l'Electricité.*

Japanese Cable Extension.—It is reported that owing to the pressure of messages, the two telegraph cables between Tokio, Japan, and the Island of Formosa, are quite unequal to the demand, and that negotiations are in hand for the laying of a third cable between the two places.

Proposed New Cables.—It is announced in the *London Gazette* that an application has been received by the Board of Trade from the Great Northern Telegraph Co., Ltd., of Denmark, for a licence to lay down and maintain, upon the foreshore and bed of the sea at Newbiggin-by-the-Sea, Northumberland, two additional telegraph cables, one from Denmark and one from Sweden.

South American Wireless Developments.—The Telefunkengesellschaft, of Berlin, has just successfully inaugurated a wireless connection across South America, from Lima on the West Coast to Para on the East Coast. This connection, which passes for 3,400 km. over primeval forest land, is the longest yet effected by the Telefunken system. The Andes range, 5,000 to 6,000 metres high, and the primeval forest districts along the Amazon River, are thus bridged without the aid of telegraphic cable. Telegrams given in at Lima are forwarded to Manaos on the Amazon River and their contents then dispatched per wireless to Para, 1,200 km. distant.—*Elektrotechnische Nachrichten.*

Vatican's Wireless Station.—A wireless telegraph station is to be installed shortly at the Vatican, under the direction of Signor Marconi.

Wireless Telegraphy at Bangalore.—Mr. Simpson, chief electrical engineer, Indian Telegraphs, visited Bangalore recently to examine conditions as to the suitability of this station for a wireless installation and to confer with the local authorities on the subject. It is by no means certain, in spite of previous statements, that Bangalore has been, or will be, decided on as a centre. Much is likely to depend on the result of Mr. Simpson's investigations.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 11th. Electrical fittings, for the Powell Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. Stores Manager, Aberaman, near Aberdare (Form No. 26).

Australia.—New South Wales.—September 25th. Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" to-day.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" to-day.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—September 3rd.—Six 60-k.v.a. transformers, for the Melbourne City Council. See "Official Notices" August 16th.

September 17th.—One fuel economiser, for the Melbourne Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" August 16th.

October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Western Australia.—November 5th. One common-battery automatic switchboard, one common-battery semi-automatic switchboard, one common-battery manual switchboard and equipment, for the P.M.G.'s department, Perth.

Austria.—Vienna.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

September 2nd.—The authorities of the K.K. Northern Railway in Vienna are inviting tenders for an installation of electric lighting at the railway station at Prerau.

Bedwas.—September 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Belgium.—September 3rd. The Société Nationale des Chemins de Fer, of Brussels (14, Rue de la Science), is inviting tenders for the supply and installation of the electrical equipment of a transformer sub-station at Dieghem, and the supply of copper rail bonds and bronze wire required by the company during the year ending October 1st, 1913. For further particulars see this column last week.

Bolton.—The Electricity Committee of the T.C. has directed tenders to be invited for 25,000 tons of coal for the works.

Bradford.—August 28th. One 300-kw. and one 1,500-kw. rotary converter, for the Corporation. See "Official Notices" August 16th.

Costa Rica.—December 9th. Tenders are invited for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Felixstowe and Walton.—September 5th. Extensions to accumulators and balancer-booster, for the U.D.C. See "Official Notices" to-day.

France.—October 8th. The French State Railway authorities in Paris are inviting tenders for the supply of the power necessary for the electrical operation of the State railway system in the Paris district. Particulars may be obtained from, and tenders are to be sent to, Le Directeur des Chemins de Fer de l'Etat, 20, Rue de Rome, Paris.

Germany.—Hanover.—September 5th. The supply and delivery of a revolving coal-loading crane to the water-power station at Döverden on the Weser is required. Particulars (2 marks) of the Royal Machine Construction Office, Brandstrasse 1, Döverden, Hanover.

Brunsbuttelkoog.—September 9th. Tenders are invited for the supply of Diesel motors with accessories, electric pumps with accessories, dynamos, generators, transformers and accumulators. Particulars of the Kanalbauamt I, Brunsbüttelkoog, Germany.

Hungary.—The municipal authorities of Dunafeldvar have lately invited tenders for the establishment of a central electric lighting station in the town.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" August 9th.

Leicester.—August 31st. Steel roof trusses, lattice girders, and columns for extensions to main tramcar depôt, for the T.C. Borough Surveyor (returnable deposit of £1).

London.—L.C.C.—September 24th. Electric spark gaps in brick cells for sub-stations. See "Official Notices" to-day.

Manchester.—September 10th. One 12,000-kw. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" August 9th.

August 28th.—Electric lighting fittings at Atherton Street Schools, Deansgate, for the Education Committee. The Offices, Deansgate. (Returnable deposit £1 1s.)

Rathmines and Pembroke.—August 29th. The Joint Hospital Board invites tenders for the electric wiring of two of the hospital buildings, the staff residence, gate lodge, and also electric lighting of drive at their Isolation Hospital at Clonskeagh. General conditions, specification, &c., from the Matron, Isolation Hospital, Vergemount, Clonskeagh, on payment of 2s. 6d., which will not be refunded. Tenders to Chairman, Joint Hospital Board, Town Hall, Rathmines.

Rochdale.—August 28th. Surface condensing plant, d.c. motors, electrical sundries and cast-iron pipes, for the Union workhouse. See "Official Notices" August 16th.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Roumania.—Botoshani.—Tenders are invited for the installation and working of an electric light and power service. Particulars of the municipality.

South Africa.—September 11th. Durban Corporation. One-ton electric storage battery vehicle. A statement on the matter can be seen at the Board of Trade C.I. Department, London, E.C.

Spain.—September 30th. Tenders are being invited by the Spanish Ministerio de Fomento in Madrid for the concession for the construction and working of an electric tramway in the town of Gijon (province of Oviedo).

Torquay.—September 2nd. One 1,000-kw. single-phase turbo-alternator, condensing plant and switchgear, for the T.C. See "Official Notices" August 16th.

Turkey.—August 29th. Ten dynamometers and 1,050 iron telegraph posts, 6 metres long. Tenders to Economat du Ministère des Postes Télégraphes et Téléphones. Deposit 10 per cent. Local representation.

West Hartlepool.—September 3rd. High-tension three-core paper-insulated cables and low-tension rubber cables and wiring, for the Corporation. See "Official Notices" to-day.

CLOSED.

Ashton-under-Lyne.—The Corporation has accepted the following tenders:—

Balcke & Co., London. Two air filters, for turbo-generators.
W. H. Allen, Son & Co.—Two sets of condensing plant, &c., for the electricity works.
Bradford Engineering Co.—Cooling tower at electricity works.

Crook.—The U.D.C. has accepted the tender of Messrs. Pease & Partners for the installation of 14 electric lights at Roddymoor, at £80, and their offer to maintain the whole of the lamps in the district at 5s. each per annum.

France.—The India-Rubber, Gutta-Percha and Telegraph Works Co. have been allotted portions of the service contracts for various descriptions of cables recently required by the Administration of Posts and Telegraphs, Paris.

Glasgow.—Provincial Cinematograph Theatres, Ltd., of London, have accepted—in connection with the reconstruction of the Picture House, Sauchiehall Street—the tender of Messrs. Malcolm & Allen, Ltd., for the wiring, at £702, and that of Messrs. G. N. Haden & Sons, for the low-pressure hot-water heating installation, at £879

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

War Office.

Accumulator batteries.—Tudor Accumulator Co., Ltd.
Electric cable.—Hooper's Telegraph and India-Rubber Works, Ltd.
Incandescent lamps.—Brimsdown Lamp Works, Ltd.; British Thomson-Houston Co., Ltd.; Corona Lamp Works; Cryselco, Ltd.
Telegraph poles.—Bullers, Ltd.

India Office Store Department.

Arresters, &c.—General Electric Co.
Motor convertor, &c.—Bruce Peebles & Co.
Projectors, &c.—Siemens Bros. & Co.

Crown Agents for the Colonies.

Telephone materials.—British L.M. Ericsson Manufacturing Co., Ltd.
Western Electric Co., Ltd.
Train lighting dynamos.—Mather & Platt, Ltd.

Office of Works.

Electrical conduit boxes.—Barton & Sons; General Electric Co.; Perfecta Co.; Walsall Hardware Manufacturing Co.
Generating set at British Museum extension. Browett, Lindley & Co., Ltd.
Main switchboard at British Museum extension. Drake & Gorham, Ltd
Main cables and additions to switchboard at Natural History Museum.—Siemens Bros. & Co., Ltd.

General Post Office.

Telephonic apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Gent & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.
Electric light cable.—Hooper's Telegraph and India-Rubber Works, Ltd.
Submarine cables.—Siemens Bros. & Co., Ltd.
Telephonic cable. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Telegraphic wire.—Rylands Bros., Ltd.; Shropshire Iron Co., Ltd.; F. Smith and Co., Wire Manufacturers, Ltd.
Telephonic wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; J. C. Fuller & Son, Ltd.; London Electric Wire Co. and Smiths, Ltd., Chas. Macintosh & Co., Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. and Smiths, Ltd.
Automatic call wire distributing equipment, Leeds.—The Automatic Telephone Manufacturing Co., Ltd.
Do. at Central Telephone Exchange, London, E.C.—Siemens Bros. & Co., Ltd.
Telephone Exchange equipment, London Wall, E.C., and Port Talbot.—The Western Electric Co., Ltd.

Margate.—The T.C. has accepted the tender of Messrs. Stuart & Moore for additional electric fire alarm posts, at £40.

Reigate.—The T.C. has sealed a contract with Messrs. Rickett, Cockerell & Co. for coal for the electricity works.

Rotherham.—The T.C. has accepted the tender of the Pulsometer Co., Ltd., for a motor pump, at £130.

Salford.—The B. of G. has accepted the tender of Messrs. R. O'Brien & Co., of Manchester, for E.L. and fire alarms at the infirmary, at £2,832. Fourteen tenders were received, the lowest being £2,123, and the highest £3,378.

Scarborough.—The tender of Messrs. Walker & Hutton, of Scarborough, has been accepted for the electrical installation at the new Roman Catholic Church being erected at South Cliff.

Worksop.—The U.D.C. has accepted the following tenders:—

Jas. Oakes & Co.—Steam, exhaust and circulating water pipes, £78.
Willans & Robinson, Ltd.—Force pump for condensing plant, £48.
E. Bennis & Co., Ltd.—Mechanical stoker, £127.
Matthews & Yates, Ltd.—Ventilating fan, £24.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—Rubber Insulated cable, £44.
British Insulated and Helsby Cables, Ltd.—Feeder pillar and joint boxes, £41.
Venner & Co.—Switchboard meters, £41.

NOTES.

Municipal Tramways Association (Inc.).—The eleventh annual conference of this Association is to be held at West Ham on September 25th, 26th and 27th. Mr. H. E. Blain, manager of the Corporation tramways there, is the president. Mr. C. J. Spencer, of Bradford, is the hon. secretary and treasurer. The programme, a copy of which is before us, shows that there is to be an informal musical conversazione at De Keyser's Hotel at 8 p.m. on Tuesday, September 24th, and the proceedings begin the following morning at 10.15 o'clock with a reception by the Mayor and the Tramways Committee at the Town Hall, Stratford, followed by Mr. Blain's presidential address and a paper on "Tramway Administration by Municipalities; a Retrospect and a Forecast," by Councillor S. C. T. Neumann, deputy-chairman of the Bradford Tramways Committee. Councillor C. Higham, vice-chairman of the Blackburn Tramway Committee, will open the discussion. After luncheon at the Town Hall the Conference will proceed to the tramway depôt at Greengate Street, Plaistow, where a discussion, opened by Mr. C. A. King, M.Inst.C.E., will take place on the Interim Report of the Corrugation Committee. An inspection of the depôt, and of the exhibition of tramway appliances, &c., at 3.30 o'clock, and the Corporation reception at the Stratford Town Hall at 7.30, are other items in a very full day's programme. On Thursday, in the Town Hall at 10 a.m., Mr. W. J. McCombe, tramways manager at Hull, will read a paper on "Tramway Fares and their Basis," and Mr. F. Schofield, tramways manager, Leyton, will open the discussion. The Corporation luncheon, a meeting of the managers' section, inspection of the depôt and exhibition, a garden party in West Ham Park from 3 to 5 p.m., and the Association dinner at the G.E.R. Hotel, Liverpool Street, at 7 for 7.30 p.m., will complete the programme for the Thursday. On Friday the annual business meeting will take place at De Keyser's Hotel at 9.45 a.m., and a motor-coach excursion to Epping Forest and Rye House will begin at 11 a.m. With such a programme the Convention bids fair to be a great success.

Bailiffs in Newcastle-on-Tyne Tramway Offices.—At a meeting of the Newcastle City Council, on the 15th inst., in reply to a question, Councillor Rodgers, the chairman of the Tramways Committee, made an explanatory statement as to the Sheriff's officer having been "in possession" at the tramway offices, on July 17th, following the compensation claim of Garland v. The Corporation.

Wayleaves for Overhead Mains.—The Prussian Ministers of Commerce and Public Works have just issued an order to the Government officials for guidance in regard to the relations between undertakers of central power stations and the communal authorities or combinations of these authorities. It is pointed out in the first place that in the arrangements made for the use of public roads, streets, &c., for mains, transformers, &c., the local authorities frequently undertake to grant a similar right to no other undertaker during a definite period. In this the Ministers see a great danger, as difficulties might arise therefrom later on which could not be overcome or only be surmounted at a considerable sacrifice. It is also impossible to foresee the future development of electrical supply, especially as the cost of production in general shows a falling tendency. It is therefore not advisable for the local authorities to deprive themselves of the possibility of availing themselves on a given opportunity of the advantages which can be offered by competition, particularly as they are also at liberty, without entering into an exclusive rights agreement, to take into account the interests of an existing undertaking by refusing temporarily to others the right of way over the streets, roads, &c., for the transmission of energy. Where the population is dense and the degree of economic development of the area of supply is great, the Ministers express the opinion that the success of the undertaking is also assured without the possession of the exclusive rights. If the grant of such a right cannot be avoided, it is submitted that it should in any case only be given for a short period.

High-Frequency Generators.—A company is to be formed in Paris early in September, to undertake the international working of the foreign patents for the Goldschmidt high-frequency generator, excluding those for Germany which are held by the Lorenz Telegraph Co., whilst the High-Frequency Machine Co., of Berlin, owns the foreign patents. French, German and American industrial and banking interests will participate in the new company, which will have an ordinary share capital of £400,000, 25 per cent. paid, and 100,000 non-redeemable deferred shares, which will be entitled to 45 per cent. of the profits remaining after a dividend of 6 per cent. has been paid on the ordinary shares. The High-Frequency Co. will receive for its patents one-half of the deferred shares and £100,000 in cash, and will also take over £100,000 in ordinary shares, upon which 25 per cent. will be paid. It is proposed to establish an experimental wireless service between the United States and Germany, and the new company will undertake the construction of a large tower near New York, whilst the tower now being erected near Hanover will remain in the hands of the German company. It is stated that the decision to form a foreign company for the working of the patents is prompted by the circumstance that a German company would not be specially suitable for negotiating with Government authorities in many countries.

Copper.—Statistics of copper supplies, as shown by Messrs. Merton's circular for August 15th, 1912, show that at present the balance is fairly well maintained. The visible supplies at mid-month stand at 46,071 tons, as against 44,996 tons for the end of July. Including Rotterdam and Hamburg, the figures are 51,234 tons, as against 50,574. We find that stocks in English ports have increased 561 tons in the fortnight; stocks at Havre, 1,064 tons; the quantity afloat from Chile is 150 tons more than for the end of July. On the other hand, the Australian consignments are 700 tons lower, the stocks in Rotterdam, 200 tons down, and stocks in Hamburg, 215 tons less. The same tone appears in American stocks, these standing at 22,446 tons for the end of July, as against 19,793 for the end of June. The world's supplies for the end of July were 73,020 tons, against 67,931 for end of June. This is the first time the supplies have shown a decided increase over a previous month since last September.

Turning to European supplies and deliveries, we find that the arrivals from North America are rather low, while the supply to England and France from Spain and Portugal is exceptionally high (1,866 tons for the half-month). Shipments from Chile work out at above average, and the same from Australia. Deliveries, however, are not very brisk, and the revival of trade to be anticipated from more settled financial conditions will probably considerably affect the present relations of supply and demand.

Summing up the general outlook, a writer in the *Financial Times* for August 20th points out that the real underlying factor in the market is the enormous growth in the world's consumption of the metal, which has been going on for a considerable time. He further says:—"During the past two years consumption has been steadily overtaking production." Practically the whole of the increase has occurred in Europe, the American consumption having shown no improvement until within the last month or two. The principal increase has been witnessed in Germany, and a table is given from one published by Messrs. James Lewis & Son, stating the figures as far as available for this year as compared with the same periods in the two previous years:—

	1910. Tons fine.	1911. Tons fine.	1912. Tons fine.
England (7 months)... ...	46,163	54,449	48,928
France (7 months)	32,587	42,913	45,857
Germany (6 months) ...	77,447	85,188	109,727
Other countries (7 months)	16,939	18,919	23,567

The decrease this year in the consumption of England, as compared with that of 1911, is to be attributed to the coal strike and other labour difficulties. According to this article, trade in the United States is improving. Supplies are not increasing in pace with the consumption; the new properties opened up as a result of the rise in 1906 have not so far had so much influence in this direction as was expected.

Institution and Lecture Notes.—Iron and Steel Institute.—At the Autumn meeting, which is to be held at Leeds from September 30th to October 4th inclusive, 18 papers are to be read, including the following :—

"On a New Type and Method of Construction of Large Gas Engines." By A. E. L. Chorlton (Manchester).
On the Thermal-Magnetic Transformations of 25 per cent. Nickel Steel." By Dr. E. Colver-Glauert (Sheffield) and Dr. S. Hilpert (Charlottenburg).
"On a new Method for the Improvement of the Soundness of Steel Ingots by the Aid of Thermit." By Dr. Hans Goldschmidt (Essen Ruhr).
"On a Method of Producing Sound Ingots." By Sir Robert A. Hadfield, F.R.S. (Sheffield).
"On a New Method of Revealing Segregation in Steel Ingots." By Sir Robert A. Hadfield, F.R.S. (Sheffield).
"On the Magnetic Properties of Manganese and Nickel Steels." By Dr. S. Hilpert (Charlottenburg), and Dr. W. Mathesius (Worcester, Mass., U.S.A.).
"On Some Aspects of Wire Drawing." By P. Longmuir (Sheffield).
"On Rolling-Mill Practice in the United States." By J. Puppe D. Ing. (Breslau).

Visits to a large number of works, including those of Kitson and Co., Ltd., J. Fowler & Co., Ltd., J. Buckton & Co., Ltd., Hathorn, Davey & Co., Ltd., Hunslet Engine Co., Ltd., Manning, Wardle and Co., Hudswell, Clarke & Co., Ltd., J. and H. McLaren, Walter Scott, Ltd., Coghlan Steel and Iron Co., Ltd., Monk Bridge Iron and Steel Co., the Leeds city lighting and tramway power stations, Farnley Iron Co., Ltd., Greenwood & Batley, Ltd., W. Johnson & Sons, Ltd., Fairnbairn, Lawson, Coombe & Barbour, Ltd., Otto Coke-Oven Co., Ltd., Taylor Bros. & Co., Ltd., Yorkshire Copper Works, Hunslet, Thos. Smith & Sons, Rodley, Wilson Hartnell & Co., Ltd., Leeds Railless traction system, and many other works of engineering and industrial interest. There will also be visits to Bolton Abbey, Fountains Abbey, and North Lincolnshire and Immingham.

Explosions on Tramcars.—On the 16th inst., at St. Helens, Michael Thomas, 20, Bond Street, Prescot, was summoned for travelling on a car of the St. Helens Tramways Co., having in his possession a certain explosion, ammonite. Mr. Kelly, who prosecuted, said that on July 18th last a number of colliers, contrary to the by-laws, left in a car, at Prescot, a tin box containing a number of ammonite cartridges, which was a dangerous explosive. Had an accident occurred there might have been a most serious explosion. Defendant was fined 40s., and ordered to pay the advocate's fee and the expert witness's fee.

Inquiries.—A correspondent asks for the names and addresses of dealers in drawn tungsten wire.

Electrical Engineers in Camp at Weymouth.—On Saturday last the members of the Dorset Fortress Electric Light Co., R.E., took to canvas on the Nothe, Weymouth, for their annual training. The company paraded at the Sidney Hall in the afternoon, and marched to the Nothe Common, where for the following fortnight important operations in electric lighting and engineering will be entered upon.

Will.—Mr. Robert Douglas Norman, of Glasgow, and formerly of Edinburgh, electrical engineer, who went down in the *Titanic* disaster, left personal estate in the United Kingdom valued at £5,973, of which £1,190 is in Scotland.

The Shops Act.—At the Burnley Police Court last Friday, Mr. James Batty, electrician of Market Street, was summoned for failing to affix in his shop the specified notice intimating the day of the week on which assistants are not employed after half-past one o'clock. On behalf of the Corporation, who prosecuted, Mr. Gray stated the Act had been in force three months and there were shopkeepers who either did not or would not take any notice of its requirements. Mr. Batty said he had a notice in his shop window, but Sergt. Ratcliffe stated, that it was not the one required, as it referred to the closing of the shop only. Mr. Batty : I received no warning. The Magistrate's Clerk : Ignorance is no excuse. You must have a notice in the prescribed form. Mr. Batty being willing to affix the notice, he was let off on payment of costs, no conviction being recorded.

Appointments Vacant.—Lecturer and instructor in dynamo design (£250), also a junior assistant in electrical engineering (£100). for the City and Guilds Engineering College, Exhibition Road ; meter tester for D.C. work, at Birmingham Corporation electricity supply department (30s.). See our advertisement pages to-day.

Annual Excursion.—On Saturday, August 17th, well over 300 of Messrs. A. Reyrolle & Co.'s employés travelled by special train to Redcar, where a most enjoyable day was spent. Sports were held on the sands in the morning, and lunch and tea were served in the Cleveland Hall, where speeches were made by various members of the staff, commenting on the success of the firm, at whose excursion, some 20 years ago, only 11 members were present.

Educational Notes.—The University of Liverpool (Faculty of Engineering). Particulars of the professors and lecturers in electrical and other engineering subjects for the 1912-13 session, which opens on Thursday, October 3rd, are given in an announcement which appears in our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. H. P. Baynham, assistant electrical engineer at Whitehaven electricity works, has been appointed to the post of works superintendent at the Carlisle Electricity Works, and on Friday last he was presented with an electroplated tea service and tray. The presentation was made by the chairman of the Electricity Committee (Alderman J. R. Musgrave), supported by the vice-chairman. The borough electrical engineer (Mr. B. Sankey) expressed his regret at losing Mr. Baynham, who had been associated with him for the past eight years.

Mr. C. R. Marshall, of the Grays U.D.C. Electricity Department, has been appointed charge engineer at the St. Albans power house, of the North Metropolitan Electric Power Supply Co. On leaving Grays he was presented with a gold-mounted fountain pen.

Mr. W. Mayall Milnes, assistant electrical engineer at Burnley, has been appointed chief mechanical and electrical engineer to the tramways department, Coventry. There were 250 applicants, and Mr. Milnes will take up his new duties a month hence.

Tramway Officials.—Mr. Geo. Hosking, late senior inspector of the Plymouth, Stonehouse, and Devonport Tramways Co., has been presented by the directors, in recognition of 30 years' service, with an upholstered armchair.

General.—A Dublin newspaper referring to Mr. Sowter's recovery after his serious accident at Bray, says : "After the occurrence Mr. Sowter displayed the greatest fortitude, and actually dictated his will while he lay in a mangled condition prostrate on the earthen floor of the works. He retained consciousness, though he suffered considerable pain, while being conveyed from Bray to St. Vincent's Hospital, Dublin, in a motor-car. In this institution a very successful operation was performed upon him by Surgeon Kennedy, and his rapid recovery has been looked upon as marvellous by the medical staff connected with the hospital. One evening last week, accompanied by Surgeon Kennedy, Mr. Sowter was removed from the hospital and driven in a motor-car to his residence, where he was received with delight by his wife and young family. It is understood that when Mr. Sowter regains his old strength he will continue to manage the electric light works of the 'Brighton' of Ireland."

On August 8th Mr. J. Rodgers, assistant engineer at the Government Electricity Works, Malta, was presented by Mr. Muller, chief engineer, on behalf of the staff, with a silver cigarette case, on the occasion of his leaving to take up a similar position in England.

Mr. Stanley J. Goddard, President of the Constantinople Telephone Co. (Société Anonyme Ottomane des Téléphones de Constantinople), and Mr. W. W. Cook, consulting engineer, left London by the Orient Express on Saturday, 24th inst., on a visit to Constantinople.

Obituary.—An Exeter paper reports the death, at the early age of 49 years, of Mr. Frank Golding, electrical engineer at the Devon County Asylum.

According to news received by the *Western Daily Mercury*, at Plymouth, the death has occurred of Mr. C. O'Brien Shaw, chief electrician of the Eastern Telegraph Co.'s steamship *Electra*, at Zanzibar. Deceased, prior to going abroad, was electrician of the ss. *John Pender*, the E.T.C.'s depôt ship, which has moorings in Stonehouse Pool. Mr. Shaw was the son of the late Capt. Sir E. Massey Shaw, K.C.B.

The *Morning Post*, in referring to the death of Capt. Arthur William Stiffe, suddenly, at Goring-on-Thames, at the age of 81 years, says that in 1862 he was employed on special survey duty for the laying of telegraph cables in the Persian Gulf. The following year he was on special duty in Turkish Arabia, and in October was appointed engineer of the Persian Gulf Telegraphs, and to the command of the *Amberwitch*. Capt. Stiffe was afterwards officiating Director of the Telegraphs and Port Officer of Calcutta. He was a member of the Institution of Electrical Engineers. In 1890 Capt. Stiffe was engineer-in-chief of the Halifax-Bermuda Cable Expedition.

According to the *Times* "Deaths" announcements, Mr. Walter A. R. Knight, A.I.E.E., superintendent of Eastern Extension Telegraph Co. at Cape St. James, Saigon, passed away in London on 9th inst., at the age of 41 years.

NEW COMPANIES REGISTERED.

Albert Green, Ltd. (123,688)—This company was registered on August 10th, with a capital of £16,000 in £1 shares, to carry on the business of wire covering, gimp, cord, braid, tassel, tape, trimming, elastic, electric cable and wire manufacturers, &c., to acquire the business carried on by A. Green at New Normanton Mills and Agar Street, Derby, and Wirksworth, Derbyshire, and elsewhere. The subscribers (with one share each) are :— A. Green, 48, Derby Lane, Derby, trimming manufacturer; T. Walton, The Bank House, Normanton Road, Derby, bank manager. Private company. The number of directors is not to be less than two or more than five ; the first are A. Green (chairman), and others to be appointed by him ; qualification, 100 shares. Registered office, New Normanton Mills, Derby.

Argentine Tramways and Power Co., Ltd. (123,780).—Registered August 14th, by Budd, Johnson & Jecks, 21, Austin Friars, E.C. Capital, £500,000 in £5 shares. Objects: To acquire the benefit of any concessions, grants, decrees, rights, powers and privileges which may be granted by any municipal or other authority, and particularly those relating to the construction or working of electric tramway lines, power station, railway lines, or other public works, and to undertake and carry out the same or any part thereof; to acquire or construct, equip and work tramways, railways, water works, factories, and public or private buildings and works; to carry on the business of an electric light, power, and supply company, &c. The signatories (with one share each) are: E. Porter, 33, Newman Road, Plaistow, E., clerk; H. S. Lewis, 33, Waverley Road, South Woodford, accountant; W. H. Jackson, 35, Park Hall Road, East Finchley, N., accountant; A. S. Jecks, 21, Austin Friars, E.C., solicitor; G. A. May, 34, Stamford Hill, N., clerk; G. P. Pleasance, 8, Tintern Road, Wood Green, N., clerk; R. Cave, 26, Beversbrook Road, Tufnell Park, N., clerk. Registered without articles of association. A letter from the solicitors states that "there are no directors of the company who have consented to act."

Rushden and District Electric Supply Co., Ltd. (123,685).—This company was registered on August 8th, with a capital of £25,000 in £1 shares, to take a transfer of the undertaking authorised by the Rushden and District Electric Lighting Order, 1912, to produce and supply electrical energy within the limits of supply prescribed by the said order and any orders amending or extending the same, to carry on the business of suppliers of electric light and power, electrical engineers, metal workers, contractors for the supply of electrical plant, &c., and to adopt an agreement with F. H. Thornton, B. Sampson and J. Clark. The subscribers (with one share each) are: F. H. Thornton, Kingsthorpe Hall, Northampton, gentleman; W. James, 31, Billing Road, Northampton, gentleman; E. M. Browne, 21, The Drive, Northampton, solicitor; G. H. Jackson, 22, The Crescent, Northampton, engineer; E. W. Sykes, 53, Colwyn Road, Northampton, gentleman; B. Sampson, 32, Market Square, Northampton, gentleman; H. St. J. Browne, 21, The Drive, Northampton, solicitor. Private company. The number of directors is not to be less than three or more than seven; the first are F. H. Thornton, B. Sampson and J. Clark; qualification, £200; remuneration, £60 per annum divisible. Solicitors, Browne & Wells, Northampton. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Bourton-on-the-Water Electric Light and Power Co., Ltd. (123,628).—This company was registered on August 7th with a capital of £1,250 in £1 shares, to carry on the business of an electric power, light and supply company in all its branches, electricians, mechanical engineers and suppliers of electricity, &c. The subscribers (with one share each) are:—L. E. Jones, Orchardleigh, Pinner, Middlesex, gentleman; S. T. Bacon, 60, Cumberland Road, Acton, W., clerk; W. G. C. [illegible], 4, New Broad Street, E.C., secretary; H. M. Andrews, 14, New Broad Street, E.C.; G. F. Moore, J.P., Chardwar, Bourton-on-the-Water; G. L. Hartwell, Bourton-on-the-Water, ironmonger; J. A. Bloss, Bourton-on-the-Water, auctioneer. Minimum cash subscription, 100 shares. The number of directors is not to be less than two or more than five; the first are H. T. Harrison and W. Riggs; qualification (except first directors), £50. Solicitor, T. F. [illegible], 62, London Wall, E.C.

Marro Manufacturing Co., Ltd. (123,745). This company was registered on August 14th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of and dealers in lamps, mantles, burners, films, globes, brackets, shades, glasses, galvanometers, ammeters, voltmeters, carbons, switches, motors, batteries, stores, turbines, pipes, wires and appliances used in connection with gas, electricity or other illuminant or generator of heat, light or power, asbestos packing and rubber for machinery, belt dressing, solvents and articles of rubber, or in which rubber is or may be incorporated, &c., and to adopt an agreement with C. Salomon and S. Salomon. The subscribers (with one share each) are:—C. H. Busch, 12, Curzon Road, Muswell Hill, N., secretary; S. Salomon, 39, St. John's Lane, E.C., director. Private company. The first directors are C. Salomon, S. Salomon, C. Krecke and C. H. Busch. Remuneration £10 each per annum. Registered office, 39, St. John's Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—A memorandum of satisfaction in full on various dates ending January 1st, 1912, of first debentures, created October 3rd, 1901, securing £250,000 and second debentures, dated from January 31st, 1907, to November 3rd, 1908, securing £189,000, has been filed.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the extent of £500 on July 1st, 1912, of debenture, dated July 10th, 1911, securing £5,000, has been filed.

West African Telegraph Co., Ltd. (21,626).—Return dated May 29th, filed June 4th, 1912. Capital, £100,000 in £10 shares; 23,109 shares taken up; £231,090 paid. Mortgages and charges: Nil.

W. Lucy & Co., Ltd. (51,908).—Return dated June 1st, filed June 15th, 1912. Capital, £15,000 in £10 shares (250 preference and 1,250 ordinary); 1,030 ordinary and 250 preference shares taken up; £10 per share called up on 781 ordinary and 250 preference; £10,310 paid; £2,490 considered as paid on 249 ordinary. Mortgages and charges: £7,000.

International P.A.Y.E. Tramcar Co., Ltd. (1,178F.)—Particulars filed July 31st, 1912; capital, $3,750,000 in $5 shares. Registered in Canada on November 15th, 1911. British address, 6, Broad Street Place, E.C., where H. M. Howard is authorised to accept service. Directors: Rt. Hon. Earl Clanwilliam, Sir Francis Lowe, M.P., C. Steel, H. J. Buckmaster, D. McDonald, R. L. Macduffie and L. C. Huppert.

Northern Counties Electricity Supply, Ltd. (67,924).—Return dated June 21st, filed June 26th, 1912. Capital £200,000 in £1 shares. 149,990 shares taken up. £1 per share called up on 145,990. £145,991 5s. paid, including £1 5s. paid on 10 shares forfeited. £4,000 considered as paid on 4,000 shares. Mortgages and charges: £190,000.

Wolverhampton District Electric Tramways, Ltd. (68,345).—Return dated May 16th, filed June 3rd, 1912. Capital, £200,000 in £5 shares. 32,200 shares taken up. £5 per share called up on 31,950 and 5s. per share on 250. £159,812 10s. paid. Mortgages and charges: £89,000.

W. A. Meadows & Co., Ltd.—Bond and debenture by way of indemnity and security, dated July 31st, 1912, to secure £608, charged on company's property and undertaking, including uncalled capital. Holder: J. Boulton, Hanley, Staffs.

Midland Electric Manufacturing Co., Ltd.—Second mortgage debenture dated July 31st, 1912, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: F. H. Jordan and J. H. Prince, 4, Temple Row West, Birmingham.

Siemens Bros. Dynamo Works, Ltd. (88,928).—Return dated July 18th, filed July 23rd, 1912. Capital £800,000 in £10 shares. 20,000 shares taken up. £10 per share called up on seven. £70 paid. £199,930 considered as paid on 19,993. Mortgages and charges: £200,000.

Telegraph Condenser Co., Ltd. (110,048).—Return dated January 10th (filed August 14th), 1912. Capital £5,000 in £1 shares. 2,000 shares taken up. [illegible]

Veritys, Ltd. [illegible] £210,000 in [illegible] and [illegible] 7,000 first preference [illegible] shares taken up [illegible] share on [illegible] paid [illegible] preference and [illegible]. Mortgages [illegible].

Banbury and District Electric Supply Co., Ltd. [illegible].—Return dated June 11th, filed July 30th, 1912. Capital, £25,000 in £10 shares. All shares taken up. £25,000 paid. Mortgages and charges: £1,000.

Industrial Plant Co., Ltd.—Issue on July 26th, of £1,000, and on July 27th, 1912, of £200 debentures, parts of a series of which particulars have already been filed.

Guildford Electricity Supply Co., Ltd.—Particulars of £15,000 second mortgage debentures, created July 12th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to £25,000 first mortgage debentures. No trustees.

Campbell & Isherwood, Ltd. [illegible].—Particulars of [illegible] debentures, created July 18th, 1912, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, except uncalled capital, but including electrical works in Raleigh Street, Bootle, Lancs. Trustees: J. W. Davidson, 6, Castle Street, and J. Tattersall, 53, Lord Street, Liverpool.

A memorandum of satisfaction in full on July 29th, 1912, of charge dated October 13th, 1911, securing all moneys due or to become due from the company to [illegible].

W. A. Stevens, Ltd.—Particulars of [illegible] debentures, created July 22nd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No [illegible].

Hill, Harding & Co., Ltd.—Issue on July 24th, 1912, of £200 debentures, part of a series of which particulars have already been filed.

Camborne Electricity Supply Co., Ltd. (57,950).—Return, dated June 13th, filed June 20th, 1912. Capital, £10,000, in £1 shares. 607 shares taken up. £605 paid, leaving £2 in arrears. Mortgages and charges: Nil.

British Westinghouse Electric and Manufacturing Co., Ltd. (62,919).—Return, dated May 23rd, filed August 2nd, 1912. Capital, £1,675,000, in 500,000 preference shares of £3 each and 75,000 ordinary shares of £5 each. All shares taken up. £1,500,000 paid on the preference. £375,000 considered as paid on the ordinary. Mortgages and charges: £1,468,853.

Trafford Power and Light Supply (1902), Ltd. (72,601).—Return dated June 25th, filed June 26th, 1912. Capital £80,920 in £1 shares (23,120 preference). 23,120 preference and 57,800 ordinary shares taken up. £80,920 paid. Mortgages and charges: £[illegible]

CITY NOTES.

Tyneside Tramways and Tramroads Co., Ltd.

THE directors' report for the half-year ending June 30th, 1912, states that the surplus of receipts over expenses is £[illegible] which with the balance brought forward of £[illegible] makes a total to the credit of profit and loss account of £5,342, and after deducting interest on debentures, loans, &c., amounting to £1,014, there remains an available balance of £4,329. The directors propose payment of dividend on the preference shares (5 per cent. per annum, less income-tax), £601; dividend on the ordinary shares at the rate of 2½ per cent. per annum (less income-tax), £1,674; to the credit of reserve for renewals, depreciation, and other contingencies, £1,000 (this fund now amounts to £11,756); setting aside for the reduction of registration and formation expenses, &c., £330, and carrying forward £724. The traffic receipts show an increase of £870, as compared with the corresponding period of last year.

The half-yearly meeting was held in Newcastle-on-Tyne on 20th inst., Dr. J. T. Merz in the chair.

The CHAIRMAN, in moving the adoption of the report, stated that the increase in traffic receipts was slightly more than last year. The £869 increase had been made up by increases of £832 on ordinary traffic and £121 on workmen's traffic, and against that there was falling off in the holiday traffic of £74, whereas last year they had to report an increase of £127 on that item. This was owing to the state of the weather. The principal portion of the increase was on the ordinary traffic. The car-miles run were 70,095 more than the corresponding half of last year, when he had to report a decrease of 582. The principal item came from the workmen's traffic. The company had carried 240,404 passengers more than in the corresponding half-year. The receipts per car-mile had been 9·288d., which was the maximum they had reached, as against 8·870d. last half-year, and 8·8d. some years ago. The expenses were going up slightly, being 6·014d. against 5·998d., and this to some extent was owing to the increased repairs to the cars and lines, which, so far, had been defrayed out of revenue. They had not called upon the reserve fund in dealing with such repairs. Since July 1st last there had been a falling off, the decrease amounting to £541, which was almost entirely due to the falling off in pleasure traffic, and the fact that last year there was a special increase as a consequence of the railway strike. There was nothing to alarm them, for they quite expected at the end of the half-year to be as well, if not better, off than last year, because the ordinary and workmen's traffic was still on the increase.

MR. G. E. HENDERSON seconded the report, which was adopted.

Liverpool Overhead Railway Co.

The half-yearly meeting was held on August 13th in the Law Association Rooms, Liverpool, Sir Wm. B. Forwood presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 228), congratulated the shareholders upon the encouraging accounts before them. They were the more gratifying because the past half-year had been one of considerable anxiety and difficulty to all railways. The coal strike not only seriously disorganised traffic, but it added materially to the cost of all railway services, and as a result, most railway companies had had to reduce their dividend by 1 per cent. per annum, and so far as his researches went, the Overhead Railway was the only line which was able to recommend the payment of an increased dividend. It was the more gratifying as it was the best dividend they had paid during the past 10 years. A dividend of 2 per cent. per annum, however, could not be entirely satisfactory, but it was certainly a gratifying improvement, and they hoped it might prove the beginning of a better state of things. They must, however, not be too sanguine. Recent legislation in the coal trade had added considerably to the cost of fuel, and the lesson of the late strike imposed upon them the necessity of carrying reserve stocks of coal. The Labour unrest had not only added to the wages bill, but it created an element of uncertainty as to the future, and the Insurance Act still further increased working expenses. On the other hand, the growth in traffic made very satisfactory progress. They had carried during the half-year on the railway and tramway 5,871,000 passengers, which not only showed an increase over the same half last year of 478,000 passengers, but it nearly constituted a "record," being the largest number of passengers they had carried in any half-year since 1903, which was only slightly in excess of these figures. The increase had been mainly in workmen and third-class passengers, and in consequence, the earnings per passenger carried remained the same, 1·69d. per passenger. They were earning before the Liverpool Corporation opened its Dingle Tramway in 1898, 1·99d. per passenger, and when it opened its service to Seaforth in 1900 they were receiving 1·90d. per passenger. If they had earned this average upon the traffic of the past half-year they would have received an increased revenue of £4,612, but their fares had had to be reduced to meet the competition of the Corporation Tramways and the Lancashire and Yorkshire Railway. The total receipts had been £40,927 against £37,856 during the same period last year, being an increase of £3,071. On the other side the expenditure had also gone up by reason of the strike and the increase in coal and wages bill, and they had spent £28,313 as against £27,229 last year, an increase of £1,084. Under the circumstances they had done very well, and much credit was due to the general manager and his staff for their careful oversight over expenditure, and the watchfulness and ability they displayed during the coal strike. The proportion of expenditure to revenue was 64·7 per cent., the best result they had achieved in this half since 1900. They had placed, as usual, £1,500 to renewal account, which now amounted to £45,166. They had also £1,500 standing to the credit of contingent fund and £1,047 to the credit of insurance fund. Both of these accounts had been added to during the half-year. The maintenance of the structure and of rolling stock and electrical equipment had received careful attention, and they were in excellent condition. To fill the vacancy on the board they had elected Alderman Hyslop Maxwell. During the many lean years through which they had passed the directors had only taken £500 per annum out of the £800 placed at their disposal by the shareholders. With the advent of better times they proposed to reinstate the amount of their fees. The chairman said he could not close without congratulating the city upon the great improvement which had taken place in the trade of the port, for the traffic on their railway was the best barometer of their trade. At the same time, they could not place out of sight the increasing competition for our oversea trade, and it would require all the vigilance of the city and dock authorities to enable them to maintain their present prosperity, and it could only be done by continued efforts to make Liverpool the most convenient and economical port in the kingdom. Nothing contributed more to the economical and expeditious conduct of the trade of the port, and therefore to its prosperity, than the overhead railway. The Railway Companies' (Accounts and Returns) Act would call upon them to render their accounts in another form next year. It would also dispense with their holding two meetings in the year, but would permit of their paying an interim dividend, and following the course adopted by other railway companies, they would in future only hold their annual meeting in February.

Mr. H. C. Woodward seconded the motion, which was carried without comment.

Perth Electric Tramways, Ltd.

The annual meeting was held on Friday last at the London Chamber of Commerce, Oxford Court, E.C., Mr. Allen H. P. Stoneham presiding.

The Chairman, in proposing the adoption of the report (see Elec. Rev., page 266), said he was gratified to be able to record a good increase in receipts over last year, and even over those of the boom year of 1906, when they benefitted by the Exhibition held at Perth. He had always said that eventually they would make large profits, and had given reasons for the faith which was in him, and he was glad now to be able to congratulate himself and the shareholders that he was not mistaken. Even now, however, they must walk warily. At the meeting in 1906 he said that they ought to put aside £2,500 a year at least for depreciation. They had not since been able to live up to that good resolution, but this year they were setting aside £9,000 to reserve, which would make that fund up to the figure it would have been had they put aside the £2,500 a year as intended. The profits for the current year promised to be much greater than those of last year, but one could never be certain what might happen. Two years ago the disastrous strike of their workmen took place, which cost them some £7,000. Since then they had only narrowly missed two other strikes, and those had only been averted by substantial rises in wages. Even now the men were not satisfied, and they had appealed to the Federal Arbitration Court, and one could never tell what the result would be. There was only one certainty, which was that the company would have to obey the award if it gave the men an increase, and the men would certainly strike if it did not give them an increase. Politicians here were fond of quoting Australian methods as a panacea for strikes, but the Arbitration Act in Australia had been nothing but a means of hitting employers, without any possibility of enforcing its awards when against the men. That attitude of the men was one of the reasons why the directors had agreed, subject to the consent of the shareholders, to sell the undertaking. The present time, however, was not an advantageous one to discuss the proposed scale. The Bill for the purchase was now before Parliament. It had passed the Lower House and would, no doubt, pass the Upper Assembly in due course, and then receive the Royal Assent, but until then it would be most injudicious to publicly discuss the matter, for at present it was only a provisional contract. As soon as possible they would call a special meeting, at which full information would be given and full discussion invited. He would then tell the shareholders why they considered the sale desirable, notwithstanding that the company was just entering upon the great era of prosperity to which they had looked forward so long, and which the directors had worked so extremely hard to obtain. He could assure them that the company had really been directed from London. The board had had to devote weeks at a time to its affairs, and to conduct very delicate negotiations continuously for the last two years. They had also had to conduct numerous other lengthy negotiations when they were getting extensions, and had had to commit themselves to those extensions, knowing that they involved capital outlay without knowing where the capital was to come from. On several occasions they had had either to borrow the money for the requirements of the company or to guarantee loans from their bankers in order to carry to a successful issue some of the operations which they had entered into in the interests of the company. They had to do that at times when the credit of the company was not good, and when the company was at a critical stage of its career. At a later stage they would ask the shareholders to vote them something more substantial than mere thanks, and they would have no hesitation in doing so, because they knew that if they had not taken the course they did the company would not have been in the position it occupied to-day. They felt, therefore, they were fully and fairly entitled to some share of the profits now being earned as a result of the exertions they had made and the risks they had run.

Mr. Charles Wren seconded the motion.

Mr. Francis complained of the late period of the year in which the meeting was being held, and asked whether the delay was due to the negotiations with the Government as to the sale of the property. He also asked why the dividend was only 5 per cent., seeing that the earnings amounted to 14 per cent. Supposing the sale went through, he would like to know whether the cash reserves would be ear-marked for the benefit of the ordinary shareholders, or whether it was proposed to let the preference shareholders participate in the distribution.

Mr. Andrews also expressed himself as disappointed at the smallness of the dividend, having regard to the profits earned.

The Chairman, in reply, said the meeting was delayed because the directors had hoped that by now they would have been able to have taken the shareholders into their confidence, and to have explained the agreement for sale. With regard to the necessity of adding to the reserve fund, they must remember that the sale was not yet through, and they did not know for certain that it would take place. If it did not, they would want the present reserve fund and a good deal more besides, and, in the judgment of the directors, it would be exceedingly unwise to pay a larger dividend until they knew what the future was going to be. Should the deal go through, they would call a special meeting, at which the whole position would be placed before them. The question as to whether the cash reserve should be divided among both classes of shareholders, or simply among the ordinary, would be one for the shareholders themselves to decide, it was not a matter for the directors.

The report was then adopted.

Walter Scott, Ltd.—The report for the year ended June, 1912, states that the profits of the steel works, collieries, &c., amount to £55,552. The directors proposed to pay the dividend on the cumulative 6 per cent. preference shares for the year to June 30th, 1912, and carry forward £655. The profits of the past year are sufficient to provide for the payment of all arrears of dividend on the preference shares. According to an abstract of the report appearing in a financial daily, the steel works have been well and profitably employed during the year, with the exception of the period covered by the railway strike in August last year, and the national miners' strike in March and April this year; but the trade disturbances mentioned have very seriously affected the production at the collieries, and in a lesser degree the smaller departments of the business. The prospects for the current year, however, are much more hopeful, and in the absence of further labour troubles a fairly prosperous period appears to be in view.

Manaos Tramways and Light Co., Ltd.

THE annual general meeting was held on Tuesday at the offices, 9, Cloak Lane, Cannon Street, E.C., Mr. W. C. Burton presiding.

The CHAIRMAN in moving the adoption of the report (see ELEC. REV., page 267) said he would first like to explain the apparent discrepancy between the surplus for the year, as shown by the monthly statements published by the operating managers, and the surplus as shown by the report. The difference arose solely from the manner in which the accounts were made up for the final report. The gross earnings as shown by the revenue account were slightly higher than those shown by the monthly statements. The local auditors' report showed the total profits in Manaos transferred to London account at £41,301. Deducting from that the London expenses and the debenture interest—£18,338, there remained a surplus of £22,963, as compared with £22,367 shown by the monthly statements made up from cabled returns—a very close agreement. When the directors considered the accounts, they felt that with a comparatively new company such as that, a conservative policy should be pursued, and, therefore, they had made special provisions and transfers against the revenue account of a total of £6,645, bringing the net surplus down to £16,318. Those transfers consisted of certain doubtful items locally charged to capital; provision in full against certain local contingent liabilities: reserve against possible bad debts: the writing down of the valuation of stores, and the settlement of certain old accident claims occurring in previous years. All of those items instead of being paid for out of revenue might have been dealt with through the renewal and contingent reserve accounts, thus making a better apparent showing for the year, but requiring larger additions to the reserves out of this year's surplus. The revenue account showed that the gross tramway receipts had increased from £105,867 to £109,718: the gross lighting receipts from £33,594 to £35,602, and the total gross income from £139,938 to £147,290. The operating expenses had increased from £110,076 to £112,634, and the net earnings had increased from £29,862 to £34,656, or an increase of 16 per cent., while the ratio of operating expenses to gross receipts had further fallen from 78½ per cent. to 76½ per cent. That ratio was still undoubtedly high, but the experience of the last few months showed that the efforts they were making to reduce it were being effective. The capital expenditure during the year amounted to £7,171. That expenditure was largely due to the extensions necessary for increasing the number of public arc lamps and to meet the demands of new consumers in the private lighting department and other amounts in the various departments of the system, all of which tended to increase the earning power of the undertaking. Throughout the year under review general business in Manaos remained in an unsatisfactory condition owing to the continued comparatively low price of rubber, and he thought it was a matter of congratulation that notwithstanding that, they had been able to show increased receipts. They were hoping to add to the revenue by the sale of more electric power and were now negotiating contracts for the purpose. Taking their gross receipts as a guide, that business depression seemed to have culminated in May this year, and now the recovery which they had hoped to have seen earlier seemed to have commenced. The current year had not started in a very encouraging way, but the more recent returns showed improved results, particularly in a marked reduction of operating expenses, and he anticipated further improvements. The number of car-miles run during the year increased by nearly 10 per cent., and the number of passengers carried by 3 per cent. from which it could be seen that they could considerably increase their net earnings without materially increasing the operating expenses. In the lighting department the number of public arc lamps increased nearly 7 per cent., and the number of lamps for private lighting by 33 per cent. After providing for debenture interest, London office and other expenses, there remained a balance of £16,318, to which must be added £3,509 brought forward, making a total of £19,827. Out of that the directors had transferred to the contingencies and accident reserve £2,500, bringing that account up to £10,000; and to renewals reserve £5,000, making a total to the credit of that account of £15,000. That left a balance of £12,327, out of which they recommended the payment of a dividend of 3 per cent., carrying forward £3,327. On the returns as they came to them a higher dividend, perhaps 4 per cent., might have been recommended, but they believed in a thoroughly conservative policy, and in only commencing the dividend at a rate which was practically sure to be maintained and increased in the future.

MR. G. M. BOOTH seconded the motion.

The CHAIRMAN, in reply to a shareholder, said there were no motor-omnibuses in Manaos, and the condition of the roads there was such that motor-'bus competition would be extremely difficult.

MR. COBBE drew attention to a circular which was sent out some months ago, and which, he said, made some very glowing statements as to the company's working, which statements did not appear to be borne out by the report. In the circular in question, dealing with the first nine months of the year under review, it was claimed that the company had made a net revenue, which amounted to 85 per cent. of the total revenue as given in the report. He would be glad to know if the circular was issued from the offices of the company, and if not, why it was not disowned in any way.

The CHAIRMAN, in reply, said that the circular was not sent out by the company or by the operating managers. He believed, however, that the figures it contained were correct in accordance with the published statements issued from the office. As to the first nine months showing a large percentage of the annual return, that was practically always the case with enterprises of that kind in the Amazon valley. By far the best months of the year were October, November and December, and the period in between February and September, inclusive, were their poorest months. It would not be at all unreasonable that 85 per cent. of the earnings for the year should come in the first nine months.

The report was adopted.

Paignton Electric Lighting and Power Co., Ltd.—The annual report of this company, to which brief reference was made last week, states that the supply of current to the Torquay Tramways Co. commenced on September 17th last. The Tramways Co. had requested the company to supply 250 KW. of electrical energy, instead of 130 KW. under the agreement. The latter quantity had been found totally inadequate for requirements. The additional plant to meet the demand would involve a capital expenditure of £1,500, but its provision would result in a working economy of about £200 to the company. The sale of electricity had increased during the year from £823 to £1,668. The destructor revealed a profit of £142 and the wiring department a profit of £239. The depreciation fund was now £962. The directors and auditors considered it sufficient for the plant, machinery and buildings, which had not yet been installed four years. During the 12 months the company had connected a further 46 consumers, representing 6,085 8-C.P. lamp equivalents. The total number of consumers was now 140, and the lamps numbered 10,308. New condensing plant had been installed at a cost of £1,200. The plant, it was estimated, would reduce the working expenses to the extent of £400 a year, and it had been found to entirely obviate the vibration. In 1908 the company started with eight customers. The receipts for the first half of the current year were in advance of those of the corresponding period of last year by 53 per cent.

Dublin and Lucan Electric Railway Co.—The directors' report, which was presented at the half-yearly meeting held yesterday, states that the gross receipts for the half-year from all sources amounted to £3,637, an increase of £182 on the corresponding period of 1911, whilst the expenditure decreased by £24. After providing for debenture interest there is an available balance of £1,120, out of which the directors recommend the payment of the usual half-yearly dividend on the 5 per cent. preference shares, which will absorb £475; that £200 be set aside for renewal of overhead wires: and that the balance of £445 be carried forward. The dividend warrants will be payable on September 15th.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

Newcastle and District Electric Lighting Co., Ltd.—£[illegible]0,000 6 per cent. second mortgage debentures.

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

American Telephone and Telegraph Co.—$[illegible] additional Collateral Trust 4 per cent. bonds of [illegible] each, Nos. [illegible] to [illegible]

Aberdeen Suburban Tramways Co.—The report for the half-year shows profit earned £1,484, with a balance of £3,614 at credit of profit and loss account. It is proposed that the latter sum be applied in adding to credit of renewal and depreciation account, £2,000; payment of a dividend of 2½ per cent, £780; payment of directors' fees, £42, leaving to be carried forward, £791.

Crossley Brothers, Ltd.—According to the *Financial Times* the directors have issued a statement saying they regret that, owing to the dislocation of business caused by the serious strike in the company's works during the half-year and to the unsettled state of labour in general, they do not consider it advisable to pay an interim dividend on the ordinary shares. The preference dividend will be paid as usual.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the preference shares at the rate of 4½ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, free of income-tax, for the half-year ended June 30th last, both payable August 31st.

Metropolitan Electric Tramways, Ltd.—At an extraordinary meeting held on 14th inst., Mr. E. Garcke presiding, the resolutions already approved relating to deferred shares, were confirmed.

Northampton Electric Light and Power Co., Ltd.—The directors announce an interim dividend of 5 per cent. per annum, less income-tax, on the ordinary shares for the half-year.

STOCKS AND SHARES.

Tuesday Evening

THE daily purchases by the Government broker of substantial lines of Consols for the Sinking Fund continue to have their effect in keeping up the price of the Funds, and this affords a steady influence to markets in general. There is nothing more unsettling to the Stock Exchange than a persistent shrinkage in the price of Consols, for no other reasons than are patent to the general eye. With Consols on the mend, confidence is at least fortified, if not entirely restored.

Home Railways hardened up after having been flat. The fact that this week's traffics run against those of the worst part of the strike last year was naturally trotted out as a bullish argument, and no doubt it has its effect in rallying prices. The absence of business, however, acts in the other direction, so that the sagging process is started very easily just now. A good deal of attention has been paid to the Undergrounds, prices falling away materially at one time. For example, Metropolitans dropped 2 to 55, and Districts fell nearly as much to 39, though in each case there have been subsequent recoveries. City and South London Ordinary shed part of its last week's rise, but the Central London trio is good, sustained by expectations of the Liverpool Street extension traffics.

Dealings are fairly frequent in London United Tramways shares, but on balance the price is unchanged, and the Debenture stock shows a fall of 1. Possibly some of the holders are a little nervous as to the outcome of the rate war—as the Americans would call it—which has arisen between the L.C.C. trams and the omnibuses. British Electric Traction Preferred stocks both fell 1, but apart from these movements the market is uninteresting.

Most of the principal shares in the Electricity Supply list are now quoted *ex* their autumn dividends, and, taking the deductions into account, the actual changes are practically negligible. City of London Ordinary are still *cum* dividend, and the price has fallen a sovereign to 17½; while the Preference went back to the same extent, it being declared that the usual supporters of these shares were "out of town." Counties, however, continue strong, and the price has advanced to 11⅝.

We are able to state that negotiations are in progress in the City for the promotion of a company to deal with a new metal filament which, it is claimed, has various advantages over the threads already in use. To what extent the assertion is justified we have had no opportunity for testing; but it seems to stand to reason that in course of time improvements will be made upon the filaments at present in use. The supply companies are hardly likely to welcome anything which would have the effect of still further reducing the consumption of current; but as they adapted themselves to the altered conditions which the metal-filament lamp introduced, so, of course, will they take whatever steps are necessary when further developments occur.

Canadian and American issues are, for them, remarkably quiet. The market remains good, and Mexican Light and Power, for instance, rose 3 points to 97½, part at least of the buying coming from Germany and Switzerland. Montreal Light and Power has risen substantially, and various bonds in this section are ½ to 1 higher. Rio Trams at 150½ are a point lower, and here again the volume of business has fallen off a good deal from what it was before the holidays got into full swing. British Columbia Electric have gone ahead still further, the Deferred particularly being in demand upon statements of the excellent season in British Columbia and the expanion of business generally over there. The bad weather of the past fortnight in this country has done a good deal to keep Stock Exchange business more active than usual, for people have been staying in town, rather than go away, where they have been able to make arrangements to do so.

The Marconi Company last week issued a long circular dealing fully with its position and prospects, and dwelling more especially upon the likelihood of the agreement with the Government being duly confirmed when Parliament re-assembles after the recess. The immediate effect was to depress the price still further, but later on came swift punishment for the "bears," the price running up against them to 4⅞, from which it dwindled to 4⅝ sellers. This influenced the price of Canadian Marconis, which hardened to 23s. 9d., though later on it eased off again. Another feature this week has been a sharp jump in West India and Panama Telegraphs, where a rise of 10s. was established in a couple of days, the price holding the improvement. This is attributed to fresh buying orders from the Americans who had the deal in hand before, and who are said to be bent upon acquiring control previous to the opening of the Panama Canal. The market is a dangerous one for the ordinary investor, but for the bold speculator who does not mind the possibility of the price moving against him at first there are certainly attractions in these volatile shares.

National Telephone Deferred has also come to the fore again, and has followed up its improvement of last week with a gain of four points. West Coast of America shares are firmer, and rises have been secured by Monte Video Telephone Ordinary and United River Plate Telephone Ordinary. Both in the Eastern group and the Anglo-American division there is little going on, prices remaining steady.

In the manufacturing group, Babcock & Wilcox shares of both classes are $\frac{1}{16}$ higher, and a considerable business in all Iron, Coal and Steel shares is being done in the provinces. The country exchanges have the best market, as a whole, for such descriptions, but dealers in London complain bitterly of the restrictive legislation of the Stock Exchange Committee as being responsible for the driving away of business from this section as well as from others. Callenders' shares picked up to five. India Rubbers hardened to 9¾, making a rise of 20s. in a fortnight. A good deal of quiet strength is displayed by the rubber share market. Raw rubber has crossed the five-shilling Rubicon, and the Mincing Lane people talk it still better, in consequence of which there has been a bear scramble amongst the active shares, while investors are picking up with quiet persistence a good many of the others in which there is not such a free market.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Aug. 14	3,442	— 127	11	17,766	— 478	14·4	..
Ayr	„ 17	1 025	— 76	13	6,248	+ 108	8	..
‡Bath..	„ 7	1,287	— 41	32	28,314	+ 1,558	..	..
†Birkenhead ..	July 28	1,168	— 3	16	19,403	— 613	13·68	..
Birmingham Corp.	Aug. 10	20,933	+2,701	19	201,252	+49,749	57·17	..
Blackburn	„ 14	2,474	— 123	20	24,720	+ 295	14·62	..
Blackpool Corp. ..	„ 15	8,901	+ 268	..	37,656	+ 4,610	11·87	..
Blackpool-Fleetw'd	„ 17	4,927	— 726	6	11,711	— 868	8	..
Bournemouth ..	„ 14	5,484	— 118	19½	37,981	+ 579	21·55	..
Bradford	„ 17	11,476	— 920	20	113,555	— 2,232	56	1·2
Brighton	„ 18	3,444	+ 155	20	22,708	— 709	9·5	..
Bristol	„ 16	15,907	+ 7	..	225,748	+ 17,154	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 9	562	+ 130	32	9,343	+ 2,447	3·65	..
Barnsley	„ 9	968	— 15	„	5,469	— 294	..	..
Barrow	„ 9	994	— 2	„	12,117	+ 2,787	5·37	..
Devonport ..	„ 9	1,354	— 102	„	17,257	+ 1,691	8·85	..
Gateshead ..	„ 9	2,210	— 81	„	32,814	— 182	11·25	..
Gravesend ..	„ 9	509	— 76	„	6,568	— 193	6·5	..
Greenock.. ..	„ 9	1,783	+ 30	„	25,489	+ 2,777	7·25	..
Hartlepool ..	„ 9	746	— 84	„	8,317	— 233	6·72	..
Kidderminster ..	„ 9	457	— 31	„	3,867	+ 68	..	..
‡Leamington ..	„ 9	497	— 64	„	5,978	+ 396	..	..
Merthyr	„ 9	508	— 37	„	6,289	— 390	2·9	..
Metropolitan ..	„ 9	18,777	—1,970	„	188,881	+ 9,216	22	..
Middleton ..	„ 9	755	— 33	„	10,668	— 47	8·5	..
Mid. Joint Com'tee	„ 9	8,151	+ 442	„	104,185	+ 4,581	..	..
Oldham—Ashton	„ 9	1,298	+ 47	„	19,467	+ 1,411	9·13	..
Peterborough ..	„ 9	349	— 15	„	4,368	+ 319	5·31	..
Potteries	„ 9	4,842	+ 157	„	60,017	— 1,565	29	..
Rothesay	„ 9	1,064	— 148	„	7,911	+ 251	2·75	..
Southport ..	„ 9	832	— 52	„	9,660	— 151	8·17	..
S. Metropolitan..	„ 9	1,835	— 380	„	27,119	— 437	..	..
Swansea	„ 9	3,088	+ 73	„	36,494	+ 60	12·5	..
Tynemouth ..	„ 9	982	288	„	7,750	— 693	8·75	..
Weston-s-Mare ..	„ 9	953	— 231	„	4,312	— 755	3	..
‡Worcester ..	„ 9	886	+ 14	„	9,363	— 52	5·75	..
Wrexham ..	„ 9	261	+ 7	„	3,836	+ 245	..	..
Yorks. Wool. Dist.	„ 9	2,159	77	„	24,427	+ 998	17	..
Miscellaneous ..	„ 9	556	54	„	7,909	+ 159	..	..
Burnley	„ 17	3,189	+ 77	..	..	..	11·78	..
Burton-on-Trent ..	„ 18	621	— 93	20	5,613	— 337	6·63	..
Bury	„ 18	2,606	— 635	20	26,678	— 646	22·5	..
†Cardiff	„ 8	2,545	+ 46	18	43,686	— 2,677	17·35	..
Chatham and Dist.	„ 15	2,148	— 99	13	27,980	— 133	14·95	..
Cork	„ 15	1,056	— 148	33	15,931	— 589	9·89	..
Croydon	„ 9	3,766	+ 469	19	35,854	— 689	11·6	·75
†Darlington.. ..	„ 10	238	— 4	19	4,804	+ 45	4·87	..
Darwen	„ 16	600	+ 22	20	5,652	+ 143	4·56	..
Dover	„ 10	670	— 108	19	4,917	— 350	4·75	..
Dublin	„ 16	12,365	—1,303	.	41,576	— 9,011	54·25	..
East Ham	„ 17	2,184	— 108	20	21,429	— 405	7·87	..
‡Exeter .. .	July 26	357	65	17	5,663	450	5·5	..
Glasgow	Aug. 17	35,776	—3,225	..	20 ,591	— 1,783	98	..
Hastings	„ 15	3,189	— 614	..	..	..	19·3	..
Huddersfield ..	„ 17	4,134	— 299	20	40,361	+ 417	29·5	5
Hull	„ 17	6 006	+ 226	20	57,798	— 15	13·5	—1
Ilkeston	„ 14	254	— 44	20	2,103	— 626	..	..
‡Ipswich	„ 10	636	— 79	19	9,005	+ 9	10·5	..
Kilmarnock.. ..	„ 17	198	— 22	13	2,302	— 233	4·25	..
Lancashire United	„ 14	3,074	— 105		43,677	— 208	39	..
Leeds	„ 10	15,792	+ 542	19	149 840	+ 4,953	112·7	..
Leicester	„ 17	5,219	— 76	33	83,607	+ 2,242	20	..
‡Leith	„ 10	672	— 103	13	9,132	+ 33	8·72	..
Liverpool	„ 10	25,4-5	+ 254	32	181,598	+ 12,141	117	1
‡L.C.C.	„ 7	83,700	—5,963	..	761,401	—32,001	140·6	..
London United ..	„ 17	14,348	—2,811	33	200,651	—10,100	..	..
Lowestoft	„ 17	1,074	— 143	46	8,711	— 524	8·5	..
‡Manchester ..	„ 13	17,091	+ 177	19	322,180	+ 12,321	105	..
Newcastle	„ 17	8,411	— 98	..	87,875	+ 232	31·3	..
†Newport	„ 3	738	+ 13	18	12,028	— 839	7·25	..
Oldham	„ 18	4 186	+ 958	21	43,669	+ 2,081	28	..
Pontypridd	„ 10	906	+ 45	19	7,141	— 916	5·5	..
Portsmouth.. ..	„ 10	5 604	— 954	19	43,854	— 3,618	15·75	..
Preston	„ 14	2,166	+ 448	20	16,984	+ 902	10	..
Rotherham	„ 14	1,602	+ 235	19½	14,114	+ 608	12	..
Salford	„ 12	9,965	— 7	19	98,249	+ 257	41	..
Sheffield	„ 18	13,830	+ 341	21	138,171	+ 3,705	40	..
Southampton ..	„ 14	2 931	— 198	19	25,406	+ 96	11	..
Southend-on-Sea ..	„ 14	2,930	+ 85	20	17,246	+ 1,940	7	..
†South Shields ..	„ 10	758	— 81	19	12,196	— 283	10·25	..
Tyneside	„ 14	1,069	— 124	7	3,886	— 542	11	..
Wallasey	„ 17	2,781	103	19	23,440	— 517	8·72	..
Walthamstow ..	„ 17	1,567	— 355	20	16,076	— 354	9	..
West Ham.. ..	„ 8	5 410	— 341	18½	50,433	— 1,778	16·45	1·2
Wolverhampton .	„ 14	2,233	+ 43	20	20,337	+ 196	13·75	..
Cen. London Rly...	„ 17	8 485	+ 815	7	29,774	— 1,088	6·78	·46
City & S. Lon. Rly.	„ 18	5 587	— 64	7	19 890	— 1,407	7·3	..
Dublin-Lucan Rly.	„ 16	578	— 17	7	1,125	— 114	7	..
G.N. and City Rly.	„ 17	2,478	— 89	7	9,898	+ 80	8·5	..
L'pool Overh'd Rly.	„ 18	3,635	+ 815	7	12,074	+ 1,215	6·6	..
Llandudno-Col. Bay	„ 16	2,098	+ 94	37·5	10,831	+ 186	6·5	..
Lond. Elec. Ry. Co.	„ 17	22 850	+ 2,130	7	85,095	+ 2,100	21·25	..
Mersey Railway ..	„ 17	8,659	— 498	7	13,615	+ 944	4·5	..
Metropolitan Rly...	„ 18	81,418	+ 2,640	7	117,679	+ 3,567	25·75	..
Met. District Rly...	„ 17	22,605	+ 3,288	7	83 878	+ 7,101	25	..
Anglo-Argentine ..	„ 19	95,674	—2,405	33	1,670,798	+ 61 121	..	..
§Auckland	„ 2	16,353	— 2,154	5	21,868	+ 5,659	28·31	..
Bombay (B.E.T.) ..	July 18	5,765	+ 163	29	87,012	+ 4,718	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 17	8,202	+ 888	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	July	2,998	..	30	21,650	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Aug. 15	1,656	+ 148	33	24,791	+ 2,753	18·5	·6
§Montevideo ..	July	25,485	+ 3 423	9	263,857	+ 37,599	..	..
Perth (W.A.) ..	Aug. 9	1 812	+ 295	32	69,660	+ 8,473	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	9[illegible]—10[illegible]xd	+ ¼	5 2 4
Do. 4½ % Pref.	10	4½	4½	8[illegible]— 9[illegible]xd		4 13 4
Do. Second 6 % Pref.	10	6	6	10[illegible]— 10[illegible]xd	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8½— 9 xd		5 11 1
Do. 7 % Cum. Pref.	5	7	7	7[illegible]— 8xd	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4¾— 4[illegible]xd	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4[illegible]xd		4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾— 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4⅝— 4⅞	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	97 —100	..	4 10 0
City of London, Ord.	10	7	8	16[illegible]— 18½	1	4 6 6
Do. 6 % Cum. Pref.	10	6	6	1[illegible] — 14	1	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	.	4 8 3
County of London, Ord.	10	5	6	11[illegible]— 11¾	+ ¼	5 1 1
Do. 6 % Pref.	10	6	6	1[illegible]— 1[illegible]	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 8 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	[illegible] — [illegible]		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾— 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 8
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	9	7½— 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	9	7½— 7[illegible]xd	..	5 18 0
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1⅛— 1⅜	..	4 0 8
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3½— 3¾xd	..	5 3 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4¾— 4[illegible]	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	+1	4 16 2
Notting Hill, 6 % Non-Cum. Pref	10	..	6	10 -- 11	..	5 9 1
Oxford	5	7½	7½	5⅞— 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8 — 8¾	..	5 14 3
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 5
Smithfield Markets, Ord.	5	Nil	2	1⅜— 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½		5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛— 1[illegible]	..	5 17 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	5	..	½— ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½— 3	..	3 6 8
Do. 4½ % First Mort. Deb.	100	4½	4½	86½— 88½		5 1 8
Westminster, Ord.	5	10	10	8½— 8¾xd	+ ⅛	5 13 8
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends 1910.	Dividends 1911.	Closing Quotations Aug. 20th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅝— 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7⅜— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5⅛— 5 5/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	3	3†	[illegible]— [illegible]	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 94	+1	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	99½—101½	+ ½	4 18 6
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— ¼	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]— [illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1¾— 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	[illegible]	89 — 91	.	5 10 0
Mexican Lt. & Power, Common	$100	4	4	96 — 99	+3	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 —112	.	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½— 98½	..	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88½— 90½	..	5 10 6
Montreal, Lt., H. and Power	$100	7	[illegible]	242 —247	+6½	3 4 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	[illegible]	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	151 —156	—1	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½— 92½	..	5 8 1
Victoria Falls Power, Pref.	1	Nil	11⅞d.	31/32— 1 1/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½—107½	.	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends 1910.	Dividends 1911.	Closing Quotations Aug. 20th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	Nil	4†	7¼— 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½— 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	149 —151		5 6 0
Do. Collat. Trust	$1000	4	[illegible]	93½— 95½	..	4 3 9
Anglo-American Telegraph	Stock	3⅜	3	67½— 69½		5 7 11
Do. 6 % Pref.	Do.	6	6	113 —114	..	5 5 3
Do. Def.	Do.	30/-	30/-	26¼— 26¾	..	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	[illegible]	102½—104½	..	4 16 2
Chili Telephone	[illegible]	7	..	7½— 7¾	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83 — 85	+ ½	4 14 2
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7⅜— 7⅝	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128½—131½	..	5 6 5
Do. 3½ % Pref. Stock	Do.	3½	3½	77½— 79½	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	+1	3 18 10
Eastern Extension	10	[illegible]	5†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	[illegible]	[illegible]	98½—100½xd	+ 1½	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	[illegible]	97½—100½	+ ½	3 19 7
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½— 13	..	4 12 4
Great Northern Telegraph	10	18	18	28¼— 29¼	..	6 3 1
Indo-European Telegraph	25	13	5†	56 — 58	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	[illegible]	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	4⅝— 4¾	+ ⅛	4 4 3
Do. 7 % Cum. Partic. Pref.	1	16	17	4 — 4¼	+ 5/16	4 0 2
Monte Video Telephone, Ord.	1	6	6	1[illegible]— 1[illegible]	+ [illegible]	5 6 8
Do. 5 % Pref.	1	5	5	[illegible]— [illegible]	..	5 6 8
National Telephone Def.	Stock	6	6	147 —149	+ 4	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100—101	..	4 9 1
Oriental Telep. and Elec.	1	8	8	1 23/32— 1 27/32	..	4 6 9
Do. 6 % Cum. Pref.	1	6	[illegible]	1[illegible]— 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	[illegible]	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	10¼— 10¾	..	3 14 5
Submarine Cables Trust	Cert.	6	[illegible]	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼— 7½	+ 1/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 10 11
West Coast of America	2½	2½	2½	1[illegible]— 1[illegible]	+ [illegible]	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	½	3 — 3¼	+ ½	..
Do. 6 % Cum. 1st Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾— 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17 7
Western Telegraph, Ltd.	10	[illegible]	6†	12[illegible]— 13[illegible]	..	5 4 8
Do. 4 % Deb.	Stock	[illegible]	4	97 — 99	+1	4 0 10
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

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* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	89 — 92	1	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	98 —101	+1	4 19 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8	74 — 76 xd	+ ½	3 19 0
Do. Pref.	100	4	4	80 — 82 xd	+1	4 17 7
Do. Def.	100	2	2	74 — 76	+1	2 12 8
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & South London, Ord. ..	100	1½	1⅝	33½— 34½	— ½	3 19 6
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	102 —104	..	4 16 2
Do. Do. 1901	100	5	5	102 —104	..	4 16 2
Do. Do. 1903	100	5	5	101 —103	..	4 17 1
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½— 11½	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅞— 2⅛	..	Nil
Hastings Trams, 6 % Pref. ..	1	Nil	6	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	+2	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4⅞— 5⅜	..	..
Do. 4 % Deb.	100	4	4	72 — 76	1	5 5 3

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 20th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅜	1⅞	55¾— 56¼xd	— ¼	2 17 10
Do. Surplus Lands	100	2⅜	2⅞	64 — 66 xd	— ¾	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87 xd	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86 xd	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	39¾— 40¼	— ¾	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3½	4½	89 — 91 xd	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def.	1	Nil	..	3/16— ¼	..	Nil
Do. 5 % Pref.	1	5	5	13/16— 15/16xd	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	99 —102	+1	4 19 0
Potteries, Ord.	1	2	..	5/16— 7/16	..	..
Do. 5 % Pref.	1	5	5	7/32— 9/32xd	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4½	..	Nil
Do. "A"	1/-	..	..	⅝— 11/16	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	90 — 92	+3	..
Yorkshire (West Riding), Ord.	5	Nil	..	½— ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞— 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5½ — 6⅛	..	5 2 4
Do. 2nd Pref.	5	5	5½	4 15/16— 5 1/16	..	5 6 0
Do. 4 % Deb.	100	4	4	93½— 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	99½—101½	..	4 8 8
Do. 5 % Deb.	100	5	5	101 —103	..	4 16 2
Auckland Trams, 5 % Deb. ..	100	5	5	102 —104	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾— 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞— 5½	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	140 —145	+4	5 10 6
Do. Pref. Ord.	100	6	6	119 —124	+3	4 16 9
Do. 5 % Pref.	100	5	5	108 —111	+ ½	4 10 1
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6⅛— 6⅝	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝— ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5½— 5¾ xd	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	3/16— 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0

La Plata Elec. Trms, Ord. ..	1	..	..	½— ¾	..	..
Do. Pref.	1	6	6	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	+1	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½ xd	..	4 17 7
Mexico Trams Com.	$100	7	7	127 —130	..	5 7 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	101 —103	..	4 17 1
Do. 6 % Bonds	100	6	6	102½—104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7⅜— 7¾	+ ⅛	6 9 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	100 —102	..	4 18 0
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16— 1 5/16	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼— 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	149 —152	—1	3 5 9
Do. 1st Mort. 5 % Bonds ..	..	5	5	103 —104	+ ¼	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	99¾—100¾	..	4 19 8
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	259 —264	—1	3 15 6
Do. 5 % 1st Deb.	$500	5	5	105 —107	..	4 13 6
Singapore Trams, 5 % Deb. ..	100	5	5	84 — 87	+1½	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	6	7	5⅞— 6⅛	+ ⅛	5 14 3
Do. 6 % Pref.	5	6	6	4⅞— 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100 —103	..	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝— ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3⅛— 3⅜	+ 1/16	4 2 10
Do. Pref.	1	6	6	1 7/16— 1 9/16	+ 1/16	3 16 10
British Aluminium, Ord. ..	1	..	..	9/16— 11/16	..	..
Do. 6 % Cum. Pref.	1	..	..	⅜— ⅝	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	6 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾— 8¼	..	6 1 3
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	5	Nil	..	7/16— 11/16	..	Nil
Do. Deb...	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¼— 11	..	6 16 4
Do. Pref.	5	5	5	4⅞— 5⅛	+ 1/16	4 17 7
Do. Deb...	100	4½	4½	99—101	..	4 9 1
Castner-Kellner	1	17½	20	3⅝— 3¾	..	5 6 8
Do. Deb...	100	4½	4½	102 —105	..	4 5 9

Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾— ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	95 — 98	..	4 10 10
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16— 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅝— 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	¾— 1	.	7 10 0
Do. Pref.	2	7	7	1¾— 2	+ 1/16	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 1
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾	..	5 16 8
Do. Pref.	5	4½	4½	4⅞— 5⅛	..	4 7 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	9¼— 10¼	+ ¼	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction	12	20	10†	32½— 34½	..	6 16 6
Do. Deb...	100	4	4	97 — 99	..	4 0 10
Willans & Robinson	1	Nil	..	⅛— ½	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

REVIEWS.

Steam Turbines. A Short Treatise on Theory, Design and Field of Operation. By Joseph Wickham Roe, M.E. London: Hill Publishing Co. Price 8s. 6d. net.

This book, of convenient size, is intended, as stated by the author in his preface, to serve as a text-book for students, and as a treatise on the principles and general design of turbines for the engineer. The scientific principles involved in turbine problems are gone into in turn with brevity and in a clear sequence, and the formulæ deducted from the facts are quoted and explained.

The mechanical problems which form so very important a part of turbine design have, perhaps, too little space assigned to them. The work has the effect of a summary of present knowledge on the subject, and it hardly falls within its scope to allude to the mishaps from which turbine builders have learned so much. The illustrations are numerous and excellent.

The Evolution of the Parsons Steam Turbine. By Alex. Richardson, A.I.N.A. London: Offices of *Engineering*. Price 21s.

The progress of civilisation to any end is the resultant of several forces—mentally the invention of printing placed the whole world on an entirely new plane and industrially the steam engine and the railway have produced results profoundly modifying sociological development. Indeed, as the author points out in his opening paragraph, "the history of invention is the key to an understanding of many of the movements of the world." A history of the evolution of an epoch-making invention, written from the perspective of the day in which the development occurred, and thus lacking the wider perspective open to the historian writing in a later age, serves a double purpose in giving precise information to the present generation, and in affording a competent authority for the historian of the future to consult.

The author's work is well done. It shows, too, the large number of subsidiary problems which arise as the immediate consequence of any one invention. The turbine has presented many such to the shipbuilder, to the maker of propellers, to the designer of alternators or direct-current dynamos, and to the metallurgist also in regard to the requisite properties of turbine blades.

Through the joint effect of the turbine and the big gun, standards of naval strengths and international policies have been largely modified.

Very many of the author's pages are devoted to the marine aspects and problems of the steam turbine, and very succinct summaries are given of the position attained up to the time of publication.

Only a small section of the book is given to the electrical side of turbine development. Yet this chapter might well be reprinted separately for the use of third-year students in engineering schools and colleges. Really, no better insight can be given to successful design than that based on a sound knowledge of the forces determining its evolution. This section is only weak in that, in the reviewer's opinion, insufficient stress is laid upon the problems of stator coil and rotor insulation for turbine-driven a.c. generators.

Another interesting section deals with the exhaust steam turbine and the turbine type of air compressor.

A Handbook of Testing Materials. By C. A. M. Smith. London: Constable & Co., Ltd. Price 6s. net.

The possibility of the attainment of a high degree of human knowledge is severely limited. The average engineer is not a genius, and no matter how keen he may be on the acquisition of knowledge, he is compelled to classify information as either immediate and practical in its value, or as remote and academic in character. Each man has to form a very elastic boundary between that which he must assimilate as concerned with daily bread and butter, and that which appeals by reason of its general technical interest. But to the engineer there can be no question as to the paramount importance of the properties of materials and methods of checking those properties.

Designed primarily as a text-book for the student in the well-equipped mechanical laboratory of a modern college, it treats of testing machines in general for iron, steel, cement, &c. In addition, it gives in all cases valuable notes as to the normal properties of materials. It may be commended to all engineers, including those no longer actually designated as students. Many such may not have had the educational facilities that are extended to the present generation. Mr. Smith's book offers to them a concise account of recent developments in testing machines with explanatory matter which renders the results obtained both intelligible and comparable.

One suggestion the reviewer would like to present to the author, and that is that the second and subsequent editions should discuss the manifestations and causes of abnormalities generally met with in the materials of mechanical engineering.

Diesel Engines for Land and Marine Work. By A. P. Chalkley, B.Sc., A.M.Inst.C.E., A.I.E.E. With an introductory chapter by Dr. Rudolf Diesel. London: Constable & Co., Ltd. Price 8s. 6d. net.

At such a time as the present, when the attention of every engineer, and indeed of every thinking individual, is directed to the consideration of natural sources of energy, the appearance of this book is particularly opportune. The recent coal strike has taught everyone that it is in the general interest to seek means for economising in the use of the stock of fuel available. The report of the Committee of the British Science Guild, upon which we commented in our issue of April 5th of this year, has given a further impetus to thought and work along the same lines. If the stock of coal on the surface of the earth can be made to go twice as far as formerly, then obviously the terrors of a coal strike are reduced by half.

Mr. Chalkley remarks, at the beginning of his last chapter, that "the possibilities which open out in the future for engines of the Diesel or similar type, are so wide that it is necessary to restrain a natural tendency to fall into immoderate language when touching upon this point." We agree; for it is certain that there is no means which would more effectually retard the growth of the use of such engines. Fortunately we can acquit Mr. Chalkley of this fault, for throughout his book he writes with studious moderation.

Starting with a chapter in which he considers the general theory of heat engines, he goes briefly but sufficiently into the consideration of the expansion of gases, adiabatic expansion, isothermal expansion, and the working cycles of heat engines, leading up to reasons for the high efficiency of the Diesel engine. The remaining seven chapters are devoted solely to the discussion of the Diesel engine—its action and working, construction, installation and running, its testing, and its use for marine work.

There are those who say that as England is a coal-producing country, having up to now no natural oil supply, and that as the use of oil fuel would render her dependent upon other countries, the Diesel engine is something which Englishmen would do well not to encourage. In the very thoughtful introduction which he has contributed, Dr. Rudolf Diesel deals effectively with this and other objections. Coal itself, tar oils, or crude tar, can all be used directly in the Diesel engine, and there is no need whatever to use petroleum. The Diesel engine will work equally well with vegetable oil, or animal, or fish oil, and the French Government has considered the question of utilising the large quantities of arachide, or ground nuts, available in the African Colonies, thus gaining not only a cheap source of power, and that independently of foreign countries, but also providing industry for the Colonies themselves. Now, England has more Colonies than any other nation, and, as a consequence, this question concerns her more than it concerns other nations. Further, the greater room available for the carrying of cargo in Diesel ships, due to the fact that less fuel is required, and that that fuel can be stored in positions which, owing to their inaccessibility, are useless for any other purpose, is most emphatically a question which concerns, very nearly indeed, the greatest shipping power in the world. True, the experience available with the use of the Diesel engine afloat is not yet so great as that which has been gained with its use on land, but it is growing very rapidly, and there is no reason whatever to expect that any undue difficulties will be encountered in so using Diesel engines. Further, the Diesel marine engine does not differ greatly from the land type, and so experience gained with the latter is, in Mr. Chalkley's words, "in a measure equivalent to that which would have had to be obtained at sea were the construction different in any marked degree."

The use of the Diesel engine in electricity works has made great strides during recent years, and we do not see any reason why progress should not be maintained, and, in fact, augmented. Central station engineers have, more than once lately, discussed the question, and the chief point which seems to be brought out is this: that these engines are considered to be most suitable and most economical in undertakings which run at a poor load factor. For a large industrial town, having a plant load factor of, perhaps, 40 or 45 per cent., it has been said that internal combustion engines are not so satisfactory. Mr. Chalkley tells us that the overload capacity is from 10 to 15 per cent. for two or three hours. When one considers the constant 60 per cent. overloads which many steam turbine sets are called upon to stand, this seems small. But what does it really mean? Simply this—that the internal combustion engine does the work which it is designed to do, and is correctly rated; while the steam turbine is designed to do a great deal more than its nominal rating. Therefore, if you want to get 7,500 KW. out of a Diesel engine, you must install a 7,500-KW. engine. If you want an occasional 7,500 KW. out of a turbo-alternator, it need only be a 4,000-KW. machine. This is a fact within our experience, and we are not exaggerating at all. The whole thing is a question of definition. If, when you say one kilowatt you mean one kilowatt, you are all right with your Diesel, but if you mean something quite different, you must learn to say what you mean.

Turning to the literary side of the book, we are glad to say that we have few faults to find. The pleonastic use of the word "one," as in the sentence "the constant-pressure cycle is a rather less efficient one than the constant volume one," on page 25, and another on page 106, which is even worse, is, perhaps, the most persistent. There are two or three split infinitives, but we are tired of pointing out this fault in scientific books. There is no need to put a full stop after the word "grams" every time it occurs, for it is not an abbreviation, except in the sense that all Americanisms are abbreviations. On page 19, fig. 5, the letters V_2 and V_4 should be interchanged, and on page 187 the angle B O A should be lettered *d*, but is not. On page 211, line 11, the figure 1 should be replaced by an italic *l*.

Concise, distinct, up-to-date, well illustrated and well indexed, the book should find a place in the library of every engineer who wishes to keep abreast of modern developments.

Elementary Internal Combustion Engines. By J. W. Kershaw. London: Longmans, Green & Co. Price 2s. 6d. net.

This is a most excellent production. It is really one of the best text-books that we have come across for a long time. The buyer obtains excellent value. The matter is good. There are 117 illustrations (nearly all of them well executed) and there are 171 pages. As a companion to the excellent little treatise on "Steam," by Prof. Ripper, we can think of no better book for the young student of motive power engineering.

The author informs us that this book is intended to give an elementary account of the construction and working of internal combustion engines and power gas producers, and to serve as an introduction to the more advanced books dealing with the subject, and he certainly accomplishes his intention. He has made his explanations fairly simple, has taken care with his illustrations, and has not attempted to cover too much ground. There are some very good numerical examples in the text, but we think it a pity that there are no examples for the student to work out on his own initiative. There is quite a good description of the Diesel engine, and a good deal about the Humphrey pump. About two pages are given to the gas turbine, which is, after all, quite enough for an elementary book. The last chapter on engine efficiency is quite up to the standard found elsewhere.

It is not often that we are able to say that a new text-book supplies a long-felt demand. We are delighted to be able to record the fact that this book has been needed for the last five or six years. It is, of course, elementary; no originality was needed, nor is it displayed. There is no evidence that the author is a prominent expert on the subject. It is probable that he is not, otherwise he would not have done his work so well. He has, however, written in a clear and careful manner a little book upon a subject which has previously caused the student difficulty, because of the lack of such a little treatise. He is, therefore, to be congratulated. After all, it is better to supply such a demand than to write ten times the amount upon a more complicated subject in such a fashion that no one understands it. A student of very average intelligence could follow the contents of this book and gain advantage from a complete study of its contents.

RULES FOR ELECTRIC OPERATING STAFFS.

[COMMUNICATED.]

(*Concluded from page* 274.)

The other department in which a set of regulations is necessary is in the keying together of operations of the various sections of the operating staff. In the electricity supply undertaking this is chiefly evident in the work of the generating-station staff as connected with the mains department. Especially on high-pressure systems this co-ordination must not be left in a haphazard condition, and numerous stations have adopted a set of rules for this purpose. By the courtesy of the Chief Engineer of the Bedford Corporation Electricity Works, the writer is able to give a complete set of regulations formulated for this purpose, and this article will conclude by detailing these as an instance of the type of regulation which will be found of value in electricity supply undertakings. It will be seen on examination that some features of the regulations are strictly local, but their chief value in connection with the present notes is that they might very well form a basis for the construction of a standard set of operating regulations which might apply in the main to all electricity undertakings of this type. If such regulations could be drawn up and accepted as standard, there would probably be less confusion in such undertakings, due to the change of *personnel.* That this is an important point will, on reflection, be acknowledged by most central-station chiefs, inasmuch as the change of operating staffs usually involves the chief engineer in a period of some anxiety until he is perfectly sure that the new man has fitted into his job without the possibility of a mistake in judgment or operation.

The regulations referred to are printed on large cards with varnished surfaces, which are hung in a prominent position in the engine room, and are therefore capable of easy inspection at all times. The small forms, referred to as A, B and C, are printed cards of postcard size, their general appearance being shown below. The regulations read as follows:—

BEDFORD CORPORATION ELECTRICITY SUPPLY.

Instructions for carrying out work on:
HIGH-TENSION SWITCHBOARD AT THE GENERATING STATION.

General.

1. *Under no circumstances is any work to be executed on any high-tension cable, transformer or other apparatus, unless the proper steps have been taken to make the same "dead."*

2. In every case, before any H.T. apparatus is touched, two persons in authority are to assure themselves independently that the apparatus is "dead," and must connect the same to earth.

3. When withdrawing or replacing any H.T. fuse or isolating switch, rubber gloves are to be worn on both hands, and a rubber mat or insulating stool is to be used to stand on. All rubber gloves must be examined for punctures each time before using by rolling

up from the wrist, and no glove is to be used or retained for use showing signs of wear, or liable to cause undue risk.

4. The doors protecting the main bus-bar cells are on no account to be removed.

5. *Generator Panels.*—Panels G 6, G 7, G 8, G 9 and G 10.

(*a*) Before removing the small inspection slate on the front of each panel—
(1) The generator must be stopped ;
(2) The exciting circuit opened ; and
(3) The switch blocked open or the isolating plugs withdrawn.

(*b*) Before removing the back door of the cell—
(1) The generator must be stopped ;
(2) The exciter circuit opened ; and
(3) The isolating plugs withdrawn.

N.B.—It follows from the above that should a potential transformer fuse blow, or the low-tension wiring become deranged in any way, no steps can be taken to repair until the generator is taken out and shut down.

6. *Main Panel.*—The back cell door to be removed only for the purpose of replacing a potential transformer fuse. Before doing this, there must be two persons present, each wearing a pair of rubber gauntlets and a pair of insulating shoes.

7. *Feeder Panels.*—When work is to be done on the feeder panels, all must be treated as being interconnected at the sub-stations, and must therefore be considered as being "alive" until disconnected outside. Before working on any apparatus in connection with a feeder panel, it will therefore be necessary to—

Send written requisition (Form A) to the mains foreman to clear feeder, stating name of feeder (as printed on the panel tablets), and only when such requisition has been returned signed by the mains foreman or other authorised person, stating that the feeder is clear from outside, may the work proceed as follows :—

8. *Queen's Engineering Works Panel.*

(*a*) Before removing inspection slate—
(1) Open switch, lock off, and before commencing work behind the inspection slate.
(2) Earth H.T. terminals at both poles.

(*b*) Before removing back cell door—
(1) Open switch and lock off.
(2) Withdraw isolating plugs.
(3) Remove inspection slate.
(4) Earth H.T. terminals.

9. *Queen's Engineering Works Fuseboards.*—Work on these fuseboards should as far as possible be done only when the same are "dead." If, however, it becomes necessary to renew a fuse without interrupting the supply, this must only be done by means of the special grips provided for the purpose, and there must be two persons present equipped as in 6. To make fuseboards "dead," proceed as in 8 (*a*).

10. *Sewage Pumping.*—(1) Feeder must be cleared as set out in 7 ; then (2) proceed as in 8.

11. *Feeder Group Switch Panels.*—

(*a*) Before removing inspection slate—
(1) Open and lock off switch.
(2) Take out all H.T. fuses on the group.
(3) Observe if group voltmeter is reading zero. Then remove inspection slate, and
(4) Earth H.T. terminals.

N.B.—This can, of course, only be done on light load, or in cases of extreme emergency, and notice must be given to the mains foreman in order that the section pillar fuses can be strengthened if necessary.

(*b*) Before removing back cell door—
(1) Proceed as above, and
(2) Withdraw isolating plugs.

12. *Fused Feeder Panels.*—

(*a*) Before removing any of the small doors protecting each individual fused feeder connection—
(1) Feeder must be cleared as set out in 7.
(2) Remove fuses on both poles.
(3) Lock off.
(4) Earth top terminal of fuse on each pole.

(*b*) Before removing door protecting sub-bus-bar, proceed as in 11 (*a*).

13. *Potential Transformer for Tirrill Regulator.*—Before renewing fuses or doing any work on transformer—

(1) Open and lock off Group C switch.

14. *Electrostatic Earth Detector.*—No work is to be done on this unless the main bus-bars are "dead."

15. *London Road Feeders.*—

(*a*) Before removing the inspection slate—
(1) Both feeders in the panel must be cleared as set out in 7.
(2) Open and lock off switches.
(3) Remove inspection slate and earth the H.T. terminals.

(*b*) Before removing back cell door—
(1) Clear both feeders as above.
(2) Open switches and lock off.
(3) Withdraw isolating plugs.
(4) Remove inspection slate and earth H.T. terminals.

N.B.—If work is to be done on the H.T. feeder or apparatus at sub-station at the same time, in addition to the above, it will be necessary to observe Regulations 17, 18, 20, 21.

For re-connections observe Regulations 18 (2), (3), (4) and (5).

BEDFORD CORPORATION ELECTRICITY SUPPLY.

Instructions for carrying out work on HIGH-TENSION FEEDERS.

16. *Clearing H.T. Feeder for Work on H.T. Switchboard.*—On receipt of a requisition (Form A) from the generating station to clear a feeder

(1) Obtain card of particulars for the feeder named on the requisition note to the effect that all instructions have been carried out, and return to engineer in charge at generating station.

N.B.—The feeder, however, is not "dead," and no work is to be done on any feeder or apparatus in connection therewith until precaution 17 has been completed.

For re-connections see Regulations 18 (2), (3), (4) and (5).

17. *Before working on any H.T. Feeder.*

(1) Obtain card of particulars for the feeder and proceed to disconnect as therein stated.

(2) Send written requisition (Form B), naming the feeder, to the engineer in charge at the generating station to lock off and earth both terminals of the feeder at the works.

(3) Receive key of locking-off gear from the engineer in charge, together with signed statement (Form C) to the effect that the feeder is "dead."

(4) Note carefully on the card of particulars the instructions for locating the feeder in the street draw-in and joint boxes.

(5) When the first cut in every draw-in or joint box is made, two persons must be present, each wearing rubber gloves and insulating shoes, or standing on rubber mats, and the blade of the saw, after it has reached one conductor, must be put to earth, and should there be any evidence of the cable being "alive," all work is to be stopped, and not proceeded with until the matter has been reported to the chief engineer or the deputy-engineer, and his sanction obtained for proceeding.

N.B.—It must be distinctly understood that no work is to commence or proceed on a H.T. feeder unless the employé actually doing the work holds on his person the key of the locking-off gear and the written statement of the engineer in charge referred to, and if others are working on the feeder at the same time, they must also hold signed statements to the effect that the feeder is "dead."

18. *Instructions for Reconnecting H.T. Feeders.*—

(1) When the employé working on the feeder has made all good and safe, he must return the key of the locking-off gear to the charge engineer, together with the statement (Form C) signed by him to the effect that the feeder can safely be connected to the H.T. supply, and if others have been working on the feeder at the same time, each must sign and return Form C.

(2) The charge engineer must then unlock feeder terminals and remove the earth connections, and test the feeder with an ohmmeter, recording the results of such tests on the disconnection form.

(3) If the test be unsatisfactory in any way, the charge engineer shall replace the earth connections, lock off feeder, and report immediately to the chief engineer or deputy, and receive sanction for proceeding.

(4) If the test be satisfactory, or sanction (as above) be received, the charge engineer, after examining and renewing (if necessary) the fuses, shall replace them, thereby making the feeder "alive."

(5) The charge engineer shall then give the mains foreman a written statement (Form A or B) to the effect that the feeder has been made "alive" at the generating station, and the mains foreman shall have the feeder reconnected at the sub-station, &c., as directed on the card of particulars.

Instructions for carrying out work on : HIGH-TENSION APPARATUS IN SUB-STATIONS.

19. Two persons must always be present when a sub-station is entered, or when the "Kiosk" transformer pillar is opened.

20. Except the renewing and replacing of fuse handles, no work is to be done on a H.T. fuseboard unless the same has been made "dead."

Before working on H.T. Fuseboards.—
(1) Carry out instructions set out in 17 as for H.T. feeders.
(2) Remove L.T. fuses of all transformers.

21. No high-tension fuse is to be replaced until signed statement (Form A or B) has been issued and received.

22. *Before working on a Transformer.*—
(1) Withdraw high-tension fuses on both poles
(2) Withdraw L.T. fuses on transformer.

23. *When reconnecting a Transformer.*—
(1) Replace middle-wire fuse.
(2) Test with 10-amp. fuses on L.T. outers.
(3) Remove 10-amp. fuses and replace H.T. fuses.
(4) Test for correct banking.
(5) If correct, replace L.T. outer fuses

The regulation forms referred to above are of the nature shown herewith :—

BEDFORD ELECTRICITY SUPPLY. A

H.T. FEEDER DISCONNECTION.

NAME OF FEEDER.

Date.................................... Time....................

TO MAINS FOREMAN.

Please disconnect the above Feeder from the H.T. external system at all points for work on MAIN SWITCHBOARD, and report by..........

....19......

Signed...Charge Engineer.

N.B.—The Mains Foreman will note that as soon as the above work is completed the above Feeder will be made ALIVE at the Generating Station, and that he must not permit anyone to work on the Feeder or any cable or apparatus connected thereto.

Date.................................... Time ....

TO THE CHARGE ENGINEER.

The above Feeder is disconnected from the H.T. external system at all points

Signed...Mains Foreman.

Date .... Time ....

TO THE MAINS FOREMAN.

The above work is completed, and the Feeder made ALIVE. Please re-connect at all points.

RESULT
OF
TEST.

Signed...Charge Engineer.

Date .... Time ....

TO THE CHARGE ENGINEER.

The above Feeder has been re-connected at all points.

Signed...Mains Foreman.

BEDFORD ELECTRICITY SUPPLY. B

H T. FEEDER DISCONNECTION.

NAME OF FEEDER.

Date .... Time ....

TO THE CHARGE ENGINEER.

Please withdraw H.T. Fuses, EARTH and lock off the above Feeder which is disconnected from the H.T. external system at all other points.

The following Jointers will work on this Feeder :—

Name of Jointer.	Locality.

Signed...Mains Foreman.

Date .... Time ....

TO THE MAINS FOREMAN.

The work being reported complete, the above Feeder has been made ALIVE at the Generating Station. Please re-connect at all points.

RESULT
OF
TEST

Signed...Charge Engineer.

Date .... Time ....

TO THE CHARGE ENGINEER.

The above Feeder has been re-connected at all points.

Signed...Mains Foreman.

BEDFORD ELECTRICITY SUPPLY. C

H.T. FEEDER DISCONNECTION.

NAME OF FEEDER.

Date .... Time ....

TO JOINTER.

The above Feeder is locked off and both poles EARTHED ; it will remain locked off until you sign below and return this card to the Generating Station, when the Feeder will be made ALIVE.

Signed...Charge Engineer.

Date.................................... Time....................

TO THE CHARGE ENGINEER.

Work on the above Feeder is completed, and Feeder left safe to be made alive at the following points :—

Signed...Jointer.

N.B.—The Charge Engineer must issue one of these forms to each Jointer working on Feeder, as set out on Form B by the Mains Foreman.

The above regulations are, of course, only given here as illustrative types, but there is sufficient in them of standard nature to render them of interest to every electricity supply undertaking, and the present notes are written with the object of initiating a discussion in this journal on the question of formulating a standard set of operating regulations which, so far as possible with local modifications, can be adopted in medium-sized electricity supply undertakings for the purpose of codifying the operating systems of such plants into a closely uniform nature, for the purpose of training operating engineers, so far as routine operations are concerned, on as standard a basis as possible.

PRIVATE BILLS OF THE PAST SESSION.

[By our Parliamentary Reporter.]

Comparatively little space is needed to sum up the results of the past session, so far as electrical clauses in private Bills are concerned. To start with, such Bills were few in number, and whilst, of course, a great deal of local interest attached to some of them, few were of national interest. Bills dealing with tramways and electric lighting are now framed in almost identical language, for past experience has led to the adoption of model clauses, with the result that, apart from the vital question of whether or not the powers asked for should be allowed, there is little discussion over the actual wording of clauses. If the projects for railless traction schemes are excluded—and these cannot really be termed new—there were no proposals of a novel character. In only one direction can it be said that there seems a bright future for big extensions of electrical enterprise requiring the sanction of Parliament, and this is in respect to the electrification of railways for the proved success of the system in London is gradually leading to its adoption on lines which go considerably beyond the Metropolitan area.

From this point of view, the most interesting Bill was that of the Midland Railway Co. for the taking over of the London, Tilbury and Southend Railway. Although the Bill itself contained no powers to electrify the line to Southend, the promoters declared that it was their intention to carry out such a scheme, and in the end the Bill was passed subject to an undertaking that the Midland Co. would come to Parliament for the necessary powers to do the work within a reasonable time. Two Bills closely associated with one another so far as the work intended to be carried out is concerned, were the London Electric Railway Bill and the London and North-Western Railway Bill. The main object of the London Electric Railway Co.'s Bill was to allow them to construct a line from Paddington to Queen's Park, and at that place to form a junction with the London and North-Western Co.'s line to Watford, now being electrified. The latter company are prepared to advance the necessary capital for the construction of the line, and they took powers in their Bill to enter into agreements, &c. The London Electric Railway Co. also obtained powers to amalgamate the Hampstead and Edgware Railway Co., who have authority to construct a line between those places, as an extension of the Charing Cross, Euston and Hampstead Railway. The Metropolitan Railway Co. failed in their attempt to obtain powers to construct a new railway at Hammersmith to join up with the authorised new line of the Great Western Railway Co. to West Ealing, and thus to have given a further route between London and Ealing, but they succeeded in getting authority to extend their line from Watford to Rickmansworth, which will add another desirable residential district to the London workers. The Metropolitan District Railway Co. got very important powers by which the London and South-Western Co. will widen their Wimbledon and Fulham Railway, and give the Metropolitan Co. the exclusive right of use. This will very materially assist the District Co. in the management of their traffic. The Great Eastern Railway Co. sought powers to raise £90,000 debenture stock, which will be devoted to the electrification of the unfortunate East London Railway Co., which has struggled with adversity for so many years, and it is to be hoped that the change will prove as successful as it has with the Metropolitan and the District Lines.

Several Tramway Bills affecting the London area were promoted at the beginning of the session, but those of the West Ham Corporation and the Metropolitan Electric Tramways Co. were withdrawn, the latter company having come to a satisfactory arrangement with the London County Council. As usual, the London County Council came forward with a big programme of new tramways, and as usual also the opposition of local road authorities prevented most of them getting through Standing Orders stage. After a great deal of opposition the Council obtained powers to extend the tramway in Tooley Street, but coupled with conditions as to the times of the day during which the extension should be used. By far the most important power obtained by the Council was, however, to run coupled cars or trailers. At present the authority to do this is limited practically to the South side of the river and the Thames Embankment, with a view to seeing how the thing works in actual practice. The London United Tramways Co. secured an extension of time for the completion of the authorised tramway at Richmond.

Of the proceedings relating to provincial schemes the most interesting was the fight for Brighton and Hove and District. Here there were no fewer than four Richmonds in the field, and in the end matters became somewhat complicated. They were (1) the Brighton and Hove Omnibus Co.; (2) the Brighton Corporation; (3) the Hove Corporation; and (4) the British Electric Traction Co. The first-named retired from the fight at an early stage, having come to a satisfactory settlement with the Brighton Corporation. As the result of the hearing before a House of Lords' Committee, the British Electric Traction Co.'s Bill was rejected, whilst both the other Bills for the construction of railless traction systems within their respective boundaries were passed, with the hope being expressed that the parties would come to a mutual understanding regarding the working of the tramways. When the parties came before the House of Commons' Committee, the British Electric Traction Co. appeared as opponents, and were successful in getting some compensation from the Hove Corporation for the removal of the present old horse tramway. It became evident also that Hove really did not want railless or any other kind of tramway within their boundary, and that they had really come forward in self-protection, fearing that an outside Corporation or company might get into the district. In the end, however, both the Bills were passed as was the case in the Lords. A strenuous fight took place over the proposals of the Birmingham Corporation to extend their tramways into the Edgbaston and Harborne district, but in the end the Corporation only got a part of the powers for which they asked. Keighley Corporation were empowered to use trolley vehicles, and Hull Corporation to further extend their tramway system. Other local authorities successful in obtaining railless trolley powers were the Ramsbottom U.D.C., Sheffield Corporation, and Stockport Corporation. One new company, *i.e.*, the North Ormesby, South Bank, Normanby and Grangetown Railless Traction Co. was successful in getting its Bill through, but the Southall, Hounslow and Twickenham Bill met an early death.

There were no English Electric Power Bills. The Sidmouth U.D.C. got powers to take over the undertaking of the Sidmouth Gas and Electricity Co. The National Electric Construction Co. got through their Bill to confirm agreements made between the company and their predecessors and certain local authorities with regard to the supply of fittings. On the Sheffield Corporation's Bill there was an interesting fight with regard to the power of the Corporation to supply electric fittings, which resulted in the Corporation being restricted to the model clause by which they are not at liberty to execute the wiring of private property except between the main of the Corporation and the consumer's meter, nor can they sell electric fittings except through a contractor.

The Bognor Gas Light and Coke Co. obtained electric lighting powers on coming to an arrangement with a local owner who already generates his own electricity for a large block of buildings and was applying for an electric lighting order for himself. The following Scotch provisional orders were proceeded with as private Bills, and carried: Lanark Tramways and Loch Ericht Water and Electric Power.

"TO THE TRADE."

By "JUGGINS."

THE system of discounts now in use in the electrical trade is, in its present chaotic form, often a source of great annoyance and trouble to those who have any dealings with it.

To many of our smaller "business" men the intricate calculations involved in arriving at cost prices and suitable selling prices are much beyond their mental capacities, and do more towards turning their hair grey than the more practical part of their work. An "electrician" is not necessarily a highly intelligent specimen of manhood, and more often than not the man who makes the best of a wiring job is the one who flounders most in the maze of figures he has to go through before he can estimate for a single contract. More than that, should the electrician have to supply goods from several different manufacturers, he has to carry in his mind numerous figures representing the various discounts offered, which are easily forgotten or mixed. Further, many of the figures are so cumbersome that it is impossible to work with them at all unless the scribbling pad is handy. It is, to say the least, very humiliating to have to use a pencil and paper every time one has to quote a price.

No one who gives thought to this question will fail to appreciate any suggestion that gives prospects of reform; but, at the same time, we all realise the difficulties to be encountered in bringing about that reform. The variations in market prices is the first and greatest obstacle in the way of progress, yet with a little care and forethought the writer is sure that even that obstacle could be surmounted.

There is another aspect to the case which it behoves us to consider, namely, the fleecing of the customer. Electricians are inclined to favour the firms giving the greatest discounts, in order that by charging full list prices to their customers, they may realise profits which, to put it very mildly, are grossly unfair. One will readily allow that a man who invests his capital, be it £5 or £5,000, in a business of any sort, has a right to make a reasonable profit, but in the electrical trade, as in other trades, profits often attain to the unreasonable. For this the manufacturers are largely responsible, for by offering a trade discount of, say, 50 per cent., they are inducing the contracters not only to buy their goods, but also to sell them for more than their worth, since, if the discount is high, the list price is then in reality much more than the real value of the article. The contractor does not buy cheaper where a big discount is offered, but charges more for the goods.

The writer now proposes to give some figures which will well illustrate the weaknesses of the present system of discounts by showing the absurdity of some discounts, the effects of varying market prices on them, and the unreasonableness of the profits made allowable by reason of badly fixed discounts.

We will take first the case of a firm who list all their goods in a single catalogue, but who give a different percentage to the trade according as the goods purchased are listed at the beginning, the middle, or the end of the catalogue. Now, this is absurd enough, but it is not quite as bad as the case where a discount of $47\frac{1}{2}$ per cent. was quoted. To work with such an unwieldy figure as $47\frac{1}{2}$ per cent. is out of all reason. The writer has tried to analyse the figure to see if there is any logical reason for adopting it, and to find some simple method of working with it, but, so far, has failed.

Another instance is rather a good one. A certain firm recently quoted a trade discount of $33\frac{1}{3}$ per cent., with a preferential discount in a special case of a further 15 per cent., and, in addition, the usual 5 per cent. for cash. Is it possible to imagine anything more beautiful? The writer has calculated that the ultimate discount in this case is $46\frac{1}{6}$ per cent.—truly a wonderful figure.

Now, why cannot we, once and for all, drop such absurdities and adopt reasonable and decent figures? Why should we dabble with $46\frac{1}{6}$ per cent. or $47\frac{1}{2}$, when 50, practically the same figure, would do just as well? More than this, why cannot we have the same discount on all lines and from all firms?

Difficulties will at once arise when the market begins to vary, but the following example of the effect under present conditions will show that things cannot be worse than they are now.

The trade were recently notified that, "owing to the increased price of raw material, prices would be increased 10 per cent.," and a few weeks afterwards a further 10 per cent. rise was announced. Now let us apply this to the case we last cited, and see the effect.

Let us assume, for convenience, a certain article is listed at £100; after the first increase, this price has risen to £110, and eventually to £121, although some firms preferred to treat the ultimate increase as one of 20 per cent. instead of 21 per cent. Now, working, perhaps, in a roundabout fashion in order that the illustration may be all the more effective, on taking $46\frac{1}{6}$ per cent. from £121 we are left with a cost price of (to be precise) £65 83/600, which leaves a discount off the original list price of 34 517/600 per cent. Truly wonderful!

Now the writer proposes to meet variations of this nature by a decrease in the discount instead of an increase in the list price. He claims that the contractor or small business man is chiefly concerned with the price he has to pay for his goods, and not the price they are listed at. He fixes his charges for them accordingly. Let us arrange then that instead of making an increase of 10 per cent. in the catalogue price we simply decrease the discount 5 per cent., that is, give the contractor only 20 per cent. in place of the 25 per cent. he was originally allowed. The tradesman would thus know readily what his goods cost and could fix his selling price accordingly. Further, variations could be arranged to affect all goods at the same time by giving a slightly less discount on all things instead of making substantial increases on some lines only. Although a suggestion of this sort would certainly come in for some scathing criticism from various sources, yet it has merit in that it tends to simplify greatly our business system. The problem of fixing a fair alteration in the discount either way would indeed be a difficult one, but we must remember that every manufacturing firm has many clerks who thrive on works costs and the like, and who would think nothing of problems of this nature. More than that, the working of one problem would finish the whole matter, whereas now each contractor has to do his own calculations, which many of them find much too difficult.

Finally, in dealing with the unreasonableness of the profits made allowable by some discounts, we must bear in mind that nine out of every ten of our customers ask for a discount off the list price, in which case it may be an advantage to be allowed 50 per cent.; but, generally speaking, 50 per cent. is too high a discount. In a case where 50 per cent. and an additional 10 per cent., and the usual 5 per cent. cash allowance were made, a certain article was sold at the full list price. On calculating out the profit, the tradesman was surprised to find that he had realised 134 per cent., which is, beyond question, unreasonable.

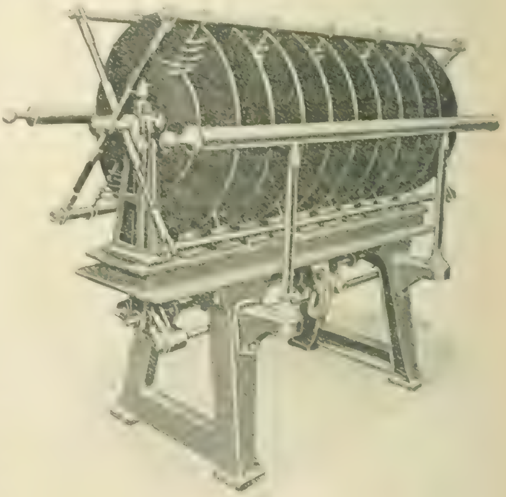
Why cannot we, then, try to adopt some system which will be fairer to manufacturer, contractor and consumer alike. The evil that is done by such large discounts can be remedied, the complications of figures can be smoothed out, and the worry that is caused to the contractor can be done away with.

If every firm were to adopt a trade discount of, say, 30 per cent., and to counterbalance increases in the production costs by small decreases in the discounts much of the present trouble could be avoided. The variations in the trade terms need not involve more unwieldy figures than 5 per cent.; and in hoping that some improvement will be forthcoming, the writer is confident that the adoption of the above suggestions would be a real boon and blessing.

A POWERFUL ELECTROSTATIC MACHINE.

Whereas high-tension alternate currents are generated with relative ease by means of transformers, the only available source in the case of direct currents are electrostatic machines.

In view of the inadequacy of these machines, as so far constructed, H. Abraham and P. Villard, in connection with their work on high direct-current potentials, recently entrusted M. Roycourt, at Paris, with the construction of an extremely powerful electric machine destined for their laboratory at the Ecole Normale Supérieure.



Electrostatic Machine for the Ecole Normale Supérieure

This machine is of the Wimshurst-Bonetti type, with opposite rotations and without sectors, the extremely high potential being due to the use of disks 73 centimetres in diameter. The current output depends on the surface area passing in a given time in front of the combs, and accordingly, on the number of disks and their speed of rotation. [illegible] therefore, adopted 20 disks with a maximum speed of 1,500 r.p.m. This machine, while [illegible] tangential speed of [illegible] metres per second, results in a perfect balancing of the disks and other rotating parts, and does away with any cause of disturbing [illegible].

The disks are mounted by pairs on cast-iron frames solidly attached to a cast-iron bed [illegible].

In order to ensure the maximum output, depending on the purity of the ebonite, the disks have been fitted with a [illegible] so that the machine may be cleaned in a few minutes.

The transmission of driving energy is effected by means of a shaft driven by the motor-belt. On this intermediate shaft are keyed the driving-pulleys of the disks, driven through belt transmission. As the strain on the belts is uniformly distributed, they are all lengthened in the same proportion. In order to tighten the belts, the position of the intermediate shaft is altered by a lever, and it is fixed by tightening a nut on a perforated sector below the bench.

In order to allow for any combination liable to arise in connection with laboratory work, the diametrical conductors are insulated against the bulk of the machine, while being so arranged as to enable their length to be readily adjusted.

In connection with the first tests of this machine, potential differences of up to 320,000 volts could be obtained, this limit being determined by the sparking set up between the metal frame and the current collectors, that is, over a length slightly exceeding the radius of the disks.

THE MINERS' ELECTRIC LAMP COMPETITION.

As our readers will remember, in May 1911 the Secretary of State for the Home Department announced a prize of £1,000 for the electric lamp suitable for miners which best fulfilled certain specified requirements. The amount of the prize was placed at the disposal of the Secretary of State by a colliery proprietor, and the object of the competition was to encourage the production of safe and efficient types of electric lamps for miners.

Mr. Charles Rhodes (a former President of the Institute of Mining Engineers) and Mr. Charles H. [illegible], member of the recent Departmental Committee on the Use of Electricity in Mines, consented to act as judges, and the conditions of the competition were as follows:—

1. The competition was open to persons of any nationality.

2. The judges were empowered to award the whole of the prize, or to divide it, or to make no award if no lamp appeared to them to be of sufficient merit.

3. The competition was open for six months, closing on December 31st, 1911.

The requirements which all the lamps submitted in competition were asked to fulfil were as follows:—

1. Each lamp was to be of sound mechanical construction so as to withstand rough usage.

2. It was to be of simple construction and easy to maintain in good order and repair.

3. It was to be so constructed as to render impossible the ignition of inflammable gas either within or without the lamp.

4. The lamp battery was to be so constructed that any liquid it might contain could not be spilled with the lamp in use.

5. The lamp was to be so constructed as not to be liable to deterioration by corrosion as a result of the action of the electrolyte.

6. It was to be effectively locked.

7. It was to be capable of giving an amount of light not less than 2 c.p. continuously for [illegible] hours.

8. The light was to be well distributed outside the lamp.

In addition to the above regard was directed to be paid to—(a) The first cost of the lamp; (b) the cost of maintenance; (c) convenience in handling; and (d) the weight of the lamp when charged and ready for use.

The judges have now issued their award, which is in the following terms:—

MINERS' ELECTRIC SAFETY LAMP COMPETITION.

We have had submitted to us [illegible] lamps, varying very considerably in design and construction.

We have awarded the first prize to the C.E.A.G. Lamp sent in by Mr. F. Farber, Beurhausstrasse, 3, Dortmund, Germany, and inasmuch as a number of other lamps possess considerable merits, we have apportioned the amount offered for competition as follows:—

Farber, F., Beurhausstrasse, 3, Dortmund, Germany	£[illegible]
Attwater, Thos., 22, Pelham Square, Brighton	50
[illegible], Adolf, [illegible], Hannover, Germany ...	[illegible]
Bristol Electric Safety Lamp Works, 40, Gt. Smith Street, Westminster	[illegible]
Electrical Co., Ltd., 112-124, Charing Cross Road, London, W.C.	50
Gray, W. H., [illegible] Street, [illegible] Town, London, N.W.	[illegible]
Joel, H. F., 134B, Kingsland Road, London, N.E.	50
Oldham & Son, Denton, Manchester	[illegible]
Tudor Accumulator Co., 119, Victoria Street, Westminster, S.W.	[illegible]

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIA.—The Customs authorities have further amended their regulations regarding the qualifications necessary for goods to secure entrance under the preferential tariff. Clause 4 of the existing certificate is amended as follows:—Certificate, Form "A." That in the calculation of such proportion of British production or British labour none of the following items has been included or considered:—Manufacturer's profit or the profit or remuneration of any trader, agent, broker, or other person dealing in the article *in its manufactured finished condition; costs incurred in the mere packing of foreign-made goods in (e.g., cartons or other containers);* cost of outside packages or any cost of packing the goods thereinto; any cost of conveying, insuring, or shipping the goods subsequent to their manufacture.

The words given in italics are now deleted.

NEW ZEALAND.—The Customs authorities have also revised their preferential tariff regulations so that they now conform more or less to the Australian regulations. The most important new stipulation is that before goods can be entered under the preferential tariff their finishing process must have been effected by British labour, in addition to the requirement that 25 per cent. of their total value shall also be produced by British labour. The following are the more important of the new regulations:—

1. The classes of goods which shall be deemed to be the produce or manufacture of the British Dominions for the purposes of the said Act shall be the following:—

(a) Goods wholly the produce of the British Dominions.

(b) Goods wholly manufactured within the British Dominions from materials produced in such Dominions.

(c) Goods wholly manufactured within the British Dominions in which all manufacturing processes are performed in the British Dominions from unmanufactured raw material of foreign origin.

(d) Goods partially produced or partially manufactured in the British Dominions, provided that the final process or processes of manufacture have been performed in such Dominions, and also that the expenditure in material produced in such Dominions and (or) labour performed within such Dominions (calculated subject to the qualification hereunder) in each and every article is not less than one-fourth of the factory or works cost of such article in its finished state.

2. In the calculation of such proportion of produce or labour of the British Dominions, none of the following items shall be included or considered: Manufacturer's profit, or the profit or remuneration of any trader, agent, broker or other person dealing in the article in its manufactured finished condition; costs incurred in the mere packing of foreign-made goods in (*e.g.*, cartons or other containers); cost of outside packages or any cost of packing the goods thereinto; any cost of conveying, insuring or shipping the goods subsequent to their manufacture.

3. Goods landed in transit. Goods which, after shipment from any part of the British Dominions, have entered into the commerce of or been subject to any process of manufacture in any foreign country, shall not be deemed to be the produce or manufacture of the British Dominions.

The following are the new forms of certificates which are to replace those of which copies have already been published in the ELECTRICAL REVIEW.

No. 1.

Form of certificate prescribed to be written or printed on invoices of all articles for entry under the Preferential Tariff of New Zealand when made and signed by an individual exporter personally.

I [*Full name of Exporter*], the exporter of the articles included in this invoice amounting to [*Total value in currency, or quantity, or length*], and dated   of goods supplied to [*Name of purchaser*], do hereby declare that I have the means of knowing and do hereby certify as follows:—

1. That the said invoice is in all respects true and correct.

2. That every article mentioned in the said invoice has been either wholly or partially produced or manufactured in [*Name of*

part of British Dominions, and is *bona fide* the produce or manufacture of that part of the British Dominions.

3. As regards those articles only partially produced or manufactured in that part of the British Dominions :—

(*a*) That the final process or processes of manufacture have been performed in that part of the British Dominions.

(*b*) That the expenditure in material produced in the British Dominions and [or] labour performed within such Dominions (calculated subject to the qualifications hereunder) in each and every article is not less than one-fourth of the *factory or works cost* of such article in its finished state.

4. That in the calculation of such proportion of produce or labour of the British Dominions, none of the following items have been included or considered : Manufacturer's profit, or the profit or remuneration of any trader, agent, broker, or other person dealing in the article in its manufactured finished condition ; costs incurred in the mere packing of foreign-made goods in (*e.g.*, cartons or other containers) ; cost of outside packages or any cost of packing the goods thereinto ; any cost of conveying, insuring, or shipping the goods subsequent to their manufacture.

Signature.

Dated at........................this.........day of..................,19......

No. 2.

Form of Certificate prescribed to be written or printed on Invoices of all articles for entry under the Preferential Tariff of New Zealand, when made and signed by a person other than an Individual Exporter.

I, [*Full name of person signing the certificate*], partner, manager, chief clerk *or* principal official, [*giving rank, as the case may be*], of [*name and address of exporter or exporters*], the exporter[s] of the articles included in this invoice to [*Total value of invoice, in words at length*] and dated............, of goods supplied to [*name of purchaser*],do hereby declare that I am duly authorised to make and sign this certificate on behalf of the said exporter[s].

I have the means of knowing and I do hereby certify as follows : (then continue as in paragraphs No. 1-4 of Form 1 printed above).

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,044. "System of electric signal or control for railway trains." G. Barker (Thomson Automatic Signal Co., U.S.). August 6th. (Complete).

18,060. "Electric couplings or connectors." J. Wilkie. (Addition to 3,772/12). August 6th.

18,065. "Electrometers and appliances for indicating and measuring variations in electric potential, especially in earth potential, and a method of applying the same for meteorological purposes." A. H. Maurice. August 6th.

18,070. "A bottom for miners' pit lamps electrically lighted." D. Morrison. August 6th. (Complete).

18,072. "Electrical attachment for motion picture machines." G. E. Ward. August 6th. (Complete).

18,080. "Electric heated glove." A. L. Carron. (Convention date, September 9th, 1911, United States.) August 6th. (Complete).

18,086. "Receiving apparatus for electric waves." F. Schneider. (Convention date, April 15th, 1912, Germany.) August 6th. (Complete).

18,087. "Cooling dynamo-electric machinery and means therefor." Siemens Bros. Dynamo Works, Ltd., and J. W. Howard. August 6th.

18,094. "Electric locomotives." J. le C. Davis. (Convention date, August 7th, 1911, United States.) August 6th. (Complete.)

18,107. "Compensation of single-phase potential regulators." Akt.-Ges. Brown, Boveri et Cie. (Convention date, August 3rd, 1911, Germany.) August 6th. (Complete.)

18,109. "Circuit breakers." E. C. R. Marks. (Clinton Wire Cloth Co., United States.) August 6th. (Complete.)

18,111. "Wireless telegraph transmitters." A. Shaw. August 6th. (Complete.)

18,115. "Electric dinner or service lifts." F. Hodgson. August 6th. (Complete.)

18,129. "Telephones." H. Sefton-Jones. (Akt.-Ges. Mix & Genest Telephon und Telegraphenwerke, Germany.) August 6th. (Complete.)

18,145. "Brush-holders of electric machinery." W. White, P. Dawson and R. H. Houghton. August 7th.

18,164. "Contacts for electric controllers or switches." G. P. Fairless and S. N. Warren. August 7th.

18,184. "Method of operating electro-magnetic striking tools by means of alternating current. L. Schuler. August 7th. (Complete.)

18,188. "Receiving apparatus for electric waves." F. Schneider. (Addition to 18,086/12) August 7th. (Complete.)

18,210. "Electric switching devices." F. Coates and A. Reyrolle & Co., Ltd. August 7th.

18,212. "Electrically-operated hot and cold air douches." A. Schaeffer. August 7th. (Complete.)

18.214. "Electrical measuring instruments." E. Fauvin, E. Amiot and E. Cheneaux. (Convention date, September 6th, 1911, France.) August 7th. (Complete.)

18,220. "Electrodes for arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 7th.

18,262. "Fire-alarm signal-boxes for automatic telephone systems." A. J. Boult. (Denio General Electric Co., United States.) August 8th. (Complete.)

18,275. "Combined plug and switch for electric circuits." W. R. Lambert. August 8th.

18,312. "Magnetic compasses." Kelvin & James White, Ltd., M. B. Field and D. Renfrew. August 9th.

18,341. "Electrodes." H. S. Hatfield and Chamberlain & Hookham, Ltd. August 9th. (Complete.)

18,349. "Ironclad electric switch and distribution boards." H. H. Berry and W. J. Markham. August 9th.

18,356. "Automatic telephone circuits." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) (Addition to No. 27,458, of 1909.) August 9th. (Complete.)

18,368. "Multiplex telegraphic printing apparatus for automatic and manual transmission and of high output also capable of being used with submarine cables." A. Colonna. August 9th. (Complete.)

18,369. "Polarised telegraphic relay." A. Colonna. August 9th.

18,371. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 9th.

18,372. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 9th.

18,387. "Time recorder for electric lamps, motors, stoves, radiators, and the like." T. Thorp, F. Thorp and H. T. Thorp. August 10th.

18,404. "Galvanic cell." J. T. Szek and A. Szek. (Convention date, August 12th, 1911, Belgium.) August 10th. (Complete.)

18,412. "Dynamo-electric machines." E. R. Clarke. August 10th.

18,422. "Wireless telegraphy and telephony." J. T. Sibley. August 10th.

18,425. "Generator regulators." W. E. Lake. (J.B.M. Electric Co., United States.) August 10th. (Complete.)

18,430. "Selector for automatic or semi-automatic telephone systems." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) August 10th. (Complete.)

18,437. "Lamp regulators." W. E. Lake. (J.B.M. Electric Co., United States.) August 10th. (Complete.

18,440. "Electromagnetic brakes." A. Thode & Co. (Convention date, August 10th, 1911, Germany.) August 10th. (Complete.)

18,444. "Electrical systems for internal-combustion engines." W. E. Lake. (J.B.M. Electric Co., United States.) August 10th. (Complete.)

18,449. "Electrolytic production of metals." R. W. Wallace and E. Wassmer. August 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

1911.

Fittings for Metallic Conduits for enclosing the Cables of Electrical Wiring Systems. L. M. Waterhouse and Simplex Conduits, Ltd. 14,650. June 21st.

Cash-registering Machines and Electrical Control Means for same. National Cash Register Co. (National Cash Register Co.) 16,727. July 26th.

Semi-automatic Telephone Exchange Systems. F. T. McBerty. 17,211. July 27th. (June 27th, 1910.)

Supports for Electrical Conductors. Callender's Cable and Construction Co. and C. W. Kay. 17,294. July 28th.

Illuminated Signs. V. von Vangel. 17,306. July 28th.

Earthing or Bonding Devices for Electric Conductors. W. T. Henley's Telegraph Works Co. and W. F. Bishop. 17,347. July 29th.

Dynamo-Electric Machines. J. W. Greenwood. 17,835. August 5th.

Testing Electric Meters. T. E. Murray. 18,763. August 21st. (October 25th, 1910.)

Apparatus for Winding Armatures. K. R. Ritter. 20,997. September 22nd. (September 23rd, 1910.)

Magneto-Electric Machines for Ignition Purposes. B. Brooks and F. H. Alston. 21,025. September 23rd.

Electrical Plug Switches. J. Y. W. MacAlister. 21,168. September 25th.

Electrodes for Arc Lamps. W. R. Ridings. 21,647. October 2nd.

Magneto Machines. W. H. Moore. 21,755. October 3rd.

Subscriber's Instrument Set for Automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 22,805. October 16th.

Electric Insulators. G. Fuller and G. J. A. Fuller. 23,324. October 23rd.

Supports for Electrical Conductors. Callender's Cable and Construction Co. and C. W. Kay. 23,565. (Divided application on 17,294 of 1911. July 28th.) October 25th.

Means for Suspending Electric Conductors. Callender's Cable and Construction Co. and C. W. Kay. 23,566. (Divided application on 17,294 of 1911. July 28th.) 23,566. October 25th.

Electric Lighting. I. Frankenburg & Sons, Ltd., and E. Fleming. 26,283. November 25th. (Addition to 28,724 of 1910.)

Method of Pointing Wires preparatory to Drawing. Julius Pintsch Akt.-Ges. 27,262. December 5th. (November 20th, 1911.)

1912.

Magnet Electric Speed Indicators. J. Schuster. 1,288. January 16th. (January 17th, 1911.)

Electric Cables for Automatic Telephone Exchange Selectors and the like. Western Electric Co. (Western Electric Co.) 3,980. (Divided application on 16,868 of 1911. July 22nd.) February 16th.

Electrically-heated Ovens. R. Haddan. (Copeman Electric Stove Co.) 5,986. (Divided application on 22,001 of 1911. October 5th.) March 9th.

Manual and Semi-automatic Telephone Exchange Systems. F. R. McBerty. 8,571. April 11th. (July 27th, 1910. Divided application on 17,211 of 1911. July 27th.)

Automatic or Semi-automatic Telephone Exchange Systems. F. R. McBerty. 8,572. April 11th. (July 27th, 1910. Divided application on 17,211 of 1911. July 27th.)

Means for Attaching Wires and Cables to Insulators. H. Parra. 9,520. April 22nd. (May 1st, 1911.)

Device for Automatically Cooling the Atmosphere in Enclosures on the Attainment of a Predetermined Temperature, and for giving an Alarm when the said Temperature is exceeded. J. A. Voigt. 10,251. April 30th.

Receiver for Telegraph Printing Machines. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 13,490. June 8th.

Hinckley Electric Supply.—The Leicestershire and Warickshire Electric Power Co. has applied to the B. of T. for consent to erect overhead lines for the transmission of energy at a pressure of 6,600 volts from Nutt's Lane power station, near Hinckley, to Battling Brook, and thence to Hollycroft Road.

THE

ELECTRICAL REVIEW.

VOL. LXXI. AUGUST 30, 1912. No. 1,814.

ELECTRICAL REVIEW.

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(J. A. Berly's).

1912 EDITION.

H. ALABASTER, GATEHOUSE & CO.,
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THE NEW RULES FOR ELECTRICITY IN MINES.

AN action involving very important issues was brought by the Home Office against the Consett Iron and Coal Co., and was reported in our issue of August 2nd. As may be remembered, a fatal accident at one of the above-named company's collieries resulted in the death of a workman employed in working a face conveyor. As a result of this the Home Office instituted proceedings against the manager for not having the switch efficiently earthed; had this been done, it would undoubtedly have saved the poor man's life. The Consett Co., however, defended the case, and maintained that under the new rules, No. 20, subsection (*b*), exonerated them from any liability to earth their installation, as it was in accordance with the old rules and was erected before June 1st, 1911.

Whatever the position may be from a legal point of view, it is, if we rightly understand the facts of the case, rather pitiful that a powerful and wealthy concern like the Consett Iron and Coal Co. should try to avoid rules which were designed, not to annoy proprietors of coal mines or to cause them unnecessary expense, but to reduce the risk of accidents and safeguard the lives of the workmen employed by them, and their own property from destruction. One would have thought that colliery companies would have welcomed anything in the shape of rules and regulations which had this object in view. We are not defending the Coal Mines Regulation Acts, or even the new Electricity Rules, but merely the humanitarian object with which they were originally framed, and no one who knows the extreme carelessness with which, in many cases, electrical installations were installed underground and managed afterwards—criminal carelessness we should be inclined to call it, were it not for the excuse of ignorance of electrical matters on the part of those responsible—will for one moment deny that some such rules were required. How many lives, we would ask, have been sacrificed to the ignorance of those in charge of the plant, and the defiance of all rules and regulations? One need only turn over the pages of the Inspectors of Mines' Reports, and total up the number of fatal accidents—most of which might have been avoided had a little common-sense been exercised in the installation and management of the plant—to be appalled.

How often have we dealt with this question in our own columns, and pleaded for common-sense methods of handling electricity in mines, and the abandonment of a cheese-paring and defiant policy. How often again have we pleaded for the employment of trained engineers, with full responsibility for the plant they have charge of. We repeat that we hold no brief for Home Office Regulations, but we do for electricity, and it is of its misuse and mismanagement that we complain. Rightly installed and rightly used, it will give mine-owners the best return of all the capital expended in the equipment of the mine; and, moreover, it is as safe and as reliable as either steam or compressed air, but vastly cheaper to install and much more economical to work.

Returning, however, to the case in point, we have before us the Report of the Departmental Committee which drafted the new rules, and which says regarding the earthing of metallic coverings of apparatus (see page 9):—"The Committee regards a sound connection to earth for all metallic coverings and casings, whether the apparatus be fixed or portable, as the best safeguard against shock that exists in underground conditions. The existing rule (No. 1*c*) makes two exemptions—(*a*) in favour of portable machinery (including trailing cables) and (*b*) in favour of low-pressure systems. The Committee recommends that exemption (*a*) *be withdrawn altogether*; and that exemption (*b*) be modified in the case of alternating-current systems, so that earthing is required where the pressure in a system exceeds 125 volts." The italics are ours, and we wish to emphasise what was evidently the view and intention of the Committee that, so far as Rule 1*c* sub-Section (*a*) was concerned, this was to be withdrawn absolutely on the date the new rules came into force. Further, Mr. W. C. Mountain, in his evidence before the Committee (see Minutes of Evidence, page 73, Q. 2,437), said in reference to Rule 1*c*:—"It appears desirable to modify this rule so that the frames of portable machines, such as coal cutters, portable haulages, compressors, motors, and machinery which is not definitely fixed upon foundations, shall be *efficiently earthed, together with the metallic cases containing the switchgear*," and we must point out that Mr. Mountain was speaking as a member of the Advisory Committee of the Coal Owners' Association of Northumberland. It is true Mr. Mountain to some extent qualified this statement—if qualification it can be called—by explaining that some collieries had successfully worked electrical machinery for 10 or 12 years without accident by merely relying upon the perfection of the insulation. "If," said Mr. Mountain, "such a degree of insulation could be maintained, of course I think earthing would not be necessary. But I am afraid there is a big 'if.' If some of these days a breakdown did occur, somebody would be killed. They are sitting rather on a powder magazine, I think." From this we gather that evidently Mr. Mountain thinks the rule is justified, and in our view it seems paltry to seize upon a legal interpretation of a clause in the Act to avoid or shirk responsibility, especially when all the facts and all expressions of opinion from experienced electrical engineers go to prove that the switch box in question *ought* to have been earthed. It has been said that the case turned upon the correct reading of the exemption clause and not in any way *upon expense*. We cannot agree with this view, for had there been any desire on the part of the colliery company to meet the intention of the new rules they would have put in a temporary earthing system, and what other objection can there be to fulfilling the requirements of the rule before the year 1920 except that of expense?

As regards the legal decision, the magistrates gave their verdict against the Home Office, who asked for a case to be stated, and as a consequence, seeing the case is still *sub judice*, it would not be proper for us to express any opinion. What does concern us though is the effect that the ultimate decision of this case may have upon colliery owners, for if the magistrates' decision be upheld, installations which ought to be attended to at once, and in which proper provision should be made for efficient earthing, will receive no attention under the plea that there is plenty of time, whilst all the time workmen are risking their lives, and electricity is earning a bad reputation. An honest man has no fear of the law, and in the same way we think colliery managers would be well advised carefully to examine the rules, and at once to set about bringing their installations into conformity with them. Accidents, especially when fatal, are not to the credit of colliery managers, and are expensive to the owners. The rules are designed to prevent accidents, and in our opinion they ought at least to be met in the spirit with which they were drawn up. Our sympathies are with Mr. Imery, manager for the Consett Co., as well as all other colliery managers, inasmuch as they have too many responsibilities upon their shoulders in the efficient management of a coal mine, but until they themselves see that it would be to their own relief and advantage to have the mechanical and electrical responsibility transferred to properly-qualified engineers, there is little hope of any change. Meantime we muddle along, and a lot of time seems to be wasted in seeing just how few of the many requirements under the numerous rules and regulations applying to coal mines may be made to serve, and in siezing upon exemption wherever possible, merely because it will relieve them from being obliged to do something, without giving the slightest thought as to whether that something is worth doing or not.

The Design of Machinery.

The Diesel explosion at Bray may be taken to heart by all machinery designers as an illustration of the inevitable fate which must eventually overtake all machinery in which some necessary safeguard has been omitted. In an ordinary crab winch, so long as the men at the handles are constantly on the alert and there is no sudden jerk to take the handles out of their charge, there is really no need for the ratchet pawl, whose resounding click makes known the fact that there is an automatic safety device on the watch against disaster. The ratchet in some form or other is a very common device in engineering. It is used in lifts, though it has become in these rather a grip brake than the suddenly acting ratchet it once was, which would act safely on a rising cage, but probably would do no good on a descending one, though a rope is more likely to break when a cage is descending if there are stops to be made on the way down.

A boiler feed-pipe without a check valve close up to the boiler may be a cause of low water and collapsed furnaces, but the check valve is never omitted now. The designer of Diesel engines intends that the air cylinder for the blast shall always carry a higher pressure than the engine cylinder, but evidence seems to be accumulating that this is not always the case. In this connection, it seems a pity that the small explosions that have occurred have not been more prominently recorded, their causes found out and explained, and an endeavour made to follow them logically to their possible worst results. Had this been done, it is possible that non-return valves, such as we have suggested, would have formed ere now a regular feature of design. It seems quite natural to suppose that serious mischief could not travel along a $\frac{3}{8}$-in. bore of some considerable length; but one of our correspondents has known this to have taken place some time ago, and his knowledge, if it had been published and had reached the right quarters, might have prevented the Bray explosion. Designers should always be on the alert to guard against the effects which may follow when pressures vary in any piece of apparatus. It is best to design such apparatus to work as it is desired to work, and then to assume that the pressures will, by some unknown means, vary from what they should be, and to follow out all imaginary consequences and to provide against them. It is not always that consequences are serious, but they are often inconvenient.

When putting in safeguards, it is most necessary to be sure that in cutting out one risk another has not been introduced of equal danger. Certain forms of isolation valve are fraught with danger, because they are afforded too long a movement in which to receive acceleration and acquire dangerous momentum. Wherever fluids can, under certain accidental circumstances, go the wrong way there may arise trouble or danger, and the non-return valve, which is, after all, only a form of ratchet, must be applied. It is the business of a designer to think out these possibilities, and not simply to design on the assumption that the matters he has arranged are going to act as they ought to do. It is easy to make these omissions, unless a special study is entered upon by supposing failure to occur and tracing its results.

The Reform of Railway Statistics.

One of the dubious joys of whole-hearted identity with any particular reform movement lies in the certainty of the fact that the reformer never gets really all he wants. There may often be very good ground for his inevitable discontent thereat. Mr. W. M. Acworth (who, with Mr. George Paish, was responsible for the authorship of a paper read a short time ago before the Royal Statistical Society on "British Railways; their Accounts and Statistics") is in the position of a partially satisfied reformer. For many years Mr. Acworth has worked for the publication, *inter alia*, of passenger mileage and ton-mileage statistics on our railways. The Board of Trade returns in regard to British railways have long been recognised as notoriously unsatisfactory. We have, from time to time, referred to the matter in these columns. Last year Parliament managed to pass a "Railway Companies' (Accounts and Returns) Act." This Act, to which we made brief reference in our last issue, throws some sort of a sop to the statistical reformers by its drastic amendment of the returns as to allocation of capital outlay and sources of revenue. It is not so satisfactory with regard to the returns giving the cost of maintenance and renewal. On the electric traction side, it is decidedly weak. For instance, the item "Electric Power Stations, &c.," in the capital account may include under the &c. the lighting of stations, or even sub-station equipment. But where are we to look for details such as the cost of, say, overhead equipment or live rails or special rolling stock or cables? As regards the maintenance and renewal of way and works (Abstract A), not one of the 20 headings seems suitable to cover maintenance of outside electrical equipment. Abstract B, which is concerned with the "maintenance and renewal of rolling stock (1) locomotives," contains no differentiation in respect of steam and electric locomotives for railways owning both types.

It is true that Abstract C, under "locomotive running expenses," contains the sub-heading "Electric train working," the items of wages of motormen, cost of energy, lubricants, and other stores, including clothing. Schedule No. 17, however, is entitled "Electric Power and Light Account." The main defect of this schedule is that there is no differentiation between the costs of lighting and traction. It is true that separate returns of the energy supplied give this under four headings, viz., Traction, Power, Lighting and "Other consumers." No particulars are given of rated capacity of plant installed, or of load factors.

Statistical Returns, Part (2), Sec. (2), Sub-Sec. (C) relates to the "Trains worked by electric power." This, while very brief, is hopeful. It is as follows:—

	Number.	*Carrying capacity.*
		Seats.
Details to be filled in as instructed by the Board of Trade from time to time by individual companies with regard to the various systems in use.		

On the maintenance and renewal of rolling stock, Part 2, Sec. (11), Abstract B, we have the serious mistake of combining "rail motor and electric" rolling stock, and the proposed publication of the numbers renewed, received heavy repairs, received light repairs, and under or awaiting repair at the end of the year, with the further sub-division of the numerical figures into the two classes of repaired in the company's workshops or "by contract."

We feel that the omission of specific information with regard to ton-mileage, average distance hauled per ton, passenger mileage, average distance travelled per passenger, average number of vehicles per train, ratio of tonnage carried to wagon capacity, and ratio of passengers carried to seat capacity, is a very serious matter. It is not beyond the wit of man to secure such data. They are the distinctive features in the administrative returns of many leading railway systems. It is rather strange that the country in which railways originated, and which administers the railway systems of our Indian Empire in a manner not surpassed by even German capabilities of analysis, should slur over the compilation of British railway returns by leaving them notoriously incomplete. It is neither fair to the manufacturing community nor to railway shareholders. Electrical engineers whose central station returns are so carefully compiled, and so capable of strict analysis, may well sympathise with those who are pressing for exactitude and utility in railway statistics. It is good that Mr. Acworth (himself a railway director), and those supporting him, are not sitting still under a partial success. On the success already attained congratulations are due, and with these we must tender good wishes for the further success which is necessary.

CABLE DISCOUNTS.

By H. R. TAUNTON.

A CHANGE in the C.M.A. discounts, such as has recently been notified to the trade, brings in its train a fresh crop of arithmetical puzzlers for the users of cable catalogues, who find all their net prices, laboriously calculated for the old set of discounts, rendered obsolete. New net prices have to be worked out; and to deduct three successive percentages from a given list price, and to reduce the result to shillings and pence, and to coils and yards, is a figuring feat that would daunt a calculating machine, let alone a busy contractor. And he generally forgets to make a note of the result, so that a week later he has the wearisome task to face again for the same size and grade. When this labour is multiplied by 50 different sizes of cable, and a score of different grades, it will be seen that the C.M.A., in changing their discounts, unwittingly entail on their customers an amount of pencilling of paper and sliding of rules that, properly applied, would produce half-a-dozen volumes of Institution Papers.

It is with the idea of minimising this waste of valuable brain power that the following short cuts are suggested. They will be found to give results considerably more accurate than those of the slide-rule, and quicker than paper and pencil; contractors especially should find them useful:—

C.M.A. Grades.

Net price in pounds per mile:—

Multiply list price by 6. Multiply the result by 2. Add $\frac{1}{10}$ of the first figure to $\frac{1}{1000}$ of the second figure.

Net price in shillings per coil:—

Add half the list price to $\frac{1}{100}$ of the list price, and increase the result by one-half.

Net price in pence per yard:—

Add half the list price to a third of list price, and divide the result by 10. (This gives a result accurate to $\frac{1}{80}$ of a penny for a list price of £100, or $\frac{1}{8}$ of a penny for a list price of £1,000, which is sufficiently close for practical purposes.)

Non-Association Grades

Net price in pounds per mile:—

Add two-fifths of the list price, divided by 10, to half the list price.

Net price in shillings per coil:—

Add half the list price to a half of that, and subtract one-tenth of the result.

Net price in pence per yard:—

Add half the list price to a half of that, and subtract one-fifth of the result. (This, as in the corresponding case for C.M.A. grades, is not absolutely exact, but sufficiently so for practical purposes.)

Tabulated for convenience of reference, these results read as follows, L being list price:—

Net Prices of Cable at Current Discounts.

C.M.A. £ per mile $= 6\,\mathrm{L}/10 + 2 \times 6\,\mathrm{L}/1{,}000$.

s per coil $= \mathrm{L}/2 + \mathrm{L}/100 + \frac{1}{2}\,(\mathrm{L}/2 + \mathrm{L}/100)$

d per yard $= (\mathrm{L}/2 + \mathrm{L}/3) \div 10$.

"Non." £ per mile $= 2\,\mathrm{L}/5 \times \frac{1}{10} + \mathrm{L}/2$.

s per coil $= \mathrm{L}/2 + \mathrm{L}/4 - \frac{1}{10}\,(\mathrm{L}/2 + \mathrm{L}/4)$.

d per yard $= \mathrm{L}/2 + \mathrm{L}/4 - \frac{1}{5}\,(\mathrm{L}/2 + \mathrm{L}/4)$.

The above formulæ could easily be written in more compact forms, but they have been so expressed as to substitute, as far as possible, additions and subtractions and shifting of the decimal point, for multiplication and division. What little multiplication and division has to be done is effected by simple factors in easy stages.

In this connection it may be useful to remember that a price in pounds per mile can be reduced to shillings per coil by multiplying by $\frac{5}{4}$; and to pence per yard by multiplying by $\frac{3}{22}$. And again, shillings per coil can be approximately reduced to pence per yard by dividing by 9.

ELECTRICITY SUPPLY IN SHEFFIELD.

It is hardly necessary to descant upon the enormous potentialities of electricity supply in Sheffield. As a centre of every class of engineering and metal working, the city stands unrivalled in situation, development and prospects. The population is increasing with extraordinary rapidity, and is now close upon 455,000. The trade depression of ten years ago has been succeeded by a great industrial boom, and there is every reason to believe that the Corporation Electricity Department will now reap the full benefit of its persistent efforts and foresight during past, less favourable, periods.

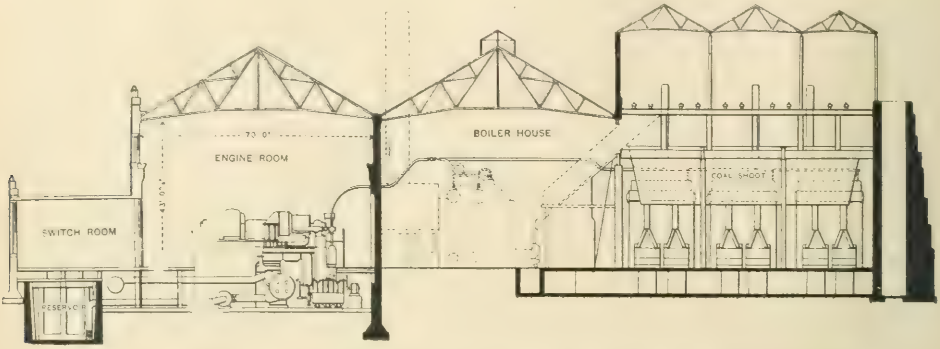

Fig. 1.—Sectional View of the Neepsend Electricity Works through the New Boiler House.

Until 1899 the system of generation was single-phase, 100 cycles, 2,000 volts, with transformer sub-stations and consumers' transformers, but, by this date, the demand for industrial electric motors had become such that 50-cycle, 2,000-volt, two-phase generators were installed, and the last turbo-alternator installed at Neepsend was (and all future extensions will be) for the supply of three-phase, 50-cycle current.

The original plant at Sheaf Street was described in detail in the Electrical Review of July 15th, 1904.

Owing to the insufficiency of condensing water, it was realised that the capacity of this station could not be further increased while maintaining low generating costs, and this led to the Neepsend development.

Ultimately the Sheaf Street works will be no more than a transformer sub-station, but at present it is called upon to help the Neepsend plant over its peak load. During winter months the Sheaf Street plant runs from 7 a.m. to 11 p.m.; normally the station is shut down during the summer (except for transforming purposes), but last year the load increase overtook the plant extension at Neepsend; hence the Sheaf Street plant was worked at full capacity throughout the summer.

The Neepsend station is located 2 miles from the centre of the city and 3·5 miles from the chief power loads (at the east end of the city), but such comparatively small transmission losses as occur under the high-tension distribution system adopted, and the high investment in feeders and distribution mains (£27 per kw.) are compensated and justified by the great natural advantages of the site.

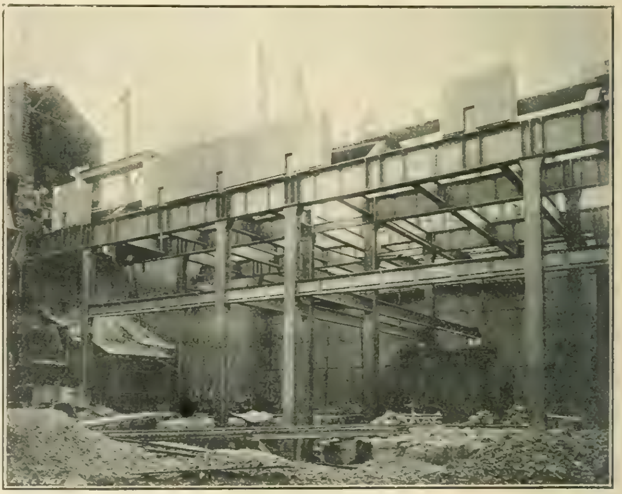

Fig. 2.—New Boiler House under Construction.

Ample circulating water is available from the River Don, which is here, above the city, comparatively pure. Excellent rock foundations are available below a deep layer of clay, which, as it is excavated, is made into bricks to be used in the station buildings and retaining walls, &c. Railway sidings run along the hill side above the works, and as the latter are built on the excavations at river level, thus arrive level with the bunkers above the boilers: the rail level is 63 ft. above the boiler house floor. Part of the site to the north of the station is now being filled in with ashes, to form future sidings. Fresh extensions to the south for future plant are justified by the value of the clay and rock removed for bricks and concrete ballast. By exchanging a small area of land with the railway company, the shape of the site will be greatly improved at its southern end, and its ultimate capacity lies between 50,000 and 100,000 kw. The space required for coal storage and cooling towers will probably determine the capacity of plant which can be accommodated.

The original equipment of the Neepsend works (totalling 3,000 kw.) has already been described and illustrated in detail. The extensions just completed have lengthened the engine room 110 ft., and added a tee-piece to the boiler room. Ultimately, the buildings to the north of the centre boiler aisle will be duplicated to the south, thus forming a symmetrical whole; at the same time the switchgear will be centralised in the room shown on fig. 1. The present dimensions of the engine room are 163 ft. × 70 ft. × 40 ft. high, and of the boiler room—old portion, 214 ft. × 70 ft.; new portion, 110 ft. × 83 ft. 3 in.

One of the most interesting features of the recent extensions is the provision made for the storing of 3,500 tons of coal (roughly, six weeks' supply). Ample as this reserve would have been considered in earlier days, the national coal strike has shown how serious may be the effect of labour trouble on a public utility service, and the Electricity Committee is seriously considering whether eight weeks' supply should not in future be held. Apart from the space occupied by, and capital sunk in, very large coal stocks, there is a gradual deterioration in the thermal value of the fuel, and a more or less serious risk of spontaneous combustion.* During the recent coal strike the station was, like many others, compelled to purchase at excessive prices—once the three weeks' stock neared exhaustion.

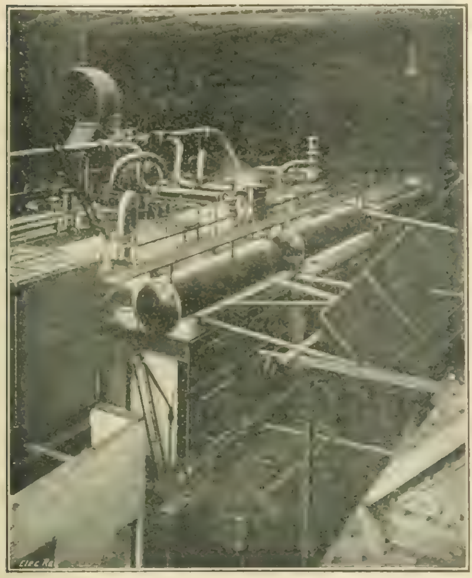

Fig. 3.—Old Boiler Plant, Neepsend.

Five sidings run directly over the new bunkers, into which coal falls through wrought-iron gratings (retaining any large pieces which might jamb in the coal shoots or valves). 9-h.p. capstans haul the trucks along the track over the bunkers, and a 9-h.p., 20-ton traverser enables wagons to be moved from one set of rails to another.

From the main store coal falls by gravity into inclined chutes (placed between the brickwork sections) and through breeches pipes and measuring chambers into the stoker hoppers. The coal consumption is initially determined by volume (the average weight of a measuring chamber full of coal of a given grade being determined by trial). The boiler attendant can only obtain coal by operating the measuring chamber valves (and incidentally the recorder) and these valves are so arranged that it is impossible to run coal continuously through the measuring chamber.

There are at present eight boilers installed in the older portion of the boiler house, and seats for six others are prepared in the new cross aisle. All the boilers are of the Stirling type, supplying steam at 200 lb. per sq. in. and 90° F. (Nos. 1-4), or 150° F. (Nos. 5-8) superheat. The principal dimensions are:—

	Nos. 1-4.	Nos. 5-8.
Heating surface, sq. ft.	6,210	8,016
Evaporation, lb. per hour	30,000	38,000

Boilers 1 to 4 have Bennis pneumatic stokers, Ellis-Eaves induced draught apparatus and the Fedden air heating boxes. Boilers 5 to 8 have chain grate and underfeed stokers, but although much less attention is required by these than by the older boilers, the latter show an appreciably higher thermal efficiency (3·0 lb. coal per kw.-hour, as compared with 3·1 lb. per kw.-hour, representing an annual saving of about 250 tons of coal). Nos. 1 to 4 have each a 15,000 cb. ft. per min. Sturtevant fan, delivering at 2·25 in. water gauge; Nos. 5 to 8 have each a 240-tube (10 ft. × 4·9 in. diameter) economiser; Nos. 5 and 6 are provided with a Sirocco induced-draught fan, and Nos. 7 and 8 with a forced-draught fan.

Isolating valves are fitted between each turbine and boiler and the main steam pipes (lap-welded wrought-steel, 7 in. and 10 in. in diameter), which run the whole length of the boiler house.

Steel smoke stacks (60 ft. × 5 ft. diameter for one and 86 ft. × 7 ft. diameter for two boilers) are employed; corrosion first occurs near the base and an average life of seven years is obtained. No firebrick lining is used and a coating of tar is given each spring.

For the removal of ashes, a narrow-gauge, hand-operated tramway is arranged immediately below the firing plates of the boilers, and this delivers to a "White" aerial ropeway, which finally dumps the ashes; this was recently described in our pages. From 10 to 15 per cent. of the coal fired is discharged as ash, and the operation of the ash tower occupies one man from 7 a.m. to 6 p.m. daily.

The new pump room is located opposite to the cross aisle of the boiler house, and above it is placed a 25,000-gallon feed tank, the level of water in which is indicated by a float gear and also by a head gauge, on the dial of which relay contacts are mounted to close an alarm circuit should the tank supply become excessive or insufficient. This precaution is found to be necessary owing to the tendency of the floats (as arranged), to wander about the tank, and also on account of their gradually becoming waterlogged.

A motor-driven centrifugal pump delivering 10,000 gallons per hour can be used to draw water from the river for feed or fire-extinguising purposes, in the event of a breakdown in the town supply. Its most common use is to supply river water to turbine tube-cleaners. Town water, which is very soft, is used for make-up purposes.

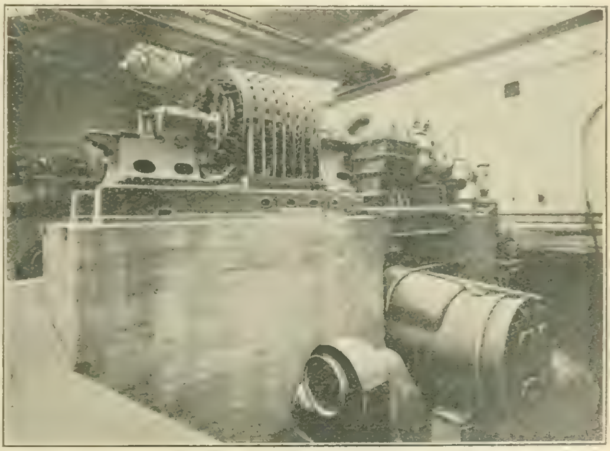

Fig. 4.—6,000-kw. Three-Phase Turbine Set being Erected.

In addition to the original two 1,500-kw., two-phase Parsons turbo-alternators, there have since been installed (parallel to the first units) a 4,000-kw., two-phase, and a 6,000-kw., three-phase set (both by Willans & Robinson-

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* Electrical Review, June 9th, 1911, page 910.

Dick, Kerr, and both running at 1,000 R.P.M. Supply is at 50 cycles throughout, and at 2,100-2,300 volts from machines 1, 2 and 3, and at 11,400 volts from the three-phase generator (No. 4).

The leading dimensions and weights of the turbo sets now in operation are :—

	Nos. 1 and 2.	*No. 3.*	*No. 4.*
Length	34 ft. 6 in.	45 ft. 0 in.	46 ft. 6 in.
Width	7 ft. 6 in.	16 ft. 6 in.	14 ft. 6 in.
Height	9 ft. 0 in.	17 ft. 2 in.	18 ft. 6 in.
Weight of magnets ; tons ...	17·5	28	50
" armature, tons ...	8	15	25
Total weight : tons	45	93	112

The decrease in the space occupied and in the weight (per K.V.A. output) of the larger units is very remarkable. The No. 4 Neepsend turbine set—occupying 744 sq. ft. and 21,550 cb. ft. (overall and including auxiliaries) —has 1·7 times as great a rated capacity and 3·0 times as great an overload capacity as the whole of the Sheaf Street generating plant (which occupies 2,437 sq. ft. and 62,000 cb. ft.).

No. 4 set, though rated at 6,000 KW. (with natural cooling), will supply 8,000 KW. indefinitely and 12,000 K.V.A. for half an hour—the ventilating fan shown in fig. 4 being used on overloads. This unusually high overload capacity is very necessary in a rapidly growing undertaking, the chief demand on which consists of heavily fluctuating power loads.

Fig. 4 shows the No. 4 set nearing completion ; it was necessary to erect the main machine on a raised bed in order to accommodate the surface condenser and other auxiliaries in the basement, the floor level of which is only 2 ft. 3 in. above river level and cannot safely be lowered.

The total power required by the auxiliaries is about 66 H.P. for each of sets 1 and 2 ; 225 H.P. for No. 3, and 275 H.P. for No. 4. At present, two local sub-stations (one of 480 KW. and the other of 400 KW. capacity) supply two-phase, 200-volt current for the various auxiliary motors in the station and 100-volt current for lighting purposes. With the installation of the next generating unit (8,500 KW. rated output), the total power for auxiliary and lighting purposes will rise to about 1,200 KW., and one of the 1,500 KW. turbo-sets will then be employed on this load alone, the second similar set acting as a general reserve unit.

The condensers maintain a 93·5-95 per cent. vacuum, the inlet and outlet temperatures of the circulating water being 72° and 85° in summer and 42° and 50° in winter, and the temperature of the hot well discharge, 95° in summer and 80° F. in winter. Lea recorders are employed and the condensate flows through a recording Venturi meter, charts from which, together with boiler house and switchboard records, enable continuous supervision of the station performance.

Circulating water is taken from the River Don through a conduit 130 ft. long × 14 ft. wide, controlled by hand operated penstocks. The conduit discharges into a reservoir flanking the engine room and measuring 115 ft. × 20 ft. × 18 ft. 6 in. average depth. The maximum capacity of the reservoir is 250,000 gallons, and the average depth of water is 7 ft. 9 in. The reservoir is intended to act rather as a settling and suction tank than as a storage tank. Inclined screens with claw scrapers arrest and remove large *débris* from the water at the point of entry to the reservoir ; fine matter in suspension settles on the floor of the reservoir which undulates in four up and down slopes (1 : 24), with intermediate trenches, into which the sludge collects or is washed during the periodical cleaning of the reservoir.

The pumps on Nos. 1, 2, and 3 sets, draw from a basement duct supplied from the reservoir through 36-in. valves, but No. 4 set draws directly from the reservoir. In future units, it is proposed to employ siphonic circulation, and a new 220 ft. 48 in. diameter discharge pipe is being laid to the Don.

The original two-phase switchboard (described in our earlier article), has been extended by two-phase panels for set No. 3, and an extra-high-tension three-phase board has been built at the western end of the gallery. The three and two-phase systems are interconnected by four 2,000-KW. transformers arranged on the Scott tee-system. When further extensions become necessary, the switchgear and transformers will be removed to the new site shown.

From Neepsend, two-phase current is distributed at 2,000 volts through three pairs of 0·5 sq. in. concentric cables, while three-phase current is distributed at 11,400 volts between phases, through two 0·25 sq. in. three-core cables to the east end of the city. All the feeders are of the diatrine, paper-insulated, lead-sheathed type, drawn into cast-iron pipes, and their chief dimensions are :—

	Two-phase, 2,000-*volt.*		*Three-phase*, 11,400-*volt.*
Rated load, K.V.A.	1,000	...	3,000
Total length installed, miles	16	...	8
Copper, lb. per mile ...	43,622	...	17,746
Lead, lb. per mile	44,222	...	33,000
Overall diameter, inches ...	2·37	...	2·70

Owing to the smaller feeders required, the capital cost of the feeders has fallen from £10 10s. in the two-phase, to £2 10s. per KW. in the three-phase installation.

TABLE I.—COMPARISON OF TYPICAL WEEKLY RETURNS FROM SHEAF STREET (3,500 KW.), AND NEEPSEND (7-9,000 KW.).

—	Week ending June 14th, 1911.		Week ending December 20th, 1911.	
	Sheaf St.	Neepsend.	Sheaf St.	Neepsend.
Boilers—Number in use ...	8	5	8	5
Average hours steaming...	17	90	30	123
Average tons coal per boiler	15	100	22	128
Engines—Number in use ...	5	2	6	3
Average hours running ...	11·4	84·0	15·3	75·3
Units generated	28,870	316,700	50,150	506,500
Units used on works ...	499	18,603	930	21,988
Combined max. demand (KW.)	7,131		10,697	
Load factor (per cent.) ...	3·89	46·99	6·76	75·16
Coal consumed, tons ...	120	500	174	640
Water .. thousands gal.	127·4	167·2	193·5	105·0
Lb. water per KW.-hour ...	24·70	19·15	25·62	17·95
Lb. coal per KW.-hour ...	9·30	3·53	7·77	2·83
Lb. water per lb. coal ...	6·35	5·41	6·55	6·34
Works costs per unit generated (*d*).				
Coal and ashes	0·35	0·13	0·32	0·10
Water, oil, waste, &c. ...	0·08	0·00	0·04	0·01
Salaries and wages ...	0·24	0·05	0·16	0·03
Maintenance and sundries	0·06	0·11	0·10	0·04
Total	0·73	0·29	0·62	0·18

SHEAF STREET AND NEEPSEND COMBINED.

	June, 1911.	*Dec.*, 1911.
Thousands B.T.U. sold...	279·9	450·9
Estimated revenue	1,500	2,388
Cost of generation per unit sold :—		
Coal and ashes	0·18d.	0·15d.
Water, oil, waste, &c.	0·01d.	0·01d.
Salaries and wages	0·08d.	0·05d.
Internal maintenance	0·13d.	0·06d.
External maintenance	0·05d.	0·03d.
Rent, rates and taxes	0·07d.	0·04d.
Management	0·06d.	0·04d.
Total	0·58d.	0·38d.

This summary affords a most interesting comparison between the working of an old-fashioned station with low load factor and a modern station with very high load factor.

About 123 miles of high-tension and extra-high-tension feeders, and 131 miles of distributors are now installed (in a supply area of 37 sq. miles), and a total of 90 sub-stations supply more or less wide districts or individual large consumers. Low-tension distribution is at 410-205 volts, and standard sizes of sub-station transformer are 40,100 and 200 K.V.A. The largest "district" sub-station (at Chapel Lane), contains four 1,000-KW. 11,000-volt three-phase 2,000-volt, two-phase transformers, and supplies two-phase, and a certain amount of three-phase demand in the neighbourhood. Cubicle switchgear with separate panels and meters, &c., for large consumers, is erected in a room above the transformer chamber, and the ultimate capacity of the sub-station is about 8,000 KW.

(*To be concluded.*)

Wallasey Electric Lighting.—An inquiry will be held to-day (August 30th) relative to the application of the Corporation for sanction to borrow, among other amounts, £6,980 for electricity purposes.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

August 16th, 1912.

The little town of Campbellford, about 130 miles north-east of Toronto, situated on the Trent River, has lost an old landmark in the shape of a dam 60 years old, which was blown up recently. The dam was the means whereby about 1,000 h.p. was supplied to various mills, &c., on the river banks. Owing to the construction of the Trent Valley Canal, it was necessary to do away with this dam; at the same time, power is now available at other points, in larger quantities, and the Electric Power Co. has obtained the right to utilise the power at several such points.

As the Dominion Government is building the canal referred to, arrangements have been made for the Electric Power Co. to supply electricity to the various factories and works which have lost their water-power, but as, also, the town has recently built a municipal hydro-electric power plant, and is anxious to supply current, there is likely to be a protest made to the Government as to its agreement with the company, and the Hydro-Electric Power Commission has, it is believed, been asked to report on the whole situation.

A recently published report states that Ontario electric railways represent capital amounting to over £3,000,000. The Toronto Street Railway accounted for 17 persons killed and no fewer than 893 injured during 1911; apparently the people here are themselves very careless, as it is said that no one was "killed from causes beyond his own control, but 201 passengers and 53 employés were injured under these circumstances"—501 passengers suffered injury owing to their own carelessness.

In view of the electrification of the C.P.R. line from Rossland to Castlegar, B.C., next year, the plant of the West Kootenay Power and Light Co. will be much enlarged.

A rather unusual accident occurred a short time ago at a town in Alberta; the engine in the power house was struck by lightning and seriously damaged, and the town is likely to have no light for some time.

The city of Toronto is trying to arrange that all the large steamers which ply on Lake Ontario calling at Toronto shall be equipped with wireless telegraph apparatus, and it is understood that the Dominion Government will establish the necessary station on shore.

The Mines Branch of the Dominion Government Department of Mines, having for some time past made careful investigations into the question of the commercial possibilities of peat as a fuel, now considers the matter proved to its satisfaction and its work, in this particular direction, over; the rest will be left to private enterprise.

Two big peat plants are under construction, one at Alfred, Ontario, and the other at Farnham, Quebec; these are expected to supply Ottawa, Montreal and other places with cheap fuel. Whether peat will be used for power purposes remains to be seen; certainly, with all the vast areas of peat bogs which exist in this country, it will be surprising if nothing be done in this direction.

FAULT LOCALISING.

[COMMUNICATED.]

Some little time ago the writer had occasion to locate a "dead earth" on a ·25 sq. in. paper-insulated lead-covered traction feeder.

The instruments available were a "Raphael fault-localising bridge" and Messrs. Nalder Bros.' astatic galvanometer. In lieu of a battery, current for testing was drawn from the overhead trolley wire through two 250-volt 32-c.p. lamps (carbon filament) in series.

To complete the cable loop one of the overhead trolley wire ½-mile sections was brought into requisition with its line-feeder cables, but difficulty was experienced in determining the equivalent length of this portion of the loop, as the trolley wire was unevenly worn along its length; it is the object of this article to show how this was overcome.

The actual measurements were:—

Faulty feeder ... 908 yd. × ·25 sq. in.
Line cables ... 35 yd. × ·0976 sq. in.
Trolley wire ... 903 yd. × ·1000 sq. in. approx.
Cable connections to instrument 10·1 yd. equivalent.

Therefore, the total "equivalent" length of cable loop was 3,265·2 yards.

As the scale of the bridge did not go beyond 1,000, the slider was set on 816·3, a quarter of the equivalent length, and the result multiplied by four when balance was obtained.

Calling the ends of the faulty feeder A and B, a test made at A end showed the fault to be 35 yards away. A second test, from end B, gave the fault 701 yards away from B; these two distances total 736 yards, whereas the feeder length was 908 yards, proving an error in calculating the equivalent length of the loop. But it was reasoned that these figures must bear some relation to the true figures, so by proportion 736 : 908 :: 3,265·2 : the true equivalent length = 4,028 yards, and a second series of tests taken with the slider on 1,000—near enough to ¼ of 4,028—located the fault 71 yards from end A, which was found to be the correct distance.

All the tests were carried out in the day-time during the ordinary working of the tramway, and each time a car came on the other trolley wire of the section the galvanometer needle was thrown over, but sufficiently reliable readings were obtained by choosing times when no cars were on the section.

CO-OPERATIVE COAL PURCHASING.

By HAROLD C. WRIGHT.

A few months ago there was a discussion at the Institution of Electrical Engineers as to the reasons why electricity was not more generally used, and how electrical energy for power, lighting and heating could be made more popular. Various suggestions were put forward, and the general idea seemed to be that it was necessary to supply everything appertaining to electrical service at lower cost, *i.e.*, "juice," radiators, cooking appliances, &c.

One of the suggestions put forward by that very able and progressive engineer, Mr. H. H. Couzens, was co-operative purchasing of all necessities used in producing electrical energy, amongst which, of course, was coal. In 99 cases out of 100 the coal bill at a power station is one of the largest annual items, and as coal is the first necessity for generating electrical power, it would certainly appear that any means of reducing the coal costs should be welcomed. Without the slightest doubt the way to reduce coal costs is co-operative buying.

The writer of this article has put before the engineers of several of the largest electricity works in London a scheme which interested them very much, but there were many small obstacles in the way which must be got over before the scheme could be properly worked, such as existing contracts falling out at different periods, geographical position which sometimes favoured the purchase of railborne or seaborne coals, &c. The above-mentioned scheme put briefly, is as follows:—

1. Establishment of an efficient central purchasing agency.
2. Purchasing direct from collieries.
3. Having steamers on charter where seaborne coal is required and hiring wagons where railborne coal is required for the sole use of contributors to the agency.
4. Having barges and tugs for sole use of contributors to the agency.
5. Leasing or hiring derricks for discharging steamers or other suitable arrangements.

The benefits to be obtained from the above scheme, taking the items in rotation, are as under:—

1. Middlemen's profit eliminated.
2. Lower prices on account of large amount of coal dealt with.

3. Delays in delivery minimised on account of steamers, barges, tugs, wagons, &c., being used for the benefit of the contributors only.

4. Charter pickings (profits) for the benefit of contributors towards reducing costs.

5. Profits obtained by difference in cost of discharging and allowance made by steamers for benefit of contributors to agency towards reducing cost.

Amongst other items, if large quantities of seaborne coal are used, preference berths are obtainable at most loading ports, thus obviating delay on steamers, and also, as the deliveries are under the control of the agency, facilities for providing stocks in order to allow for contingencies can be well arranged. The recent national coal strike proved the necessity of better arrangements for providing stocks of coal, and as it is practically impossible for a lot of works to secure adequate reserve bunker room, owing to the high value of land, &c., especially those situated in the heart of London, the only remedy is a continuous and regular supply of coal, and special reserve supplies either in barges or coal wagons.

In support of this scheme it is interesting to note that some few years ago many of the big steamship owners were brought together under a co-operative scheme for the supply of bunker coal to their steamers, and the fact that the the Steamship Owners' Coal Association of 9, Fenchurch Avenue, E.C., is not only still in existence, but that it is necessary for them to extend their already large discharging hoists at Purfleet, Essex, goes to show that the scheme is a successful one.

In conclusion, it is the writer's opinion that one of the chief factors preventing the expansion of electrical energy is the lack of co-operation amongst the various municipal authorities and private companies, and petty jealousies that did obtain, but now, fortunately, are gradually disappearing.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Strength of Drawn-Wire Tungsten Lamps.

Referring to your issue of August 9th and the extract given on page 240 of an article by Mr. Bainville in *L'Industrie Electrique* with reference to drawn-wire filaments, I should like to make the following comments :—

Mr. Bainville, among other writers on this subject, appears to consider that because the drawn-wire filament may lose some of its ductility after burning, therefore the drawn-wire lamp becomes as fragile as the pressed filament lamp.

This is an entirely wrong conclusion, as the strength of the drawn-wire lamp does not result from the ductility of the drawn-wire filament alone, but very largely from the method of winding and mounting which the drawn-wire filament permits.

To summarise, the strength of the drawn-wire lamp is due to three features :—

1. The strength of the drawn-wire filament itself.
2. The use of a continuous one-piece wire of uniform cross-section.
3. The method of support of the filament mounted on flexible supports in which there are no rigid joints or welds at the point of support.

The combination of these features causes the drawn-wire filament to be many times stronger than the ordinary pressed filament lamp at any time during its life.

Evidence in support of these merits, and of the greater strength of drawn-wire lamps, has been shown in a number of cases of practical service tests, proving that the drawn-wire filament is suitable in fields of service in which it was not possible to use the pressed filament lamp. Among other notable cases are the following :—The United States Navy tests of drawn-wire lamps on board battleships; the Argentine Navy tests of drawn-wire lamps on board cruisers; tests by the Interborough Rapid Transit Co., of New York City, of drawn-wire lamps on their underground trains.

Besides these service evidences of the superiority of drawn-wire lamps, we have also the evidence of extensive tests conducted over long periods of time by the principal lamp manufacturers using the drawn-wire filament process.

A special filament testing machine has been devised and employed by the Engineering Department of the National Electric Lamp Association, of Cleveland, Ohio, to accurately measure the bending as well as the tensile strength of lamp filaments. As a result of extensive tests made by this machine, the following results were obtained :—

Tensile tests made on both pressed and drawn-wire filaments at various stages of life indicated a strength of from 20,000 to 60,000 lb. per sq. in., which is doubtless far greater than is required of lamp filaments. The drawn-wire showed a greater strength for all sizes.

Specimens of the same lamps tested in bending showed for equal loads 100 per cent. greater deflection for the drawn-wire than for pressed filaments. The breaking load in bending was also greater for the drawn wire.

The greater mechanical strength of the drawn-wire lamp is therefore evident, and is accounted for by the style of filament mounting and the greater strength to withstand shock in the filament itself.

Again, Mr. Bainville is in error in his statement that lamps with drawn-wire filaments show more serious bulb blackening over pressed filaments. This is purely a question of proper manufacturing methods; a drawn-wire lamp improperly exhausted will show blackening to a greater extent than a pressed filament lamp properly exhausted. With proper exhausting methods, however, adapted to each type of filament, there is no excess of blackening for drawn-wire lamps.

To secure correct results on lamps involves much more extensive testing than many writers like Mr. Bainville can afford to undertake. When tests are made on a sufficient number of lamps to give a true average, and the lamps represent the best skill and experience in drawn-wire lamp manufacture, the results will show that drawn-wire lamps have superior strength to others at any time during life.

F. W. Willcox.

London, *August 23rd*, 1912.

The Compulsory Purchase of Tramways.

I read your article on this subject with interest, but I find it very difficult to accept (*c*) paragraph 2, p. 237, that the undertaking is to be valued as a present profit-earning concern, including a proper sum in respect of statutory powers and privileges. The Corporation allows the company to obtain the privileges for a term of years, the concession being of the nature of a lease, only as a rule there is no rent payable for the same. To ask the Corporation to pay for the return of the privileges at the end of the period agreed, is very much as if a man had to compensate a telephone company for moving a telephone wire from his building after they had enjoyed the use of the same for a number of years at a nominal rent! Furthermore, if the payment for the undertaking is to include a sum for its present profit-earning powers, it appears to me that an arbitrator can only allow this after taking careful evidence as to past and probable future profits, and this seems to be prohibited by the Act.

However, no doubt a main object of legislation is to provide points on which lawyers may argue at a suitable remuneration, and the Tramways Act will meet this requirement admirably.

Purchase.

August 26th, 1912.

Trade Discounts.

I have read, with much interest, the article by "Juggins" entitled "To the Trade," and, in commenting on it, would like to endorse all that he says concerning the unbusinesslike systems of discounts adopted by manufacturers.

I should like to emphasise the fact that "Juggins" has in no way exaggerated the wretchedness of the present methods, by quoting the following example :—A few days ago I had occasion to inquire some *net* prices from a certain manufacturing firm, and I should like to repeat them as I received them. Article 1, 11d. plus 20 per cent.; article 2, 8d. plus 5 per cent.; article 3, 2d. plus 5 per cent.; article 4, 1s. 10d. plus 20 per cent.; article 5, 1s. 3d. plus 5 per cent.; article 6, 4d. plus 5 per cent.

Further comment on this is superfluous, but there is just one other point I should like to raise. "Juggins" seems to think that 50 per cent. is an exceedingly high discount, but I should like to remind him that, compared with some trade terms, this is relatively low. For example, in the iron and steel trades, discounts often range between 70 and 80 per cent., which I agree with him are decidedly absurd.

In conclusion, I may point out that although the suggestions forwarded by "Juggins" are extremely ingenious, they do not strike one as being a practical way out of the difficulty.

R. C. S. Perry.

London, S.W., *August 23rd*, 1912.

FIRE AT THE LONDON CENTRAL TELEGRAPH OFFICE.

On Saturday last, about 7 p.m., a serious fire occurred on the third floor of the General Post Office West, where the main telegraph gallery is located. The seat of the fire was under the floor close to the large test box for the provincial wires, the most vital part of the vast and complex system of wires and apparatus which constitutes the largest telegraph office in the world. The first intimation of fire was smoke which was observed issuing from beneath the floor of the test room. It was then seen that the fire had obtained a serious hold of the mass of wires leading from the main cables to the test box, and such was the danger that it was considered advisable to order the staff to leave the building.

The fire brigade were soon on the scene and in a comparatively short time were able to master the outbreak. As a precautionary measure, all sources of power, electric, pneumatic and mechanical, were shut off from the telegraph office, and thus, probably for the first time in the history of the telegraphs of the United Kingdom, London was isolated.

The engineering staff was quickly on the scene and commenced the work of restoration at once. Communication by means of alternative routes was quickly effected to some of the large provincial towns. The amount of damage done to the building was comparatively slight, but the communications of the country were completely dislocated owing to the vital point at which the disaster occurred. Fortunately a year or two ago the whole of the Central Telegraph Office was recabled with modern fire-proof cables laid in steel troughing. It is quite probable that had not the modern system of cabling buildings been in use at the Central Telegraph Office the whole building might have been in danger.

Delay in communication with the provinces was experienced on Monday and Tuesday, but normal conditions were practically attained by Wednesday.

Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that a consulting engineer, an Englishman, resident at Sault Ste. Marie, Michigan, U.S.A., is desirous of acting as an agent in Canada for British makers of machinery and plant used in connection with hydro-electric development, pulp mills and steel works. Further particulars can be obtained at the Board of Trade Commercial Intelligence Department, London, E.C.

Patent Surrender.—The Comptroller-General of Patents announces, in the *London Gazette*, that Ettore Bellini has offered to surrender Patent No. 11,339, of 1911, for "Improvements in or relating to transmitters and receivers for wireless telegraphic and telephonic apparatus." Anybody desiring to be heard with reference to such surrender must advise the Comptroller by September 21st.

PRACTICAL NOTES ON METER ERRORS.

By S. M. Powell.

With the small margin of profit allowed to central stations by the tariffs now in force, meter errors of 2 per cent. or even 3 per cent. may be of great financial importance as regards the net profit realised. Accuracy in meters is now of greater moment than ever before, and on this account and remembering the great number of new types of meters which have been placed on the market during the past decade, special interest attaches to the comprehensive and highly practical paper read by A. Durand, of the Laboratoire Centrale d'Electricité, before the 1911 Congress of Electricity at Turin. From this lengthy thesis, the following notes are abstracted.

Despite recent innovations, meter errors are still due to the same causes as they were, say, ten years ago, and are still of much the same magnitude. The causes may be grouped as due to (1) Meter itself. (2) Accessory apparatus. (3) Nature of current metered. (4) External agencies. Owing to these causes producing a number of errors, the chief of which are detailed below, certain errors have necessarily to be allowed as "permissible." The meter errors permitted, under various conditions and loads, by the legislatures of various European States are summarised in Table I, p. 331—whence it appears that the English and French requirements involve the highest accuracy.

Reserving a discussion of electrolytic and special-tariff meters to later paragraphs, the magnitudes of the errors due to various causes in different types of meters are as follows:—

Temperature. Meters should always be tested with their cases closed, for the internal losses have then a very appreciable effect on the temperature of the windings, &c. French law permits a loss of 4 watts per 100 volts in the shunt windings of Thomson meters and 1 volt drop in the field winding, so that, in a 10-ampere, 110-volt meter on full load, the internal losses amount to 15 watts. The temperature rise within the case of a meter of this type, due to the shunt coil alone, may be 10° C., rising to 25° C. (actual temperature then 50-60° C.), when the series circuit is also fully excited. This temperature rise diminishes both the driving and braking torques of the meter and, theoretically, exact compensation between the two effects is possible but, actually, the temperature coefficients of the driving and braking systems are unequal. By using materials of zero temperature coefficient of resistance for the shunt coils and braking disk, the difficulty may be surmounted, but the high electrical resistance of such materials necessitates the use of additional braking magnets or a larger disk to get a sufficient retarding torque. The temperature of the braking disk varies with the position of the latter in the meter case; in spite of agitation due to the moving system, the air is always warmer near the top of the case. Fig. 1 shows the variations (with time on full load), of the air temperature within the case of a 15-ampere 220-volt watt-hour meter, of a type much used in practice; the resultant error increases as shown (about + 0·4 per cent. per 1° C.). This increase is quite typical of the behaviour of all non-compensated watt-hour motor meters of the Thomson type. Oscillating meters, of the A.E.G. type, have a certain temperature coefficient, but the heating of the shunt circuit is quite low; Aron meters have negligible temperature error unless used with a shunt; the new "O.K." meter has a temperature coefficient of about 1·5 per cent. per 10° C. rise in temperature, but there is a thermal lag between its indications and variations in the power metered. Brakeless ampere-hour meters have no temperature coefficient unless in the shunt; in braked ampere-hour meters, the driving circuit is tapped across a shunt and fixed on the braking disk, so that these two parts rapidly assume the same temperature, and variations of the latter are of little importance. Mercury ampere-hour meters are largely used in this country; if connected to a shunt, they have a certain temperature coefficient. In alternating-current induction meters, the driving and braking torques act on the same disk, variations in the resistance of which are, therefore, of little importance. Owing to variations in the resistance of the shunt circuit, and of devices regulating the starting, a temperature error of 0·1 per cent. per 1° C. is usual,

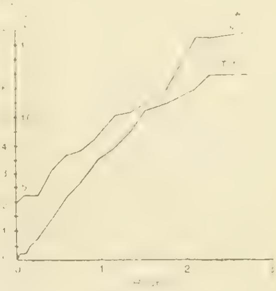

Fig. 1.

Voltage Variations.—These do not greatly affect meters having no iron cores, providing the shunt circuit has a low temperature coefficient. "Creeping" due to high voltage may be easily avoided, and is little liable to occur when the brushes and commutator have become somewhat worn. In induction meters, ± 10 per cent. voltage variation may cause several per cent. error variations owing to the change in the shunt field, and the braking torque provided by the latter.

Friction.—Brush friction in commutator watt-hour meters may reduce readings by 10 per cent. at $\frac{1}{10}$ load. Owing to the cumulative effects of commutator sparking a short-circuit may occur between bars or an armature conductor may be broken, and, in either case, the meter will show about 10 per cent. error on full load, and will stop on light loads. The use of vibrating brushes facilitates starting, and improves the calibration curve of the meter. In commutator ampere-hour meters, the low armature potential difference reduces sparking to a minimum, but, in braked meters, the increased armature resistance may lead to low readings. In mercury motor-meters amalgamation of the driving disk, and changes in the mercury, gradually vary the total friction. Wear in pivots and jewels is less the lower the weight and speed of the moving system, and friction is of less importance the greater the driving torque. Aluminium braking disks are light, but their high resistance diminishes the resisting torque. It is not sufficient that the ratio (driving torque/rotor weight) be high ; the absolute value of the torque must also be sufficient. Hammering of pivots on jewels, due to heavy external vibration or the use of alternating current, may necessitate rejewelling at intervals of one month or so ; faulty jewels may cause 10 per cent. error at $\frac{1}{10}$ load. Many meters are insufficiently protected by dust-proof and damp-proof cases.

External Magnetic Fields.—A commutator energy-meter with horizontal field, calibrated with the latter in the magnetic meridian, but first aiding and then opposing the earth's field, differs 8-12 per cent. in its $\frac{1}{20}$ load calibration in the two cases, hence it is necessary to standardise such meters with reference to their position relative to the earth's field. When the instruments are installed, the altered effect of the earth's field must be compensated by varying the compounding of the meter. In large meters it is often necessary to take account of the field set up by the cables feeding the meter. In Thomson-type meters the main field is only of the order of 60 gauss, so that special care must be exercised in the disposition of neighbouring current-carrying conductors. Two 300-ampere meters of this type were, in a certain case, mounted 23 cm., axis to axis. When one meter worked at full load, the other was subject to 10 per cent. error at $\frac{1}{10}$ load and 20 per cent. error at $\frac{1}{20}$ load ; by placing a guard plate of sheet-iron between the instruments, the trouble was completely cured. The field magnets of ampere-hour meters may be weakened by external fields, but seldom to a serious extent ; in induction meters, stray fields are of even less importance.

Short-Circuits.—In Thomson watt-hour meters, short-circuits may affect the accuracy of registration by mechanically closing the bobbins together, but are of special danger in that the strong stray field, temporarily induced, may alter the strength of the braking magnets. The seriousness ot a "short-circuit" obviously depends upon the resistance of the "short" and of the circuit feeding it and upon the power which can be supplied to the latter. M. Durand presents oscillograph records of short-circuit occurrences in a testing circuit protected by a 20-ampere lead fuse (= double full-load current capacity of the meter), and supplied by various direct current and alternating current sources. According to the available power and the resistance in circuit, the maximum short-circuit current ranged from 100 amperes to about 1,000 amperes (over a period of from 0·7 to 0·04 sec.). After three tests of this nature on a direct-current motor-meter, the latter ran on light load with a registration corresponding to 130 watts, while an induction meter similarly tested afterwards showed 30 per cent. error on half-load. To avoid such brutal tests, the French regulations stipulate a short-circuit current not exceeding 10 times the normal maximum current of the meter, but the worse conditions might evidently arise in practice. The demagnetising effect of short-circuits on the braking magnets may be avoided by placing the latter as far as possible from the field coils and by interposing a magnetic shield. The latter should not be too small, or, by becoming permanently magnetised, it will set up fresh parasitic fields. Errors due to the above cause may amount to 10 or 20 per cent. in meters with small braking magnets, after some time in service ; demagnetisation is a minimum if the magnets are perpendicular to the main stray field. Clock meters are not susceptible to the above source of error. Mechanical displacement of the series bobbins is impossible in induction meters, and the stray field is so small that the error seldom exceeds 1 per cent. after a 10-fold short-circuit. Apart from the possible influence on the magnets of commutator ampere-hour meters, short-circuits damage the brush and commutator surfaces, and may even melt the plates. The high current flowing through the armature during the "short" is due to the elevation of the shunt potential difference, and if the meter is stopped, to the absence of back E.M.F. In mercury motor meters, short-circuits may affect the magnet strength and expel the mercury from its receptacle.

Shunts.—The use of shunts simplifies the measurement of large amounts of energy, and enables the meter to be removed from the influence of parasitic fields. The smaller meters required are easier to build, but it is difficult to maintain the correct ratio between the resistance of the shunt and that of the low resistance series circuit of the meter. The shunt is usually of manganin, whereas the series circuit is of copper, and must be of liberal section if temperature errors are to be avoided. In alternating-current meters, shunts may only be used if their time constant equals that of the meter circuit which they bridge

Creeping.—Vibration, voltage variations, permanent magnetisation of shield plates by short-circuits, orientation of the meter in the earth's field or other external magnetic influences may cause creeping in commutator watt-hour meters. The remedy is to mount magnetic buttons on the brake disk, thus providing a slight "locking" action with the brake magnets. No-load running in Aron meters is due to constructional defects or to variations in the period of one of the pendulums, and is often difficult to detect. Slots or holes in the disk, or magnetic locking buttons thereon, suffice to prevent creeping in induction meters.

Frequency and Wave Form.—Changes in frequency and wave form alter the phase displacement between the shunt current and applied voltage, in commutator meters, by an amount varying with the time constant of the shunt circuit, which should therefore be as low as possible. Aron meters are unaffected by frequency changes, and ± 5 per cent. frequency variation seldom produces more than 1 or 2 per cent. error in induction meters at half load. On the other hand, the presence of different harmonics in the wave form may easily cause 15 per cent. error in induction meters—a fact which largely compensates the advantages which this type possesses over commutator meters in first cost, maintenance and excitation.

Power Factor.—The accuracy of clock and motor-meters depends on the time constant of the shunt circuit and on the power factor of the load supplied. Thomson meters on a 0·4 power factor load show ± 4 per cent. error, according as the current lags or leads. The error may be tolerably corrected by the Frager short-circuiting device or by the insertion of capacity in the shunt circuit, in which case, however, there is danger of harmonic resonance. On single-phase networks where power factors less than 0·5 occur only during the relatively short period in which motors are started, acceptance tests at 0·2 power factor are superfluous. In three-phase meters, low power-factor tests are necessary, and the windings should be tested separately, for there often exists a supplementary phase difference of ± 30°, so that, for a supply power factor of 0·7, one of the meter circuits may have a power factor of 0·25 and the other 0·96. Errors at low power factor have, however, minimum effect on the total energy recorded. The effect of power factor in induction meters is easily compensated.

Transformers.—The use of transformers complicates the question of meter accuracy by introducing supplementary phase displacements (varying from 0·1° to 10°) between the primary and secondary currents. To take account of the characteristics of the transformer, the meter must be tested with the latter connected as for subsequent use. In order that the transformation ratio be constant, the transformer core should be built of thin plates with no joints, worked at an induction not exceeding 2,000-3,000 gauss, the object being to avoid magnetic reluctance and leakage. Ring transformers conform best to these requirements.

Voltage transformers are in permanent service at practically constant induction, hence the only difficulty of construction is in the provision of adequate insulation. Errors due to these transformers may range from —1 per cent. to −5 per cent. ($\cos \phi$ 1·0 to 0·2), and should not exceed 2 per cent. difference between $\cos \phi$ 1·0 and 0·6. Current transformers operate at continually varying induction. At high loads the error should not exceed ± 1 per cent., but below $\frac{1}{10}$ full current no guarantee can be given. In a particular case the error ranged from − 2 per cent. to + 5 per cent. at $\frac{1}{10}$ load for $\cos \phi$ 1·0 to 0·4. Single-phase equipments may be adjusted for an average power factor of 0·8, but no such compensation is permissible in three-phase meters.

Foucault Currents.—These are only of importance in large meters without shunts or transformers. Such meters, if calibrated on direct current, may show 10—20 per cent. error when used in alternating-current circuits. The remedy—which is often neglected—is to laminate the windings and slot all metal parts near the windings.

Construction and Erection.—The chief points requiring attention in the design and construction of meters are : the avoidance of overcrowding of parts, such as leads to mutual electromagnetic influence between parts and obstructs inspection and repair ; the provision of high driving torque ; liberal design of windings to avoid temperature rise and errors ; provision of dust and damp-proof cases. Somewhat higher capital cost need not be grudged, for meter rents equivalent to 20 per cent. on capital outlay are at present common. In erecting meters, the main spindle must be perfectly upright—a point which is of greater importance the heavier the moving system ; reliance cannot always be placed on plumb lines mounted in the meter case. Incorrect connection of both circuits in a D.C. meter will not change the direction of rotation, but, by reversing the orientation of the field, may cause 10 per cent. error on light loads. In three-wire meters, energy is not measured correctly if the shunt is connected across a single side of the circuit. The $\frac{1}{10}$ load error in three-phase meters may vary 3—10 per cent., according to the connection of the phases.

Special Meters.—All the above errors naturally arise in ordinary meters adapted to special purposes by the provision of special switchgear. "Excess" or "peak" meters deserve special mention, as they have already led to several lawsuits. A negative torque, provided mechanically by a spring or electrically by a reverse motor device, prevents the meter from recording till a predetermined limiting demand (up to which a certain contract tariff is in force) is exceeded. The accuracy of the registration depends upon preventing reverse running under the negative torque and on the maintenance of the correct negative torque. One of the best means of securing these aims is to utilise the hysteresis torque exerted on a small mass of nickel rotating between the poles of a magnet. A further point of great importance is to decide whether the permissible error shall be based on the excess demand registered by the meter or upon the total demand as a fraction of the maximum capacity of the instrument. In the former case we are faced with the uncertain starting load of the meter and all the inaccuracies of a meter when running near its starting point (this condition existing when the total demand little exceeds the critical limit). The author, therefore, recommends that the permissible error should be based on the total demand as a fraction of the maximum meter capacity, and the latter should be either 1·2 or 1·5 times P (where P = critical demand at which meter commences to register); accuracy limits should then be laid down for total demands 1·05 P, 1·10 P, 1·20 P and 1·50 P. Electrolytic meters theoretically measure ampere-hour consumption accurately at all loads. Variations in temperature are liable to cause crystallisation of the electrolyte, and the resistance of the meter being thereby altered, the distribution of current between the meter and the shunt is altered, and serious errors result.

Calibration Curves.—The calibration curve of direct-current meters is practically linear from full to $\frac{1}{10}$ load, whence it is positive or negative, according to the preponderance of friction or compounding; the slope of the linear portion is a function of the internal temperature of the meter. The error in induction meters frequently passes from 3 per cent. slow at full load to 2 per cent. fast at half load; compounding affects the shape of the curve at low loads. Pendulum meters are theoretically accurate, the actual errors depending on friction and the compounding employed to prevent "creeping."

Starting.—Commutator watt-hour meters start at 1 per cent. full load when newly erected and correctly adjusted, and if special vibrating brush-gear is used, the instrument may start at 0·5 per cent. full load—a matter of importance in high-range meters. Ampere-hour meters start at $\frac{1}{100}$ load if braked, and at 0·2 per cent.—0·5 per cent. load if unbraked. Aron meters, without compounding, will start at 0·1 per cent. full load.

Tests in Situ; Accuracy of Measuring Instruments; Official Acceptance Tests.—Tests *in situ* should be more frequent the less the care bestowed on the maintenance of meters; the tendency is for meters to develop slow running and poor starting, and the loss thereby thrown on the central station justifies frequent testing. To allow for the less favourable conditions obtainable in tests of this nature, the permissible error is usually twice as great as that allowed in the corresponding laboratory (acceptance) tests. Meters serving a rapidly varying load may be tested by a portable standard recording meter, or by observations on indicating instruments at intervals of 5 or 10 seconds. Motor meters are found to be very accurate on rapidly varying loads. D.C. wattmeters are very liable to errors caused by stray fields; torsion instruments are only suitable for the measurement of constant loads. Moving-coil instruments are subject to a number of errors, but if frequently calibrated, should be accurate to within 1 per cent. at 0·8 full deflection. Potentiometer measurements in the laboratory may be made to within 0·2 per cent. accuracy under practical conditions; A.C. wattmeters are affected by the power factor of the circuit metered and by supplementary phase displacements, but 0·5 per cent. accuracy at 0·8 full load is obtainable in good types of instrument; if the sensibility is varied by coils in parallel, great care must be taken with the connections. In a 1-minute test, 0·2 second error in releasing and stopping the chronometer may produce 0·3 per cent. error in the result. The methods of measurement and the accuracy of the meters themselves do not justify laboratory certificates being given to 0·1-0·01 per cent. accuracy, as is often the case. The Laboratoire Centrale d'Electricité gives certificates to ± 0·5 per cent. accuracy, and denies the significance of any higher accuracy.

Among the meters tested for "acceptance" at the Laboratoire Centrale d'Electricité, 14·3 per cent. of the commutator watt-hour meters, 40·0 per cent. of the commutator ampere-hour meters, and 47·0 per cent. of the commutator induction meters, at once pass the statutory (French) tests. These figures, referring to modern types of meters, show that the French error limits (which are very similar to our own, see Table I), cannot yet reasonably be narrowed.

STEAM TURBINE RUNNING.*

Large turbines are built essentially on the principle of high efficiency, and their design and mechanical construction is accordingly more elaborate and complicated than for small ones.

The present remarks apply to this class of turbines only, as requiring naturally more careful attendance and being subject to more disturbances.

Clearance.—With regard to this point, impulse and reaction turbines show somewhat different requirements. Whereas the radial clearance in impulse turbines is practically unlimited and the axial distance can be made 0·1 to 0·2 in. and more without appreciable loss in efficiency, the reaction turbine demands reduced the radial clearances to the lowest practical amount. The blades need not run close together, but, to prevent excessive leakage over their tops, the distance between the ends of the moving blades and the casing and between the ends of the fixed blades and the rotor must be kept down to 0·025 to 0·125 in., according to the size of the machine and the length of the blades.

The axial adjustment is controlled by the thrust bearing, which can be moved in either direction by bolts acting on the casing. This adjustment being made with minute care in the erecting shop, it is advisable for the operating engineer to leave it undisturbed, except in case of necessity. After the machine has been taken apart and put together again a new adjustment must be made. This will be done with the machine slowly running. The thrust bearing is moved one way until a slight contact is noticed (the noise will be more easily detected by a proper piece of wood applied to the casing and the ear), then brought back the desired amount of clearance.

Gland Packings.—A few types of turbines, especially the original Parsons turbine, apply the principle of the labyrinth to the stuffing-boxes. This has the advantage that friction losses are absolutely avoided, at the cost, it is true, of a small steam loss.

The leading firms in this country have adopted devices of another kind; the General Electric Co. uses a carbon packing, the Westinghouse and Allis-Chalmers companies a water-gland packing. With the former the engineer will have to remember that the carbon rings should have a loose fit on the cold shaft; as carbon does not expand, but contracts through heat, the expansion of the shaft would open the segments of an exactly fitting ring when warming up, and leakage would occur. The carbon rings do not need lubricating, but are likely to break and wear out. In the long run they have been seen to cut regular grooves in the shaft; the latter, therefore, often has an interchangeable bushing.

The water-gland packing ensures a perfect closing of the turbine, but the runner, forming a little centrifugal pump which forces the water in a circumferential sealing space, absorbs a certain amount of power. Besides, if the water is not perfectly clean, it will deposit scale in the glands which has to be removed, sometimes frequently. Finally the water which passes into the turbine will evaporate there, and may cause the formation of a considerable layer of scale on the blades, with a very detrimental effect on the steam consumption. The water supply must be carefully regulated to keep the leaking quantity as small as possible. To avoid evaporation in the glands the temperature should be the lowest obtainable. The water should come to the glands with a few pounds pressure.

Bearings.—The next important parts to be considered are the bearings. They constitute with a few gears (worm-gear for governor shaft, tachometer drive, oil-pump gear) the only parts of the turbine where actual metallic friction takes place. As no other acting forces are transmitted by the shaft besides its own weight, the wear of the babbitt shells will be extremely little.

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* Abstract of prize article by Paul Hoffmann, which appeared in *Power* (U.S.A.).

TABLE I.—Comparison of Statutory Limits on Meter Errors in Various Countries.

—	Load. ± % error at various loads.				Frequency.		Power factor. ± % error at half-load power factor 0·5.	Voltage variation. Effect of ± 5 % variation.	Short-circuit. % error due to Ct. 10 [illegible]	Creeping. Power registration permitted.	Starting. Maximum power to start.
	1/1	1/2	1/10	1/20	% frequency change (±)	% error (±)					
England (A)	2	2	2	—	10	2	—	—	—	Nil ; even with	—
(B)	3	3	3	—	10	3	—	—	—	10 % excess V.	—
Germany ...	3·3	3·6	6	9	—	—	7·1	—	—	0·25 % of P.	—
Austria ...	4	4	4	—	2	4	—	Nil	—	0·02 % of P.	1·5 % P above 3 a. 2 [illegible] P. 3 a. and below.
Spain ...	—	4	—	—	—	—	—	—	—	—	—
France (C)	3	3	—	5	5	N ± 1	3	—	Q ± 1	Nil	1·0 [illegible] of P.
(D)	3	3	—	2 w. at 20-w. load.	5	N ± 1	3	—	Q ± 1	Nil	2·0 [illegible] of P.

D.C. or A.C.: normal voltage and frequency; p.f. unity.
A = above 3 amperes; B = 3 amperes and below; C = above 500 watts; D = 500 watts and below; N = error at normal frequency; P = normal maximum meter power; Q = error at half load before "short."

Further French Regulations:—

Voltage drop in series circuits	Ampere-hour meters, 1·5 volts Watt-hour meters, 1·0 volt above 500 watts, 1·5 volts 500 watts and below
Watts dissipated in shunt circuits	Direct current, 4 watts/100 volts Alternating current, 1·5 watts/100 volts
Meters with transformers	Error at 1/20 full load not to exceed ± 7 per cent.

The bearings are flooded with oil under pressure; this enters between the babbitt and spindle and forms a continuous film, acting like an elastic cushion. The oil pressure is furnished either by a special oil pump driven from the turbine shaft, or by gravity. A disadvantage of the former system is the necessity for an auxiliary steam or hand-driven oil pump, as the main pump does not deliver enough pressure right from the start.

For gear and helicoidal pumps the decrease of delivery due to the wear must be considered.

In a gravity system the oil is supplied to the bearings from an elevated tank to which it is returned after use by a separate oil pump, and the stored quantity of oil can be much larger.

Starting a Turbine.—A turbine to be started for the first time, or after a long stop, should be cleaned and inspected with special care. This applies chiefly to the bearings, the oil pipes and oil reservoirs, where the least particle of dirt or grit is harmful. The steamways and piping should be gone over, too, very carefully. The steam pipe should be blown out from the boilers, the last connection to the turbine being removed. All kinds of dirt, chips of gaskets, red lead, &c., will appear on this occasion, which would have obstructed the steam passages (guide vanes) if not removed.

The oil should be strained through cloths when poured into the machine. A sufficient quantity must be provided. The air should be driven out of the oil piping by operating the auxiliary oil pump. The bearings will have to be generously oiled before starting.

Revolving the shaft by hand will show if there is any hindrance to its free rotation. This preliminary work being done, the warming up of the turbine can begin. To begin with, open the throttle-valve just a little, and increase gradually; open the drains, and leave them open until the turbine is nearly at full speed.

Reaction turbines require more careful treatment on account of the smaller clearances and the large mass of the rotor. One-half to two hours is not too much for these machines. For impulse turbines, half this time may be sufficient. In an emergency, when a turbine must take up the load of a broken-down unit as quickly as possible, the time for warming up may be considerably shortened. A practice followed in Germany, is to start the turbine running slowly from the beginning, the warming up going on while the speed is being gradually increased.

During the time the turbine is warming up, the auxiliary machinery can be got under way. Where the turbine has water glands, the vacuum can only be created and the air-pump started after the turbine is at a certain speed, because the glands do not act before a certain centrifugal force is developed, and until then a great quantity of air can pass through the stuffing boxes into the condenser. If a central condenser is used, such a turbine has to be put up to speed with the valve between the turbine and the condenser closed, exhausting in the meantime to the atmosphere.

A turbine should always be speeded up slowly. If accelerated too quickly, vibration may start quite unexpectedly and continue a good while after starting. The passage of the critical speed, if a flexible shaft is used, is an exception to the above rule; it has to be done promptly, as, in that range of revolution, vibrations have a particular tendency to develop and to increase dangerously.

After normal speed is reached, with a good vacuum established, the load should be put on by steps, to avoid a sudden inrush of steam into the turbine, which will very likely be accompanied by a water slug.

If the turbine is to run in parallel with other units, the governor can be adjusted for variable speed while the turbine is in operation, thereby facilitating the synchronising of alternators.

It is helpful to always follow the same routine of duties when a turbine is started or stopped. For instance, the operation of the auxiliary oil pump has to be combined with the observation of the pressure gauge, which indicates the moment when the main pump begins to work. The moment for opening the water supply valve to the cooling coil must be delayed until the oil is warmed up a little and becomes more fluid, &c.

Operation.—Although the turbine takes care of itself automatically, so to speak, and intelligently, it must receive due attention.

At regular intervals, the engineer in charge of a watch should go over his machine, observe the pressure and vacuum gauges, the tachometer, measure the temperatures of the bearings and of the oil, and inspect the water supply to the cooling coil, the packing glands or the water-cooled bearings, if there are any.

An equal share of supervision should be given to the condensing plant, and especially should any drop of the vacuum or irregular behaviour of the vacuum gauge incite a thorough investigation.

The sources of trouble in a turbine can often be located in the oiling system. It should be seen to that the cooling coil remains effective, that deposits of mud through the water, or of gum or vaseline-like substances on the side of the oil, are removed. The water used for cooling and other purposes should be clean; if necessary it should be filtered or treated against scale-forming elements.

Only pure mineral oil of not too high viscosity—a light-bodied oil—is to be used.

The temperature of the oil at the outlet of the bearings should be about 140° F.; not much higher, for fear of heating, nor much lower, for the sake of fluidity.

If a bearing gets hot it can be easily smelled and seen by the dense white fumes of the burning oil. There is generally some radical cause for a hot bearing, which should be immediately removed—a tight cap, grit or foreign substances in the oil, insufficient oiling. The maximum oil supply should be tried, and if this gives no relief the turbine should be stopped at once rather than have the bearing burn out. It is to be remembered that quick action is necessary: the high circumferential speed of the journal does not allow much chance for reflection or hesitation, and there is no time for nursing the bearing back into good condition.

Any other, and especially internal diseases of a turbine, are indicated by one sure symptom—vibrating of the machine.

A considerable lack of balance causes vibration at any speed, and is the principal, if not the only, cause of all vibration. It has been known to result from the irregular expansion of the rotor due to quick warming up, but every sudden change (especially rise) in temperature may equally provoke distortion of the wheels or warping of the spindle. When superheated steam is dealt with this point should always be observed. A change from condensing operation to atmospheric exhaust calls for attention for this same reason, and should not be rushed.

On the other hand, water drawn into the turbine with the steam will act as a very effective unbalancing mass and mostly with very bad consequences; and very obviously a blade flying off will create an overweight on the opposite side of the rotor without regard to the other effects.

Vibration due to any one of these causes always has the same effect; it brings the revolving and stationary parts of the labyrinths into contact, with friction, heat and deformation as results, and the least that will happen will be the destruction of the small clearances and increased leakage and steam consumption.

It is, therefore, always advisable, when a turbine begins to vibrate for some unknown reason, to moderate the speed at once, and to give the rotor an opportunity to get into good shape again. If the vibration persists after a new start, and goes on increasing, the trouble should be looked after.

If at all possible, turbines should be supplied with superheated steam. In the first place the probability of getting water into the turbine becomes much smaller, and further, superheated steam causes far less erosion of the blades than wet steam.

In turbine plants large dimensioned condensers are usually provided. With either surface, barometric or jet condensers, a vacuum of 27 in. to 28 in. can easily be maintained and should be. The water temperature is here the principal factor, and other facts might have to be considered, which would require a detailed treatment. Running the condensing apparatus properly is a task which takes generally more of the engineer's time and attention than the turbine itself. Before leaving the subject, the importance of frequently inspecting relief valves may be mentioned.

A last rule for the benefit of economy: reduce the amount of idle running of a turbine working in parallel with other units. Care should always be taken to handle the load so that no turbine runs for any length of time at much less than half load.

Shutting Down.—When an independent turbo-generator is to be shut down, the throttle valve can be closed before the load is taken off; the latter acts as a brake and brings the turbine quickly to rest.

A turbo-generator running in parallel must have the load thrown off first and then the throttle quickly closed. Then the condenser is stopped and the steam drain opened to break the vacuum. Finally the water supply is shut off, but the oiling should be continued until the turbine is completely stopped.

Inspection.—At regular intervals, and at least once a year, the turbine should thoroughly inspected and all details gone over. This applies to the interior of the turbine especially. Having lifted the cover, the clearances between rotary and fixed parts should be examined and readjusted. The rotor had better be removed and the blades minutely examined for erosion, scale, cracks, &c. The guide blades should undergo a thorough inspection, too, and be cleared of obstructing matter.

The whole oiling system, chiefly, wants complete cleaning; the oil coils should be scraped outside and blown out with steam. Paraffin oil removes the gummy oxidised deposit, mentioned before as a result of bad oil. The oil strainer should be cleaned and an entirely new supply of oil put in. This is usually only necessary once a year: in the meantime the oil can be filtered and some new oil added to compensate for losses from leakage and evaporation. Bearings and stuffing-boxes will probably want some overhauling, too, and the governor and valves, the gears and oil pump should be gone over thoroughly. Great care must be taken in handling the rotor that no blades are injured; much trouble may arise from small damage.

The inspection will have to extend to the condensing plant. Air leaks may be looked for, and water leaks in surface condensers. Pumps, pipe lines, especially foot valves and strainers, must be cleaned and put in good shape.

The indicator diagram, which affords an excellent guide to the reciprocating engineer, is of no use with a turbine. Steam measurements, compared with electrical output, are here the thing required.

The average engineer cannot be expected to proceed with the care used in acceptance tests, and refined measuring apparatus will generally not be at his disposal, but a scale for weighing the condensed steam and a few thermometers will give sufficient data for fairly approximate results.

Manufacturing in Mexico.—H.M. Legation at Mexico City report that a contract has been signed between the Ministerio de Fomento and Senor A. Elozua for the establishment of factories in Mexico for the manufacture of all kinds of rubber goods, including motor and carriage tires, waterproof cloth, insulated wire, &c. At least £25,000 must be spent on the first factory. All materials and plant necessary for the establishment of the industry, as well as electric lighting equipment and fire extinguishing appliances, may be imported duty free.—*Board of Trade Journal.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Terroid" System of Electric Wiring.

A new wiring system has just been introduced, under the above title, by the Western Electric Co., Ltd., of North Woolwich, with a view to lowering the cost of an installation without detriment to its efficiency or durability. The leading features of the system are shown in the accompanying figures. The wire (fig. 1) consists of a principal insulated conductor of standard pattern, to the outside of which is attached a return conductor having a lower insulation, or none at all, in such a way that the two can be readily separated for local distribution. The cost of the combined conductor is much less than that of two insulated wires of similar carrying capacity. The wire can readily be drawn into conduit, being smaller than a pair of insulated wires; no special tools are required, and the conductor can be used with casing or for open wiring. The system has been adopted for use by one of the Government departments, and it is claimed that it conforms in every particular with the I.E.E. Wiring Rules, the Home Office and B. of T. Regulations, &c.

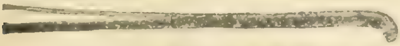

Fig. 1.—"Terroid" Conductor.

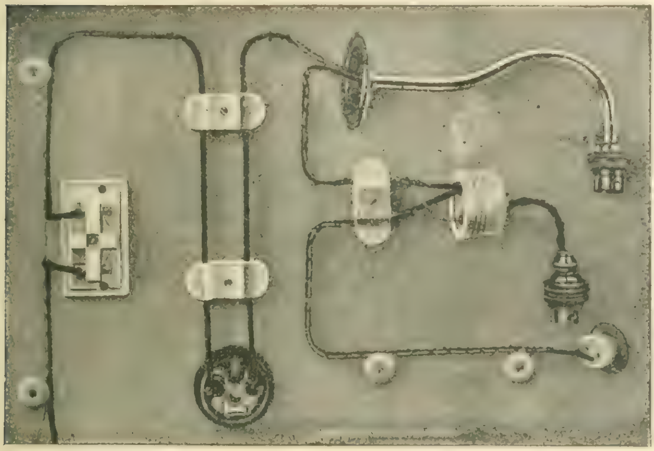

Fig. 2.—Method of using "Terroid" Wire for Open Wiring.

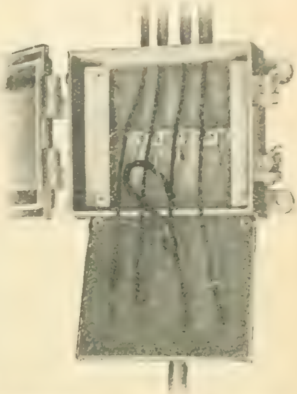

Fig. 3.—Fuseboard Wired with "Terroid."

G.E.C. Coffee Percolator.

A recent addition to the General Electric Co.'s electric heating and cooking appliances is a newly designed coffee percolator with a self-contained heater. It is neatly constructed of copper, heavily nickel-plated, with a handsome black handle. When this percolator is filled with cold water, spraying will begin in less than three minutes after the current is turned on. A small quantity of the water is rapidly brought to the boil, and then this water is automatically forced through a tube to the top of the vessel, where it sprays down and over the coffee grounds. The latter are placed in a separate chamber in the upper part of the pot and thus are not kept soaking in the liquid, with the result that coffee made in this way is as light and clear as wine and possesses the pure and delicious flavour of the coffee berry. Incidentally, less coffee is needed and cheaper berries may be employed, yet the coffee will be better; the quality of the coffee is uniformly excellent and does not vary day by day.

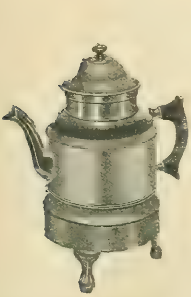

Fig. 4.—G.E.C. Coffee Percolator.

Fuller's Patent Block Accumulators.

An interesting type of storage cell has been developed by Messrs. John C. Fuller & Son, Ltd., of Woodland Works, Wick Lane, Old Ford Road, E., and is now being marketed under the above title. Defying the accepted view that electrolytic action is confined to a shallow layer of the active material, the makers have constructed electrodes in which large masses or blocks of paste are carried on small grids, the weight of the paste far exceeding that of the grids; these blocks are either triangular or segmental in section, as shown in the accompanying illustration, fig. 5, and are formed right through. The result, we are informed, is that the electrodes are immune from damage due to vibration and short circuiting, are free from sulphating, and retain their charge for a year or more without dropping below two volts per cell. There are no "plates," with their liability to buckling; two segmental electrodes, wrapped with glass wool and perforated celluloid separators, form a cell similar to a round primary dry cell, about 6 in. high × 3 in. in diameter, or four triangular electrodes are coupled together so as to form a cell square in section, with either a celluloid or a glass container. Larger numbers of electrodes up to eight are used to build up cells of greater capacity; fig. 5 shows a round cell (without container) consisting of six electrodes, smaller round and square cells, a segmental grid and complete segmental positive electrode, and a triangular negative electrode. Two cells mounted as usual in a celluloid box form a four-volt ignition accumulator, which is made in various sizes. The cells have already been extensively adopted in place of dry cells and plate accumulators for telegraphy, telephony, train-lighting, car-lighting, ignition, &c., and we understand that they have proved admirably adapted for all these purposes. On account of the construction of the electrodes, their internal resistance is not so low as that of plate cells, but this has

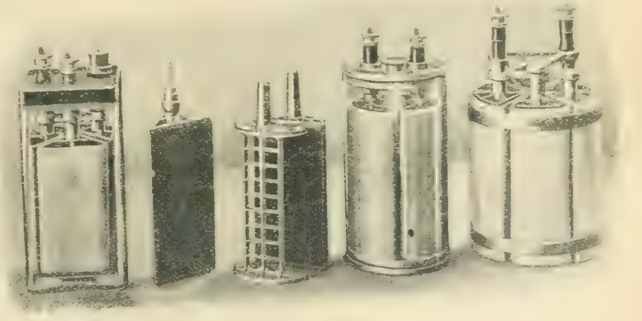

Fig. 5.—Fuller Block Accumulators and Parts.

little effect on their efficiency at low discharge rates, and their ampere-hour capacity, it is claimed, is considerably greater per pound of cell than that of plate cells at low rates. The block cells recover their voltage instantly after a short-circuit, and can be short-circuited for an hour without injury. Owing to their ability to hold a charge almost indefinitely and their consequent freedom from sulphating, they are particularly suitable for use where frequent charging would be inconvenient or impossible; unlike dry cells, which are useless when discharged, the block cells can be used for similar purposes for many months, and when run down can be sent to a charging station for restoration to their full initial value. The grid being buried in the block, can be made of antimonial lead without fear of troubles due to growth, and the active material cannot fall out of place. Fig. 6 shows the result of a test on a 280-amp.-hour train-lighting cell discharging at 20 amperes, made by Mr. C. E. Wright, electrical engineer to the North-Western Railway of India; at o the cell was short-circuited for 1½ minutes, but immediately recovered.

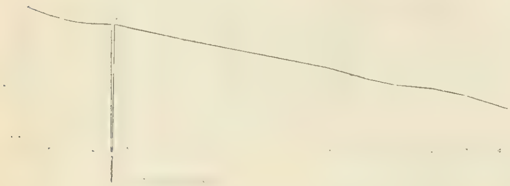

Fig. 6.—Test of 280-amp.-hour Train-Lighting Cell.

LEGAL.

Attorney-General v. London Electric Railway Co.

The motion by the Attorney-General at the relation of the Gordon Hotels by which an interim injunction was sought to restrain pumping by the defendant company in alleged breach of their Act of Parliament, and in a manner likely to cause damage to property in the neighbourhood of Northumberland Avenue, was again before Mr. Justice Bankes sitting as vacation judge, on Thursday, August 22nd. Mr. Felix Cassel, K.C., and the Hon. B. B. Ponsonby were counsel for the plaintiffs, and the defendants were represented by Mr. Bramwell Davis, K.C., and Mr. Mossop.

Mr. Bramwell Davis said that affidavits filed by the plaintiffs had been placed in his hands that morning, and as they raised new matter he must ask for a further adjournment in order to answer them.

Mr. Cassel said they were affidavits in reply.

Mr. Justice Bankes said that he had read all the affidavits that had been supplied to him, and it seemed the questions between the parties were entirely defined. First of all, there was a question whether what the defendants were doing was an infringement of their Act of Parliament. Then, supposing it was, ought he to interfere by way of interlocutory injunction if he was satisfied upon the evidence that there was no immediate danger to the relators' hotel. It must be borne in mind that the Hotel Co. had raised no objection to the pumping on the assumption that it was not going to do any damage, and now supposing that it did, ought he to interfere by interlocutory injunction?

Mr. Cassel submitted that that was not the position, but even if it was he should cite authorities to show that laches by a layman could not interfere with the rights of the Attorney-General. He had only allowed the laches on the assurance that they were going to do them no damage—that was to say, the relators.

Mr. Justice Bankes said he was only speaking of the relators.

Mr. Cassel: They were justified in what they did, because there was evidence that at the time there was no real danger.

Mr. Justice Bankes said the difficulty he felt was this: Supposing the plaintiffs were to satisfy him that danger was now anticipated, could he interfere if the effect of an injunction would be to flood the defendants' works?

Mr. Cassel: Our engineer says that really is nonsense. The only person that says there is danger of flooding is the engineer of the works himself. Further, the defendants had affidavits by six very eminent engineers, and none of them supported that suggestion.

Mr. Bramwell Davis: There is evidence that the effect of stopping this pumping might be to flood the Victoria Embankment.

Mr. Cassel: I submit that that is a perfectly ridiculous suggestion. There was a number of methods by which that might be easily prevented.

Mr. Justice Bankes: The affidavit of the defendants' engineer seems to say, "If I cease pumping I shall flood the whole place."

Mr. Bramwell Davis said he must answer the later evidence. It said that the defendants had six pumps working, and that was not so.

Mr. Cassel did not care if they had only four. It was quite sufficient for him that they took away 100 gallons a minute—50,000 gallons a day.

Mr. Justice Bankes said that because there had been an infringement of the Act of Parliament it did not compel him to grant an interlocutory injunction, supposing there was no danger. He was very strongly impressed by the suggestion that to stop the pumping at this station would flood all the other works. The evidence did not say that the work could be done in any other way; but supposing he was satisfied that it could be done in some other way, of course there would have to be time allowed the defendants to enable them to adopt some other way. They did not say in their affidavits how long it would be going on, and he did not see on the evidence as it stood why he should not stop it.

Mr. Bramwell Davis said the cases would show that his Lordship had a discretion in the matter.

His Lordship: When there is an Act of Parliament that says you shall not do it?

Mr. Bramwell Davis: Yes.

His Lordship: If I am satisfied that the work could be done in some other way, even though the work might be more expensive? Are you prepared to say that it cannot be done in some other way?

Mr. Bramwell Davis: It could only be done in some impracticable way, and at enormous expense.

His Lordship said he had not any material before him upon which he could exercise his discretion.

Mr. Justice Bankes said the mere fact that the defendants were not causing immediate injury to the hotel would not lead him to exercise his discretion in their favour is he was satisfied that they could do the work in some other way. If they could, and the way they were now doing it was an infringement of the Act of Parliament, he should grant an injunction.

Mr. Bramwell Davis said there was an overwhelming body of evidence to which he would draw his Lordship's attention, that there would be no danger anywhere by their workings.

His Lordship: But there is a clause in the Act of Parliament which says you shall not pump.

Mr. Bramwell Davis said that was a model clause and it had been inserted in all these underground railway Acts now since 1908, and yet they always pumped.

His Lordship suggested that the matter might stand over, for if he granted an injunction he should suspend its operation. Why should the motion not stand over to be dealt with by Mr. Justice Neville on the first motion day in next sittings?

Mr. Cassel pressed for some immediate relief, for although since the defendants' assurance the water had not up to then fallen below its normal level. He understood that at the plaintiffs' bore hole there were now some signs of shrinkage.

His Lordship said it seemed to him that the question was whether there was any other practicable way of doing this work. It was not on any of the affidavits so far as he could find. It was a most important point, and, therefore, Mr. Bramwell Davis must have time to file further evidence.

Mr. Cassel said if his Lordship considered that was the point, and desired further evidence, he could not resist a further adjournment, but asked that it should be only for a week. Whatever time was given the defendants to adopt a new method of working, that time would be so much longer if an injunction was not granted until after the vacation. They had now reduced their pumping to 30 gallons a minute, and if an undertaking were given that that quantity should not be exceeded, he was willing that the motion should stand over the vacation.

Mr. Bramwell Davis said he could not give that undertaking, but was willing to say that they would continue pumping as at present, except in a case of great emergency.

Mr. Cassel said he could not accept that assurance, as he was instructed that the water in their bore hole had already gone down.

Mr. Bramwell Davis said he would undertake not to pump more than 60 gallons a minute, and after some further discussion, it was agreed that the motion should stand over until the second motion day in next sittings, the defendants undertaking to pump as little as possible, and not to exceed 60 gallons a minute except in case of grave emergency. The defendants were to file their evidence by September 14th, and the plaintiffs to complete theirs by the end of the vacation. Liberty was given to either party to apply in the vacation if necessary.

Mr. Bramwell Davis asked for leave to inspect the plaintiffs' borehole.

Mr. Cassel had no objection, but asked that the plaintiffs should be allowed to inspect the defendants' pumping.

Mr. Bramwell Davis thought that was quite reasonable.

Mr. Justice Bankes: Then there will be liberty to the plaintiffs to inspect the defendants' works and pumping, by an engineer, in the presence of some representative of the defendants, and there will be a like liberty to the defendants to inspect the relators' trial hole and take levels. There would also be liberty to the relators to inspect the defendants' daily pumping returns.

Fencing Electrical Machinery.

At Glasgow Sheriff Court last week the Scottish Tube Co., Ltd., were charged with having failed to securely fence the pinion wheels of an electric motor which drives a travelling crane in their works in Swanston Street, at which, on June 10th, a workman, named William Duffy, was accidentally injured.

In tendering a plea of guilty, it was stated by a law agent that the accident was of a trifling nature. Duffy had been oiling some parts of the machinery, and, bending over, his coat caught between the pinion wheels. He sustained a few bruises and a cut on the head, and was only off work a few days. He did not claim compensation. The machinery was pretty well guarded, and it had not occurred to anyone inside the works that the pinions should be fenced.

By the Sheriff: No request had been made that they should be fenced.

The Inspector of Factories and Workshops said the obligation to fence machinery was absolutely clear; and the Court would understand the great necessity for such precautionary measures when he stated that no fewer than 15,000 cases of neglect occurred in the Glasgow district last year.

The Sheriff imposed a £5 penalty, with expenses.

NOTES ON IMPREGNATION OF WOODEN POLES.

By W. MANKTELOW.

Creosoting is undoubtedly the best preservative treatment yet devised for wood, but a deep penetration of the impregnant is less readily obtained with the tar product than with mineral substances. To facilitate thorough butt saturation, various methods of perforation of the wood have been tried, and the results of a specially elaborate investigation by Messrs. Haltenburg and Berdenick (of the Hungarian State Impregnating Department at Puspokladany) were recently announced in a paper before the Societe Electrotechnique de Dresden.

Radial holes, about 2 mm. diameter and 4 cm. deep, are formed in the pole by high-speed nail-formed spikes, which displace but do not remove the wood. The loss of strength in poles perforated by this process is negligible. On comparing the mechanical strength after treatment of poles in which radial perforations were made by displacement with the strength of a similar batch of poles in which 3 mm. holes were drilled and plugged after impregnation, it was found that the former were weakened to no appreciable extent, whereas the latter lost 25 to 40 per cent. in strength.

Several hundreds of poles of various timbers were tested, and the effect of the distribution of the radial perforations was especially examined. By placing the perforations on a spiral of about 50 mm. pitch and at a distance, hole to hole, of about 40 mm., each hole being about 10 mm. to the right or left of the hole in the spiral beneath it, excellent impregnation is obtainable even in such timbers as pine and fir. Only that portion of the butt which is below and immediately above the ground level is perforated, and a special machine has been designed to enable the rapid and accurate treatment of poles.

From an analysis of statistics extending over the past 50 years, M. Cristiani concludes that the average life of poles is as follows :—

Impregnated by Boucherie $CuSO_4$ process	...	11·7 years
„ „ zinc chloride „	...	11·9 „
„ „ Kyan $HgCl_2$ „	...	13·7 „
„ „ early creosote processes	...	20·6 „

American authorities estimate the life of creosoted timbers of various kinds to range from 20-30 years (being from 2·0 to 2·5 times the life of the timber untreated). German returns—probably the best in the world—show, during a period of 52 years, an average life of 21 years for creosoted Baltic fir. There is no doubt that several of the recent creosoting processes will show even better results, while involving less initial outlay, and avoiding a considerable amount of the unpleasantness hitherto inseparable from the handling of creosoted timber, by leaving a "cleaner" pole, *i.e.*, one with less surplus creosote in the surface layers.

Poles are almost invariably creosoted before use in this country, but in America only about 20 per cent. of poles are treated (though the proportion is steadily increasing), owing to the greater relative cost of creosoting in that country. An approximate formula for estimating the annual charge to be debited to poles is—

$$a = \frac{200 \cdot p}{200\, n + (n\,(n-1))\, r}$$

where, a = annual charge; p = investment (including cost of treatment, if any); n = years life; r = interest (say, 6 per cent).

As illustrative of the unfavourable position of creosoting in the States, it may be noted that the Virginia Railway and Power Co. recently installed 900 untreated chestnut poles and 300 creosoted loblolly poles (the loblolly pine contains a very large percentage of sap, and hence will absorb a large percentage of creosote[*]). The cost of the chestnut poles ranged from 13s. to 14s. 6d. each, and that of the treated loblolly poles was 28s. 9d. each (35-ft. poles, 8 in. top diameter). The life of the chestnut poles is expected to be 13 years, so that the longer life of the loblolly is balanced by its greater cost. In many cases, consumers pay for a pole of 36-in. ground circumference rather than for a creosoted pole 28 in. in ground circumference (thus allowing for 1·25 in. decrease in ground diameter by rotting in the untreated pole). Such wastage of large timber is a serious matter at the present day, when the area of forests (let alone timber ready for felling), is decreasing at such an alarming rate.

Intermittent reports come to hand of methods of timber preservation based on the electrolytic replacement of sap by saline solutions. These systems are fairly rapid in operation, and the electrolytic action causes a certain amount of chemical change to take place in the cells of the timber during treatment, which would otherwise occur during its use. This tendency to a more durable preservation is quite offset by the readiness with which most salts are leached out by rain. In the Nodon-Bretonneau process a compound electrolyte is used, in which magnesium sulphate effects seasoning, zinc sulphate acts as preservative, and ammonium sulphate and boric acid exercise a fireproofing and antiseptic action. The seasoning and preservative action occupies 7 to 14 hours, and the fireproofing process from 14 to 24 hours.

The electrical seasoning of wood, apart from any preservative treatment, has recently been successfully demonstrated in Melbourne. Current at 2,000 volts was applied to two large green logs, and the sap boiled out at such a rate that the logs lost 400 lb. in weight during three hours' treatment. It is estimated that a growing tree could be seasoned within six months by this process, but no information is yet available concerning the loss of strength, which it seems likely would be considerable.

COMPANY AND CONSUMER.

[FROM A LEGAL CONTRIBUTOR.]

Questions frequently arise which involve a discussion of the legal relations between electric supply companies and consumers. While much depends upon the terms of the contract which is entered into when the supply is first taken on, there are certain general principles which can be laid down upon a consideration of the Electric Lighting Acts, 1882 and 1888, and, more particularly, the schedule to the Electric Lighting Act, 1899, which contains a form of provisional order which is now applicable to the supply of electricity in nearly every district.

It is proposed in the present article to discuss some of the points which are continually arising :—

1. Generally.
2. Epitome of rules as to the supply of electricity.
3. Legal liability to grant a supply.
4. Supply within a certain area.
5. Regulations for ensuring a proper and sufficient supply of electricity.
6. Liability to pay a minimum.
7. Whether consumer bound to take continuous supply.
8. Agreement not to take supply from elsewhere.

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[*] It is fairly easy to get 22-24 lb. of creosote per cb. ft. in loblolly, whereas 10-15 lb. per cb. ft. is considered a very high allowance in pine.

9. Methods of ascertaining amount of energy supplied.
10. Agreements between company and consumer.
11. Who is liable for electricity supplied ?
12. Time for proceedings.
13. Notice to disconnect.
14. Alteration in the price of electricity.
15. Remedies of the consumer for failure of supply.
16. "Power companies" and consumers.

1. *Generally.*—Upon making an inquiry into the Electric Lighting Acts, 1882 to 1909, with a view to finding out the exact legal relations which exist between company and consumer, the first difficulty with which the investigator is confronted arises from what is known as "legislation by reference." For some obscure reason, many enactments which deal with the recovery of charges by the company, or the enforcement of their strict rights by consumers, are to be found in older statutes relating to gas and water supply. The result is that, in order to ascertain their exact legal position, those who are interested in the supply of electricity must refer to Acts which relate to gas and water, and to cases decided upon the construction of such Acts. In the following summary of the law we are, therefore, compelled to draw our conclusions from some parts of the Electric Lighting Acts, as illustrated and explained by previous legislation, and the cases which have arisen thereunder.

Just as gas and water are supplied compulsorily under and subject to the terms of an Act of Parliament, so every consumer within the district of an electric lighting company is entitled to demand and obtain supply from any company or local authority who have statutory powers to give a supply. Nevertheless, it is quite competent for any company, or even for a private individual, to supply electricity commercially without any legislative sanction. The Electric Lighting Acts are enabling only, and do not confer any monopoly upon those who have Parliamentary powers. As the conditions upon which a private undertaker supplies energy depend entirely upon the contract which he chooses to make, it is proposed to confine ourselves for the present to public supply. It may be mentioned, however, that by the Electric Lighting Act, 1909, which came into force on April 1st, 1910, no one is allowed to make a business of supplying electricity to his neighbours in any district where there is a provisional order already in force. The words "make a business" are used advisedly, for to supply current to a neighbour will be legal if the supply is merely ancillary to the ordinary business of the person who supplies it.

2. *Epitome of Rules as to the Supply of Electricity.*—The following rules, which are taken from the Electric Lighting Act, 1882, apply generally to the supply of electricity. Undertakers are not entitled to prescribe any special form of lamp or burner to be used by any company or person, nor must they in any way control or interfere with the manner in which electricity supplied by them is used. This is subject to the proviso that a consumer must not use any lamp or burner, or deal with the current supplied to him in such a way as to unduly or improperly interfere with the supply of electricity supplied to other consumers. The undertakers are bound to supply all consumers within their district on equal terms, and in making any agreements for supply they are prohibited from giving any undue preference to one consumer, or class of consumers.

3. *Legal Liability to Grant a Supply.*—The legal liability of a company to furnish consumers with a supply is further pointed out in Sec. 27 of the Schedule to the Electric Lighting (Clauses) Act, 1899, which is incorporated with every Provisional Order. That section provides that the undertakers shall furnish an adequate supply to every consumer within 50 yards of a distributing main of the undertakers in which they are required to maintain, or are maintaining, a supply of energy for the purposes of general supply. The necessary lines, &c., must be laid by the undertakers subject to the following conditions :—(i) The cost of all electric lines laid on the premises of the consumer, and (ii) the cost of so much of such connecting lines as it may be necessary to lay for a greater distance than 60 ft., are to be borne by the consumer if the undertakers so require. By Sub-Sec. 2 it is provided that each owner or occupier requiring a supply must (*a*) serve a notice upon the undertakers specifying the premises to be supplied, the amount required, and the date upon which the supply is to commence ; (*b*) if required, contract to receive and pay for a supply of energy for a period of at least two years of such an amount that the payment to be made shall not be less than 20 per cent. per annum on the outlay incurred by the undertakers in providing electric connecting lines in accordance with this section ; (*c*) if required, give security for the payment to the undertakers of all moneys which may become due to them in respect of lines and energy. It is further provided that undertakers may, at any time while they are supplying a consumer, by giving seven days' notice, require the owner or occupier to give security for moneys due and to become due. (As to supply of electricity to premises having already a separate supply, see paragraph 7 *infra.*)

4. *Supply within a Certain Area.*—Every local authority or company authorised to supply electricity was bound formerly to limit operations to its own district ; it could not supply a single consumer outside. In one case (Attorney-General *v.* Metropolitan Electric Supply Co., 1905, 1 Ch. 24, 757), a limited company was authorised by statute to supply electricity within certain areas only, and also by a later statute to erect a station for generating electric current or electrical energy at a place outside those areas for the purpose of transmitting such current or energy therefrom to certain distributing stations within those areas, and for the purpose of supplying such current or energy within the same areas. It was held that the company, though incorporated under the Companies' Acts with unrestricted powers of producing and supplying electricity, was restricted by the Special Acts to the supply of electricity within the special areas.

In another case it was decided that a gas company had no right to supply gas outside the statutory area. A railway company had received gas at its terminus and sent it down the line to be consumed at another station down the line which was outside the area. It was held that this was illegal. It may be mentioned that on account of the inconvenience to which observance of the strict letter of the law has given rise, the Act of 1909 provides that, upon certain formalities being complied with, supply may be granted outside the area with the consent of the Board of Trade.

The difficulties and hardships suggested by these cases have been set at rest by the Electric Lighting Act, 1909, which provides that (1) any local authority, company, or person authorised to supply electricity in an area may, with the consent of the Board of Trade, supply at any point within that area electricity for the purpose of haulage or traction on any railway, tramway or canal, situate partly within and partly without that area, and for the purposes of lighting vehicles and vessels used on any such railway, tramway, or canal ; but the Board of Trade shall not in any case give any such consent until notice of the application for the consent has been given by advertisement or otherwise in such manner as the Board of Trade may direct, and an opportunity has been given to any person who appears to the Board to be affected, of stating any objections he may have thereto.

The Board of Trade may by provisional order authorise any such local authority, company, or person so to supply electricity to be used for purposes incidental to the working or lighting of the railway, tramway, or canal, other than the purposes aforesaid.

It also provides that a supply to premises wholly without the area may be justified. Thus, where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board of Trade may, if the local authority within whose district the premises are situate, and the undertakers (if any) authorised to supply electricity to such premises, consent, by order permit the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit.

Provided that if, in the opinion of the Board of Trade, any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given.

5. *Regulations for Ensuring a Proper and Sufficient Supply of Electricity.*—The duties of a supply company are described in detail in the Board of Trade Regulations. According to those regulations, the company must give notice of their intention to switch on the current in the mains, and

must thereafter maintain a supply of sufficient power for the use of all the consumers for the time being entitled to be supplied. In case it becomes necessary to stop the supply through any portion of a main for more than one hour, the system must be so arranged that the disconnection does not exceed 200 KW. or extend to the premises of more than 80 consumers. The pressure of supply must not vary more than 2 per cent. from the standard pressure, while the variation of pressure at any consumer's terminals shall not under any conditions of the supply which the consumer is entitled to receive, exceed 4 per cent. from the declared constant pressure. As to fixing the standard pressure, the result of an inquiry held by the Board of Trade was that this may be altered, even without the consent of consumers, upon terms and conditions to be settled, in case of dispute, by an arbitrator appointed by the Board of Trade.

A number of interesting questions arise upon the interpretation of the above clauses and regulations with which it may be convenient to deal *seriatim*.

6. *Liability to Pay a Minimum.* We have seen that a consumer may be bound to take and pay for a minimum supply of energy. Suppose he takes no energy for a whole year, can he still be compelled to pay the minimum amount? In the absence of any express authority on the point, it is submitted that the payment must be made, whether a supply is or is not taken. The object of the clause is to protect the undertakers, and it is clear that, whether a supply is taken or not, the initial expenditure will be just the same.

7. *Whether consumer not Bound to take Continuous Supply.*—The fact that a consumer had it in his power to keep the mains as a "stand-by" in case of the breakdown of a private installation, gave rise to considerable dissatisfaction amongst the undertakers. As a result, the Electric Lighting Act, 1909, contains a section providing specially for the supply of premises having a separate supply. The provisions of this section (15) are as follows:—Notwithstanding anything in the Electric Lighting Acts, or in any Act of Parliament or Provisional Order authorising an undertaking, a person shall not be entitled to demand or to continue to receive from undertakers authorised to supply electricity in any area, a supply of electricity for any premises having a separate supply, unless he has agreed with the undertakers to pay to them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises; the sum to be paid shall be determined in default of agreement by arbitration.

8. *Agreement not to Take Supply from Elsewhere.*—It is competent for undertakers to agree with the consumer that he will not take a supply from elsewhere during a certain period. Such an agreement has been upheld by the Court. In the Metropolitan Electric Supply Co. *v.* Ginder, 1901, 2 Ch. 799, the defendant had signed a form of request to the plaintiff company to supply him with electrical energy subject (*inter alia*) to the following terms:—(1) The consumer agrees to take the whole of the electrical energy required for the premises mentioned below from the company for a period of not less than five years; (2) The charge for electrical energy to be 4½d. per Board of Trade unit. There was no covenant by the company to supply, nor by the defendant to take any energy. Similar forms of request had been signed by other persons for different terms of years, and at different prices. After receiving a supply for some time on the above terms, the defendant gave notice to the company to disconnect, and received an instalment of energy from the County of London and Brush Provincial Co., who were rivals of the plaintiffs within their district. On threat of legal proceedings, he had plaintiffs' service reconnected, but he again gave notice to the plaintiffs to disconnect in February, 1901. The plaintiffs brought an action in the Chancery Division for an injunction to restrain the defendant from obtaining a supply from any source other than their own mains. Evidence was called on the part of the defendant to prove that the plaintiffs had failed to furnish a proper supply, and it was argued on the defendant's behalf that there could be no injunction to enforce a negative stipulation. It was decided by Justice Buckley (1) that the contract in this case implied an undertaking by the defendant not to take energy from anyone except the plaintiffs; (2) That the contract was one which could lawfully be imposed upon the defendant by virtue of the plaintiffs' provisional order; (3) That the provisions of the Electric Lighting Act, 1882, Secs. 19 and 20, which compel a supply company to give a supply to a consumer on the terms upon which any other person in the area "is entitled under similar circumstances to a corresponding supply," had not been infringed; and (4) that the plaintiffs were entitled to an injunction.

This was a case in which the consumer took energy from other undertakers. It is presumed that if he had erected a private installation on his own premises, and had obtained energy therefrom during the period in question, he could in that case have been restrained by injunction.

9. *Methods of Ascertaining Amount of Energy Supplied.*—The amount of energy supplied by undertakers to their consumers is to be estimated, in the absence of agreement, by meters. The Board of Trade does not undertake to inspect meters, it being provided in the rules issued by the Electrical Standardising Laboratory, 1897, "That meters for the measurement of quantity of energy cannot be received with a view to certification for use in connection with the supply given by undertakers under Electric Lighting Orders." It is provided, however, by Sec. 51 of the schedule to the Clauses Act that any consumer, on paying the required fee, may employ an inspector to examine any meter, and to certify it as a "certified meter."

10. *Agreements between Company and Consumer.*—An agreement made between an electric supply company and a local authority for the supply of electricity should generally contain a penalty clause. By Sec. 174, Sub-Sec. (2) of the Public Health Act, 1875, it is provided that every contract made by an urban authority whereof the value or amount exceeds £50, "shall specify some pecuniary penalty to be fixed in case the terms of the contract are not duly performed." This provision is obligatory and not merely directory, and if the penalty is not specified, an action on the contract against the local authority cannot be maintained (British Insulated Wire Co. *v.* Prescot Urban District Council (1895), 2 Q.B. 463, 538).

It has been decided that where a company contracts to supply energy on special terms under Sec. 83 of the Electric Lighting (Clauses) Act, 1899, the consumer may sue for breach of contract if there is a failure of supply. He need not confine himself to the recovery of penalties (Morris and Bastert *v.* Loughborough Corporation, 1908, 1 K.B., 217).

The importance of entering into a contract with the undertakers was well illustrated in the case of Husey *v.* The London Electric Supply Corporation (1902; 18 T.L.R., 296). In that case a receiver appointed by the High Court in a debenture-holder's action against the St. Ermin's Hotel Co. entered into possession of the hotel which was then being carried on by the company. At the time when the Receiver entered, the hotel company owed a sum of £437 to the defendants in respect of electric current which had been supplied for the lighting of the hotel. The Receiver entered into no fresh contract with the supply company, nor would he pay the arrears. Consequently the supply company threatened to disconnect the hotel from their mains, and an action was brought to restrain them from so doing. In was argued on their behalf that if the Receiver were a new occupier of the hotel, he was bound to enter into a new contract before he could receive a supply, and that, if his occupancy was a mere continuance of that of the hotel company, the defendants were entitled to disconnect until the arrears were paid. Mr. Justice Kekewich granted an injunction, but his judgment was reversed in the Court of Appeal, where Lord Justice Vaughan-Williams said: "In my view, it is plain that, under the Act of 1882, no one is entitled to demand a supply of electric current until he has entered into a contract with the company which supplies it. If there has been no change in the occupancy of the hotel, then, *a fortiori*, the defendants ought not to be restrained 'from cutting off the supply.'"

In the above case, the Receiver either represented the old tenant, and was therefore liable to pay such rent as was in arrears, or he was a new tenant, not entitled to be supplied until he entered into a contract for that purpose with the company.

(*To be continued.*)

BUSINESS NOTES.

Argentina.—Although the general trade of Argentina in the first quarter of 1912 showed a shrinkage, the imports of electrotechnical articles were marked by decidedly enlarged figures, having advanced from 977,000 gold pesos in the same period in the previous year to 2,263,000 gold pesos in the first quarter of the current year. The increase was observable not only in dynamos and motors, but also and especially in accumulators, measuring instruments, and materials for electrical purposes. The increase in accumulators was owing to the large orders by the Deutsche Uberseeische Electricitäts-Gesellschaft in the quarter under review. Including various not specifically electrotechnical products, the aggregate imports of the articles grouped under "electrotechnical products" amounted to 2,263,122 gold pesos against 1,286,122 gold pesos in the first quarter of 1911. In detail, electrical machines and motors were imported to 566,531 gold pesos, an increase of 393,298; electric fans, 6,120, an increase of 1,464; accumulators and batteries, 757,161, increase 146,847; current and pressure meters, 4,678, increase of 1,388; electric bells, 5,891, increase 339; electric meters, 104,628, increase 54,396; arc lamps, 19,264, increase 20; glow lamps, 107,324, increase 492; lamp fittings, 16,855, increase 6,966; carbons, 25,291, increase 14,246; materials for electric purposes, 160,151, increase 108,938; and porcelain, clay and glass insulators, 25,262, increase 6,893. Articles showing shrinkage were—Small motors, 4,080, a decrease of 1,576; wire and cable, 558,830, decrease 17,531; telegraph and telephone apparatus, 10,536, decrease 9,337; switches, &c., 40,771, decrease 26,979; conduits, 36,862, decrease 12,741; and material for telegraph and telephone installations, 11,069, decrease 1,099.—*Electrotechnische Zeitschrift.*

Canadian Manufactures.—Lord Strathcona, High Commissioner for Canada, has just received from the Census and Statistics Office at Ottawa a bulletin stating that the census of the manufactures of Canada taken last year for the calendar year 1910, as now compiled, gives the following comparative statistics, compared with those of the census of 1901 for the calendar year 1900, viz.:—

	1910.	1900.	*Increase.*	*Increase.*
Establishments ...	19,202	14,650	4,552	31·07 %
Capital ...	$1,245,018,881	$446,916,487	$798,102,394	178·58 %
Employés ...	511,844	339,173	172,671	50·91 %
Salaries and wages ...	$240,494,996	$113,249,350	$127,245,646	112·36 %
Materials ...	$600,822,791	$266,527,858	$334,294,933	125·42 %
Products ...	$1,164,695,032	$481,053,375	$683,641,657	142·11 %

The capital employed in manufactures increased during the decade by 178·58 per cent., and the value of products by 142·11 per cent. The number of establishments employing five hands and over last year was 19,202, being an increase of 4,552 in the decade.

Canadian Trade.—Among the inquiries relating to Canadian trade received at the office of the High Commissioner for Canada, 17, Victoria Street, London, S.W., during the week ending August 26th, were the following:—

A firm in South Wales who are about to commence the development of a mica property in India, are open either to do business with Canadian importers, or to dispose of the property to a Canadian company.

The City Commissioner of an important Western Canadian city will be in London in September, and is desirous of getting into touch with manufacturers of large gas engines to be used for the purpose of generating electric light and power.

An important Canadian company who are dealers in motor boat accessories desire to get into touch with United Kingdom manufacturers from whom they could purchase. They are particularly interested in ignition cable, brass propellers, marine accessories, and lamps. A catalogue of what is required can be seen at the Canadian Government Office, as above.

Consular Notes.—Nicaragua.—The American Consul at Corinto reports that the National Electric Signal Co., of Pittsburg, Pa., has corresponded directly with the Nicaraguan Government relative to the establishment in Nicaragua, at its risk, of several wireless stations. The company is the one which put in the stations of the United Trunk Co., and is now taking up the matter of establishing a number of others along the Atlantic coast of Mexico and Central America, for the purpose of obtaining constant communication between these countries and the United States. The company also offers to put in at Managua a wireless tower of sufficient power to communicate with Salvador. The engineers were to leave for Nicaragua in May to carry out the work.

France.—The British Consul at Lyons, in a recent report, states that the development of the resources latent as water-power in the mountain streams of South-Eastern France continues to make rapid progress, and it is estimated that no less than 475,000 H.P. is now generated by the various hydro-electric works in the French Alps, with a minimum at winter low water of 180,000 H.P. The employment of this power may be distributed as follows:—Metallurgical works, 210,000 maximum H.P.; light and power, 155,000; chemical products, 60,000; paper and wood pulp, 30,000; traction, 10,000; various, 10,000; making a total of 475,000 maximum H.P. Of this total about 356,000 H.P. maximum and 136,820 minimum H.P. are produced by the river systems in the Lyons Consular district, chief among them being the Isère and its numerous feeders, the Arve and the Rhône. In addition to this large aggregate of power actually generated, fresh streams are being harnessed representing many thousands of horse-power; chief among these schemes may be mentioned one for obtaining from the waters of the Drac to the south of Grenoble, an average of 10,000 H.P., by means of a dam, from which the collected water will be carried through a tunnel 250 yards long, and then along conduits for nearly 4 miles to a power house in Grenoble itself. It is expected that the electricity thus generated will be used for lighting the town. Another enterprise nearer Lyons contemplates the erection of works on the Fier at its junction with the Rhône for generating 10,000 H.P., which will be conveyed to industrial works at Port de Cherery (Isère) for motive power, and to Lyons for lighting purposes. Previous reports have described the scheme for the construction of a dam 220 ft. high across the Rhône at Genissiat, below Bellegarde, at an estimated cost of £4,800,000 for the generation of electric power, estimated at a maximum of 326,000 H.P., which would be conveyed by overhead wires under the enormous pressure of 120,000 volts to Paris, and in last year's report, extracts from which were given in the ELECTRICAL REVIEW, reference was made to the hostility which had been aroused locally by this scheme for carrying off to Paris the energy latent in the waters of the Rhône, which is considered to be the natural heritage of the neighbouring districts. This opposition, so far from diminishing, gathered momentum throughout 1911, and has found expression in a regularly organised campaign against the granting of the concession, in which Lyons and the Department of the Rhône have taken a prominent part. The opponents of the Genissiat scheme are for the most part in favour of the counter-project aiming at the construction of two smaller dams, one below the other, for generating power for more local use. Nothing, however, has as yet been settled, though it would appear that the central authorities are more favourably disposed towards the Genissiat-Paris power concession than towards an alternative, which would only benefit the immediate neighbourhood and would bring no advantage to Paris. The eternal jealousy between Paris and the provinces, aroused by this threatening filching of Rhône water-powers for the benefit of the capital, was further inflamed towards the latter part of 1911 by the publication of a scheme laid before the Paris Muncipal Council for carrying off from the Lake of Geneva, water required to make up existing deficiencies in the supply of the town, to the amount of 2,000,000 cb. m. (70,632,000 cb. ft.) every 24 hours, or 730,000,000 cb. m. (25,780,680,000 cb. ft.) a year. This proposal raised a perfect storm of protest, not only from Lyons, whose water supply, already seriously defective at times of low water, would be materially compromised, but also from nearly all the riverain districts between Lyons and the sea, on the ground that it would lower the height of the water by from 15 to 20 centims., and would be highly detrimental not only to the navigation of the river, already difficult enough, but to its utility for irrigation purposes in the more southern districts. It is alleged indeed that such a tampering with the stream would substantially increase the number of days in the year on which, by reason of the lowness of the water, no navigation on the Rhône is possible. The present position of the matter is that the Minister of Public Works, in answer to a question in the Chamber of Deputies, has denied any official knowledge of it; but the various bodies interested are still on their guard, and a formidable agitation is being steadily organised under the hegemony of the Lyons municipality, in order to weld into a solid front of opposition the hostility which the scheme has aroused in the 10 riverain Departments of the Rhône.

Proposals have also been on foot for the development of the navagibility of the Rhône. Two separate schemes have been put forward in recent years, both of which, are more or less bound up with hydro-electric development. The first of these was the result of deliberations of a committee representing the various departments interested and contemplated the erection of a canal from Lyons to Arles at an estimated cost of £12,000,000, which would serve the double purpose of facilitating navigation and providing electric power by utilising the fall of water in the numerous locks. By this means it was estimated that 60,000 H.P. could be generated from 12 power houses at different points along its banks, which could be disposed of for lighting and industrial purposes and bring in a large revenue. The other scheme was propounded by the chief engineer of "Ponts et Chaussées" at Lyons and was of the same nature, with this difference, that the current would be much slower and easier for navigation, while as a consequence the generation of electricity would play a much smaller part—only some 5,700 H.P. being expected to be derived from the fall at the locks—while the cost was estimated at the enormous total of £20,240,000. Neither of these schemes having commended itself to the authorities, a competition was organised in 1909 under the auspices of the Lyons and Marseilles Chambers of Commerce for encouraging the drawing up of further projects and prizes amounting to £2,000 are to be awarded for the best solution of the difficulties with which the question bristles. No announcement on the subject has up to the present been made by the Office des Transports du Sud Est, which was created for the purpose of dealing with this and kindred questions, but, meanwhile, a third scheme has been propounded which would substitute for a lateral canal a series of dams, 25 to 30 in number, across the Rhône itself at regular intervals between Lyons and Arles, each provided with a large lock capable of accommodating vessels of large draught and tonnage; at a power house in connection with each lock electricity would be generated from the fall of some 19 ft. By this means it is estimated that from 400,000 to 1,000,000 kilowatts could be obtained, according to the height of the water, from which a considerable revenue might be derived. A minimum depth of 13 ft. would be maintained, enabling vessels of much larger draught to navigate the river than would be possible with a lateral canal. The scheme includes facilities for irrigating the land on both banks an almost indispensable feature of any project likely to commend itself for acceptance, as water is badly wanted in the arid Southern Departments through which the Rhone passes.

Portuguese East Africa.—The British Vice-Consul at Lobito reports that the electrical distributing plant, consisting of transformer stations, at Catumbella, Lobito and Benguella, and the poling and wiring for street lighting at these three places, were completed towards the end of 1911, under the supervision of the contractors, Messrs. Johnson & Phillips, Ltd., of London. Owing to there having been little or no rain during 1910-11 wet season, the water in the River Catumbella was lower than ever remembered by the oldest residents; consequently conditions were never so favourable for the completion of the dam, but it was nowhere near completion when the heavy rains of October commenced. The result was that the temporary dam protecting the foundations in course of erection for the power house was carried away, and all pumping plant washed into the river bed. At the end of January the contractors sent out an hydraulic engineer, and work was resumed, the rise of water due to the October and November, or small rains, having subsided. Parts of the foundered pumping plant were recovered, and work was started on a new temporary dam.

Canary Islands. -The American Consul at Teneriffe reports that the Electric Tram Co., composed of Belgian capitalists, and employing modern methods and equipment, materially improved its system all along the line last year. The 15-mile extension from Tacaronte to Orotava has not been carried out, and the prospect looks forlorn, for the reason that, besides being an expensive road to build because of the unusual gradients, the company would, as heretofore, have to give the Government the usual 25 per cent. of the gross receipts. As this leaves a very small margin of profit at present, it would leave still less, if any, on the road projected. The completed portion of the road consists of two sections of approximately 7 miles each, from Teneriffe to Laguna, and again from the latter place to Tacaronte. Laguna has 15,000, and Tacaronte nearly 3,000 inhabitants; both have altitudes of over 1,800 ft. The power works are situated at Cuesta, a village with an altitude of about 600 ft., nearly midway between Teneriffe and Laguna. This work is elaborate and up-to-date. Two engines (direct-coupled) drive the 200-KW. dynamos (Dulait system). Galloway boilers, Green economisers, and Tudor accumulators are included in the equipment. The condensing water is cooled by a tubular refrigerator (Koerting system). On account of the steep inclines, each car is equipped with two 50-H.P. motors. Apart from the actual beauty of the journey, the ride is interesting as an example of modern Belgian electrical engineering.

Holidays.—The works and offices of FERRANTI, LTD., at Hollinwood, will be closed this evening (August 30th), until Monday morning, September 9th. A small staff will deal with urgent correspondence.

Diesel Engine Orders.—We learn that the M.A.N. Co. have recently received orders for the following M.A.N. Diesel engine plants:—

Belliss & Morcom One horizontal engine of 120 B.H.P.
Colombo Tramways.—One vertical engine of 240 B.H.P.
Société de l'Air Comprimé, Paris.—One horizontal engine of 2,000 B.H.P., and one vertical engine of 150 B.H.P.
A.E.G. Thomson-Houston, Iberica, Madrid. One vertical engine of 290 B.H.P. (repeat order).
Central Station of the Rio de la Almeda, Mexico.—Two horizontal engines of 1,500 B.H.P. each.

Prices Advance.—Owing to recent increases in the cost of raw material, the BRITISH THOMSON-HOUSTON CO. have made a 5 per cent. advance in the prices of all their wires and cables, taking effect from August 21st.

Bankruptcy Proceedings.—ALFRED SLATTER, electrical engineer and agent, Bridge Street, Blackfriars, S.E.—The public examination was held last week before Mr. Registrar Hope, at the London Bankruptcy Court. The receiving order was made on June 24th at the instance of a creditor and a statement of affairs has been submitted by the debtor showing total liabilities £3,112, of which £2,003 is expected to rank for dividend, against assets valued at £198, apart from book debts to the face value of £1,441, but returned as irrecoverable. Questioned by Mr. J. B Knight, Official Receiver, the debtor stated that in 1887 with a capital of about £500, he commenced in business as an electrical engineer and agent for telegraph material at 4, St. Mary Axe, E.C. The business was at first successful, his net profits averaging about £500 a year, but owing to the severity of competition, he gave it up in 1892. Witness next obtained an appointment as manager to an electrical company at a salary of £300 per annum, and in 1898 he resigned that appointment to accept a similar one bearing a salary of £400 a year. Whilst in business on his own account, witness became indebted for £650 to a Mrs. Garry, who advanced him that amount for the purpose of the trading; he was to retain the loan for his lifetime in consideration of paying interest regularly, and of educating her son as an electrical engineer. Since 1895 witness had acted as chairman of the Wycombe Borough Electric Light and Power Co., Ltd., at a salary of £35, and of the Chesham Electric Light and Power Co., Ltd., at a salary of £20 per annum. Asked if he were a director of the Wycombe Co., the debtor replied that he was the originator of the scheme. He added that he was not the promoter of the Chesham Co., but obtained the sanction from the local authority. He held shares in the Wycombe Co., but they were pledged in 1906. In 1902 witness commenced business as a consulting electrical engineer at Bridge Street, Blackfriars. He had also been interested in the construction of a railway in Mexico. Then in August, 1910, witness obtained an option to acquire water rights in the State of Oaxaca, Mexico, for the development of a hydro-electric transmission installation; in December, 1911, he entered into a contract with a French banking firm, who were to provide £400,000 for constructional purposes, to pay him £15,000 by March 25th, 1912, and to issue to him £100,000 of the common stock of the company. The French bankers, however, failed to carry out their agreement, and the option lapsed in February, 1912. Witness had to provide for the whole of the expenses of obtaining and preserving the concession, which necessitated raising money from friends and professional moneylenders—from the latter at heavy rates of interest—and in all he had expended about £2,000 on the scheme. A judgment of £75 was obtained against him last February by professional moneylender, and a petition was subsequently presented, upon which the receiving order was made. The debtor attributed his failure and insolvency to the failure of the French bankers to carry out their agreement to finance the Oaxaca scheme. The examination was concluded.

T. E. MORGAN, electrical engineer, Ecclesall Road, Sheffield.—First and final dividend of 20s. in the £, plus 4 per cent. interest payable August 26th, at Official Receiver's Offices, Figtree Lane, Sheffield. This sort of thing is always good to read. May we be excused if we put aside our editorial reserve, and say "Bravo!" The failure was only of the proportions of the excusing servant's baby, and the proceedings were reported in our pages as long ago as December, 1902. We wish it were our duty to record full settlement, even after many days, a little more frequently.

According to a notice in the *London Gazette*, the estates of FRANCIS MCKAY, electrical engineer, 25, Elmbank Crescent, Glasgow, were sequestrated on August 24th. A meeting to elect trustee and commissioners will be held on September 4th at Glasgow, and a composition may then be offered.

JOHN TIZZARD, electrical engineer, Torquay.—Last day for receiving proofs for dividend, September 20th. Trustee, Mr. A. E. Ward, 9, Bedford Circus, Exeter.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." August, 1912. Vol. XXXI, No. 8. New York: The Institute. Price $1.

"The Central." August, 1912. Vol. IX, No. 28. Reading: Old Centralians Association. Price 1s. 6d.

"Year-Book of the Michigan College of Mines." 1911-12. Houghton, Mich.: The College. 1912.

"*Journal* of the Franklin Institute." August, 1912. Vol. CLXXIV, No. 2. Philadelphia, Pa.: The Institute. Price 50 c.

"*Journal* of the U.S. Artillery." July-August, 1912. Vol. XXXVIII, No. 1. Fort Monroe, Va.: Coast Artillery School Press.

"Handbuch der Elektrizität und des Magnetismus." By Prof. Dr. L. Graetz. Leipzig: J. A. Barth. Price M. 6.

"*Proceedings* of the Forty-fifth Annual Convention of the American Institute of Architects." 1911. Washington: The Institute.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 4. April, 1912. Chicago: The Society.

"The Motor-Generator: In Theory and in Practice." By J. W. Barber. London: Ganes, Ltd. 1912. Price 1s. net.

"Mémoires sur L'Electricité et L'Optique." By A. Potier. Paris: Gauthier-Villars.

"*Journal* of the South African Institution of Engineers." Vol. X, No. 11. June, 1912. Johannesburg: The Institution. Price 2s.

The Finsbury Technical College Old Students' Association *Magazine* for August mentions that Mr. R. J. Wallis-Jones has presented to the Association (of which he is past-president) the dies for a handsome medal, which he will present to the author of the best paper read by a member of the Association during the year ended June 30th, 1912. Such papers must be sent to the Hon. Secretary not later than 31st inst.

"Life Understood." By F. L. Rawson, M.I.E.E. 1912. London: The Crystal Press. Price 7s. 6d. net.

The A.E.G. in Mexico.—The A.E.G. Co. have founded a subsidiary company in Mexico with the title of "A.E.G. Compania Mexicana de Electricidad S.A." This company's sphere of operations will not be confined to Mexico alone, as it will operate in Cuba and Central America as well. Its managing directors will be Messrs. Friedrich von Bluecher and Otto Ruesche.

Ductile Filament "Goblin" Lamps.—MESSRS. DAVID SMITH & CO., of 2 and 3, Red Lion Court, E.C., inform us that they have now an improved lamp on the market, the filaments of which are stronger than anything yet produced, and even after burning 2,000 hours are found to be as flexible as before use. Other special features are that the lamp will not blacken under any conditions; also, it will not sag, and it can be used at any angle. According to a test at the National Physical Laboratory on six lamps of 205 volts, 32 to 36 watts, the average wattage is 1·27 British standard candle-power. The lamps can be made any size or shape required, and all standard voltages and candle-powers are kept in stock at the company's London warehouse.

Liquidation.—TRACTION SUPPLIES CO., LTD. (in liquidation).—At the meeting of creditors, held on August 15th, the statement of affairs as at July 30th, 1912, showed liabilities as follows:—Share capital issued, less £3 calls unpaid, £2,200; secured creditors, &c., including debentures (£700), £720; unsecured creditors, £1,175. The assets, consisting of stock-in-trade, plant and machinery, work in progress, fixtures and fittings, patents and debtors, all as shown in the books, amounted to £3,116, and were estimated to produce £945: cash in hand, £2. Deducting the amount of secured and preferential creditors, £720, there was left for the creditors and the cost of winding up £227. A scheme of reconstruction was submitted by Mr. White, the manager of the company, which proposed that the creditors should agree to accept payment of their accounts in instalments, amounting to 10s. in the £, and take preference shares in the company for the remaining 10s. in the £. A committee was appointed to confer with the debenture-holders in regard to the scheme, and a meeting took place on the 21st inst., but as debenture-holders representing £460 of the £700 debentures were were not in favour of the scheme, it was decided to ask all the debenture-holders to meet the creditors at their adjourned meeting on the 26th inst., to discuss the scheme. This meeting took place on August 26th, but as there was no change in the attitude of the debenture-holders in regard to the scheme, a resolution was passed confirming the appointment of Mr. Thomas Metcalf as liquidator, and electing an advisory committee of three, consisting of Messrs. C. Bertram (Henley's Telegraph Works Co., Ltd.), H. Barkes (British Electrical and Manufacturing Co., Ltd.), and A. L. Cook (Cook Bros.), representing the creditors, to assist the liquidator.

Catalogues and Lists.—Messrs. Souper and Callaghan, 16, Deansgate, Manchester.—Illustrated leaflet relating to a new workshop combination tool, combining on a single bedplate the following :—Rotary blower forge, anvil, mechanic's vice, pipe vice, emery wheel and drill press.

The Electrical Co., Ltd., Charing Cross Road, London, W.C.—Thirty-two-page pamphlet entitled "Sunshine after Sunset," giving very full particulars of the "Sunshine" flame arc lamps, their construction, operation, users, prices and so forth.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Sixty-four-page pocket list, containing a large amount of illustrated matter, together with prices, of their Holophane globes and reflectors. In addition to their standard line reflector bowls, sphere globes, and residence reflectors, there are the new "Bank" and Billiard lighting units, Holophane-Benjamin steel reflectors for mill and factory lighting, the new "Uniflux" reflector for picture lighting, &c. Information is published regarding use, spacing, light distribution (with curves), &c. Copies of the booklet will be supplied overprinted with contractors' or supply companies' names.

The Schniewindt Electric Co.—Illustrated leaflet describing their "Stangerotherm" electro-medical specialities, and the manner of their application. Copies can be obtained on application.

The Phelps Manufacturing Co, Detroit, Mich., U.S.A.—Bulletins relating to motorless flashers for electric advertising and other signs, also to small electric-heating devices.

Messrs. Ferranti, Ltd., 78, King Street, Manchester.—Eighteen-page illustrated list (No. H302) relating to totally enclosed high-tension ironclad panels, the matter being arranged in a special manner to facilitate cabling orders from abroad.

Trade Announcements.—The Walsall Electrical Co., Ltd., announce that, owing to Mr. S. H. Fielden, their London agent, having decided to go abroad, they are at present unrepresented in the London district. All inquiries should be forwarded direct to Walsall for the present.

The North-West Electrical Appliance Co., of Railway Appliances Works, Darlington (formerly of Glasgow), have changed the name of the firm to the Arc Lamp Lowering Gear Co. There is no alteration in the management, &c,, of the business.

The British Thomson-Houston Co., Ltd., have opened a branch office at 25, Suffolk Street, Dublin (Tel. No. 1557), where they will hold a complete stock of lamp and wiring supplies.

The business of Jens Orten-Boving & Co. will henceforth be carried on under the title of Boving & Co., Ltd., the latter company having been formed, with a capital of £60,000, one-half in preference and the other half in ordinary shares. The change has been made in order to facilitate dealing with the great growth in the business. The partners in the old firm (Messrs. Jens Orten-Boving and Douglas Spencer) will act as joint managing directors in the new company. The business will be conducted on the same lines as before through the London office (9½, Union Court, E.C.), and through the various branch offices abroad.

From to-morrow, 31st inst., the Electrical Accessories Department of the Metallic Seamless Tube Co., Ltd., will remove from the works to more central premises at Meta House, 153, Corporation Street, Birmingham. Telegraphic address: "Meta, Birmingham": Telephone No.: Central, 3414. Larger stocking facilities and a fittings showroom will be among the features of the new premises.

Mr. H. Gielgud has transferred the goodwill of his iron and steel merchant business, also his agency for the Société Anonyme des Acieries d'Angleur, of Tilleur, Belgium, to Messrs. Andrew Brown & Co. (successors to H. Gielgud), 7a, Laurence Pountney Hill, E.C.

Mr. G. H. Baker is commencing business as a lighting engineer at 59, Station Road, Bexhill-on-Sea.

South America.—The *Review of the River Plate* says that the Government has authorised the Sociedad Anonima A.E.G. Cia. Sud Americana de Electricidad to open a branch in Argentina. This is a branch of the A.E.G. Co., of Berlin, which has hitherto been represented in the market by an agency.

Stock List.—The Victoria Dynamo and Motor Co., of Craven House, Kingsway, London, W.C., are holding a large stock of standard A.C. and D.C. motors for immediate delivery. Their August stock list appeared in our advertisement pages last week

LIGHTING and POWER NOTES.

Acton.—At the last meeting of the Council, the chairman reported that the Metropolitan Electric Supply Co. had intimated that, subject to a settlement being come to as to the terms for the supply of electricity for main street lighting and sewage pumping, it would accept the final offer of the Council of £3,000 in full settlement of all outstanding disputed items on either side in connection with the transfer of the local undertaking. Accordingly, an interview was arranged between representatives of the Council and the company, and, as the result, the following recommendation was submitted to the Council for confirmation: "The confirmation of the Council's final offer, with the following alterations or variations: (*a*) The company to continue to supply electricity to the sewage pumping station (with no restriction as to user by the Council, who will use their best endeavours to avoid the pumps being used during the peak load except in cases of emergency) at the present flat rate of 1¾d. per unit; (*b*) the Council to accept the company's offer for main-street lighting for five years, viz., 94 lamps of 450 C.P. each, at an annual cost of £900; (*c*) the amount of rent for the site of the generating station to be settled by a friendly arbitration between the Council and the company; (*d*) the way-leave for the cables through the Acton Park, in the amended line agreed, be granted by the Council in accordance with the terms of the draft agreement already settled between the parties, and the seal of the Council affixed to an engrossment of the same in time for the company to commence work by September 1st, 1912." On the question being raised at the interview, it was mentioned that the company would be prepared to supply electricity to all the Council's buildings at present lighted by electricity, excluding the Council offices, library and baths, at a flat rate of 4d. per unit, but no recommendation was made thereon. The chairman, in moving the adoption of the recommendations, said that the Council had before it the very best that could be done. Councillor Poulton said he hoped the agreement would not be accepted, as he did not see why the company should have the lighting of the main roads when the gas company had offered to do it for £500; nor did he approve that part of the agreement which was to allow the company to charge at the rate of 1¾d. per unit for current at the pumping station. He thought the Council ought not to pay more than 1¼d. The Chairman stated that he himself did not like the terms, but it must be remembered that the position was that the Council either secured the £5,710 from the company or went to law and fought for it. In the result, Councillor Poulton withdrew his opposition, and the recommendations, with a slight amendment, were carried.

Argentina.—The Mayor of Buenos Ayres has signed an *ad referendum* contract with the Cia. Italo-Argentina de Electricidad for establishing electric light and power stations in the Federal capital. The concession is for 50 years, at the termination of which the Corporation can take over the plant, paying the amount of capital not amortised: or, on the other hand, the concession can be extended for a further period of 25 years, at the end of which all would revert to the Corporation without cost. If the latter project is adopted, the company will pay the Corporation 6 per cent. of its gross revenue and 15 per cent. of its profits.—*Review of the River Plate.*

Barton-on-Humber.—The U.D.C. has accepted the offer of Mr. F. Hopper, on behalf of a local syndicate, for public lighting by electricity from August 1st, 1913, at £2 2s. per lamp per annum.

Belfast.—On and after October 1st, electricity used for driving machinery in connection with lighting apparatus will be charged for at the current rates for lighting, and all consumers at present being charged at power rates for the same purpose will be charged at lighting rates.

Blackpool.—The Electricity and Street Lighting Committees have decided to illuminate the new Princess Parade during the whole of September. The smaller gardens will be pointed out with vari-coloured electric lamps, the whole of the parade being encircled with fairy lights. Some 12,000 electric lamps will be employed, and the two Committees have agreed to bear the cost of the scheme, the illumination to be on the scale employed during the festivities which accompanied the opening of the parade in May, by H.R.H. Princess Louise.

Brazil.—The firm of Buxton, Cassini & Co. are erecting an electric power station at Pelotas, Rio Grande do Sul.

Canada.—According to the *Standard* correspondent, the Canadian Light and Power Co. has secured the assent of the shareholders to an increase in the capital stock from $6,000,000 to $7,000,000. The company, which is a subsidiary of the Montreal Tramways and Power Co., will complete a dredging project in the Beauharnois Canal this autumn, which will give them a total of 30,500 H.P. The company has been operating to part of this capacity since the beginning of the year. Once the present work is completed it is understood that the flow of water and the amount of power which the company can develop will be increased by further dredging operations and enlargement of plant. The Shawinigian Water and Power Co., which delivers power in Montreal from a distance of about 100 miles, is asking the consent of its shareholders to an increase in its stock issue from $10,000,000 to $15,000,000. The company last year completed a new installation of two units of 15,000 H.P. each, bringing the capacity of the plant up to 85,000 H.P. It is presumed that the increase in capital will be to install three further units of 15,000 H.P. provided for in the recent development. The Cedar Rapids Power and Manufacturing Co., which is now building a plant at Cedar Rapids, is understood to be about to close two contracts for 50,000 H.P. each, to be delivered on the completion of the plant in about two years' time.

Cavan.—The Urban Council is proceeding with the scheme for electric supply to the town, both for public and private lighting.

Continental Notes. — Austria.—The Poetovia Co. located at Pettau in Steiermark has secured the concession to utilise the water-power of the River Drau, from Pettau to Friedau, for a period of 90 years. This section, 30 km. in extent, comprises the best portion of that river. The plans, drafted by the Swiss engineer, S. Spychiger, contemplate the transmission of 65,000 H.P. over a distance of 240 km. at a pressure of 110,000 volts. The power stations will be equipped with seven Francis turbines, each with an output of 6,600 H.P., giving an 8-monthly capacity for the first power house equal to 39,400 H.P., and for the second, 25,600 H.P., or a total of 65,000 H.P. The Oesterreichischen Siemens-Schuckert Werke have prepared the plans for the generating plant, the pressure at the terminals being 10,000 volts and on the mains 110,000 volts. The undertaking has been designed to serve the whole of Steiermark, including that part of Lower Austria, where are situated the densest and most numerous industrial populations, but near the stations the call for current is relatively small. The total cost of the scheme, including concession, plans, &c., is estimated at 20,000,000 kronen or 300 kronen per horse-power at the turbines. —[illegible]

France.—According to the [illegible] several districts in the most fashionable part of Paris were thrown into darkness on Sunday night by the rupture of an electric cable of the Place Clichy section. All the large hotels, cafés and restaurants in the Champs Elysée's quarter were affected.

It was at first thought that "King" Pataud, the director of the electricians' strike in Paris last year, was again becoming active.

A new company has just been formed at Nancy, with a capital of £40,000, and the title La Société de l'Energie Electrique de l'Est.

Germany.—The efforts made by the Uberlandcentrale zu Mulhausen, a private company, to develop the use of electrically-driven weaving machinery in the Eichfeld district, have met with a fair measure of success. Some 20 installations have up to the present been made. It is expected that within a measurable period the whole of the hand looms in use by the villagers in the Eichfeld district will be superseded by electrically-driven machines, as it becomes recognised that the quality of the woven product is better, and the output of the individual weaver is greatly augmented.

Italy.—There is great discontent amongst the consumers outside the town of Modena in consequence of the insufficient supply of electrical energy for manufacturing purposes. Unless a better supply is provided, some of the factories threaten to close.

A referendum of the town of Bagnocavallo has been taken on a proposal to adopt municipal electrical works for the town. The vote is in favour of the proposal.

The Adriatic Co. is completing the electrical installation in the town of Badiu-Polesine, which will be inaugurated during the autumn. Also the inter-provincial installation of telephones in the district is being rapidly proceeded with and will in a short time be completed.

Messrs. Bianchi, Steiner & Co., of Milan, have applied to the prefectural authorities of Belluno, for a concession to utilise the water-power of the River Piave al Mel in the generation of electrical energy for lighting and power purposes in the town of Fener. It is stated that about 6,000 H.P. will be available.

Spain.—A company has been formed in Paris under the style of the Energie Electrique du centre de l'Espagne, with a capital of 1.250,000 fr. for the purchase, building, and working of power stations for the generation and distribution of electric current for lighting and power purposes, primarily in the centre of Spain, but optionally elsewhere.—*L'Industrie Electrique.*

Doncaster.—The R.D.C. has decided to accept the offer of the Manvers Main Collieries, Ltd., for lighting by electricity the roads from the Swinton and Knottingley Railway Bridge, Roman Terrace, to Wath Crossing, and from Adwick Sidings to Hound Hill Bridge, Adwick-on-Dearne.

Dudley.—At the next monthly meeting of the T.C., the members will consider an offer to purchase the Corporation's electric light undertaking, which was founded in 1899 in order to carry out what became well known amongst municipalities as the "Dudley Tramways Agreement." The substance of this was that the Council should supply electrical current for the whole of the tramways within the borough; that it should subsequently purchase when completed, the tramways and rolling stock of the British Electric Traction Co., which constructed the lines, and lease the same to the company for a period eventually settled at 30 years. Up to date there has been spent upon the works £98,460. From 1903 till 1909 the undertaking returned an annual profit of about £500; but the Committee, it is stated, never made any allowance for depreciation of plant. The net profits were consequently held in reserve, and have been absorbed. In 1910 there was a loss on the year's working of £600. The report issued in March, 1911, stated that the income had been £13,000, as against £12,091 in the previous year, making the gross profit £5,959, an increase on the year of £135. The undertaking had been, however, debited with £500, the cost of a B. of T. arbitration, which had reduced the price of current supplied for tramway purposes, and the loss on the year's working was £1,206. But for the arbitration and its unfortunate result, it was noted that there would have been a net profit of £302. The rent from the tramway company amounts to £5,923, and the amount it paid for current at 1d. per unit during the year ended March last was £4,000. Private consumers are supplied at from 2d. to 3¾d. per unit, according to the amount required, and power is being supplied to manufacturers at from ·95d. to 1¼d. per unit. The sum repaid on the electricity loans is £30,000, reducing the amount outstanding to £68,000. An estimate of what it would cost to convert the business into a paying concern is £30,000, and rather than boldly face this expenditure the Council, at its meeting in September, will discuss the advisability of selling the works.

Fife.—A new contract has been arranged with Messrs. R. Bruce & Son, contractors, Edinburgh, for the construction of an electric power station at Crombie, near the new naval dockyard at Rosyth. This power station will have its site near the western extremity of the Admiralty's ground, and will be used for the purposes of the Naval Explosives Works. No details are yet made public of the installation, but it is understood that it will be on a comprehensive scale.

At the new power station for the large dock at Methil, on the Firth of Forth, the work of installation is being carried through by the North British Railway Co. themselves. Practically, the station is now equipped and ready for duty.

Greenock.—The negotiations which have proceeded for some considerable time now for the purpose of bringing Port Glasgow within the Greenock electric supply area proper have fallen through. This emerged at the last meeting of the Greenock T.C., at which, it was explained by Mr. J. W. Bailey, the convener of the Electricity Committee, that Port Glasgow Corporation had not only refused to give Greenock T.C. the guarantee asked for, but had refused to meet and discuss the propositions. All Greenock asked was that it should have security for its capital in giving a supply to the six power users, but in doing so it did not intend to prevent Port Glasgow obtaining a lighting supply throughout the burgh at any time during the period of agreement. Greenock Corporation was better able to give that supply than any other authority, but should it decline to do so, it would put no obstacle in the way of any other company or authority giving the supply. Complications had really arisen through the B. of T. inserting a provision regarding the purchase of the Greenock plant, and if the Board had given an indication when first approached four months ago that such a condition would be attached to the order, Greenock might have adjusted terms with Port Glasgow before lodging the application. When the position was made clear and the matter discussed in a friendly spirit he believed they would be able to come to an agreement which would ensure to Port Glasgow T.C. that it would not be prevented from obtaining a lighting supply throughout the burgh because of Greenock's supplying the six large power users. The minutes were subsequently approved.

Hindley.—The B. of T. has informed the U.D.C. who had asked for a further extension of time of the Provisional Order, that the grounds submitted for further extension would not justify the Board in continuing the order.

Honiton.—In regard to our note under this heading, last week, we are asked to state that the Honiton and District E.S. Co. have obtained the contract to install electric light and to supply electricity at the workhouse—not the Devon E.L. Co.

Hoylake.—The condition of the U.D.C.'s electrical undertaking was reported upon at a recent meeting, when Mr. English, in moving the minutes of the Electric Supply Committee, said the profits of the past year amounted to £400, although he had only anticipated a net profit of £250. The amount would go to the capital account of the undertaking, which now stood at £2,600, and in a few years £4,000 would be reached.

Leek.—The U.D.C. has decided, in connection with the charges for electricity, that a flat rate of 4½d. per unit be offered for factory lighting, in future, as an alternative to the maximum demand rate. It is thought that this will be an advantage to consumers in simplifying the charges, and will not make any real difference to the Committee.

Mexico.—The Compania Idroelectrica Mexicana has been founded in Mexico with a capital of 30,000,000 pesos. The falls on the River Naranjo will be used to supply power, and a station will be erected there with a capacity of 65,000 H.P. This station will cost 2,000,000 pesos to erect, and the plant will be supplied by the Siemens-Schuckert-Werke. The capital of the company has been chiefly subscribed in France.

Norwich.—On Tuesday night the serious flooding of the city owing to the recent rain, reached the Corporation electricity station, where the boiler furnaces were drowned out, and the whole of the electricity supply cut off. The position is a serious one for electricity users, and, we believe, the tramway undertaking has also suspended operations.

Nuneaton.—The T.C. has arranged to replace each year, for three years, 50 street gas lamps by electric lamps.

Peterborough.—At the meeting of the T.C. on Tuesday, the city engineer reported that an extension of the generating plant at the Corporation works, and probably of the buildings also, would in all likelihood be required to meet the increasing demand in the winter of 1913-14. The engineer was instructed to prepare alternative reports and estimates for extensions by the H.T. alternating and L.T. continuous current system.

Owing to the great floods, the Corporation electricity works have been surrounded by water, access to them being obtained only by means of planks laid on brick supports. The works lie on slightly rising ground, but cottages adjoining have had two to three feet of water in their lower rooms

Philippine Islands.—According to the local Press, a company, with a capital of about £153,000, has been formed, for the purpose of generating electric power from the Agno River for supply to the mining plants and saw mills on the river, and for the lighting of Bagnio.—*Board of Trade Journal.*

Rawtenstall.—The L.G.B. has forwarded its sanction to the borrowing of money by the Corporation for the extension of the existing engine room, a new generating set and switchboard, mains, rotary converter, transformer, &c., at the electricity works.

South Africa.—At a meeting of the Durban T.C., held on July 30th, the Electrical Committee's recommendations with regard to the amendment of the tariff for the supply of current to private residences were discussed and approved. Under the new arrangement, users can remain on the old tariff, if they prefer, or enter into an agreement to come on to the new tariff for a period of at least 12 months, after which period three months' notice has to be given if for any reason it is desired to again revert to the old tariff. Briefly, the new tariff is based on a certain number of units (at 6d. per unit) in proportion to the rateable value of the house, but not the land, as a minimum charge; and, thereafter, all units at ¾d. per unit. The object aimed at in this tariff is the encouragement of electric cooking and heating, which it is anticipated will be largely taken up. The minimum for a brick house rated at £200 is 10 units; £400, 16 units; £800, 24 units; £1,000, 26 units, and so on, up to a maximum of £1,200, with a minimum of 29 units, and all current consumed in excess of the foregoing minima will be charged at ¾d. per unit, less the usual 10 per cent. if paid for within seven days.

This tariff comes into force at the option of any consumer as from August 1st, and does away with the present cheap-rate day supply, which is controlled by a time switch. The Committee has yet to consider a tariff suitable for other consumers other than private residences, and also the question of hiring out apparatus.

Ordinances have now been passed, authorising the T.C. of Pietermaritzburg to borrow £50,000, of which £41,000 is for the purpose of extending the electric supply undertaking within the borough, and £9,000 for the erection of a bridge over the Umsiudusi River; also authorising the T.C. of Ladysmith to borrow £25,000, of which £12,000 is to be spent on improving the electric lighting and power system of the town.

Swanage.—The B. of T. has deferred the question of revoking the E.L. Order, 1906, for three months from June 29th. Dr. Purves, of Exeter, has the electricity scheme in hand.

Tasmania.—An offer has been made by the Hydro-Electric Power and Metallurgical Co., which is erecting its station at the Great Lake in the centre of Tasmania, to the Hobart City Council to supply electric power for the tramways, which the Council is about to purchase, at ¾d. per unit up to 476 H.P., and ½d. per unit for all above that amount. The offer is for a 10-years' contract, and may be renewed for 10 years at the flat rate of a ½d., the Council to have power for all municipal purposes at the same rate. The company would also lease the present power station and plant, using the building as a transforming station and the plant as a stand-by, and paying £750 a year rent. The company would take over without the tramways, the Tramways Co.'s present contracts for lighting and power.—*Australian Mining Standard.*

Wellingborough.—The E.L. company has offered to dispose of its undertaking to the U.D.C. for £27,000. The Council has informed the company that the price is very much in excess of what was anticipated, and the offer will not be entertained.

TRAMWAY and RAILWAY NOTES.

Argentina.—The firm of M. Herlitzka y Cia., Sociedad Para Empresas Electricas, which works with the support of the Banco Frances del Rio de la Plata and French capitalists, has secured the control of the generating stations at Bragado (Buenos Ayres), Necolhea (Buenos Ayres), San Juan and Resistencia, with the telephone network. A short time ago it founded the Compania General de Ferro-Carriles Economicos, which has acquired the narrow-gauge line from Corrientes to Caa-Caty and Mburucuya, with other extension concessions, and the tramway company in Corrientes with a 22-km. steam and electric track.—*Elektro. Zeitschrift.*

The Santa Fe municipality has been treating for the transfer of the Winby concession for electric tramways to the firm of Parcus and Co., of Buenos Ayres.

Australia.—A deputation, representing the 76 municipalities in and around Melbourne, has waited on the Premier to ask his support in introducing to Parliament a Bill for taking over and extending the Melbourne tramways, providing for cheap sectional fares, and that all municipalities should share in the profits or losses, as the case might be.

Birmingham.—Mr. Baker, the general manager of the tramways, is preparing a scheme showing the probable cost and working charges of a system of railless cars.

It is stated that the Tramways Committee contemplates introducing a service of single-deck cars on the new route along Hagley Road.

Bradford.—The receipts on the Corporation tramways for the 139 days of the present financial year have been £113,555, a decrease of £2,232, as compared with the corresponding period of the previous year.

Continental Notes.—Italy.—The Italian Minister of Public Works has received a provincial deputation representing Rovigo, Mantua and other provinces, when evidence was put before him illustrating the importance of a network of tramways approximating 200 KW., and the urgent necessity of putting such work in hand without delay. This will be the largest network in Italy. Discussing the preliminary financial questions, the Minister assured the deputation of the sympathy of the Government in a matter of such apparent necessity, which would so greatly facilitate intercommunication between the numerous provinces concerned. The deputation left the Minister with the firm impression that it would be possible to put the work in hand at an early date.

A large network of tramways is now being advocated and studied for the district of Reggio. Representations have been made to the Government concerning the construction of five important lines running into the various suburbs. Engineers from Rome are working on the project.

Germany.—The Ruhr-Lippe Light Railway Co. is considering the question of converting its line between Arnsberg and Solst to electric traction.

Dublin. The *Freeman's Journal* has a quarrel with the Dublin United Tramways Co. on the question of fares. The complaint is that three separate 1d. fares will carry the passenger over a greater distance than one 4d. through fare on the same route; also that 3d., 4d. and 5d. fares are made up of overlapping 1d. fares. The *Journal* asks if, when the Dublin Corporation insisted on minimum 1d. stages, it was intended that these stages should overlap, and through passengers pay twice over for portions of the journey. The question of half fares for children is also brought forward.

Glasgow.—At its last meeting, the Tramways Committee had a number of topics under discussion. Succinctly the findings were: That the general manager should continue with the experiments in the welding of rail joints; that more motor meters, such as are at present in use on the cars, should be purchased; and that the proposal for the erection of cottage dwellings for employés upon the vacant ground at Newlands depôt be continued meantime.

Oswaldtwistle.—With reference to the question of the rating of tramways, upon which there was an appeal in the law courts pending, it was stated by Mr. A. Hargreaves at the monthly meeting of the Oswaldtwistle U.D.C. that unless the decision was reversed the Council would only receive a quarter instead of the full rate from the Accrington and Blackburn Corporations. The Blackburn authority, he was glad to notice, had this year sent its full rate, but he could not say the same of Accrington. The latter had deducted three-quarters of the rates, and he thought it would only have been courteous on its part to have refrained from making any deduction until the question was definitely settled. The Oswaldtwistle Council allowed the Accrington Corporation to construct tramways in Oswaldtwistle on the understanding that Oswaldtwistle received the full rateable value. If that had not been understood, Oswaldtwistle would have gone in for a larger share of compensation from Accrington. In Mr. Hargreave's opinion the Accrington Council ought to have sent the full amount or a note explaining why it did not.

Keighley.—A statement submitted last week to the Corporation reveals the fact that, whilst the working of the year ended March 31st last, shows a profit of over £1,100 in connection with the electric cars, there has been a loss of £2,437 on the motor-'buses running in connection with the department. The tramways receipts were £9.839, as compared with £9,616 in the previous year, and the 'bus receipts were £5,628, as against £4,935. In moving the adoption of the report, Mr. Smith said he did not think such a loss would be tolerated, but for the fact that the 'buses were feeders of the tramways. Alderman King (chairman of the Finance Committee) said he did not think the 'buses were feeders to an extent sufficient to justify a loss of £50 a week, and he intended to move, at the next meeting, that the 'bus service be discontinued. The report was adopted.

The Tramways Committee has been authorised by the Corporation to prepare a scheme of railless traction between the existing terminus at Ingrow and the junction of Haworth Road and Hebden Road, and to obtain tenders for the necessary equipment. This is in furtherance of a general idea of extension of the railless trolley system, which has found in Keighley, as elsewhere in the West Riding, considerable favour.

Ramsbottom.—In connection with the railless traction scheme the members of the Council have had an interview with Mr. J. B Hamilton, the manager of the Leeds tramway system and it is understood that the latter has been empowered to draw up specifications at an early date.

West Yorkshire Tramway Developments.—On all hands the network of electric tramways in the West Riding of Yorkshire is constantly becoming more intricate by reason of the frequent extensions of their respective systems by the local authorities of the crowded cities and towns of this industrial locality. At the present moment, Leeds, Bradford, Halifax, Huddersfield, Brighouse and others are concerned in various extensions of their routes. The latest project is a proposed arrangement between the Corporations of Bradford, Huddersfield and Halifax so to extend existing lines as to permit of through tramway service between Bradford and Huddersfield, *via* Brighouse, and also a connection between those towns and Halifax, only broken by reason of the smaller gauge of the Halifax lines, an obstacle which, of course, could, if necessary, be overcome by means of a third rail along the narrow-gauge tracks, or even by means of the extensible axle system which is already established, on the through Bradford to Leeds route. The Bradford authorities have decided to extend from Wyke to Bailiff Bridge. Halifax has 726 yd. of track between Bailiff Bridge and Brighouse, and Huddersfield proposes to apply for powers to construct a line to Brighouse *via* Raistrick. Halifax, realising that if Huddersfield carries out its intention, it might have to relinquish the Bailiff Bridge line to the Huddersfield and Bradford authorities on the ground of public interest, and also that, at any rate, much of the present traffic between Brighouse and Halifax would be diverted from that route, has decided to apply for powers to construct lines from Salterhebble, along Elland Wood Bottom to Elland, and from the present Brighouse terminus to Raistrick. These proposals have the approval of the Brighouse and Elland authorities, and therefore there seems to be no likelihood of opposition.

TELEGRAPH and TELEPHONE NOTES.

Australia.—According to a recent statement of the Postmaster-General, wireless stations are now open at Melbourne, Hobart, Adelaide, Brisbane and near Port Moresby. The Government intends to construct 10 other stations this year along the coast, and eventually the whole coast line will be linked up and connected with the Imperial system. It is reported by the *Australian Mining Standard* that negotiations are in progress between the wireless companies and the Government, with a view to the settlement of the disputes now before the High Court in respect of infringement of patent rights.

Wireless telegraphy is to be adopted for military purposes by the Australian Defence authorities.

Falkland Isles.—The Falkland Islands are to have a wireless telegraph station capable of communicating with Buenos Ayres and Monte Video.

Japan.—The connecting work on the cables between Fusan and Shimonoseki, and between Seoul and Fusan, is now completed, and a through telegraph service between Shimonoseki and Seoul has been opened.

Paris-Odessa.—It is reported from Odessa that apparatus has been installed there for correcting chronometers by the Paris Observatory through the wireless telegraph station on the Eiffel Tower, Paris, over a distance of 3,000 km.

Telegraphic Breakdowns.—During the past week, in addition to the fire at the G.P.O., London, reported elsewhere in this issue, the telegraph department has had to contend with serious troubles in the provinces due to the wet weather. A landslide in Norfolk isolated Norwich, Yarmouth and Lowestoft, on Monday evening, and the northern wires were working badly. Communication with Germany was also affected by the landslide.

Venezuela.—The Government intends to install wireless telegraph stations at La Guayra, Puerto Cabello, Maracaibo and Cumana. Provision for this will be made in the 1912-13 and succeeding Budgets.

Wireless Telegraphy from Aeroplanes.—The wireless apparatus designed for military aeroplanes by the Société Radio-Electricité weighs only 66 lb. and absorbs less than ½ H.P., with an antenna of 82 ft. Excellent results have been obtained up to a distance of over 50 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 11th. Electrical fittings, for the Powell Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. Stores Manager, Aberaman, near Aberdare (Form No. 26).

Australia.—New South Wales.—September [illegible]th. Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 2nd.—N.S.W. Government Railways. Six 1,000-KW. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, [illegible], Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" August 23rd.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

October 23rd.—100 common-battery table telephones, for the P.M G.'s Department. See "Official Notices" to-day.

Victoria.—September 3rd.—Six 60-K.V.A. transformers, for the Melbourne City Council. See "Official Notices" August 16th.

September 17th.—One fuel economiser, for the Melbourne Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" August 16th.

October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—November [illegible]. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Bedwas.—September 5th. Electrical goods for a year for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Bulgaria.—September [illegible]. The [illegible] Administration of Finances, in Sofia, is inviting tenders for the supply of a number of electrically-operated cranes for the Bulgarian State Railways.

Bury.—August 31st. Electric light installation for the Infirmary. Specification 20s. (returnable) from the Secretary at the Infirmary, Walmersley Road.

Costa Rica.—December 9th. Tenders are invited for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Felixstowe and Walton.—September 5th. Extensions to accumulators and balancer-booster, for the U.D.C. See "Official Notices" August 23rd.

France.—September 3rd. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a quantity of rubber-insulated electric cables.

Glasgow.—The engineer of the electricity department (Mr. W. W. Lackie, Waterloo Street) has been instructed to obtain and submit to the departmental committee offers for the supply of 400 additional flame arc lamps.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" August 9th.

London.—L.C.C.—September 24th. Electric spark gaps in brick cells for sub-stations. See "Official Notices" August 23rd.

Manchester.—September 10th. One 12,000-KW. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" August 9th.

Middleton.—September 11th. One 300-400-KW. steam dynamo, for the Corporation. See "Official Notices" to-day.

Newport (Mon.).—August 31st. Special track work, for the tramways, for the T.C. Mr. A. Nichols Moore, electrical engineer, Town Hall. (Returnable deposit of 10s. 6d.)

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Torquay.—September 2nd. One 1,000-KW. single-phase turbo-alternator, condensing plant and switchgear, for the T.C. See "Official Notices" August 16th.

Warrington.—September 11th. Electrical sundries, for six months, for the B.G. Mr. A. Bottomley, clerk, Bewsey Chambers.

West Ham.—September 12th. Electrical fittings for six months, for the B.G. (Form 15). Mr. Thos. Smith, clerk, Union Road, Leytonstone, N.E.

West Hartlepool.—September 3rd. High-tension three-core paper-insulated cables and low-tension rubber cables and wiring, for the Corporation. See "Official Notices" August 23rd.

September 14th. Steam, exhaust and other pipework, for the Corporation Electricity Department. See "Official Notices" to-day.

CLOSED.

Ashton-under-Lyne.—The water-cooling tower contract mentioned last week was placed with the Davenport Engineering Co., of Bradford, not the Bradford Engineering Co., as stated by us. We understand that there is no company with the latter name.

Australia.—The New South Wales Public Works Department has ordered two electric goods lifts for the new warehouse, "Bushell's" Stores, George Street North, Sydney, from Hydraulic Engineering and Hercules, Ltd., Sydney, for £1,190.—*Australian Mining Standard.*

Glasgow.—The T.C. has approved of the acceptance of the following tenders :—

Welding rails.—Tudor Accumulator Co.
91/17 E.H.T. single core cable.—St. Helens Cable and Rubber Co.
Three-core E.H.T. lead-covered cable.—National Conduit and Cable Co.
Traction street poles. Stewarts & Lloyds.
Fuel for depôts. John Kennedy & Sons. Wm. Young & Sons.

Johannesburg.—The municipality has accepted the tender of the Union Electric Co., of Johannesburg, for 20 "Union" transformers, ranging from 35 to 100 K.V.A., of the single-phase oil-cooled pattern, at a total price of £1,421.

Launceston.—The T.C. has accepted the tender of Messrs. Lord & Shand for installing the electric light at the municipal buildings, at £74 odd.

London.—Messrs. Francis Reade & Co., of Finchley, have obtained the contract for the electric lighting at Messrs. Carter, Paterson & Co.'s new depôt at Finchley, N.

Manchester.—Messrs. W. Geipel & Co. have secured the major portion of the Corporation contract for the two years' supply of time switches, for various sizes up to 100 amperes 500 volts, those for the two-rate power schemes being their latest model with oil-immersed switch.

Nuneaton.—The T.C. has accepted the tender of Messrs. Marshall, Osborne & Co. for an electrically-driven turbine pump, at £146, and that of the British Insulated and Helsby Cables, Ltd., for 600 yd. of ·05 three-core cable, at £127, and 880 yd. of 7/16 three-core cable, at £120.

Portsmouth.—The Tramways Committee of the T.C. has accepted the tender of Messrs. Cammell, Laird & Co., Ltd., for steel tires for tramcars, at £1 11s. 6d. each.

Rawtenstall.—The T.C. has accepted the tender of Mr. Geo. Bullock for a multi-jet condenser and the pipework and valves, &c., required at the electricity works.

Southend-on-Sea.—The T.C. has accepted the following tenders :—

Callender's Cable and Construction Co., Ltd.—Cables for two years.
Bristol Wagon and Carriage Co., Ltd.—Four rubber-tired wheels for motor tower wagon, £124.
British Thomson-Houston Co., Ltd.—Armature for tramcar motor, £23.
Worthington Pump Co., Ltd.—Pump and motor for fountain, £25, and centrifugal pump, £62.

FORTHCOMING EVENTS.

British Association. Wednesday, September 4th to Wednesday, September 11th inclusive. Meeting at Dundee.

North-Eastern Counties Electrical Exhibition.—Saturday, September 7th to Saturday, September 28th inclusive. At the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne.

Appointments Vacant. — Assistant engineer for the Burnley Union Workhouse, 35s. ; works superintendent (£130) and charge engineer (£90), for the Corporation Electricity Works, Bridlington. See our advertisement pages to-day.

NOTES.

Inquiries.—Makers of an electrically-propelled bath chair are asked for. A correspondent asks for makers or dealers in "Atroon," and also what this substance is used for.

London Telephone Service.—A circular, entitled "How Subscribers may Help to Improve the Telephone Service," has been issued from the Controller's Office, and is reproduced below :—

Many subscribers think that the question whether telephone service is efficient or inefficient depends upon the exchange alone. This view is entirely wrong. Quality of service depends upon the joint work of exchange and subscriber, upon the degree to which the work of each of the two parties helps or hinders the other. Each of the two parties has a definite work and responsibility which the other cannot take. It is, therefore, important that subscribers should bear in mind the following points :—

1. Telephonic transmission blurs the distinctive sounds of consonants and tends to make words containing the same vowels sound alike. In passing numbers, therefore, it is necessary to speak more distinctly than in ordinary conversation. There is great risk of confusion between five and nine, and much difficulty in distinguishing between two and three. Special care in passing these numbers is, therefore, necessary.

2. Each figure in a number should be given separately, thus—"1234" should be given as "one—two—three—four" and not as "twelve hundred and thirty-four" or "one thousand two hundred and thirty-four."

Double figures should be given thus—"2234" as "double two three four." "0" should be given as "Oh" and not as "nought"—except in the case of even thousands, when the word thousand should be used.

3. It is the duty of the operator to repeat every number passed by the subscriber, in order to give the subscriber an opportunity of correcting any misapprehension. If in any case the repetition is not clear, the operator's attention should be called to the fact. If the repetition is incorrect, the right number should be repeated very distinctly, with emphasis on the figures misunderstood.

If the operator is not sure she has taken a number correctly it is her duty to ask the subscriber to repeat the particulars. Prompt compliance with the request is of great assistance to the service.

4. To gain the operator's attention after she has taken a number, the receiver rest should be moved up and down at the rate of about one depression per second until the operator answers. The movement should cease directly an answer is received.

5. If you wish to bring any difficulty under notice ask the exchange for "Clerk in Charge." If the difficulty cannot be settled by this means, ask for the Exchange Manager.

Marked improvement in the service will inevitably result if subscribers, as a whole, act upon the foregoing suggestions.

Annual Outing.—On Thursday, August 22nd, in connection with their recreation club, a party of officials and employés of the Mexborough and Swinton Tramways Co. paid a visit to London. The party, consisting of motormen, conductors, and station staff, was accompanied by Mr. G. Priestly, engineer and manager ; Senior Inspector H. J. Smith ; Inspector A. Hayes ; G. Durber, chief clerk ; and a few local gentlemen. By the permission of Mr. E. Cross, engineer and manager of the Rotherham tramways, and Mr. A. R. Fearnley, of the Sheffield tramways, the party were conveyed by special through-car from the Rawmarsh depôt to the Sheffield Midland Station. Luncheon was served *en route* to London, and following a prepared programme, a tour of the Metropolis was made, and many places of interest were visited, London being seen at its best in glorious sunshine. After tea, part of the company spent the evening at music halls, whilst others visited the "White City." We are informed that it was a happy company that met again at St. Pancras at 12.35 a.m.

Electrical Fatalities.—According to reports in the daily Press, a woman and child were killed, and a second woman was seriously injured by electric shock at Fodderty Glen, near Dingwall, on Monday. An overhead electric conductor running from Raven's Rock to Dingwall short-circuited and fused, subsequently falling on the grass, through the falling of a tree branch owing to the heavy rain. An 11-year old child observing the sparking put her foot on the wire and was killed immediately, her foot and hand being burned. A woman was killed in attempting her rescue, and the girl's own mother received a bad shock in attempting to remove the wire from the earlier victims.

Educational. — UNIVERSITY OF LONDON, Goldsmith's College, New Cross, S.E.—An announcement is made in our advertisement pages to-day regarding evening courses in the various branches of engineering, &c. The session commences on September 23rd.

UNIVERSITY OF LEEDS.—Notice is given in our advertisement pages to-day regarding the departments of electrical and mechanical engineering, fuel, &c. The next session commences on October 1st.

Institution and Lecture Notes.—At the International Congress of Mathematicians at Cambridge on Monday, Sir J. J. Thomson lectured on "Multiply Charged Atoms." The lecture, which was illustrated by experiments, dealt with recent developments of the author's method of determining the chemical constitution of atoms and radicles, and the existence of groups hitherto undetected, by means of their electric charges as determined by deflection of the path of the projected radicle in electric and magnetic forces, when such forces are applied to very small quantities of a substance placed in a highly exhausted vessel.

On Saturday Sir W. H. White delivered a lecture on the place of mathematics in engineering practice. He said that an adequate knowledge of mathematics must be possessed by every educated engineer. Some authorities now favoured special courses in "practical mathematics"; others believed that engineers should be taught by professional mathematicians, because this method must lead to broader views and greater capacity for original investigation. His experience led him to rank himself with the supporters of the latter view, and this view had now been adopted at the Imperial College of Science and Technology.

A joint excursion of the National Association of Colliery Managers and the Association of Mining Electrical Engineers took place to Loch Lomond on Saturday. About 150 took part.

The Norwich Floods.—As we go to press the following notice comes to hand from Messrs. Laurence, Scott & Co., Ltd., Gothic Works, Norwich:—"Owing to the disastrous floods, the stoppage of post and railway traffic, and the fact that our offices and works are deeply flooded, we regret that there must be an unavoidable delay in attending to all correspondence." We are quite sure that all our readers will feel sympathy with the firm, with the other electrical undertakings, and, indeed, with everybody in the city of Norwich and the Eastern Counties in their present unparalleled experiences.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. FRED TYRRELL, late chief assistant to the Ascot District Gas and Electricity Co., has been appointed commercial assistant to the Battersea Borough Council electricity department for the west district.

MR. CECIL D. FALCKE, chief engineer and manager of the Stratford-on-Avon Electricity Supply Co., Ltd., has accepted an important appointment in London. MR. JULIAN G. THAIN, chief assistant engineer, has been appointed chief engineer and manager, and takes up his new duties on the 1st prox.

General.—At St. Hilda's Church, Westcliff, Whitby, on August 21st, the marriage took place of MR. HENRY FIRTH, electrical engineer, of Whitby, and Miss S. Willis, youngest daughter of Capt. James Willis, of Crescent Avenue, Whitby.

MR. LEONARD ANDREWS, joint managing director of the Canadian British Engineering Co., Ltd., which was recently floated for the promotion of trade with Canada, is sailing for that country on the *Laurentic* to-morrow in connection with the further organising of the company. Since the objects of the company were made known in May last, the directors have been approached by a large number of British manufacturers who apparently look upon the new organisation as being a means of successfully catering for the Canadian market; but although the company have been offered a large number of other agencies, they have not entered into any agreements other than those mentioned in their prospectus, as they have been anxious to avoid taking up any agencies until they are satisfied that they can handle them with credit to themselves and their principals. One of the objects of Mr. Andrews's coming visit to Canada is to ascertain what are the particular products of British engineering works for which there is the greatest demand in Canada, the company's intention being to concentrate their efforts in the first instance principally upon these lines. They have been glad to learn from British manufacturers that they are, in practically all cases, prepared to make any modifications to their standard designs that the company advise them are genuinely necessary in order to meet the requirements of the Canadian market, and many of the principals of British firms have assured the company that they will be prepared themselves to visit Canada to acquaint themselves better with the conditions there, and assist the company to introduce their manufactures, immediately they receive an assurance that the demand for their particular products is sufficient to justify this step. During Mr. Andrews's absence in Canada the English end of the business will be under the direct management of his colleague, Mr. Reginald Porter, who has for some years been a co-director in the Key Engineering Co., and has now joined the board of the Canadian British Engineering Co.

The marriage took place in London last Saturday week of MR. C. W. CROSBIE to Miss Margaret Hearn, a well-known Northampton singer. Mr. Crosbie was with the British Westinghouse Electric and Manufacturing Co., Ltd., for 10 years down to October last, when he joined Messrs. Ferranti, Ltd., as deputy sales manager in the meter sales department. Upon Mr. Reisch's resignation in February last, Mr. Crosbie took over the representation of the South of England for meters and electric cooking and heating apparatus.

MR. H. PERKINS, of Messrs. A. Emanuel & Sons, Ltd., who has represented the firm for some years in the Midlands and Eastern Counties, has been appointed their south coast representative.

Obituary.—The death occurred at Brayford, Oxford Road, Moseley, Birmingham, on August 20th, of MR. EDWARD D. PRIDEAUX, electric fittings manufacturer, of Birmingham. Deceased was 63 years of age.

NEW COMPANIES REGISTERED.

Walton & Clough, Ltd. (123,815).—This company was registered on August 17th, with a capital of £8,000 in £1 shares (5,000 5 per cent. preference), to take over the business of electrical, mechanical, mining and general engineers, carried on by C. C. F. Walton and C. H. Clough, at Horton Works, Beckside Road, Bradford, as Walton & Clough. The subscribers (with 50 shares each) are:—C. C. F. Walton, Moresby, Whitehaven, engineer; C. H. Clough, Stanwix, Guiseley, engineer. Private company. The number of directors is not to be less than two or more than [illegible]; the first are C. C. F. Walton and C. H. Clough, each of whom may retain office while holding 75 per cent. of the shares allotted to him under purchase agreement; remuneration as fixed by the company. Solicitor, H. Hammond, 35, Hustlergate, Bradford. Registered by Gordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Electro-Osmose Syndicate, Ltd. (123,807).—This company was registered on August 17th, with a capital of £2,300 in £1 shares, to adopt an agreement with the Gesellschaft fur Elektro-Osmose m.b.H., of Frankfort-on-Main, Germany, for the working of certain British patent processes for the purification of clay. The subscribers (with one share each) are:—A. H. Howard, 10, Clifford's Inn, E.C., solicitor; A. G. [illegible], 6, Radnor Gardens, Twickenham, clerk. Private company. Table "A" mainly applies. Secretary, V. W. Robinson, High Street Chambers, Coventry. Registered office, 53A, Barton Arcade, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

San Luis (Mexico) Tramways, Ltd.—Particulars of £200,000 debentures, created July 4th, and secured by trust deed dated July 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1[illegible]. Property charged: The company's undertaking and property, present and future, including uncalled capital and goodwill, 2,997 shares in Compania Limitada de Tranvias de San Luis Potosi, S.A. Trustees: H. C. Waters and A. Naylor.

Church Stretton Electric Supply Co., Ltd.—Further charge dated July 24th, 1912, to secure £75 charged on freehold premises at Crossways, Church Stretton, a provisional order granted to the Church Stretton Land Co., Ltd., and certain other assets. Holder: E. Bond, 43, Thurloe Square, W.

CITY NOTES.

National Electric Construction Co., Ltd.

THE directors report that the gross profit for the year ended December, 1911, was £16,568, and deducting therefrom expenses of administration, debenture interest, &c., there remains a balance of £5,176, plus £5,156 brought forward, making a total of £10,332. From this there has to be deducted £1,550 for the debenture redemption fund, leaving a balance of £8,782, which the directors recommend be dealt with as follows:—Depreciation on free wired installations, £2,000; rolling stock, &c., Dewsbury and Ossett Tramways, £239; furniture, fittings, plant and tools, £100; consols purchased for Parliamentary deposits, £2,086; carry forward, £4,857.

The monetary conditions that have prevailed during the past two years have not altered, and the difficulty in financing tramway undertakings in this country still exists. The negotiations for the important contract abroad, to which reference has been made on previous occasions, have not yet been settled, but are in a fair way to a satisfactory conclusion. Other foreign contracts are in course of negotiation. The Bill to confirm the free wiring agreements between the company and various local authorities received the Royal Assent on the 7th inst. There was strong opposition by several local authorities, which, however, after lengthy negotiations, was withdrawn. As regards the undertakings in which the company is interested.—

The Rhondda Tramways Construction Syndicate, Ltd. (in Liquidation).—Cash distributions amounting to 72½ per cent. have been made by the liquidators. In addition to this, the N.E.C. Co. is entitled to receive approximately £20,000 in 6 per cent. cumulative preference shares, and £9,000 in fully-paid ordinary shares of the Rhondda Tramways Co., Ltd. The contract referred to in the last directors' report for extensions to the Rhondda Tramways Co. was duly carried out, and the extensions were opened for public traffic in April last. During the past 18 months the Tramway Co. has suffered heavily from, first, a local miners' strike, then the general miners' strike, and, finally, a strike of the company's own employés, which lasted about a month, the men eventually returning to their duties on the company's old terms. The receipts since the resumption of work have been quite satisfactory, indicating that given freedom from labour troubles, this company's interest should be a valuable one.

Mexborough and Swinton Tramways Co.—The profit for 1911 permitted of a slightly higher dividend being paid than for 1910, The recent miners strike has prejudicially affected the traffic receipts, but it is hoped the loss will be made up during the remaining portion of the year.

Musselburgh and District Electric Light and Traction Co., Ltd.—The profit was below that for 1910, due to a decrease in the traffic revenue and boiler troubles, which, owing to the condition of the water, increased the expenses. Condensing plant has now, however, been installed, with the result that the works costs for some months past have shown a considerable decrease.

Torquay Tramways Co., Ltd. The progress here was eminently satisfactory. The traffic revenue for 1911 was £22,635, as compared with £16,401 for 1910, and the profit earned enabled a first dividend of 1½ per cent. to be distributed on the ordinary shares of the company. The receipts to date this year show a further improvement.

Dewsbury and Ossett Tramways.—The profit, after providing for the sinking fund and interest payments to the local authorities, amounted to £1,033. as compared with £261 for 1910. There is a satisfactory increase both in receipts and profits from January 1st, 1912, to date.

Town Lighting Installations.—At Bo'ness the gross profits showed an increase of £993 and at Carnarvon £145, as compared with 1910 accounts, and in both cases the results were adversely affected by the coal strike, and in the case of Bo'ness also by a serious water famine in the summer.

During the year under review, Dr. G. T. Moody retired from the board, and Mr. W. B. Cownie, who for many years acted as general manager and secretary of the company, was elected a director in his stead, and was appointed managing director from January 1st, 1912.

The annual meeting was held on Tuesday at the offices, 3, Laurence Pountney Hill, E.C., Mr. L. B. Schlesinger presiding.

The CHAIRMAN, in moving the adoption of the above report, said they would remember that at the last meeting he referred again to a contract for the construction of an electric railway on the Continent, negotiations for which had been in hand for some considerable time. It then looked as if those negotiations were likely to be brought to a successful issue at an early date, as he was in a position to inform that all the local authorities—some 30 in number—had settled their differences, and had signed a petition to the Government to authorise the formation of a joint board, or some such authority, to carry out the scheme. The Government, however, had taken much longer to deal with the business than was anticipated by any of the parties concerned, but the position of the matter now was that the Government, after numerous meetings with the representatives of the local authorities, had drafted a concession which would meet their requirements, and submitted it to the authorities for their consideration. The company had points to raise on the draft, and the local authorities also had a number of points, and progress was again delayed while the representatives of the numerous authorities came into line. Eventually the representatives had a further meeting with the Government to discuss their amendments to the draft, and to put forward the points raised by the company. They had now been informed that an agreement had been arrived at, but that the completion would in all probability be delayed until after the holidays. They had had to exercise great patience over this business, but at the same time it was encouraging to the directors to know that the many points raised in connection with the proposition had all been gradually disposed of, and that progress towards completion had from all accounts been sure, although slow. They would remember that he stated that the initial contract would run into about £150,000, but that before the work was finished it was probable that extensions would have to be dealt with, and that the final scheme might reach the figure that was first discussed. That was important from their point of view, as when the scheme went through it would be the first of its kind in that country, and if successful—and they had every reason to believe it would be—there should be a good field there for future work. In addition to that proposition they had been closely in touch with other businesses abroad, and as a matter of fact their chief engineer left only a fortnight ago with the representative of an engineer of the highest standing to investigate and report on a proposition for which an option had been secured, and from all accounts it was a business which should be taken up. They had already sounded the representative of a strong financial group in the City with regard to the business, and they were sanguine that, if the report was right, the finance would be arranged, and the contract, which would run into about £250,000, or thereabouts, would come to their company. They had found it impossible to arrange the finance for new schemes in this country, although they had a couple of tramway propositions which they were confident would be profitable to those who would deal with the finance. They were still hopeful of getting them through, but there had been for some years past a great prejudice against the financing of home tramways, and that prejudice still existed. During the year they had carried out the construction of the extensions to the Rhondda tramways, which were opened for public traffic last April. Proceeding to deal with the various undertakings in which the company was interested, he said that, taking first the Rhondda tramways, the gross receipts for 1911 were not so favourable as those for the previous year. The decrease, however, was solely attributable to the Cambrian Combine strike, which lasted some 10½ months, the men only returning to work in October. The profits, however, after putting £2,000 to reserve and renewals fund and providing £2,000 for the redemption of debentures, enabled the full 6 per cent. dividend on the preference shares to be paid from the date of issue. The traffic receipts however, from January 1st this year to the beginning of March showed a large increase over those for the corresponding period of 1911, but owing to the general miners' strike the increase was turned into a decrease. However, with that strike over, and with the extensions opened, they would soon have regained the lost ground; but, unfortunately, the company's employés went on strike, which resulted in the closing down of the system for about a month. In the end, the men went back on the old terms, and the undertaking was now feeling the effects of normal times and of the extensions, and a considerable portion of the loss entailed by the strikes had been recovered, and the weekly traffic receipts continued to show good increases over the corresponding weeks of last year. In the case of the Musselburgh and District Electric Light and Traction Co., notwithstanding the miners' strike, which necessitated a considerable curtailment of the service, and the dreadful weather experienced, the traffic receipts showed a decrease of only £911. The traffic revenue of the Mexborough and Swinton Tramways Co. again showed an increase over that of the previous year, the revenue being £17,198, against £16,523 for 1910, £15,630 for 1909 and £12,712 for 1908, and until the commencement of the coal strike the receipts this year were in excess of those for the corresponding period of last year. The coal strike, of course, affected the drawings considerably, but the deficit might be made up by the end of the year. The results of the working of the Torquay Tramways Co. for 1911 were very gratifying. The gross receipts were £22,947 compared with £16,569 for 1910, and working expenses, including directors' and trustees' fees, amounted to 62 per cent. of the revenue as compared with 83 per cent. for 1910. That substantial reduction in expenses reflected great credit on the management, bearing in mind that for the first three months the surface contact system was working, with its heavy maintenance expenditure, and that the extension to Paignton, which was proving so profitable, was not opened until July 17th. The receipts from January 1st this year to date showed an increase of £4,640 over those of the corresponding period last year, and under ordinary summer conditions there was no doubt that the increase would have been more marked. In the case of Dewsbury and Ossett Tramways the profit, after providing for the sinking fund and interest payments to the local authorities, amounted to £1,033 compared with £261 for 1910 and with a loss of £829 for 1909. From January 1st to date there was a substantial increase both in receipts and estimated profit over the corresponding period of last year. The Bo'ness and Carnarvon electricity undertakings had made further progress last year. In the case of Bo'ness the gross profit showed an increase of £455, as compared with the previous year, and in the case of Carnarvon an increase of £229. Turning to the accounts, the profit and loss account showed a profit of £5,176, as compared with £1,028, and adding to this £5,156, the balance brought forward from 1910, there was a total of £10,332, from which had to be deducted £1,550 for the redemption of debentures, leaving £8,782, the disposal of which was dealt with in the report. On the credit side of the balance-sheet free-wired installations stood at £23,766, compared with £25,771, the decrease being represented by the addition to the depreciation account of £2,000. Contracts in course of completion amounted to £8,120, compared with £4,644. The expenditure to date on the Parliamentary Bill *re* free wiring was £352. The Bill received Royal Assent on the 7th inst. To their surprise they met with considerable opposition from the local authorities, and to overcome it they had to make substantial concessions to those authorities who wished to purchase their installations outright. The agreements which they asked to be confirmed had been entered into with the local authorities, in most cases at the local authorities request, and the company had expended its capital in good faith, yet when a decision was given in Court, which practically upset the agreements, they had a number of local authorities seeking to evade their moral obligations and endeavouring to secure their capital expenditure practically for nothing. They took up a position which he was sure no business man would ever of dreamed of taking, and their action confirmed the opinion they had held now for some considerable time, that one should deal with local authorities in this country as little as possible, and when one was obliged to do so, then more than ordinary precaution should be taken to protect one's interests, because if there was a loop-hole it would be taken advantage of.

MR. J. CARR SAUNDERS seconded the motion, which was adopted without discussion.

Consolidated Gas, Electric Light and Power Co., of Baltimore.—The directors have declared a dividend on the common shares of 1¼ per cent., or at the rate of 5 per cent. per annum, for the quarter to September 30th, and on the preferred shares 3 per cent. for the half-year to September 30th.

Ascot District Gas and Electricity Co.—The directors have declared an interim dividend at the rate of 5½ per cent. per annum (5s. 6d. per share), less income-tax, on the ordinary shares for the past half-year.

Belgium.—La Société Belge pour la Fabrication des Cables et Fils Electriques, of Brussels, is increasing its capital to £80,000.

Mackay Companies.—The directors have declared the usual quarterly dividend at the rate of 5 per cent. per annum on the common shares.

Bank Rate.—The Bank Rate was yesterday raised from 3 to 4 per cent.

British Continental Electricity Co., Ltd.

The directors report for the year 1911-12 states that during the year 216 new installations were connected, while the number of lamps added during this period, calculated on the usual basis of 8-c.p. (carbon), has been 1,307 (motors calculated in equivalent lamps). After writing off £165 depreciation at the usual rates in respect of furniture, tools, meters, &c., and £180 depreciation of plant and stock, the balance standing to the credit of revenue account, including the amount brought over from last year, is £3,076. This the directors propose shall be appropriated as follows :—Dividend of 5½ per cent. on the 5½ per cent. cumulative preference shares for the year ended April 30th, 1909, £550; addition to the reserve fund of £400; leaving to be carried forward £2,126. The directors hope to be in a position to make a statement at the general meeting with reference to the negotiations now proceeding with a view to satisfying the arrears of the preference dividends by the issue of income debentures, and, should this scheme be approved by the preference shareholders, the directors will recommend the declaration of the whole of the dividends in arrear up to the end of the past financial year. After prolonged negotiations the arbitration referred to in the last report has been settled to the satisfaction of the directors on terms which are already proving advantageous to the company in the reduction of working expenses. £553 has been spent on capital account during the year. The annual meeting is to be held at 82, Victoria Street S.W., to-day, August 30th.

Blackpool and Fleetwood Tramroad Co.

The general meeting was held at Fleetwood on August 23rd. Mr. Geo. Richardson, the chairman, said that the receipts and profits were a record. The majority of carrying companies had suffered owing to the coal strike, but this did not affect their company. The directors, fearing an early strike of miners, ordered a special supply of coal to be stored for emergency, with the result that they had not had to purchase at fancy prices. The coal contract ran out in December. They had an increase in the wages bill, like other companies, and materials had gone up in price. These accounted for the increase in expenditure for the half-year against the same period last year. The receipts were £756 more than in the corresponding half of last year, whilst the expenditure had only increased by £508.

Following the adoption of the report, several questions were asked. Mrs. Needham raised the question of economy, and Mr. Greenwood said Mr. Cameron worked the service more economically and with better results than other tramways in the country. Mrs. Needham persisted in her criticisms, causing the chairman to observe, "Certainly we will not hand over the management of this company to any person who comes and makes charges against our manager in the way you have done."

The Chairman moved that out of £6,574 standing to net revenue account, a dividend be declared for the half-year at the rate of 4 per cent., which would absorb £3,000, that £3,000 be written off to depreciation reserve, £500 to general reserve, and the balance of £1,074 carried forward.

Mr. Greenwood seconded, and said the company's investments consisted of £10,400 of 4 per cent. preference L. and Y. Railway Co. stock.

This was carried.

Swiss Electrical Companies.

Escher, Wyss & Co., of Zurich, whose ordinary shares are held by the Felten & Guilleaume Co., report a considerable increase in the turnover in 1911-12. The company was reconstructed during the year, and the profit and loss accounts balance, this comparing with a loss of £5,000 in 1910-11.

The Watt, A.G. fur Elektrische Unternehmungen, of Glarus which is associated with the Zurich Bank for Electrical Enterprises, reports that the supply works in which the company is interested, experienced a satisfactory development in 1911-12. As net profits, the accounts show the sum of £23,300, as compared with £31,000 in 1910-11, and a dividend of 6½ per cent. is proposed on the paid-up capital of £280,000, this contrasting with 6 per cent. in the preceding year.

The net profits realised by the *Compagnie de l'Electricité et Mécanique, of Geneva*, amounted to £3,290 in 1911-12, as compared with £6,650 in the preceding year. After placing £3,000 to the depreciation fund, as in 1910-11, the balance has been carried forward. This result contrasts with the distribution of 4 per cent. on the priority shares in 1910-11. The report of the directors states that the situation was unfavourably affected by the low prices caused by keen competition during the year, and by the high interest payable on the bank debt.

The accounts of the *Bank für Elektrische Unternehmungen, of Zurich*, the Swiss investment and financing campany which is associated with the Berlin A.E.G., show a profit-balance of £265,000 for the year ended June 30th, 1912, this amount comparing with £259,000 in the preceding 12 months. It is proposed to pay a dividend of 10 per cent. on the share capital of £2,400,000, being the same rate as in each of the four previous years. The extension of the bank's business renders it necessary for additional capital to be raised, and the directors, therefore, recommend an increase to £3,000,000 by the issue of 15,000 new £40 shares, which will be taken over by a banking syndicate at the price of 150 per cent. Of the total issue 10,000 shares will be offered to existing shareholders, whilst the remaining 5,000 will be held by the syndicate for some years. The loan capital of the Zurich Bank already amounts to £2,680,000, an augmentation of £600,000 having been carried into effect last February.

The report of [illegible] for 1911-12 states that the conditions of manufacturing decidedly improved, and the orders for all departments were uniform throughout the year. Sale prices further declined in the first six months, although the efforts made for general increases in prices in the final months should, at most, afford compensation for the greater cost of raw materials. On the other hand, the endeavours put forth to improve manufacturing methods had led to an increase in the production without extending the plant and without incurring a considerable advance in working expenses. The company received much larger orders from mines and ironworks, and some important crane installations were carried out. As far as the operation of electric railways is concerned, it is mentioned that several large works were in course of execution. These included six locomotives of 2,500 h.p. for the Lotschberg Railway and eight locomotives for the Rhatian Railway. Nevertheless, the report states that the orders had hitherto not yielded the financial results which corresponded with the immense expense and labour incurred. The works of the Alioth Electricity Co. at Munchenstein are to be taken over by Brown, Boveri & Co. at the end of December, so as to introduce uniformity in manufacturing, and the former will then merely be continued as a "trust" company. After allocating £22,000 to depreciation, as against £21,000 in 1910-11, the accounts indicate net profits and balance forward of £97,000, as compared with £92,000 in the previous year on a share capital of £1,120,000. It is intended to pay a dividend of 7 per cent., this being the same rate as in 1910-11.

Prospectus.—*The Vacuum Electric and Gas Heating Appliances, Ltd.*—A company with this title has this week been offering to the public £65,000 in £1 shares, out of a total issue of £80,000, the difference being part of the payment to be made for the purchase consideration. The company has been formed "more particularly" to acquire certain inventions and patent rights belonging to the patentee, Mr. John Mann, trading as the Vacuum Electric and Gas Heating Co. (of Kilburn) "which has been carried on for experimental purposes in perfecting various appliances for electric and gas heating." The *provisional* patent rights comprise the following :—No. 12,367 of 1912 for vacuum electric water heater; No. 26,485 of 1911 for electric flash boiler heater; No. 27,332 of 1911 for gas flash boiler heater; and No. 11,849 of 1912 for electric flash boiler heater. We tried to obtain copies of the first three of these specifications as they are stated to have been filed, but are informed at the Patent Office that they are "not yet printed." In regard to the fourth, the specification is not yet filed. Before entering into an examination of the technical objects of the company, let it be remarked that Mr. John Mann, the patentee and vendor, is also the secretary of the company, and he is to receive, for the sale of the above-mentioned inventions, patent rights, &c., £30,000, payable as to £15,000 in cash (£2,500 immediately and £12,500 in three months) and the balance in shares. The T.O.R. Syndicate, Ltd., pays the expenses of promotion and underwrites 5,000 shares in consideration of £5,000 in cash payable by the company. Mr. John Mann is also under agreement to act for the company as works manager for five years. He is described as "a first-class marine engineer," and "a practical engineer and electrician of high standing."

In the absence of technical details of the inventions for which so high a price is asked, we are compelled to confine our comments to a consideration of what has already been done and what is physically possible in heating water

We have no hesitation in saying that electric water heaters can be obtained which have an efficiency of more than 90 per cent., and that no useful object would be served by striving after a material reduction in the loss of heat, for even at the lowest current rates for electrical energy the cost of heating water on a large scale by this means is prohibitive. Further, there are various excellent and thoroughly practical designs of electric water heaters already on the market: the patentee therefore cannot hope to escape severe competition, still less to establish a monopoly. Lastly, owing to the cost of energy, the large currents required, and the necessity of a separate meter, the outlook for heating water by electricity is with rare exceptions most discouraging, and this applies particularly to rapid heaters and flash boilers. Even the most enthusiastic advocates of electricity admit that water heating by its means is a costly luxury, and the demand for electric boilers is very small. As for the apparatus itself, although the information available is most meagre, we must point out that heating with coils is the obvious and customary method, and that the feature for which novelty appears to be claimed—the use of a vacuum to prevent loss of heat—is unnecessary, and, in this case, of doubtful utility.

We conclude therefore that, while the invention may be practical and effective, its value cannot possibly be more than a small fraction of the price demanded.

Dublin and Lucan Electric Railway Co.—At the half-yearly meeting held on 22nd inst., Mr. J. W. Hill, who presided, said that the receipts were £182 better than for the corresponding half of last year, and the net reduction in expenditure was £23. The coal strike made it necessary for them to slightly curtail their morning and evening service, but though they had to pay a considerably higher price for coal, their coal bill was £15 less for the half-year due to smaller consumption owing to the revised service. Mr. J. M'Cann seconded the adoption of the report, and it was carried.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, August 28th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£24 15	..
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£25 10	..
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7¼d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3¼d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	
b ,, Wire, in ton lots	,,	£102	.
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	.
c Brass (rolled metal 2" to 12" basis)	per lb.	8¾d.	¼d. dec.
c ,, Tube (brazed)	,,	11¼d.	¼d. dec.
c ,, ,, (solid drawn)	,,	9¼d.	¼d. dec.
c ,, Wire, basis	,,	8¾d.	¼d. dec.
c Copper Tubes (brazed)	,,	10¾d.	¼d. dec.
c ,, ,, (solid drawn)	,,	11¼d.	¼d. dec.
g ,, Bars (best selected)	per ton	£95	
g ,, Sheet	,,	£[illegible]	
g ,, Rod	,,	£95	
d ,, (Electrolytic) Bars	,,	£82	..
d ,, ,, Sheets	,,	£[illegible]0	
d ,, ,, Rods	,,	£88 10s.	
d ,, ,, H.C. Wire	per lb.	10[illegible]d.	..
f Ebonite Rod	,,	6/3	.
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/7	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	5/[illegible]¼	1¼d. inc.
l Iron Pig (Cleveland warrants)	per ton	[illegible]2 10½	1 10½ inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£21 10	inc
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 15	10s. dec.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£213 to £215	£2 inc.
a ,, Wire, Nos. 1 to 16	per lb.	2/4	1d. dec.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£30 5	10s. inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

Only stern necessity would compel any journalist, of course, to mention the weather, but unhappily the duty has to be faced by the writer upon financial subjects. For the incessant liquidation from overhead affected even the market in Undergrounds, and the damp—the final letter of that adjective deserves attention—atmosphere has caused the courage of Home Railway holders to ooze away until they realised their stocks in despair, piling flatness upon depression and bear sales upon their bull closing.

Rightly regarded, the weeping weather ought to prove a decided bull point for the Tubes, since obviously it drives people into their trains at the expense of 'bus travelling. Yet so closely knit are the bonds of sympathy between one market and another, and between one section of a market and its neighbour, that falls in the securities of the passenger and the trade companies' stocks have been reflected in those of the older Undergrounds. Metropolitans and Districts have both suffered to the tune of a point or more. Districts we ventured a fortnight ago to sound a warning note about, as the price appeared to be running up rather rapidly. The big interests are letting the market sag quietly, probably content to wait until conditions improve enough to re-attract public attention to the stock, when a further advance is quite on the cards. The Company's 3½ per cent. guaranteed stock has risen 1. other similar securities being put up along with the recent rise in Consols: the return is still the handsome one of nearly 4⅝ per cent. on the money.

Central Londons are unchanged. City and South London is ½ better; East London has gone back to 8⅛. Whatever damage has been wrought by the downpour to the crops, it can only influence the Tubes indirectly, and there is no reason for the dulness of prices other than the sympathy cited above. reinforced by hints of dearer money such as usually are heard at this season of the year.

British Electric Traction 7 per cent. Preferred stock has dwindled again. the price losing a point, and London United Tramways Preference fell ⅛, because some of the speculators closed up their purchases as the Stock Exchange settlement approached. The various Underground Electric Railways issues have been quiet. the company's shilling shares drooping a trifle with the Home Railway market.

Buying of electric supply shares has been resumed upon a quiet scale. Some of the people best qualified to know what is happening amongst the various London undertakings, are somewhat disappointed with the sluggishness of the share market. but in their impatience they overlook the fact that a rise in any kind of "illumination shares" is a rarity in August, and they do not seem to appreciate the steady advance made in the list of quotations week by week. Westminsters are 7s. 6d. higher, and St. James's put on 5s. Chelseas gained ⅛; the Debenture stock 1. South Metropolitan Preference are $\frac{1}{16}$ to the good, and London Electric Preferences are the only shares in the list this week to show a fall. Much interest awaits the announcement of the County of London's interim dividend, which will be made next month. some people thinking it is likely to maintain the 6 per cent. recently inaugurated, while others put their estimates 1 per cent. lower.

To illustrate the willingness of the investor, we may mention that a large block of Debenture stock in a well-known supply company has been placed within the last few days, and the buyers found no difficulty in getting rid of part of it very quickly.

In answer to various inquiries with reference to a new metal filament mentioned in our last "Notes," we have to say that we have no more to say about it—at present.

Sinister statements are in circulation to the effect that all is far from being well in Mexico, and that the rebels are still a power in the land. These brought down prices of some of the Mexican favourites, but have not disturbed to any extent the traction and power stocks of companies operating there. Mexican Light and Power holds its substantial advance: Mexico Tramways Fives are a point higher. Vera Cruz Debenture has risen 1½. Monterey Debenture fell 1, and these constitute the only alterations on the week.

Other members of the group are inclined to ease off a shade, for which the settlement week and the apprehensions of dearer money are sufficient to account. Rio Trams shed a point, and Sao Paulo Trams lost 2, the latter being connected—probably quite erroneously—with a steep drop in Sao Paulo Railway stock, on the suggestion of German competition. Calgary Power bonds are ½ lower.

The Anglo-Argentine Tramways group is very steady, and no special importance is attached to the whisper that the Company has its eye on fresh fields for extension; presumably a concern of this kind is always open, as a matter of course, to new areas for development. Some of our home undertakings have been known to experience the same Alexandrine desire; some of their shareholders, incidentally, may have wished they had not given way to it quite so extensively.

About Telegraphs and Telephones there is little to say. The New York Stock Exchange is rather exercised in its mind over a possible cut in the dividend on American Telephone and Telegraph stock, and the price is 1 down. West India and Panama went back 1s. 3d. after its 10s. spurt of last week, but it recovered this decline, and rose another 2s. 6d. in addition. Reuters have fallen ⅛. The dislocation of the telegraph service caused by the fire at the G.P.O. last Saturday night caused a certain amount of delay and inconvenience in the Stock Exchange. but the general comment amongst members was one of admiration at the prompt way in which the trouble was tackled and surmounted.

National Telephone Deferred advanced 5 points upon purchases by plucky buyers. Marconis have been a dullish market. and very quiet. the reawakening of the Rubber boomlet diverting speculative attention to this quarter, which drew away those who follow financial fashion, into rubber shares. at the expense of other sections. The rubber rise has been the latest feature in the Stock Exchange, a really enormous business being transacted. Rises took place at a speed so breathless that the experienced wondered whether it could last, a question that can be answered better on the day that this journal appears than it can to-night.

In the manufacturing list. Henleys have risen 5s., and so have India-Rubber shares. while Telegraph Constructions gained 10s. British Westinghouse Preference are being picked up by a few people, the price responding with a half-crown rise. The 4 per cent. Debenture stock. it may be worth noticing, pays rather over 6¼ per cent. on the money. Castner-Kellners are $\frac{1}{16}$ better. and Babcocks lost this fraction. Other shares are quietly firm.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Aug. 27th	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	5½	5½	9⅞ — 10⅛xd	..	5 2 4
Do. 4½ % Pref...	10	4½	4½	8⅞ — 9¼xd		4 12 4
Do. Second 6 % Pref. ..	10	6	6	10¼ — 10¾xd	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	10†	8¼ — 9 xd		5 11 1
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8¼xd	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4⅝ — 4⅞xd	..	5 2 7
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4¾xd	.	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4½	..	5 6 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4¾ — 5	+ ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	+1	4 9 1
City of London, Ord.	10	7	8	18 — 18½	..	4 6 6
Do. 6 % Cum. Pref.	10	6	6	12 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	5	6	11½ — 11¾	..	5 1 1
Do. 6 % Pref.	10	6	6	11 — 13	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅞ — 1⅛	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	9	7½ — 8	.	5 12 6
Kensington & Knightsbridge, Ord	5	9	9	7½ — 7¾xd	..	5 18 0
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 1
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82		5 9 9
London Electric, Ord.	8	2	2½	1⅛ — 1¼	..	4 0 8
Do. 6 % Pref.	5	6	6	[illegible]	+	5 11 7
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	[illegible]	..	[illegible]
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4¾	.	4 17 4
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4¾ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	6⅛ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8¾ — 9	+ ⅛	5 11 1
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	83 — 86	..	4 1 5
Smithfield Markets, Ord. ..	5	Nil	2	1⅜ — 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½		5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	99 —101	.	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛ — 1¼	+ 1/16	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	£3	5	..	½ — ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2¾ — 3		3 6 8
Do. 4½ % First Mort. Deb...	100	4½	4½	86½ — 88½		5 1 8
Westminster, Ord.	5	10	10	8½ — 9	+ ⅛	5 11 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5¼	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅝ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	8½	7½ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5 1/16 — 5 5/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	95½ — 97½	½	5 2 7
Canadian Gen. El. Com. ..	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	8†	[illegible]	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	99½ — 101½	..	4 18 6
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	[illegible]	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1⅞ — 2⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	[illegible]	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	96 — 99	..	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 —112		6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½ — 98½	..	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87½ — 89½	−1	5 11 9
Montreal, Lt., H. and Power ..	$100	7	8	242 —247	..	3 4 9
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	89 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	[illegible]	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	151 —156	..	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ — 101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 94	+1½	5 6 5
Victoria Falls Power, Pref. ..	1	Nil	11⅞d.	[illegible]	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105½ — 107½	.	5 11 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7½ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96½ — 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	148 —150	−1	5 6 8
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	8⅜	8	67½ — 69½	..	5 7 11
Do. 6 % Pref.	Do.	[illegible]	6	113 —114	..	5 5 3
Do. Def...	Do.	80/-	80/-	26¼ — 26½	..	5 13 2
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	102½ — 104½	..	4 16 2
Chili Telephone	5	7	..	7½ — 7¾	..	4 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	[illegible]	4	83 — 85	..	4 14 2
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable ..	10	4½	5	7⅜ — 7⅞	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	128½ — 131½	..	5 6 5
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77½ — 79½	..	4 8 1
Do. 4 % Mort. Deb.	Do.	[illegible]	4	99½ — 101½	..	3 18 10
Eastern Extension	10	[illegible]	5†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	98½ — 100½xd	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97½ — 100½	..	3 19 7
Globe Telegraph and Trust ..	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph ..	10	18	18	28¼ — 29¼	..	6 3 1
Indo-European Telegraph ..	25	18	5†	56 — 58	..	5 3 5
Mackay Companies Common ..	$100	[illegible]	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	[illegible]	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	4 9/16 — 4 11/16	− 1/16	4 5 3
Do. 7 % Cum. Partic. Pref.	1	16	17	3¾ — 4¼	— ⅛	4 2 6
Monte Video Telephone, Ord...	1	6	6	[illegible]		5 6 8
Do. 5 % Pref.	1	5	5	[illegible]	.	5 6 8
National Telephone Def. ..	Stock	6	6	152 —154	+5	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	..	4 9 1
Oriental Telep. and Elec. ..	1	8	8	1 23/32 — 1 27/32	..	4 6 9
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	[illegible]	98 —100	..	3 18 5
Reuter's	8	5	5†	10½ — 10⅞	— ⅛	3 15 9
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼ — 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 11/32 — 1 15/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	[illegible]	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	½	3¼ — 3¾	+ 1/16	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10¼ — 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	100½ — 102½	..	4 17 7
Western Telegraph, Ltd. ..	10	[illegible]	6†	13 — 13½	+ ⅛	5 3 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Aug. 27th.	Rise + or Fall —	Present Yield p.c.	NAME.	Stock or Share.	Dividend for		Closing Quotations Aug. 27th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.		*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	[illegible]	..	Nil	Metropolitan Railway Consol. ..	100	1⅜	1⅝	54¼ — 55¼ xd	—1	2 19 0
Do. 5 % Pref.	1	5	5	[illegible]	..	6 3 1	Do. Surplus Lands	100	2¾	2¾	64 — 66 xd	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5	Do 3½ % Deb.	100	3½	3½	86 — 88	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..	Do. 3½ % Pref.	100	3½	3½	85 — 87 xd	..	4 0 6
Do. Do. Deferred ..	100	..	..	6 — 8	..	..	Do. 3½ % Con. Pref.	100	3½	3½	84 — 86 xd	.	4 1 5
Do. Do. 6 % Cum. Pr'f.	100	..	6	84 — 92	..	6 10 5	Metropolitan District Ord. ..	100	Nil	Nil	28½ — 30	—1¼	Nil
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	—1	..	Do. 6 % Deb.	100	6	6	141 — 143	..	4 4 0
Do. 5 % Perp. Deb. ..	100	5	5	98 — 101	..	4 19 0	Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2	Do. 4 % Prior Lien	100	4	4	99 — 101	..	3 19 3
Central London Railway, Ord.	100	8	8	74 — 76 xd	..	3 19 0	Do. 4½ % First Pref.	100	3½	4½	89 — 91 xd	..	4 19 0
Do. Pref.	100	4	4	80 — 82 xd	..	4 17 7	Do. 3½ % Gtd.	100	3½	3½	75 — 77	+1	4 11 0
Do. Def.	100	2	2	74 — 76	..	2 12 8	Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛		5 6 8
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3	Do. Def.	1	Nil	..	⅛ — ¼	..	Nil
City & South London, Ord. ..	100	1½	1⅜	34 — 35	+ ½	3 18 6	Do. 5 % Pref.	1	5	5	13/16 — 15/16 xd	..	5 6 8
Do. 5 % Pref., 1891	100	5	5	106 — 108	..	4 12 7	Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. Do. 1896	100	5	5	102 — 104	..	4 16 2	Do. 5 % Deb.	100	5	5	99 — 102	..	4 18 0
Do. Do. 1901	100	5	5	102 — 104	.	4 16 2	Potteries, Ord.	1	2	..	[illegible] — 7/16	..	..
Do. Do. 1903	100	5	5	102 — 104	+1	4 16 2	Do. 5 % Pref.	1	5	5	⅝ — ¾ xd	..	6 19 0
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3	Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Dublin United Trams, 6 % Pref.	10	6	6	10¾ — 11¾	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Great Northern & City, Pr'f. Ord	10	Nil	..	1½ — 2½		Nil	Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Hastings Trams, 6 % Pref. ..	1	Nil	6	½ — ¾	..	8 0 0	Underground Elec. Railways	10	..	..	4 — 4½	..	Nil
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5	Do. "A"	1/-	..	..	⅝ — [illegible]	..	..
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0	Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0	Do. 6 % Income	100	1	1½†	90 — 92	..	..
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6	Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	.	4 3 4	Do. 6 % Pref.	5	Nil	3	2¾ — 3⅜	..	4 9 0
London United Trams, 5 % Pref.	10	Nil	..	4½ — 5½	— ½	..	Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3							

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	4⅞ — 5⅜	..	5 2 4	La Plata Elec. Trms, Ord. ..	1	..	..	½ — ¾	..	..
Do. 2nd Pref.	5	5	5½	4 13/16 — 5 3/16	..	5 6 0	Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3	Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 4½ % Deb.	100	4½	4½	99½ — 101½	..	4 8 8	Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	101 — 103	..	4 16 2	Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Auckland Trams, 5 % Deb. ..	100	5	5	102 — 104	..	4 14 4	Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 — 102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12	..	5 0 0	Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11	Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ — 102½ xd	..	4 17 7
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0	Mexico Trams Com.	$100	7	7	127 — 130	..	5 7 8
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8	Do. Gen. Con. 5 % Bonds ..	..	5	5	102 — 104	+1	4 16 2
Do. 5 % Pref.	5	5	5	4¾ — 5¼	..	4 15 3	Do. 6 % Bonds	100	6	6	102½ — 104½	..	5 14 10
Do. 4½ % Deb.	100	4½	4½	101½ — 103½	..	4 7 0	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7⅜ — 7⅞	+ ⅛	6 7 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	140 — 145	..	5 10 6	Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. Pref. Ord.	100	6	6	119 — 124	..	4 16 9	Do. 5 % 1st Deb.	100	5	5	100½ — 102½	+ ½	4 17 6
Do. 5 % Pref.	100	5	5	109 — 112	+1	4 9 1	Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/16 — 1 5/16	..	1 18 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ — 102½	..	4 7 10	Do. 5 % 1st. Deb.	100	5	5	99 — 102	..	4 18 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 — 105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % Con. Deb.	100	4½	4½	102 — 104	..	4 6 7	Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Calcutta Trams, Ord.	5	6	7	6½ — 6⅝	..	5 5 8	Rio de Janeiro Trams	$100	4½	5†	148 — 151	—1	3 6 2
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	102 — 104	..	4 16 2
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3	Do. 5 % Mort. Bonds ..	100	5	5	100 — 101	+ ½	4 19 0
Cape Electric Trams	1	Nil	2½†	½ — ¾	..	..	Sao Paulo Tram, Lt. and P. ..	$100	10	10†	257 — 262	—2	3 16 4
City Buenos Aires Trams (1904)	5	5	5	5½ — 5¾ xd	..	4 6 11	Do. 5 % 1st Deb.	$500	5	5	105 — 107	..	4 13 6
Do. 4 % Deb.	100	5	5	99 — 102	..	4 18 0	Singapore Trams, 5 % Deb. ..	100	5	5	84 — 87	..	5 15 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 — 103	..	4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5¾ — 6⅛	..	5 14 3
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil	Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0	Do. 5 % 1st Deb.	100	5	5	100 — 103	..	4 17 1
Do. 6 % B Deb.	100	5	3	35½ — 43½	..	6 18 0	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 — 106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝ — ¾	..	8 0 0	Crompton & Co.	8	Nil	Nil	⅛ — ⅜	..	Nil
Do. 6 % Pref.	1	9	9	11/16 — 13/16	..	7 7 8	Do. Deb...	100	5	5	56 — 66	..	7 11 6
Babcock & Wilcox	1	26	28	[illegible]	[illegible]	4 2 10	Dick, Kerr	1	5	5	¾ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	3 16 10	Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
British Aluminium, Ord. ..	1	..	..	[illegible]	..	..	Do. Deb...	100	4½	4½	95 — 98	..	4 10 10
Do. 6 % Cum. Pref.	1	..	..	⅝ — [illegible]	..	..	Edison & Swan, A, £3 paid ..	5	Nil	..	[illegible]	..	Nil
Do. 5 % Prior Lien Debs. .	100	5	5	93 — 96	..	5 4 2	Do. fully paid	5	Nil	..	1⅞ — 2⅛	..	Nil
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0	Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3	Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1	Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Deb...	100	4½	4½	101 — 103	..	4 7 5	Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10	Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 6 8
British Westinghouse, Pref. ..	3	Nil	..	[illegible]	+ ⅛	Nil	Do. Deb...	100	5	5	92 — 94	..	5 4 2
Do. Deb...	100	4	4	58 — 61	..	6 11 2	General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. 6 % Prior Lien	100	6	6	102 — 105	..	5 14 3	Do. Deb...	100	4	4	92 — 97	..	4 2 6
Browett, Lindley, Ord.	1	Nil	..	2/- — 3/-	..	Nil	Henley's, Ord.	5	15	10†	12½ — 13	+ ½	5 15 5
Do. Pref.	1	Nil	..	4/6 — 5/-	..	Nil	Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 0
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil	Do. Deb...	100	4½	4½	102 — 104	..	4 6 7
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0	India-Rubber, G. & T.	10	10	..	9½ — 10½	+ ¼	..
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10	Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0	Telegraph Construction.. ..	12	20	10†	33 — 35	..	6 14 5
Callender's Cable	5	15	10†	10½ — 11	..	6 16 4	Do. Deb...	100	4	4	97 — 99	..	4 0 10
Do. Pref.	5	5	5	4¾ — 5⅛	..	4 17 7	Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Deb...	100	4½	4½	99 — 101	..	4 9 1	Do. Pref.	5	Nil	..	½ — 1	..	Nil
Castner-Kellner	1	17½	20	3 11/16 — 3 13/16	+ 1/16	5 5 3	Do. Deb...	100	4	4	58 — 60	..	6 13 4
Do. Deb...	100	4½	4½	102 — 105	..	4 5 9							

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., May 9th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JULY, 1912.

The returns of seaborne electrical business for July disclose exports amounting in value to nearly £120,000, as against £161,777 in the preceding month. In the case of the imports the value was £181,345, representing an appreciable increase over the June total of £171,032, while the re-exports, valued at £12,687, show a decided fall in value as compared with that month, when the total was £19,036.

Reference to our last returns shows that the exports are still well ahead of the first half-year's average of 1911, while the imports show a considerable falling off as compared with the same period.

The feature of the exports is the cable total of £94,201, largely contributed to by Japanese purchases, amounting to £39,000 approximately, and which resulted in Japan being our best customer during the month. Machinery, telephonic and telegraphic exports reached satisfactory levels, although the latter were somewhat eclipsed by the previous month's high total, notwithstanding the inclusion of a substantial export to British West Africa.

The import section calls for no particular comment, but it will be noted that the glow lamp imports were appreciably smaller than the exports; and, in fact, less than in the preceding month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electric [illegible] machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus, [illegible]	Telegraphic cable and apparatus.	Totals.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	923	240	37	229	...	286	11,003	41	395	110	1,225	702	15,191
Germany	2,352	4,065	6	529	...	12	2,585	...	31	5	38	26	9,649
Netherlands, Java and Dutch Indies ...	331	1,929	220	11	...	128	1,130	44	2	14	8	695	4,512
Belgium	208	436	261	...	304	222	2,748	3,310	49	105	161	1,238	9,042
France and French West Africa	527	...	2,529	26	54	57	7,452	1,606	...	62	178	71	12,562
Portugal	36	132	33	10	...	6	486	...	92	30	562	135	1,522
Spain and Canary Isles	225	603	...	60	31	140	1,476	856	18	17	22	6,301	9,749
Switzerland, Italy and Austria-Hungary ...	558	185	148	...	93	150	8,184		84	589	347	240	10,578
Greece, Roumania, Bulgaria and Turkey ...	250	109	4	...	...	...	806	39	19	3	8,363	3,617	13,240
Channel Isles, Gibraltar, Malta and Cyprus...	18	...	53	272	...	11	572	53	4	...	48	...	1,031
U.S.A. and Philippines	265	70	126	47	...	4	2,098	38	15	...	...	45	2,708
Canada and Newfoundland	2,230	2,415	940	1,246	652	2,839	10,224	897	114	40	102	1,193	22,892
British West Indies and British Guiana ...	96	13	294	99	15	4	205	...	28	...	244	16	1,014
Mexico and Central America	16	...	24	...	...	3	93	149	...	...	712	...	997
Peru and Uruguay	12	152	68	...	...	...	37	77	...	...	100	20	466
Chile	363	185	44	17	...	254	1,191	...	2,792	373	23	1,128	6,370
Brazil	1,021	2,095	506	92	130	394	2,516	466	17	...	164	474	7,875
Argentina	1,220	6,406	545	275	78	797	9,173	2,883	390	125	2,176	922	24,990
Colombia, Venezuela, Ecuador and Bolivia...	46	...	2	31	...	...	454	...	...	...	...	...	533
Egypt, North Africa and Persia	154	1,338	190	...	13	72	1,437	440	145	...	237	933	4,959
British West Africa	42	266	58	137	22	568	198	5	313	38	228	42,107	43,982
Rhodesia, O.R.C. and Transvaal	2,234	956	330	855	10	94	2,000	4	602	32	749	694	8,560
Cape of Good Hope	1,083	2,654	794	859	61	215	5,082	267	2,625	7	1,050	369	15,066
Natal	1,356	3,568	732	1,298	...	36	2,910	113	312	47	152	402	10,926
Zanzibar, Brit. E. Africa, Mauritius and Aden	3	69	51	114	21	20	279	31	24	...	2	381	995
Madeira and Portuguese Africa	97	483	172	53	510	90	732	...	34	...	...	58	2,229
China and Siam	355	882	357	707	27	832	788	619	297	162	42	355	5,423
Japan and Korea	1,215	38,840	440	36	229	687	6.642	3,296	1,336	29	...	...	52,750
India	8,257	8,005	4,281	2,760	133	608	13.152	1,436	2.924	157	366	1,360	43,739
Ceylon	159	728	228	68	...	100	813	21	91	...	...	346	2,554
Straits Settlements, Fed. Malay States and													5,981
Sarawak	966	1,842	568	57	...	264	923	325	97	156	327	456	1,600
Hong Kong	204	568	88	439	10	...	216	...	16	33	6	20	695
West Australia	25	56	32	249	...	196	137	...	...	...	...	...	
South Australia	660	1,037	197	67	48	136	536	...	58	10	955	661	4,365
Victoria	1,012	3,795	626	3,087	...	298	2,693	171	242	...	644	87	12,655
New South Wales	3,082	8,046	345	1,945	38	1,592	7,138	417	533	77	7,318	3,901	34,432
Queensland	206	456	36	144	12	150	1,161	...	460	...	223	134	2,982
Tasmania	107	...	...	155	...	262	...	...	30	...	...	...	554
New Zealand and Fiji Islands	1,382	1,577	380	538	...	445	5,383	189	201	...	316	119	10,530
Total, £	83,326	94,201	15,751	16,512	2,551	11,982	114,886	17,402	14,420	2,251	27,389	69,226	419,898

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electric [illegible] machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus, [illegible]	Telegraphic cable and apparatus.	Totals.
Russia, Norway, Sweden and Denmark ...	33	58	...	89	...	48	3,019	180	633	...	1,739		5,799
Germany	5,124	14,080	1,889	10,580	4,850	3,996	59,380	520	2,195	6,784	12,703		122,101
Holland	14	93	13	163	320	...	27	...	16	2	27		675
Belgium	506	984	96	34	34	777	856	111	488	1,152	7,302		12.340
France	289	59	1,144	135	185	658	307	...	1,358	7.181	3.274		14,581
Switzerland	39	1,883	89	29	68	64	1,320	55	12	...	852		4,411
Italy	...	856	6	...	...	...	406	...	...	...	1,142		2.410
Austria-Hungary	...	1,100	...	40	38	...	7	...	16	324	239		1,764
United States	2,035	62	32	215	711	174	9,054	4,073	...	100	165		16.621
Total, £	8,040	19,166	3,269	11,285	6,206	5,717	74,376	4,939	4,718	15,543	27,443		180,702

Additional imports: Spain, carbons, £410; Japan, goods, £45; Canada, goods, £148, machinery, £40.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electric [illegible] machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus, [illegible]	Telegraphic cable and apparatus.	Totals.
Various countries, mainly as above ...	6,961	323	...	721	325	...	3,870	...	140	347	...		12,687

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

TOTAL EXPORTS: £419,898. TOTAL RE-EXPORTS: £12,687. TOTAL IMPORTS: £181,345.

THE MAINTENANCE OF TRANSFORMER SUB-STATIONS AND STREET BOXES.

[COMMUNICATED.]

In most of the alternating-current systems of electric light distribution in ordinary town supplies the transformation from the high-transmission pressure to the low-tension distribution voltage is accomplished by means of transformer sub-stations containing one or more static transformers. These are situated either in the basement of a building used for other purposes, or in some cases in specially built chambers placed underground in the thoroughfares. In addition to this, there are always to be found a considerable number of street-boxes for inspection and drawing-in purposes, and such static transformer sub-stations and street boxes must be subjected to careful inspection and maintenance, or otherwise, sooner or later, a serious breakdown is sure to occur. As a matter of fact, such underground compartments may be reckoned as either the strength or the weakness of a cable distribution system, according to whether they have been properly designed or not in the first case, and have been kept under an efficient system of inspection and repair. There is a great danger in neglecting this portion of the equipment, inasmuch as it is not so readily accessible as the generating plant at one end and the consumers' panels or fuses at the other; and it may, therefore, be advisable to make some reference to the care which may be bestowed on this part of the installation in order to keep it in good working order.

It very greatly adds to the efficiency of the system if one man, or set of men, is detailed off to be responsible directly to the chief engineer for the maintenance of such street boxes or transformer sub-stations, as the importance of these warrants most careful attention. The duties of such inspectors should be primarily to ensure that every switch, instrument and other piece of apparatus installed should be kept scrupulously clean and in absolutely perfect working order. Slackness in this respect means ultimate breakdown. In addition to this, they should be instructed to take notes as to whether, on any visit to the sub-station or street box, there is any indication of an escape of gas or water into the compartment. If the slightest suspicion of this prevails, the matter should be immediately brought before the notice of the chief, and it should then be the duty of the latter to see that such leakage is corrected in such a way that it will not occur again. There have been too many mishaps through the percolation of gas and water, for which electricity has been blamed, and this is an important point.

A transformer sub-station or street box forms a convenient point for noting the conditions under which the network is operating, and part of the inspector's duties should be, on each visit to any feeding point, to note the output of that feeding point as indicated in amperes on the secondary or low-tension bus-bars, and also the differences of potential existing between the secondary bus-bars, these particulars, together with a note of the date and time of the visit and observations taken being entered in a note-book or log-book kept at the feeding point; in addition, the inspector should enter up the same particulars in his own note-book, so that he may always have them available for reference wherever he may be. In this way two purposes are achieved. The first is that, at every feeding point, a more or less continuous record is permanently kept as to its behaviour and the conditions under which it works, while the inspector has his own report, which he enters on every round of visits, as to the condition of affairs at every feeding point. These notes can be made more valuable if, in addition, careful particulars are given of any unusual occurrence or condition noticed during the visit. If more than one person has access to the chamber, the record at each visit should be initialed by the man making the entry, in order that, at any future time, reference may be made to the man who made the observations. It is almost needless to say that stringent precautions should be taken to see that no unauthorised person enters the transformer chamber, and inspectors should be especially warned not to permit any unauthorised person to accompany them into the chamber when they are making their rounds.

Another duty of the inspector during his visit to any feeding point should be to test the insulation resistance both of the transformers and the circuits which they supply. In most transformer sub-stations it is a rule to install more than one transformer in order to provide means for changing over should a breakdown occur on one of the transformers, and also to allow of the transformers being switched in and out in accordance with the load upon them, in order to cut down, as far as possible, the magnetising or no-load losses of the system. For this reason it is nearly always possible, except, perhaps, during a peak load, to switch out one of the transformers at a time for the purpose of insulation testing, and these tests, which should be entered in the log-book belonging to the feeding point, should include the insulation resistance between primary and secondary coils, insulation between primary coils and earth, and also resistance between secondary coils and earth. By keeping a history of the transformer in this way, it is very often possible to detect tendencies to breakdown of insulation, which, if allowed to remain, might perhaps cause a failure of the supply. In addition to this a voltmeter should be installed on the secondary side of the system with a two-way switch and an off position, so that one terminal of the voltmeter may be connected at will to either pole of the secondary supply. The other terminal of the voltmeter should be connected directly to earth, and the readings of the voltmeter should be logged to furnish an indication of the insulation resistance of the secondary network to earth, which will be useful as a history in determining the behaviour of the cables.

As the transformers and circuits will be protected at the feeding points both on the high and low-tension sides by means of fuses, it is necessary that the inspector should see at each visit that a sufficient supply of spare fuses is always available in case of emergency. Furthermore, he should make sure that the fuses are of the proper size, no more and no less. If this point is neglected there is a great danger of some incompetent person fusing up the transformer and supply circuits too strongly in order to get over a peak or to give himself less trouble due to an intermittent short or fluctuating load. Cases of very serious trouble have occurred owing to an ignorant or negligent man seeking to save himself a little trouble in finding out the real cause of fuses blowing by attempting to mask the trouble by stiffening up the fuses unduly, and the inspector should see to it that this kind of malpractice is checked. Another point he should see to is that the wires giving an earth connection to the sheathing of cables, the cases of the transformers, the iron framework of switchboards, &c., are carefully examined at regular and frequent intervals, inasmuch as it is by no means uncommon to find such earth connections becoming loose or corroded. If there is any doubt at all as to the efficiency of the earth plate or other earth connections, they should also be frequently tested, and it is a very good rule that no earthing connection should be less substantial than tinned copper cables of seven strands of No. 15 S.W.G. wire. The connection between the wires and the parts which need earth connection must be effected in a strong and substantial manner. The point to be remembered by the inspector is that earth connection is a good safeguard against fatality if it is real. If there is any doubt about it the transformer chamber becomes a death trap. Particular attention should be paid to the sheathings of all high-tension cables in the sub-station. These should be earthed at every joint.

There are certain things in connection with the routine of transformer chamber maintenance which are perfectly safe if they are done in the right way, but which if slackness is allowed to creep in, may cause serious trouble, and possibly accident. For example, only an experienced man should be allowed to carry out any work whatever in connection with the high-tension mains, and, indeed, it is highly advisable that no inexperienced person, even if he is in the employ of the supply authority should be allowed to enter a transformer sub-station if it is giving or taking any supply. An experienced man should be employed to clean switchgear, replace or take out fuses, and do any other work connected with the high-tension supply, and should be instructed always to wear rubber gloves, and any employé neglecting to do so should be instantly dismissed. Moreover, defective gloves should not for a moment be tolerated, and every employé should be instructed to report the matter at once should he find any glove defective, and a stock of new gloves should be kept ready, so that a new glove can be served out at once. It is "Penny wise and pound foolish" to have anything to do with a rubber glove which has any suspicion whatever attached to it. The men engaged in switching and cleaning operations, even of the most routine order, should be instructed that the switches on both the high and low-tension sides of the transformer circuit in which a fuse is to be placed, should be opened—first on the high-tension side, and, then, on the low tension side—in order to avoid any possibility of a fuse, while being inserted in a faulty circuit, closing the circuit and blowing again while the man's hand is anywhere near it. The proper place to close the circuit is at the switch, and when a fuse blows it is just as well to be out of the way of it. Should anything in the way of persistent fuse blowing or any other unusual thing happen it should be the duty of the inspector to report it at once to the chief. Another point with regard to routine work, which should be impressed upon all those engaged in controlling the operation of transformer sub-stations, is to give careful attention to the question of switching transformers in and out of circuit. It is astonishing what a saving of energy from the generating station can be effected by a careful system of switching out transformers on a light load, and switching them in again when peaks come on. Where the load is fairly regular, and can be predetermined as to time and amount the question of switching in and out is comparatively simple, and can be made a matter of routine. Where the supply is subject to violent fluctuations, as, for example, in a town liable to sudden storms, it is necessary to have some means of getting round the sub-stations easily and quickly in order to switch in extra transformers to meet the load, and this can be best done by providing one man, who is an expert cyclist, with a key for the transformer chambers, and keeping this man in attendance at the main generating station (where work can always be found for him to do), so that directly an indication of a peak is shown either by weather conditions or by the ammeters on the main switchboard, he may be despatched round the sub-stations to put in the necessary transformers. It is worth while taking this extra trouble in order to save the magnetising losses in the case of a large system of transformers in operation. In switching transformers in, an attempt should be made as far as possible to give to the transformers an equal amount of work to do, so that they will be operated in rotation as far as possible. This is not always practicable, as in some transformer stations the units are of different sizes, the small one being reserved for day loads, and the larger ones being put in for peaks. Where, however, the system of rotation is possible it should be adopted.

In connection with the maintenance of transformer sub-stations and the network in connection with them, very stringent precautions should be taken to see that a complete system of switching on and off is adopted in connection with the cables. Many mistakes, some of them very serious ones, have occurred in connection with repairs of cables, owing to workmen starting operations on a cable which was supposed to be dead, but which was actually alive either from the power house end or from some feeding point, and for this reason a careful set of rules should be made as to switching on and off. For example, taking the case of cables, the mains engineer should personally see that the circuit switch and fuses have been drawn at the power house end of the supply, and also that the switch has been locked in its off position, and a danger notice hung up on the circuit panel; also a note should be inserted in the station log book of the fact that the circuit is out of commission and must not be switched in. He should make it his duty to personally acquaint the engineer in charge at the time of the fact that the cable is out of commission, and ask him to draw the attention of each succeeding charge man to the same fact. He should then personally see the sub-station inspector and proceed with him to the feeding point to which the cables are connected, and repeat the operations, drawing fuses, locking off, and recording this in the log book of the sub-station. When this is done, every pole of the cable should be bound together with stout copper wire, one end of this wire having been previously connected to an efficient earth, and this wire should not be removed until all operations on the cables have been completed. Some systems have a more elaborate method of earthing cables, but the above is suggested as one method which can usually be adopted in most ordinary systems. After the work is done, the mains engineer will personally inspect the job and make sure that everything is to his satisfaction, and will make the necessary insulation tests, and on a three-phase supply, phase-connection tests. When he is satisfied that everything is in good order, he should, by memorandum, and not by word of mouth, inform the charge engineer at the power house and also the sub-station inspector that the cable may be placed in commission again, and he should also remove the earthing connection which he had previously placed on the cable. It is advisable that he should be present both at the power house and at the sub-station when the fuses are replaced and the cable switched into commission again, in order that, should anything be wrong, he may obtain a first-hand impression of what occurs. Somewhat similar precautions should be taken in any sub-station in which repairs to a transformer or the cleaning of a transformer is taking place. The switches connecting the transformer to the supply both on the high-tension and low-tension sides should be opened and locked off, the keys being given to the man who is in responsible charge of the cleaning or other work in connection with the transformer. The fuses of the high and low-tension sides should also be drawn and an entry should be made in the log of the sub-station that the transformer is out of commission and must not be used.

No one but an experienced person should be allowed in the sub-station or have anything to do with the transformer, and the inspector should personally take all necessary precautions to ensure the workmen against accidental contact with any surrounding apparatus under pressure. Needless to say, the sub-station should be so designed that such accidental contact is impossible without gross carelessness. The inspector should impress upon the workman every danger point in the place before allowing him to commence work. When the work has been done, and the necessary tests made, the man in responsible charge of the work should be allowed to replace the fuses and switch in the transformer again, but only in the presence of the sub-station inspector, after the inspector has personally satisfied himself that so far as he can see these are in good order. When this has been done, an entry of the fact that the transformer is again in commission should be made in the sub-station log-book. These remarks apply to the more or less sectional repairs and maintenance jobs which occur from time to time in all sub-stations. Where, however, it becomes necessary in order to carry out more extensive work, such as reconstruction or extension in transformer sub-stations, there is a danger that inexperienced workmen may be introduced to the compartment. If this has to be done, then all possible arrangements should be made at the power house and at the distributing network, so that this particular sub-station can be entirely isolated, so that while inexperienced men are in it, both the high and low-tension bus-bars can be earthed, and no pressure whatever, either high or low-tension, allowed in the sub-station. Where, from the size or importance of the feeding point, or from any other consideration it is impossible to put the sub-station entirely out of commission, it is necessary from the point of view of safety that during the whole time that an inexperienced workman is in the sub-station he should be under the personal surveillance of the sub-station inspector in order to prevent him from doing anything which might cause trouble.

In the above notes attention has been chiefly paid to the transformer sub-station, inasmuch as it is larger and more complicated than the usual street box. It will be seen, however, that a considerable proportion of the above remarks apply with equal force to street boxes, the only difference being that imposed by the smaller and simpler character of the work involved. It may possibly be thought that in some cases the requirements indicated in the above notes are too stringent, and that the ordinary mains staff may not be able to cope with the amount of work involved. While this is to some extent true, and while also local conditions may considerably alter the conditions of some of the above suggestions, the main purpose of the above notes is to emphasise the importance of attending very much more strictly than is often at present the case, to that portion of the distribution equipment which is apt to be neglected from its concealed situation and stationary character.

MAGNETITE ARC PROJECTORS FOR ELECTRIC VEHICLES.

By R. E. Neale.

Enclosed-arc projectors have been considerably used in the United States during recent years, as headlights for electric vehicles. The essential features of all the types used are much the same—a cylindrical shell encloses the mechanism and a single or double solenoid actuates the regulator armature. The lower, negative, carbon is carried by a fixed clamp, and the series ballast resistance is formed by several coils of high resistance wire.

As a result of the steady increase in size and speed of the vehicles, such projectors are no longer sufficiently powerful, and several of the high-speed interurban lines have evolved special types of arc projector, of which the most interesting employs a Magnetite arc. A block of copper, provided with a hood of non-oxidisable metal, is used as the anode and lasts 2,000-3,000 burning hours. The cathode consists of a thin welded steel tube containing a mixture of iron oxide and other salts: this electrode burns 50-75 hours without replacement. The arc, in which the cathode vapours are brought to incandescence, provides the whole of the light emitted, and the candle-power per watt is approximately double that of the ordinary carbon arc.

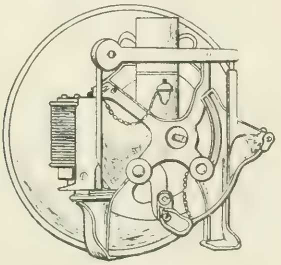
Fig. 1.

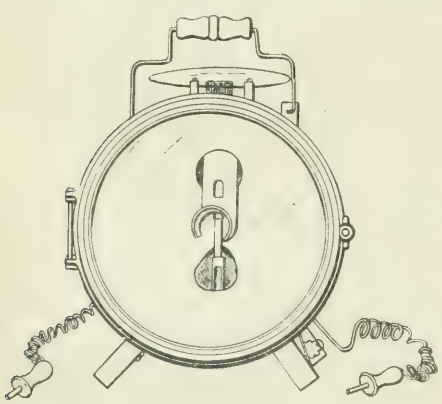
Fig. 2.

Fig. 1 illustrates the general arrangement of the lamp mechanism, which is carried by a framework of galvanised iron, attached to the case by screws. The ends of the electrodes penetrate a parabolic mirror, at the focus of which the arc is permanently maintained. The front of the projector is closed by a glass lens of a form adapted to the proposed use of the lamp. The whole is arranged in easily portable form, and connection is made to the supply circuit by flexible leads with attached plugs; access for inspection and cleaning is thus easily obtained.

Fig. 2 represents a lamp having a parabolic mirror and a chimney intercepting the direct rays; this type is largely used on suburban medium speed lines where crossings and curves are frequent. The beam obtained diverges 100° on either side of the axis, and a wide field of view is illuminated.

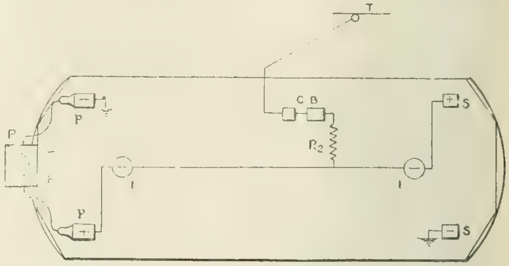

Fig. 3.

Certain towns prescribe a maximum intensity for headlights on electric and other vehicles running within their boundaries. These regulations may be satisfied by the use of screens temporarily placed over lamps which are otherwise too brilliant, but a more satisfactory solution is possible, where Magnetite arcs are employed, by simply reversing the polarity of the supply. The arc then continues to burn steadily but with much reduced intensity. Some companies, however, prefer to fit one or two filament lamps in the projector casing, using these and extinguishing the arc when running within town areas. A single 16-c.p. auxiliary filament lamp is usual in parabolic-mirror projectors, and two, mounted in inclined positions, when Mangin mirrors are used.

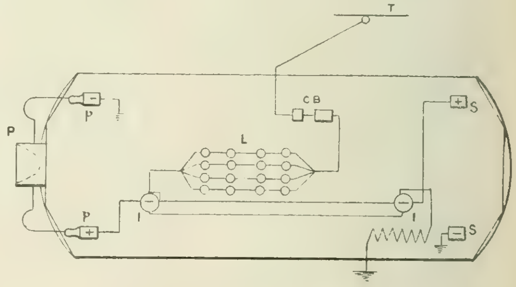

Fig. 4.

An exceptionally robust type of projector, designed for use on high-speed interurban railways, has a spherical mirror and lighthouse-type front lens (with concentric rings). High concentration of light is secured, and it is possible to see the track clearly for 650 yards ahead; as the train can usually be stopped within 570 yards, the power of the lamp is ample.

None of the above types have any internal globe liable to blackening, and involving frequent cleaning and renewal. The front glasses are strong, and so designed as to withstand uneven heating. The burning life of the electrodes is long, and control of the lamps is extremely simple.

In the connection diagrams (figs. 3 and 4), P represents the projector; P P the plug and socket connections; I I the contacts of the main interrupter switch; S S lamp sockets at other end of car; R_2 resistance; L lamps; C B a circuit-breaker; and T the overhead or rail supply. Fig. 3 represents the simplest possible connections, no provision being made for reversing the lamp current. Fig. 4 shows an arrangement for running the projector in series with incandescent lamps this being the most economical system available: when the incandescent lamps are to be used alone, the projector is replaced by a substitutional resistance.

REVIEWS.

Calcul et Construction des Alternateurs. By Heinr. Birven. Translated from the German by P. Dufour. 1911. Paris: Gauthier-Villars. Price 6 fr.

The chief value of this book lies in the part relating to the complete calculations required for the construction of alternators of given output, although a good deal of attention is given to the consideration of the general theory of single and polyphase currents. The book starts at once with the calculation of the sine curve and R.M.S. value of electromotive force and current as obtained by integrating the instantaneous values of each. For arriving at the effective value of the functions on curves other than sine curves, there is a useful table giving different values for the coefficient k (2·22 in the case of a sine curve), with seven various forms of curve. Chapter I concludes with several diagrams of armature windings relating in all cases to machines of the revolving field type. The last 15 pages of the chapter are spoilt by bad binding and printing, the omission of many pages breaking up the calculations completely. Between pages 34 and 48, for instance, eight have been completely omitted, and seven have been printed twice; diagram 33 has a slight omission.

In the second chapter, the author deals principally with the excitation of alternators. Kapp's diagrams and formulæ relating to the dispersion flux of the magnetic system are freely used, the author duly pointing out that the use of such formulæ is entirely dependent on coefficients obtained experimentally from other machines, and that they are applicable only under limited conditions as regards the form of construction of the machine. The methods of regulating the voltage of alternators are touched upon, automatic regulators being rather deprecated on the ground that a very fine degree of regulation is not consistent with several other important factors, including the cost.

Diagrams are given of three methods of compounding for voltage drop, but no mention is made of such well-known systems of regulation as the Heyland and Tirrill automatic systems. In a rather unconvincing way it is recommended that in the case of alternators working in parallel and excited by a common machine, storage battery plant should be installed as a stand-by and for lighting use in case of necessity. Except with a combined lighting and traction plant it is not likely that such a battery installation would be necessary or of commercial advantage.

Chapter III, dealing with the working of alternators in parallel, is more or less a repetition of Kapp's treatment of the subject in "Dynamos, Alternators and Transformers," and introduces nothing new. However, the running up, switching-in, and the conditions accompanying the processes are put in a clear and interesting way, as is also the subject of the periodic oscillations of alternators when connected to the circuit. No mention is made of the steam regulation of engines driving alternators connected in parallel, though it would have been particularly useful to state here the general principle concerned.

In Chapter IV, the subject of the energy losses in alternators is dealt with, and though it is considered briefly, it is put in a form likely to be interesting to students, which is a great point in a work of this kind. Having by now got thoroughly into the subject of the alternator as an independent unit, the author follows up with the two most interesting and useful chapters of the book. These chapters deal in a very complete way for such a comparatively small work, with the construction of alternators and the proportions between the various parts. They include illustrations of various types of machine, with the method of supporting them on foundations, the means by which the magnet coils and pole-pieces are attached to the spider, and calculations of the best proportions of spider arms, shaft and trunnions.

In the second of these two chapters, which concludes the book, the author goes systematically and completely through the electrical calculations, first of all, for a single-phase alternator of 150 KW. output working with a power factor of 0·8. The calculations are given methodically and completely, and would serve as a most useful guide to anyone in the design of machines of comparatively small size. They are followed by a comparison of the proportions, as calculated, with those of an existing 100-KW. single-phase machine built by Brioschi, Finzi & Cie., of Milan. The same process is then gone through for a three-phase alternator of 69 KW., a similar comparison being made with a three-phase machine by the Vereinigte Elektrizitäts Gesellschaft, and with another built by Garbe, Lahmeyer & Cie.

There is an error on page 124 in the formula for the distance between poles, in that on page 139 for the armature current in the single-phase alternator, and on page 140 in the current density in the armature coils.

In general, although there is no original treatment of the subject, which, indeed, is not intended, and although a great deal of the method of calculation seems to have been borrowed from Kapp's work on "Alternators," the book is of real value as giving in a clear, simple way, and consecutively, the calculations to be followed in alternator design. It takes nothing for granted; explains the facts on which each step in the calculations is founded, and has evidently been written by a man who understands the necessity, for the ordinary student, of having such a subject put in the clearest possible way, and who, moreover, has had some experience of the difficulties the student finds in other works of a similar nature.

Simplicity and clearness being the tone of the whole book, it is a great pity that in its present form it has not been carefully revised. It is disconcerting to get thoroughly into a calculation and then to find a page missing, and the many errors in the diagrams and formulæ, though obvious enough, if the latter are closely followed, oblige the reader to be particularly careful in checking them. The discipline may be good, but it leaves an impression of carelessness on the part of the author or the translator, or both. For English readers, the use of a comma instead of a point for the decimal notation, with a point for the multiplication sign, is also a little confusing.

Éléments de Calcul Vectoriel. By C. Burali-Forti and R. Marcolongo. Paris: A. Hermann et Fils. Price 8 francs.

The present edition of this work has been translated from the Italian. It is a treatise on vector calculation pushed to extremes, introducing many new symbols and methods of operation, with numerous applications to the solutions of questions relating to geometry, mechanics and mathematical physics. It aims to replace the system of co-ordinates by one of vectors. It is pre-eminently a work for the pure mathematician, and is quite unlikely to influence the present treatment accorded to engineering problems by practical men.

Tables Annuelles de Constantes et Données Numériques de Chimie, de Physique et de Technologie. Vol. I. (1910.) London: J. and A. Churchill. 1912. Price 24s. net.

This large volume is published under the ægis of the Association Internationale des Académies by the International Committee appointed by the Seventh Congress of Applied Chemistry, which met in London in 1909. It represents an enormous amount of labour; more than 300 periodicals, besides many other sources, have been consulted for information by a host of abstractors, under the guidance of an authoritative committee, with the aid of contributions from numerous Governments and scientific societies, and the work has considerably exceeded the expectations of the compilers, leading to some delay in publication. Unfortunately, in order to save time, it has been found necessary to omit the alphabetical index from this volume, and although it is hoped to issue the volume for 1911 before the end of this year, containing a general alphabetical index and an index of all the substances mentioned in both volumes, the omission cannot but be regarded as very regrettable. There is, however, an index of chapters and an analytical table of contents, which, to some extent, mitigate the loss.

Regarding the contents, of course these are not of a nature well adapted for reviewing. There are over 700 pages of tabular matter, relating to the properties and characteristics of the substances included within the enormous range indicated by the title, often accompanied by an extended bibliography. The data are those published in the year 1910, and while they indicate the intense activity of modern research, they do not necessarily represent the most authoritative values—though they are selected with a view to including only results of high accuracy. On the other hand, of course, a large number of the tables relate to properties which have not previously been investigated in detail. The bulk of the work is in French, but headings and tables of contents are given also in English, German and Italian, and little difficulty will be found even by those not familiar with French in understanding the tables. The volume is one without which no scientific reference library can be considered complete, and the printing and binding are of the highest order.

Berechnung von Wechselstromfernleitungen. By Dr. C. Breitfeld. Brunswick: Fried. Vieweg & Sohn. Price 4 M.

This seventeenth volume of "Elektrotechnik in Einzeldarstellungen" is confined to the electric calculations of A.C. transmission lines, and is intended as a simplification of the larger works, such as G. Roessler's, on the same subject.

The problem of long transmission lines is admittedly a fascinating one to the mathematician, but, at the same time, it is one which has fairly frequently to be handled by the practical engineer nowadays, and the theoretical point of view adopted throughout this book makes it unlikely that the actual designer of lines would obtain much help from it.

The physical meanings of the often lengthy formulæ deduced are not clearly explained, if mentioned at all, and the simplified expressions, which are the only ones that most engineers have time to use, are very scantily treated; the important question of their relative accuracy to that of the fuller solutions is hardly touched upon. A good many more explanatory diagrams might also have been introduced with advantage.

As an introduction to the complete theoretical study of transmission lines the book has its uses, but its general utility would be much enhanced, and it would take its place more naturally amongst the other volumes of the series to which it belongs, if the treatment adopted were a good deal less theoretical.

Wiring Calculations and Electric Light and Power Installations. By G. W. L. Patterson. London: Scott, Greenwood & Son. Price 5s. net.

Perhaps the first thing that should be said about this little book is that it immediately extracts from the reader the remark that, Surely such a book would have commanded a big sale many years ago? Its lateness does not, however, detract seriously from its present value, except in so far as its contents can now be found in more or less convenient form in some pocket-books and appendixes to text-books.

The tables and hints given should prove of the utmost value to the wireman and wiring contractor; their value is enhanced by the conciseness of statement and the absence of unnecessary theoretical matter. The writer is evidently of the opinion that an ounce of experimental evidence is worth a ton of theorising, and he has certainly given a vast quantity of data on all branches of wiring. The sections on alternating-current work are specially good, some quite difficult points being cleared up with an ease of diction rarely found in books intended for practical men, and this without lapsing into unscientific or inaccurate statement.

The tables occupy nearly one-third of the book, and are tolerably, but not entirely, free from typographical errors. The table of the electrical and mechanical properties of aluminium and copper is interesting and valuable.

One would prefer to see familiar formulæ and laws given their well-known names on their first appearance in the book —for instance, the time-honoured $C = E/R$ is quoted many times without any mention of Ohm's law; but beyond this, the book has no serious defects.

The Electrical Properties of Flames and of Incandescent Solids. By H. A. Wilson, F.R.S. University of London Press: Hodder & Stoughton. Price 6s. net.

There can be no doubt that among the theories that have been developed during the past few decades none has been more fruitful of experimental investigations than the ionic theory of gaseous conductivity.

Sir J. J. Thomson's part in the conception and development of this theory needs not to be laboured. His have been the suggestions that have occupied the Cambridge School of Physicists with a multitude of problems bearing on all sides of this question. And not only has he directed the many researches carried on in the Cavendish Laboratory and elsewhere, but with his own hands he has laboured continuously for nearly a quarter of a century on ionic problems needing great experimental skill, and still more of that scientific insight and experience—the Philosopher's Stone—which has turned so many apparently negative results into valuable additions to our scientific knowledge.

Chief among the experimenters who attacked the important problems of electrical properties of flames were McClelland, Richardson, Rutherford and H. A. Wilson. The last-named is responsible for the present volume, which is intended "to give a concise but fairly complete account of recent researches," "to present the mathematical theory required in as simple a form as possible," and "to make estimates of the reliability of some of the measurements described." Prof. Wilson has produced a book which is entitled to rank with the other "Ionic" classics of Rutherford, Whetham and Thomson himself.

No single branch of the subject is left untouched, and the hand of one who has been in intimate contact with the very experiments described can be clearly traced throughout the book. Here, too, we have the rare advantage of hearing from one who is in a position to judge something of the importance to be attached to the various kinds of experiments, and at the same time learning the directions in which future research is likely to yield fruitful results.

Chapter III may be cited as typical of the book. The discharge of negative electricity by hot platinum in hydrogen is discussed both experimentally and mathematically. The experiments are described and results given. Then Prof. Wilson, whose experiments figure so largely in this as in many other chapters, proceeds to touch upon his own recent work on the discharge in other gases, and concludes with the suggestive remarks that in the case of some observed peculiar thermionic currents "investigation is needed to find out their cause," and that the effect of other substances on these thermionic currents might yield interesting results if systematically studied. These examples of the true scientific spirit are typical of the book as a whole.

But while one cannot help waxing enthusiastic over the general conception and method of the book, there are some details which one cannot admire. In general the line diagrams are good, but a few seem to have been afterthoughts and ought not to have been included in such a rough and ready form.

Fig. 18 would not grace a cheap elementary text-book; still less does it match its well executed neighbours on pages 75 and 78. The formulæ on pages 65 and 67 should agree but do not, and there are a few minor typographical errors.

The first part of the book is devoted to the study of the discharge of negative electricity by hot bodies in vacuo and in various gases; then follows a chapter on the discharge of positive electricity. The whole subject of thermionic currents is treated mathematically as well as experimentally, and references are given to practically every paper describing original work on the subject.

Then follows a section on the "Conductivity of Bunsen Flames," a subject to which the author returns later in order to discuss the effect of "Alternating Currents and Magnetic Fields," the treatment of the latter being most lucid and complete.

The influence of salt vapours on the electrical properties of flames receives full consideration in the remaining chapter—the longest in the book. The Name Index is useful, but the lack of a Subject Index is regrettable.

Since this book is the only important work on the subject in English, it would be no praise to dub it the best of its kind, but if we adopt as a criterion the very high standard set up by the Cambridge school of writers on Physics, Prof. Wilson's book must take a high place.

NOTES ON INSTRUMENT TRANSFORMERS.

By CECIL TOONE.

Modern conditions of central station generation are such that most large undertakings employ instrument transformers to a greater or less extent, and the importance of these accessories has consequently greatly increased during recent years. In order that the presence of the transformer may be allowed for, once for all, in the calibration of the instrument to which it is connected, it is necessary that the ratio of transformation should be constant under all conditions of load and that the secondary current be but very slightly out of antiphase with the primary current. It is easy to correct for ratio and phase angle in those transformers used with switchboard instruments from which only commercial accuracy is required, and in volt and amperemeters, very accurate correction can be made by aid of tedious calculation. In watt-hour meters, however, it is impossible to compensate automatically for changes in the ratio and phase angle of the transformer with variation in the main load and power factor of supply. As a result of investigations into this subject, A. Maxwell, Am.I.E.E., concludes that if care is bestowed on the selection of a transformer for use with energy meters, the accuracy of the latter is not seriously affected by the ratio and phase characteristics of the transformer.

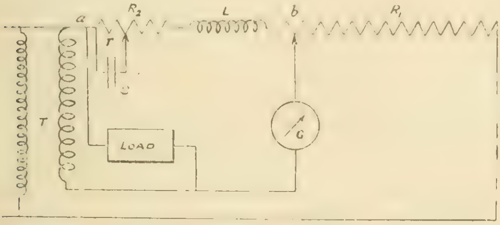

Fig. 1.

Potential Transformers are generally used on constant voltage systems and with constant secondary load. The ratio can be taken into account in calibrating the meter, but the phase angle can only be compensated for a single power factor of the load; the deviation from ideal phase relationship is generally negligible.

A simple method of testing these transformers (due to Agnew, Am.I.E.E.) is shown in fig. 1. Across the high-tension side of the transformer is connected a high resistance R_1, in series with a smaller resistance R_2, and an inductance L. The low-tension side is reversed across $a\ b$, through the vibration galvanometer G. Adjusting R_1 and L, till G is balanced, the ratio of the transformer $= [(R_1 + R_2) \times \cos\theta]/R_2$. The phase angle $\theta = \tan\theta =$

$$3{,}438\ P\ .\ L\left(1/R_2 - \frac{1}{R_1 + R_2}\right)\ \text{minutes.}$$

The best means of making the phase angle adjustment is by inductance in series with R_2 and a condenser across part of R_2. The condenser shunt is practically equivalent to a negative inductance of $C\ .\ r^2$, and, neglecting the term $(p^2\ C^2\ r^2)$, the effective inductance of the circuit $= L' = L - C\ .\ r^2$ and R_2 is unaffected by C.

Current Transformers of modern design show satisfactory ratio curves down to a load = 5-10 per cent. of the rated value, and the angle by which the secondary departs from its ideal 180° phase relationship with the primary is small over a wide range of current but may introduce serious error at low loads.

The ratio curve usually shows an upward bend at low loads, and by adjusting the light load running of the meter to be 1 per cent. to 2 per cent. fast (at 5 per cent. load), the effect of this alteration in ratio can be compensated without introducing risk of "creeping." A decrease in transformer ratio at low secondary loads is rare but offers no difficulty in compensation. So long as the shape of the ratio curve is similar to that of the accuracy curve of the meter, there is no difficulty in adequately compensating for ratio changes. In order that the ratio curve may be of the desired form, the load on the secondary of the transformer should be a minimum—preferably only the series meter coil and short connecting leads.

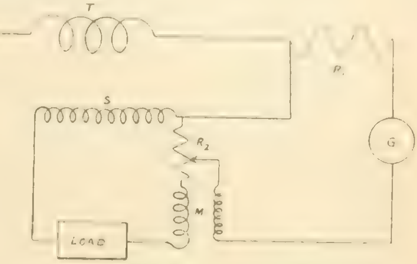

Fig. 2.

Errors due to phase angle cannot be compensated for all values of line load and power factor. In the best transformers, the phase angle remains practically constant over a range of secondary current from 10 to 100 per cent. of rated value, and in any case, the angle should not rise to more than 2° on 10 per cent. secondary load. Tests show the following meter errors due to the stated phase angles (secondary leading), when the line power factor has various values. (The meter runs fast on lagging line power factor and slow on leading line power factor.)

Transformer phase angle.	Meter error with line power factor —				
	1·0	0·8	0·6	0·4	0·2
15′	Nil	0·3	0·5	1·0	2·0
30	Nil	0·6	1·0	2·0	4·2
1°	Nil	1·2	2·2	3·9	
3°	Nil	4·0	7·0	—	—

The addition of reactance to the secondary circuit corrects the phase angle but alters the ratio curve at a faster rate, hence this method of compensation is not to be recommended. If a transformer is chosen with as small a phase angle as possible and loaded very lightly on the secondary side, the error due to phase angle is not serious for ordinary line power factors.

Transformers with poor ratio and phase characteristics—which category includes most transformers in which lightness has been made a special feature of design—should never be used with energy meters, though they may be quite suitable for operating trip coils and relays.

A method of testing current transformers, uniform with that described for potential transformers, is shown in fig. 2. Current is passed through the primary T and a standard non-inductive shunt R_1, and the secondary current flows through the normal instrument load, the primary of a mutual inductance and a non-inductive resistance R_2, a variable part of which can be included in the vibration galvanometer circuit. R_2 and M are adjusted till G shows no deflection, thus indicating equal (C R) drop in R_1, R_2 and compensation of the phase angle by E.M.F. due to M. The current ratio then $= R_2/R_1\ .\ \cos\theta$, and the phase angle $\theta = \tan\theta = 3{,}438\ P\ .\ M/R_2$ min. As a rule, the term $(1/\cos\theta)$ may be neglected, differing from unity by less than $\frac{1}{2000}$.

The methods of transformer testing described above possess many practical advantages. No polyphase voltage supply, phase shifter or rotating commutator is required. The test can be conducted by a single observer, and a single instrument serves for all ranges of transformers. Without any intermediate change of connections, transformers may be tested in which the phase angle changes from leading to lagging, and the inductance L (fig. 1) is of fixed value, and may be placed where its uni-directional stray field will not affect G. As high a sensitivity as $\frac{1}{10000}$ may be obtained at $\frac{1}{10}$ load—when testing current transformers under working conditions (*i.e.*, without temporarily over-loading the windings and thus altering the magnetic characteristics of the core)—by using a Campbell vibration galvanometer with a four-turn moving coil of No. 28 wire. A frequency range from 80 to 20 cycles/sec. is covered by varying the length and tension of the suspensions and loading the coil with a tiny brass washer.

OPENINGS FOR FOREIGN TRADE.

By W. H. BOOTH.

While our manufacturers are very eager to keep their shops full of work, comparatively little is being done to increase new outlets for business. The struggle is to get hold of a share of the business which is going. And so our trade representatives are seeking business in South American countries, where there are, perhaps, two to three million people spread over five or six hundred thousand square miles. There is nothing wrong with the countries, for they are fertile, and, as Uncle Sam has shown at Panama, they can be made healthy by abolishing flies, and, it may be added, whiskey, which, despite frenzied claims for its excellent results, is not entitled to many good words, though it may, perhaps, be useful as a temporary aid after snake bite. To hear some men talk, and to watch them act, one would imagine snakes were as prevalent as mosquitos.

South America is a great undiscovered continent. Taken all round, it is the most fertile part of the globe, and is literally a Mesopotamia. It has suffered, and suffers to-day, from bad Governments. Governments are, in their individual members, out for profits, and they are so shortsighted that they will lawlessly grab a shilling to-day rather than wait a year lawfully to receive a sovereign. It was much so at one time in the Argentine, but in some way Argentina was made the investing ground of many millions, and capital flowed in so quickly that it became safe, because too bulky to meddle with, and conferred wealth on the natives quickly enough to put the predatory instincts more nearly on a par with their holdfast instincts. They ceased to risk what they had. The Spanish-American, being a careless have-not sort of fellow, did not mind risking what he had when this was all under one straw hat.

But it is different now in the Argentine. The lesson of the Argentine has not been wholly lost, but it has certainly not been exploited as it might have been, or, perhaps, even yet may be. A cinematograph show of things before and after the coming of capital would be the best commercial pioneer that could be sent through South America from the Caribbean to La Plata.

The continent lacks settlement, transportation and security. As regards products, it is highly mineralised, but prospecting is difficult in a land so much grown over. River transport is excellent, but occasional shallows require attention, and there are shallow bars at river mouths. The Amazon is navigable to big ships almost across the continent, for the river is 79 ft. deep at 2,000 miles from the sea.

The Orinoco is a paltry stream beside the Amazon, yet it is 5 miles wide 300 miles up, and is over 480 ft. deep at the up-river port of Bolivar. But it has a bar of 15 ft., and a rock ridge at one place which only allows of 9 ft. draught for three weeks during the low season.

In itself it is not a power producer, though it could be made to furnish a good deal of small power by way of float wheels, for it has a very rapid current. On its left bank it receives many tributaries, which have few sudden falls, except towards their Andean sources, in Columbia.

The country south of the Orinoco is mountainous; 100 miles south of its confluence with the Orinoco, the Cuchivero tumbles over a 20-ft. fall. The Cuchivero is the smallest of the named tributaries of the right bank, but it is fully as large as the Thames at Richmond. Further in the mountains there are other falls. The river is rated as of the second class, and runs a course of 60 leagues.

The Caroni, a river of the first class, has a considerable fall close above its confluence with the Orinoco, and something has already been proposed, if not done, by way of a hydro-electric scheme, for working the mines of the Yuruari district. It has a course of 185 leagues, and is an immense river, navigable for 160 leagues. Its source is in the Parima Mountains.

Between the two rivers named is the Caura, a river of the second order, which takes its rise in the Parima ranges, as the two streams, Erewato and Merevari. After joining they become the Caura. At Mura there are extensive rapids capable of giving a great power. Further up stream, at Para, the level of the land changes 900 ft. in a few miles, and, since the Caura, with a course of 175 leagues, would make several rivers like the Thames, a rough notion may be formed of what could be made of it by way of hydro-electric works.

Venezuela offers a fine field for colonisation under steady, methodical and scientific management, for crops are heavy, and, of some products, more than one crop a year can be ripened. There are so few railways that electrical working could be employed from the start, avoiding scrapping of old plant, which is so serious an obstacle to electrification at home. There would be power for lighting purposes, estate purposes, saw mills and sugar works.

It is difficult adequately to describe the country, because it is so very fertile, and, though tropical, is not particularly hot. The temperature is high, but this is tempered by constant air movement. It is useless to attempt any systematic colonisation by individuals. Colonisation in a country like Venezuela can best be done under a paternal organisation on the lines somewhat of the British South Africa Co., some powerful company with a liberal charter, that should operate in a number of large sections of land up to 5,000 or 15,000 sq. miles in area.

In these tropical countries it is the worst of folly to dot a few isolated settlers far apart, with no society, no proper transport for their products, and no feeling of security such as would be gained through being a member of a powerful organisation. The Putumayo horrors arise from the operations of unprincipled adventurers in far-away localities. There are no such horrors in the rubber industry of Venezuela, but even there the poor peon is very badly exploited by the padrone system, for he is paid in goods on the truck system, and such goods are priced much too highly, and the result is that the fellow is always in debt to the padrone. All this would be stopped by a good organisation, and it would be more profitable than the truck system. The company would be able to establish stores, and would sell at fair and profitable rates to its own workers as soon as they realised they were not under compulsion, and they would also do a growing trade with others. The country is ripe for such an organisation, and our workshops are ripe for what results such an organisation could accomplish.

The above is no overdrawn picture, and, though written from personal knowledge of only a small part of the South American continent, it is believed to apply very generally to most other parts.

Traders' Needs.—Mr. S. J. Sewell, of 27, Chancery Lane, W.C., an old trade journalist, informs us that, finding that commercial men are determined that Parliament shall next year, by way of a change, seriously consider what burdens on trade can be lessened or removed, and how trade can be fostered instead of repressed, he is editing a 3d. book which will detail not only the laws which injure trade, but also the full needs of all classes of traders. He solicits suggestions of a non-partisan character, commerce, not party, being his sole concern.

ELECTRICAL AUTHORITIES AND THE LAW OF LANDLORD AND TENANT.

BY A LEGAL CONTRIBUTOR.

Among the legal questions which trouble those who are responsible for the supply of electricity, that which concerns the title to property and fittings is of considerable importance especially in view of the fact that hiring agreements have become more common in recent years.

It is clear, in the first place, that apparatus belonging to undertakers cannot be taken by a landlord as distress for rent in arrears. Thus, Sec. 25 of the Electric Lighting Act, 1882, provides that: Where any electric lines, meters, accumulators, fittings, works, or apparatus, belonging to the undertakers, are placed in or upon any premises not being in the possession of the undertakers for the purpose of supplying electricity under this Act, or any licence, order, or special Act, such electric lines, meters, accumulators, fittings, works, or apparatus, shall not be subject to distress or to the landlord's remedy for rent of the premises where the same may be, nor to be taken in execution under any process of a court of law or equity, or any proceedings in bankruptcy against the person in whose possession the same may be.

Had it not been for this section a landlord whose rent was in arrear, might seize any meters, switches, wires, &c., found on the premises when rent is in arrear. There are no cases in the law reports as to the meaning of the section, but there is a very similar section in an Act of Parliament relating to gas. It has been held that the words "any fittings for the gas" have a sufficiently wide meaning to include a gas stove. It may, therefore, be presumed that the words used in the above section would include an electric stove, cookers, kettles, shaving pots, &c., which may have been let on hire (see Gas Light and Coke Co. *v.* Hardy 17 Q.B.D. 619).

A most important provision with regard to electric fittings let on hire is to be found in Sec. 16 of the Electric Lighting Act, 1909. Certain fittings may, owing to the operation of a legal maxim *quicquid plantatur solo, solo cedit*, many fittings which are put up in a house—*e.g.*, wires, wires for pipes, and wood-casing—would become the property of him who owns the house.

Consequently, a motor affixed to the floor would become the property of the landlord. The case of Reynolds *v.* Ashby & Son (1903), I.K.B. 87, illustrates this. Their machines were supplied by the plaintiff on the hire-purchase system to the lessee for a long term of years, of a factory which he had mortgaged. The machines were affixed to the premises by the plaintiff's workmen by means of upright bolts let into the floor, which passed through holes in the bases of the machines, and upon which nuts were screwed. By the terms of the hire-purchase agreement, the machines were not to become the property of the mortgagor until the last of a series of payments for their hire had been made by him, and, if default were made in those payments, the plaintiff was to have power to determine the hiring and remove the machines. The mortgagor failed to make the specified payments. The mortgagees having entered into possession of the factory, the plaintiff gave notice to determine the hiring, and claimed to remove the machines, but the mortgagees refused to give them up, claiming them as fixtures. In an action brought by the plaintiff against the mortgagees to recover the machines or their value, the Judge held, on the authority of Hobson *v.* Gorringe (1897), 1 Ch. 182, that the machines were fixtures, and gave judgment for the defendants.

Owing to the hardship occasioned to hirers of electrical machinery by this state of the law, Sec. 16 of the Electric Lighting Act, 1909, provides that: All electric fittings, lines, apparatus and appliances let by any undertaker on hire, or belonging to any undertakers, but being in or upon premises of which the undertakers are not in possession, shall, whether they be or be not fixed or fastened to any part of any premises, in or upon which they may be situate, or to the soil under any such premises, at all times continue to be the property of, and be removable by the undertakers, and Secs. 24 and 25 of the Electric Lighting Act, 1882, shall extend and apply to all such electric lines, fittings, apparatus and appliances, provided that such electric lines, fittings, apparatus, or appliances have upon them respectively a distinguishing brand or other mark conspicuously impressed or made thereon, sufficiently indicating the undertakers as the actual owners thereof.

For the purposes of this section electric lines, fittings, apparatus, and appliances disposed of by the undertakers on terms of payment by instalments shall, until the whole of the instalments have been paid, be deemed to be electric lines, fittings, apparatus, and appliances let on hire by the undertakers.

Nothing in this section shall affect the amount of the assessment for rating of any premises upon which any electric lines, fittings, apparatus, or appliances are or shall be fixed.

Passing on to consider the relation between landlord and tenant in connection with electric light and fittings, it will be seen that while Sec. 16 above-mentioned settled an important question between company and consumer that question remains at large between landlord and tenant. Suppose, for instance, A takes a lease of a house and installs machinery therein, to whom does it belong? If an electric motor is put up in the basement to drive a washer or a grindstone, does that motor become the property of the landlord at the end of the lease? This question can only be answered by reference to decided cases. For instance, in Hellawell *v.* Eastwood (L.R. 4 Ex. 329) it was held that spinning mules fixed, some by screws to the wooden floor of a mill, and some by screws fastened with lead into holes in the floor, were not fixtures, on the ground that they were affixed for a temporary purpose, the object of the annexation not being to improve the inheritance, but merely to render the machines steadier and more capable of convenient use as chattels. But this appears to have been erroneous both in the use of the word "temporary" and in the object assigned for the annexation.

That this case cannot be much relied upon, appears from the later case of Crossley Bros. *v.* Lee (24 T.L.R. 35), in which the facts were these. A gas engine was let by a hire-purchase agreement to the tenant of certain premises, the engine being attached to the premises in the following way:—A rectangular hole was excavated in the floor, and at each corner of the hole a spindle was set up, being made fast to the ground and projecting 18 in., and the hole was then filled with concrete. The gas engine, which had four holes in its base, was laid upon the spindles, and nuts were placed on the spindles and screwed down. The landlord of the premises distrained upon the gas engine for rent due from the tenant. It was held that the engine was a fixture, and had become part of the freehold and was therefore not distrainable.

The annexation is not temporary if it is intended to last during the interest of the tenant in the premises, and if the machines, although steadied by the annexation and made more useful as machines, are really meant to enhance the value of the mill. Hence, in other similar cases, machines have been held to be fixtures. But a hydraulic press, fixed by bricks and mortar to the floor of a factory, which is a convenience, but not essential to carrying on the works, has been held to be a chattel, and so has a switchback railway, upon the ground that it was erected, not for the purpose of enhancing the value of the land, but only for the purpose of its more convenient use for machinery.

A gas meter fixed in a private house is a chattel, but the retorts, boilers, gas-holders, &c., at a gasworks, which are essential for the purpose of the works, are fixtures.

Physical connection with the land is not essential to constitute a fixture. Keys are so identified with a house as to rank as fixtures; and it is the same with the stone belonging to a mill. Similarly, when machinery becomes fixtures, parts of it which are not fixed, but which are essential to its working are fixtures also.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—VII.

The hearing in the Australian Arbitration Court, before Mr. Justice Higgins, of the application of the Australian Tramway Employés' Association for an award fixing by law their minimum rates of pay and conditions of labour, has been continued. In our last report the case for the men was practically concluded, and Mr. Hilton, the chief inspector of the Prahran-Malvern Tramway Trust, was giving evidence for his company. He stated that he had not heard of dissatisfaction among the men as to hours, classification, overtime or holiday. They had six days' annual relief, and four extra days for good conduct. The men had good notice of their days off. It was not possible to keep the lengths of shifts within 8¾ hours. As regards Sunday work, Mr. Hilton contended that the industry was a seven-day one, and that those engaged in it ought not to expect special payments for working on that day. The same rule held in the case of public holidays. Questioned as to the company providing watches, he said that, so far as he could tell from his own observation, every man who applied for a situation had a watch. Mr. H. S. Dix, the engineer and manager of the system, stated that the total increased cost in granting the whole of the men's claims would, on their system, amount to £12,505 per annum. Their revenue last year was £26,314, and their expenditure £20,437. The trust was now building other lines in new districts, and it was probable that for some time the expenses would increase faster than the receipts. Mr. Cameron, the chairman of the trust, pointed out that the trust had met the men's demands as far as they could, in some cases going beyond the men's Union demands, but they could not meet the claims now made.

Mr. Meakin, one of the lessees of the Northcote tramway, was then examined. There were only 40 employés, and there had been no serious complaints made by the men. The undertaking could not pay the demands now made by the men's Union.

Mr. Wilcox, for the Melbourne Tramway Co., wished to speak on the general results of the various demands, but was overruled by the Judge. Mr. Denham, the chief inspector of the line, stated that he thought gripmen ought to get 3s. per day more than conductors. At present the difference was 1s. He considered that if the employment of casual workers was not permitted, both the company and their employés would suffer. He would not agree that preference was given to non-unionists, though the company's dislike to the men's Union was well known. A notice issued by the company warning their employés against joining the Union was put in, and witness was asked if he did not consider it a threat to the men. He said he did not think this was in the minds of the directors.

At this stage of the proceedings, owing to some dispute with his committee as to the way in which the men's case was being conducted, Mr. Prendergast retired from the case, and his place was taken by Mr. A. C. Warton, the general secretary of the men's association.

The traffic superintendent of the Melbourne system explained that it would not be practical, without considerable additions to the staff, to abolish the employment of casual labour.

The Judge expressed the opinion that he was unwilling to fetter the freedom of the management unless it could be shown that it could be done without serious inconvenience to the public. He thought that it rested with the men to prove that the changes they advocated were practicable.

He further considered that during the forthcoming recess every effort should be made by both masters and men to meet and try and come to some mutual agreement. He was growingly convinced this would be the best course, as the agreements need not be identical, but modified to suit local requirements. Mr. Warton, on behalf of the men, stated his willingness to follow this plan, and after a day or two's consideration the employers partially agreed too. After some further general evidence had been taken, and the Judge had emphasised his desire that the case should be settled by mutual agreements rather than a definite binding award, the case was adjourned till the close of the recess.

The appeal against the decision of Mr. Justice Higgins granting to the members of the men's association the right to wear their badge of membership while on duty was argued in the Court of Appeal. It will be remembered that this was the ostensible cause of the Brisbane strike. Counsel on the employers' side argued that this was not an industrial matter, and that consequently it did not come under the Act at all, so that the action was *ultra vires*. On the men's side, it was claimed that it did concern the men, inasmuch as it affected the ordinary course of the industry. After hearing the arguments, judgment was reserved.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,458. "Variable-speed driving by electric motor and self-contained mechanical change gear." H. V. James. August 12th.

18,477. "Circuits for the transmission of alternating, undulatory, and pulsatory electric currents." E. F. Furtado. August 12th.

18,479. "Electric secondary clock alarm." G. Lange. August 12th.

18,482. "Electric lamps for vehicles." C. E. Pehrsson. August 12th. (Complete.)

18,498. "Circuit arrangements for automatic telephone systems." Siemens and Halske Akt.-Ges. (Convention date, August 14th, 1911, Germany). August 12th. (Complete.)

18,529. "Telegraphic-transmitters." W. S. Steljes. August 12th.

18,562. "Electrical signalling-device." T. Weiss and T. A. Walther. (Convention date, October 21st, 1911, United States.) August 13th. (Complete.)

18,571. "Electrical accumulators." C. de Sedneff. August 13th. (Complete.)

18,596. "Electrodes for electric arcs." A. J. Boult. (Dynamit Akt. Ges. vorm. A. Noble & Co., Germany.) August 13th. (Complete.)

18,603. "Metal vapour alternating-current rectifiers and similar apparatus." Hartmann & Braun Akt. Ges. (Convention date, March 2nd, 1911, Germany. Divided application on 5,415/12, March 4th.) August 13th. (Complete.)

18,632. "Production and wireless transmission of electrical oscillations." H. Heinicke and M. Jasper. (Divided application on 28,851/11, December 16th.) August 14th. (Complete.)

18,654. "Electric clocks and the like instruments." C. H. Davies. August 14th.

18,655. "Telegraphy and telephony by submarine cables, long-distance overhead lines and the like." J. Schiessler. (Addition to and divided application on 4,061/12, February 17th. Convention date, February 18th, 1911, Austria.) August 14th. (Complete.)

18,676. "Telephone system." J. Baumann. (Convention date, August 14th, 1911, Germany.) August 14th. (Complete.)

18,677. "Telephone system." J. Baumann. (Convention date, August 14th, 1911, Germany.) August 14th. (Complete.)

18,689. "Arc lamp electrodes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 14th.

18,746. "Electric cranes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 15th.

18,747. "Electric rectifying apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 15th.

18,764. "Electric lighting and ignition apparatus of motor-vehicles and the like." B. Brooks and W. Holt. August 16th.

18,777. "Brush gear for dynamo-electric machinery." Lancashire Dynamo and Motor Co., Ltd., R. S. McLeod and J. H. Wild. August 16th.

18,809. "Apparatus for the measurement of electrical energy." H. Gottschalk and H. Aron Elektricitatszahlerfabrik G.m.b.H. August 16th. (Complete.)

18,810. "Electric meters." H. Gottschalk and H. Aron Elektricitatszahlerfabrik G.m.b.H. August 16th. (Complete.)

18,847. "Electric clock systems." A. R. Upward. August 16th.

18,848. "Electric clock systems." A. R. Upward. August 16th.

18,889. "Device for locking electric incandescent and like lamps in their holders." W. H. Lowth. August 17th.

18,893. "Means for producing magnetic or electric fields." M. Plohl. (Addition to 15,774, 1912. Convention date, August 18th, 1911, Austria.) August 17th. (Complete.)

Spain.—On the authority of the German Consul at Barcelona, the *Nachrichten für Handel* (Berlin) states that there is a large demand in Spain for electrical apparatus, such as dynamos, motors, incandescent lamps, transformers, &c., and that there are excellent opportunities for doing business, especially in the case of the lighter machines weighing up to 8 cwt., as well as in the case of small electric fittings. Particularly noticeable is the great increase in the use of electric incandescent lamps, in which it is stated that there is a large import trade to be done, in spite of the increasing number of works manufacturing these articles in Spain. —*Board of Trade Journal.*

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electrolytic Cells. R. Threlfall. 10,142. April 26th.

Fusible Cut-outs for Controlling Electric Circuits. V. Hope. 14,803. June 26th.

Application of Radioactive Phenomena to Telephony. A. Vojen. 17,027. (Convention date, August 30th, 1910.)

Automatic Electric Burglar Alarm working by the Opening or Short-circuiting of its Protective Circuit, and fed by a Double Circuit connected to the Two Terminals of a Single Battery producing a Constant Current. H. C. Basuyau and V. A. Leroux. 17,086. July 26th.

Electric Motors and Dynamos. T. L. R. Cooper. 17,716. August 3rd.

Automatic Telephone Exchange Systems. Western Electric Co. (Western Electric Co.) 18,648. August 18th, 1912.

Regulators for Electrically-driven Ring Spinning and Doubling Machines. Siemens Bros. Dynamo Works, Ltd., and Kieffer. 19,083. (Addition to 23,641 of 1910.) August 25th.

Speed Regulation of Electric Motors. J. Wagner. 19,362. August 30th.

Receiving Apparatus for Use in Radio-Telegraphy and Telephony. A. de C. Bower. 19,829. September 6th.

Mercury Jet Interrupters. F. W. W. Baker and G. Pearce. 25,860. November 26th.

Switches for High-tension Electric Currents. Marconi's Wireless Telegraph Co., Ltd. (Entwistle.) 26,158. November 22nd.

Electric Maximum and Minimum Excess Voltage Switches. E. Eisemann and E. Eisemann & Co. Ges. 27,729. December 9th.

Electric Door-Operators. T. Nakahara. 28,488. December 18th.

Dynamo-Electric Machines. A. Juston. 28,750. December 20th. (December 27th, 1910.)

1912.

Receiving Apparatus for Electric Oscillations. Ges. fur Drahtlose Telegraphie. 2,883. January 30th. (March 14th, 1911.)

Electromagnets. D. E. Barnes and A. A. G. Jensen. 2,702. February 2nd.

Brush-shifting Mechanism for Dynamo-electric Machines. British Thomson-Houston Co. and Young. 4,688. February 24th. (February 24th.)

Negative Electrodes for Electric Searchlights. Geb. Siemens & Co. 4,780. February 26th. (April 28th, 1911.)

Insulators for Telegraph, Telephone and other Electric Wires and Cables. T. Taylor. 5,053. February 29th.

Suspension of Overhead Conducting Wires for Electric Railways. A. G. Bloxam. (Bergmann-Elektricitats-Werke Akt.-Ges.) 6,670. March 18th.

Method of obtaining Electricity from the Air. Johannsen. 7,263. March 25th. (March 25th, 1911.)

Germany and Electrical Export Trade.—Commenting on the recent progress of the German electrical machinery industry, which represents one-third of the national production, and in particular of the export trade, the *Electrotechnische Zeitschrift* points out the misleading character in this case of round figures, as a large portion of the cost of electric installations is represented by non-electric machinery, such as boilers, engines, rails, cars, &c.; also by accessory objects, such as porcelain insulators, carbons, accumulators, standards, &c. Of a normal month's shipments of electrical exports, less than half are represented by electrical machinery, fully two-thirds being composed of cables, lamps, carbons, accumulators, and accessory material. In electric installations generally, strictly electrical machinery—dynamos, transformers, motors, &c.—constitute actually only one-tenth of the total outlay. In this relatively restricted field, nevertheless, German industry has made great strides, and as regards the foreign trade, by dint more especially of, judicious capital investments. "There is," says our contemporary, "no other (German) industry which has made, and still makes, such large investments of capital abroad as the electrical. We need only to consider the foreign investments of the big German banks, or of the two great electrical concerns, A.E.G. and S.S.W. and their daughter companies, or the share of the Felten & Guilleaume concerns in the trans-Atlantic cable companies called into being by them, to recognise what German capital and German enterprise have effected abroad. The German electro-technical industry has everywhere abroad where a possibility was offered, and where the anti-German animus or tariff barriers were not insurmountable, and especially on the European Continent and in South America, created the largest of installations. In English South Africa, by the lucky combination of German and English capital, the way has been opened to German industry, of which the Great Victoria Falls power station is only one example; albeit the entry of our manufactures into English Colonies generally is much handicapped by the preferential tariff which the Motherland enjoys. In none of these lands, as indeed universally, are we loved, and products "Made in Germany" are only taken there when they are actually better, and the personal advantage of the buyer stills his national hate. North America will always be a closed field to us, for a lightening of the import tariff—as our exclusion from the San Francisco Exhibition also showed—will never be made. North American industries suffer too much from excessive over-production to be likely to facilitate the competition of one of their largest world competitors. From the foregoing it may be seen that the German electrotechnical industry, especially in the last decennium, has attained respectable dimensions, and it may be concluded that, with the inclusion of new fields, as, for instance, that of main railway construction, a steady growth is assured.

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MORALS FOR CONSULTING ENGINEERS.

OWING in great measure to the attitude of the ELECTRICAL REVIEW, electrical manufacturers and contractors are not troubled so frequently now as heretofore by specifications drawn solely in the supposed interests of the buyer. Consulting engineers now act usually as if they really understood the fundamental nature of their function, which is to act as an unbiased mediary as between buyer and seller, seeing that the buyer gets that for which he contracted, but ensuring equally that the seller is treated honourably by the buyer. Too often in time past consulting engineers conceived themselves solely as protectors of the poor buyer, whom they surrounded with a laager of prickly clauses and conditions, while they themselves retired into bomb-proof shelters impenetrable to the contractors' cries for mercy and justice, which seemed to buyer and engineer to be the savage roars of malign and crafty creatures out for their blood.

Occasionally even now specifications are issued as if from the right hand of God, but there are not many consulting engineers in good practice who think it shameful to admit even tacitly that they are at least as fallible as eminent personages in other professions and businesses to whom our Lady Justice still presents the blindfold eyes and even balance which Englishmen are said to adore.

If we think of the reasons which guide an engineer in drawing specifications unfairly to the seller we find two which seem radical. The first is that inaccurate conception of the primary function of a consulting engineer, mentioned above; and the second is sheer ignorance. Both reasons need not be operative in any one case, of course; and it would be difficult to say under which buyers have suffered most.

A very interesting clause from a psychological point of view occurs in many specifications at the present day, and, as it is responsible for much unnecessary hardship, it is desirable to draw public attention to the fact in the hope that alleviation may be obtained.

When a consulting engineer is employed, let us suppose, to devise and superintend the electric lighting of a building, he finds that he has to provide for "cutting away and making good."

He wonders whether he will treat this as part of the wiring contract, or whether it should be left to the builder: and, in reasoning out the matter, he considers first of all the effect upon his client. Obviously it is essential that the cutting away and making good shall be done in such a way that the fabric is not damaged, and to ensure this the work should be done by the proper tradesman, who, in this case, is a builder. Very well, specify that the wiring contractor shall employ a builder to do this work, or simply that it shall be done to the satisfaction of the client's architect. But the client always employs a particular firm of builders, and will not hear of any other touching the building; or perhaps the building is in course of erection, and it would be impolitic to risk the introduction of two builders on the job. Let us then omit "cutting, &c., . . . " from the wiring contract, and, in order that the client shall know all his liabilities, get the builder to give an estimate for the work. This the builder, like a wise man, refuses to do, as he has no data, and the consulting engineer is not sufficiently well acquainted with the commercial side of electrical work to help him. Here is a dilemma, and here is just where the engineer sometimes lets his feet slip from the path of justice. He resorts to violence to shield ignorance which in this case is quite excusable, and he forthwith places the wiring contractor on the rack. Scratch goes the pen, and out on the innocent paper comes a clause declaring that the cutting away and making good shall be done by Mr. So-and-So, the builder in possession, and shall be paid for by the wiring contractor.

That was a clever stroke! Out comes the buyer from the bog of unknown liabilities, but in goes the contractor. Where now is our Lady Justice? Weeping in a corner while the consulting engineer peeps out of the eye-bandage and tilts the scales to the buyer.

It is easily seen how the tendering contractors are placed, and what the builder will do under the circumstances. The tenderer who estimates human nature most highly will get the job, and the builder will act just as anyone of us below the rank of an angel would act if he were a monopolist.

And the sad end of it all is that the buyer, the very man in whose interest this clever way out of a dilemma has been found, has to pay more for the wiring than if the contractor had been permitted to buy in the open market.

Why do you tender? says the outsider. Why, Oh! Outsider, does anybody gamble, and speculate on and off the Exchange, and bet even on human nature?

As an extreme instance of the cost of "attending electricians," as the builder's phrase goes, comes to memory a contract for £300 on which the builder-in-possession charged between £500 and £600 for this work.

One, at least, of the Government departments has an excellent way of dealing with this admittedly difficult point. Cutting, &c., is excluded from the wiring contract, and a builder is employed by the Department, under the supervision of its skilled officials, to prepare for the wiring contractor, and, if necessary, to make good after him. The contractor has to set out the work, and is required to keep the builder going without intermission; but should the same work have to be gone over again, or should the contractor have forgotten or delayed to set out the builder's work, the cost is borne by the contractor.

The conclusion of the whole matter is that the buyer, or the buyer's engineer, has no right to contract for anything and then close the market to the contractor.

* * *

When a Leak is not a Leak.

A recent issue of one of our contemporaries devoted to the furtherance of the gas industry contained an analysis of the working of 18 well-known municipal gas undertakings for the year 1911-12, which at first sight gave us rather a shock. For it appears that the gas unaccounted for by these concerns — which we presume disappears somewhere between the works and the consumer—averages out at 5·4 per cent. of the total production, or, roughly, 300,000 cb. ft. per mile of main.

Birmingham, the largest undertaking mentioned, managed to lose some 378 million cb. ft. during the year, averaging 445,000 cb. ft. per mile of main, while its small neighbour Smethwick, with even more elusive gas, got rid of 550,000 cb. ft. per mile of main in the same way.

We have, of course, always known that gas people were callous in regard to leakage on the consumer's side of the meter, and that the discovery of gas in electrical street boxes was a matter of painful surprise to them; now we have in black and white a candid declaration that gas to the tune of half a million cb. ft. per mile of main goes astray, disappears— in fact, anything but escapes. The poor central station engineer tied up by Government regulations enjoining that leakage current shall not under any conditions exceed one-thousandth part of the maximum supply current and compelled to provide instruments to record continuously the deficiencies, if any, of his distribution network, may be pardoned for wondering why this laxity is permitted in the case of a huge quantity of poisonous gas disappearing.

For it does not leak—no one would suggest that for a minute. Indeed, another issue of the same journal in referring to the subject assures us that "the attack is quite wrong in assuming that 'loss of gas' in the annual reports means gas which has escaped—it is simply gas not accounted for, in which leakage is only a factor at any time . . . ."

What could be more convincing?

Miners' Electric Safety Lamps.

On another page we give a description of the "Ceag" lamp which was successful in receiving the chief prize of £600, and also one of its competitors, the "Stach" lamp, which, with seven others, was awarded a prize of £50 each. Both these lamps, it will be noticed, are German inventions; out of the nine successful competitors there were three from Germany, and amongst them one of such excellent merit that, taking a money value, the judges deemed it worth 12 times more than any of the others. From the descriptions of the two lamps in this issue, it will be easily seen why the "Ceag" is the better, and we may assume that the "Stach" lamp is fairly representative of the other lamps which obtained the minor awards. It is a little difficult to understand why British manufacturers have so neglected this really very important piece of mining equipment, as neglected it undoubtedly has been, and even the offer of a £1,000 prize scarcely roused them from their lethargy. Probably now they will wake up when they really understand that a miner's electric safety lamp is not something that might be wanted sometime, but is already being demanded. For instance, in the report of the late Mr. Pickering (H.M. District Inspector of Mines for Yorkshire and Midland District), we read the following:—"The total number of safety lamps in use was 211,356, being an increase of 3,081, as compared with the preceding year. A striking feature of the table is the increase in the number of portable electric lamps from 69 to 922. With my approval the management of two mines introduced this type of lamp into the workings. They give an incomparably better light than the safety lamps, and their general use would have the effect of reducing accidents, especially from falls of roof and from haulage."

Again, in Mr. Walker's (Scotland district) report, we find:—"At three mines electric lamps have been introduced, and, as far as I have heard, have given satisfaction. There is, in my opinion, a great future for such lamps, and I trust one of this description will be devised and adopted which will meet all the conditions it is claimed the Scotch lamp at present does without the danger it possesses of igniting small quantities of fire-damp, owing to its being carried in the miner's cap."

Altogether, we find that in the mines of Great Britain there were 4,298 miners' electric safety lamps in use during 1911, out of a total of 723,924, so that it would seem there is any amount of room for development. We also note that 341,345 of the ordinary oil safety lamps were lighted by electricity.

Turning for a moment to accidents caused by explosions of fire-damp, we find that the use of naked lights caused 17 separate fatal accidents, resulting in 21 deaths, and 119 separate accidents caused injuries to 184 workmen. One fatal accident, causing three deaths, was traced to a safety lamp, while three other accidents with safety lamps caused injuries to four workmen. Another fatal accident, not included in the above, is supposed to have been caused either by a man "striking a match after his safety lamp was extinguished by gas, or by the gauze of the safety lamp becoming so hot by its burning with a full-sized flame in firedamp that the outside gas was ignited."

That "familiarity breeds contempt" is well enough known, and as we are all more or less guilty of treating daily occupations as if nothing untoward ever would or could happen, so it is with the miner. He, last of anyone, expects an accident to him, so that one can understand—though not excuse—a little carelessness on his part, for which he is often severely punished. He must be protected against himself, and the best way to do this would be to supply him with an electric safety lamp. We are quite certain that he would gladly accept it on account of the better light—and there can be no doubt of its being a real "safety" lamp, and not one in name only.

The Gas Danger in Train Lighting.

From time to time we have called attention to the danger of train lighting by gas; indeed, this danger has been officially recognised in this country, although, so far, official warnings on the subject do not appear to have led to any tangible result.

Only last month two further accidents happened. One, at Manchester Exchange Station, where the gas reservoirs of a train were being charged, and escaping gas became ignited by a lamp which one of the men carried, resulted in an explosion and injuries to seven men; the other in Toronto, Canada, resulted in a sleeping car and a baggage car being practically destroyed, while the passengers had barely time to make their escape.

There is a startling similarity between the two cases, as the *Toronto Mail* states that the accident at the Union Station was due to the torch carried by a car tester setting fire to the gas tank under the car, presumably because the latter leaked. At any rate, the flames spread so quickly that the 25 occupants of the car fled in their night attire, minus their belongings, which were destroyed with the car, a similar fate befalling an adjoining baggage car.

So many accidents of one kind or another have been reported in connection with gas-lighted trains, and the safe alternative of electric lighting is so ready to hand, that one begins to suspect Government and railway departments of being alike indifferent as regards the safety of both passengers and employés.

Strikes and the Public.

One is inclined to question the wisdom of setting up a Council to inquire into trade disputes so as to prevent strikes, such Council having no compulsory powers. What can it effect? If it secures respect for its conclusions, it may be able to direct the public sympathy in the right line. No strike can really be a success if the general public do not sympathise. The public did not sympathise in last year's railway strike, because they felt that the strikers had deliberately set themselves to inflict all the injury they could on perfectly innocent people. The public usually come to fairly just conclusions, and one thing they do insist on is that privileged workers, such as Government servants, railway and tramway employés, and the staffs of gasworks and electricity works should have special consideration for the public.

No class of the community can raise its status as a class, except by the will of the general community. Hence the fact that the community really determines the success or failure of a strike according as it approves or disapproves of the action of either side. Thus in the strike of 1897 in the engineering trades the men virtually lost very largely because the public saw that the Trade Unions were acting inhumanly towards the unskilled men, especially in the matter of machine-tool attendance. The strict Trade Union attitude was that the smallest automatic tool should of itself absorb the whole time of one skilled tradesman. We have heard workmen claim that a man has a better chance of rising in America; that in Great Britain a man is kept down to his class by those in higher classes. Yet these very men were rigidly keeping down their assumed inferiors to the lower unskilled ranks from which Trade Unionism forbade them to rise. This sort of thing, of course, prevails in all professions and employments. Medical men of no serious knowledge object to the quack, who may be a mere humbug or may be a far better man than his detractors. But he is of the great order of quacks, and there is no distinction made. George Stephenson was an engineer, if we accept Telford's definition of the title, but he could not enter the Institution, simply because he had not been a pupil to a member of it. To-day all the engineering Institutions have among their members many who are proprietors of works, and some of these men have no title to be regarded as engineers; but their draughtsmen would be shut out or granted Associateship by grace, and yet might be engineers in every fibre. This is all akin to the spirit of the recent strikes, which have been instituted by men in good positions at the expense of their equals who have been less fortunate in securing steady work. The general community is so very largely composed of those whose billets are much less permanent and less remunerative than those of tramway or railway men, that these more or less casual workers count heavily in public opinion.

Any strike Council to be of use must really gauge and act upon the general popular opinion. It is to be hoped that strikers have now learned that they cannot outrage public sentiment and secure public sympathy. The public perceived that the recent dock strike, which put so many unionists into starvation, commenced with a demand to prohibit a non-union man from working. He was to be starved. And the public withheld their support, with fatal consequences to the strike.

A Large Russian Contract.

Some particulars have recently appeared in the daily Press regarding an exceptionally interesting scheme which is under consideration in connection with the supply of water to St. Petersburg. The river Neva being the source of supply, the water has to be purified and sterilised before it can be used, and for some years past the municipal Duma has tentatively employed ozone for the process of sterilisation; the results have been so satisfactory that the system is now to be adopted on a very large scale at the Spalernaia waterworks, where no less than 60 million gallons will be dealt with daily. The estimated cost of the installation—which includes buildings, power plant of several thousand kilowatts, ozone generating plant, air driers and coolers, ozonisers and sterilising towers, and the necessary air and water pumps—was about 10 million roubles, and three tenders were submitted by Continental firms in the neighbourhood of that figure. We are pleased to notice, however, that a British tender has been put in, quoting a price some 3 millions lower for the complete installation; so large a difference must necessarily weigh heavily in our favour, in spite of the well-known influences which are notoriously met with in Russian enterprises, and we can hardly imagine that the City Council will sanction the expenditure of the larger sum in the face of the British offer. The latter, of course, emanates from the Ozonair Co., who, without making any fuss, have been quietly developing their system and have carried out a surprisingly large number of permanent installations, one of the most recent being that for the supply of ozonised air to the whole of the Central London Railway tunnels.

The contract under consideration is not only the largest as yet undertaken by the company, but is also the most important of its kind in the world, and we sincerely trust that the British tender will receive fair and impartial treatment at the hands of the municipality of the Russian metropolis.

National Sporting Club Illumination.—A recent installation of Osram drawn-wire lamps has been put in at the new theatre of the National Sporting Club. The main lighting scheme of this hall consists of three large panelled electroliers, 6 ft. in diameter, carrying 16 frosted round-bulb Osram lamps on the perforated corona at the top and 16 clear 50-C.P. Osram lamps in the interior. The panels of the fittings are glazed with rolled obscured plate glass. A most brilliant light is secured, giving a perfect illumination from ceiling to floor.

THE BRITISH ASSOCIATION.—I.

On Wednesday the British Association opened its annual meeting at Dundee—exactly 45 years to the day and hour, as the President pointed out in his address, from the moment when the Association met at Dundee under the presidency of the Duke of Buccleuch. "There were giants on the earth in those days": such men as Francis Galton, John Tyndall, Archibald Geikie, Sir William Thomson, W. J. Macquorn Rankin, J. Clerk Maxwell, Charles Wheatstone, William Crookes, Alfred Russel Wallace, and Sir William Armstrong—to name only a few—were present on that occasion, when the tide of progress in science and engineering was running high, and boundless fields of discovery were open to the genius of research.

Then John Tyndall delivered an Evening Discourse on "Matter and Force": now the keynote of the meeting, struck by the President, Prof. E. A. Schäfer, is the problem of the nature, origin and maintenance of Life—life in the scientific sense, which is essentially associated with matter. We are unable in this place to deal at length with Prof. Schäfer's masterly exposition of this fascinating subject; suffice it to say that, while vast progress has been accomplished and remarkable discoveries have been made in connection with the nature and maintenance of life, the man of science appears to be no nearer to a solution of that eternal mystery—the origin of life on this globe. Regarding the evolutionary hypothesis, the President says:—"The origin of life must have been due to the same process, this process being, without exception, continuous, and admitting of no gap at any part of its course." Quite so; the difficulty is found, not in following the course of evolution, but in accounting for its initiation. Various theories are discussed by Prof. Schäfer, but there is no evidence to support any of them, and eventually he passes on with the remark, "*Assuming* the evolution of living matter to have occurred . . . ." and the word we have italicised aptly sums up the position.

On taking the chair of Section A (Mathematics and Physical Science), Prof. H. L. Callendar, LL.D., F.R.S., briefly referred to four distinguished members who had died during the year: George Chrystal, Professor of Mathematics at Edinburgh for more than 30 years, and secretary of the Royal Society of Edinburgh since 1901, author of well-known mathematical works and of the classical article on "Electricity and Magnetism" in the "Encyclopædia Britannica"; John Brown, F.R.S., who will be remembered for his experimental work on the Volta contact effect between metals; William Sutherland, sometime Professor of Physics at Melbourne and author of numerous papers on molecular physics; and Osborne Reynolds, the first Professor of Engineering at Owens College, chiefly famous for his accurate determination of "J" over a large range of temperature and for his last great work on the "Submechanics of the Universe."

The present year has been one of remarkable activity in the world of mathematical and physical science, if we may measure activity by the number and importance of scientific gatherings for the interchange of ideas and the general advancement of science. Prof. Callendar spoke of the vast importance of such gatherings, not only in their effect on the particular societies or industries involved, but also in their promoting "that ever-growing fellowship among men of science, which is one of the surest guarantees of international progress." The facilitation of the interchange of students between different Universities as discussed at the Congress of Universities of the Empire and the peculiar advantages that would thus accrue to students in the higher branches of research were also touched upon; also the work of the recent Optical Convention in revealing the extent of our optical industry and talent, and that of the Radio-Telegraphic Conference in formulating regulations for extending the applications of modern physics to saving life and property at sea.

Observing the impossibility of reviewing in detail the important work of these Congresses and the equal impossibility of giving any connected account of the recent developments in the rapidly-widening field of physics and mathematics in the short time at his disposal, the President proceeded to adopt an "appropriate alternative . . . to select some theory or idea, sufficiently fundamental to be of general interest, and to discuss it in the light of recent experimental evidence." The advantage of taking stock of our fundamental notions in this way and of determining how far they rest on experimental evidence as distinct from developments of some analogy, reasonable enough up to a point but leading into error if pushed too far, cannot be gainsaid, and in proposing to consider in this way some of our fundamental ideas with regard to heat, Prof. Callendar has created a wise precedent.

At the outset, he remarked that the general impression that there was something fundamentally wrong about the old caloric theory had been gained as a result of the method commonly adopted of selecting all the mistakes made in the application of this theory, and contrasting them with the correct deductions made from the kinetic theory. It was his intention to show this fictitious antagonism between the two theories to be without real foundation, that they should rather be regarded as different ways of describing the same phenomena, and that although the kinetic theory might be generally preferable for elementary exposition, the caloric theory would have the advantage of emphasising the importance of fundamental physical conceptions, which are often lost sight of in the kinetic method of treatment.

The experiments of Rumford and Davy, although proving that caloric did not possess in any marked degree the properties of an ordinary ponderable fluid, did not prevent the simple conception of caloric, as a measurable quantity of something, leading, in the hands of Laplace, to correct values for the ratio of specific heats and to the adiabatic equation for gases. In the same way the conception of the electric "fluids" played a very useful part in the description of electrical phenomena long before their actual existence as physical entities had been demonstrated.

Although still misrepresented on the ground that much of his reasoning is expressed in the language of the caloric theory, the work of Sadi Carnot, "Reflections on the Motive Power of Heat," remains the greatest contribution of the caloric theory to thermodynamics.

Carnot set himself to investigate the conditions under which motive power was obtainable from heat, how the efficiency was limited, and whether other agents were preferable to steam. The answer which Carnot found embraces the whole range of science in its ever-widening scope.

By means of the "cycle" which now bears his name, and using only the simplest conceptions of the caloric theory, Carnot evolved the simple but sufficient rule for maximum efficiency:—"In order to realise the maximum effect, it is necessary that, in the process employed, there should not be any direct interchange of heat between bodies at sensibly different temperatures": and his famous principle, "The motive power of heat is independent of the agents set at work to realise it. Its quantity is fixed solely by the temperatures between which in the limit the transfer of heat takes place."

By considering a cycle of infinitesimal range of temperature Carnot deduced his derived function, which must be the same for all substances at the same temperature.

This function he proceeded to evaluate from the rough data then available for water stuff, alcohol and air. The method used in this evaluation now generally goes by the name of Clapeyron's equation, because Carnot did not give his equation in algebraic form. During this evaluation for air, Carnot obtained an expression for the heat absorbed by a gas in expanding at constant temperature, and its constant ratio to the work of expansion—a remarkable anticipation of Joule's work nearly half a century later.

This prediction has generally been overlooked chiefly on account of the inclusion of the unknown value of $F_1 t$. A few years ago Prof. Callendar himself discovered in a footnote in Carnot's work, the solution to the whole problem, viz., that if temperature be measured on the perfect gas scale, the value of $F_1 t$ on the caloric theory would be the same for all temperatures, and if represented by a numerical constant A in the equation $W = AQ(T - T_0)$ would exactly correspond with the value of the Joule equivalent.

As Prof. Callendar remarked:—"This solution obtained by Carnot from the Caloric Theory, so far from being inconsistent with the mechanical theory of heat, is a direct statement of the law of conservation of energy as applied to the Carnot cycle." Perhaps the actual statement by Carnot in 1824 that "motive power (energy) changes its form, but is never annihilated" is the most remarkable evidence that, but for his early death, the equivalence of work and heat would have been discovered and evaluated as a direct outcome of the caloric theory.

The caloric tneory would measure heat precisely as we measure a quantity of electricity. The mechanical theory measures heat as energy just in the same way that we measure electrical energy when we buy it in KW.-hours. In fact, we have the following exact analogues if we adopt caloric as our term for quantity of heat on the caloric theory.

Caloric—Quantity of electricity $= q$
Temperature—Voltage $= (T - T_0)$ or $(V - V_0)$
Heat energy—Electrical energy $= W$.

Then in these two cases we have the equations—

Heat equation $W = JH = Jq(T - T_0)$
Electrical equation $W = q(V - V_0)$.

The measure of a quantity of caloric is the work done per degree fall.

What Prof. Callendar termed the "re-discovery of caloric" has been attended by the invention of new names, such as the *thermodynamic function* of Rankine, and the *equivalence value of a transformation* in Clausius' formula, all of which, including the more general term "entropy," are mere aliases of the original caloric, since the quotient of heat energy by temperature is caloric.

The value of importing into our modern theory some of the old "material theories" appears in many ways, and, perhaps, it is not too much to hope that "caloric" as a measure of heat may become as useful a conception as the "charge" as a measure of electrification.

Having outlined his scheme for an amalgamation of the two theories of heat, Prof. Callendar spent a short time in a discussion of the question, "What is caloric?" and after dealing with some of the difficulties of the material theory of heat to explain observed phenomena, proceeded to "speculate a little on his own account."

His speculations are best stated in his own words, and will no doubt form food for further speculation on all sides, opening up as they do new fields into which physicists have scarcely yet dared to enter. He said, "I should prefer to regard the molecules of caloric, not as being identical with the corpuscles of negative electricity, but as being neutral doublets formed by the union of positive and negative corpuscles, in much the same way as a molecule of hydrogen is formed by the union of two atoms. . . . . . In the symmetry of nature it is almost impossible that the positive corpuscle should not exist, but even if we regard the existence of neutral corpuscles as not yet definitely proved, it is, I think, permissible to assume their existence for purposes of argument, in order to see whether the conception may not be useful in the interpretation of physical phenomena." Adopting this suggestion, the Professor outlined a theory of heat conduction of the "dissociation" type, and threw much light on many of the vexed questions of the relation between matter and energy and the structure of the ether.

After touching upon the question of the "weight" of caloric and upon its "awkward habit of becoming infinite," Prof. Callendar concluded his address by expressing the hope that he had succeeded in conveying the impression that a caloric theory of heat was not so entirely unreasonable in the light of recent experiment as they were sometimes led to imagine.

In the course of a masterly address to the Chemical Section, **Prof. A. Senier**, D.Sc., after reviewing the evolution of chemical science, put the question, "Why should we pursue chemistry?" "It is suggested that intellectual discipline is a reason; but, I ask, for what purpose? Will anyone pretend that intellectual discipline without utilitarian object, without the possibility of using it for the betterment of society, is a worthy pursuit? I think not. . : . Research in chemistry, apart from the possibility of applying it to the advantage of humanity, cannot be defended. The mastery of the seemingly unlimited resources of nature which chemistry achieves more and more, and its use to alleviate the misery and add to the happiness of mankind, is the only worthy and effective defence. . . . But, of course, no narrow idea of utility must be aimed at. Practically any chemical inquiry may lead to results of material advantage. Certainly, nothing could be more mischievous than to make a narrow immediate utility the test. . . . On the other hand, it should not be forgotten that, in making use of the manifold advantages derived from the growth of science, humanity, on its part, owes a great debt to scientific inquirers, and ought to feel it a sacred duty to do in return all in its power by support and encouragement to further scientific research."

In connection with the manufacture of explosives, he pointed out that the ability to wage war was becoming more and more dependent on the work of chemists. When the supply of mineral nitrates is exhausted, or even before that event, the requisite nitrogen compounds will have to be provided in some other way, and almost certainly they will be obtained synthetically from the atmospheric gases which even now are becoming a commercial source.

Turning to the present indiscriminate elementary teaching and neglect of research, he said "if this is not good for scholars or students, it is worse for masters or professors. Our professors work 'whole time' at this 'stall-feeding' process, and if they happen to be strong men mentally and physically they may be able when weary with work to devote any overtime to—what I submit is far the more important matter for the State—the advancement of science by research. But this pursuit requires, for its successful prosecution, for resource and initiative to be at their best, that all the faculties should be in readiness in their fullest strength, freedom, and adaptability." In Germany this strain of elementary teaching is more recent, and is only now being felt.

"Sir Walter Raleigh says that every university is bound to help the poor . . . but that does not mean that a university is doing good if it helps those who have no special bent for learned pursuits to acquire with heavy labour and much assistance just so much as may enable them to pass muster; on the contrary, it is doing harm. I would like to invite the attention of all who are seriously interested in the country's welfare to reconsider the present policy in the teaching of chemistry; and this applies also to other sciences. For the advancement of civilisation, for the increased welfare of the race by the technical applications of our science, it is not the indiscriminate teaching of the masses and the multiplication of examinations that is wanted, but the training of the few, of capable investigators." "Our first endeavour should be to secure under present conditions in the present college or works laboratories, or in laboratories to be specially provided, that capable men, of whom we have many, should be able to devote themselves to research without the worry of teaching and examining or of providing the ways and means of livelihood."

In his address to the British Association at Winnipeg, Prof. Sir J. J. Thomson said: "I have had considerable experience with students beginning research in experimental physics, and I have always been struck by the quite remarkable improvement in judgment, independence of thought, and maturity produced by a year's research. Research develops qualities that are apt to atrophy when the student is preparing for examinations, and, quite apart from the addition of new knowledge to our store, is of the greatest importance as a means of education."

"The object and ideal," said Prof. Senier, "is wrong also in our system of technical training. We aim too much at giving elementary instruction to artizans, which, though important in itself, can never take the place of the higher education of leaders or managers of industrial works. This is different in Germany, where, although the training of artizans is by no means neglected, the chief energy is directed to the training and teaching of the smaller class of managers. There is, too, in Germany a far more intimate relation between academic and industrial work, and the leaders in each often interchange posts. In one respect we have an advantage over Germany; it is important that this should be understood. The higher technical instruction across the Rhine has not been undertaken by the Universities, but is carried out in separate institutions. With us the Universities have gradually undertaken, in addition to the older technical subjects, theology, medicine and law, the various branches of engineering and agriculture, and even commerce. This, it is to be hoped, will be extended, so that the highly-trained technologist may have the advantage of the undoubted humanising influence of the University."

Prof. Archibald Barr, President of Section G (Engineering), dealt with the æsthetic aspect of engineering, holding that the engineer failed in his duty in so far as his works were detrimental to the health, or destructive to the property, of the community, or in so far as they were unnecessarily offensive to any of the senses of those who were compelled to live with them. Municipal authorities would spend large sums on the adornment of the streets with stately buildings, and on the purchase of works of art—yet they would tolerate the presence of unnecessarily ugly and noisy tramcars in those streets, and draw a paltry income from the display of hideous advertisements. The injuries and inconveniencies resulting from engineering activities were due, he considered, in almost all cases to failures rather than to successes; the more completely the engineer achieved the primary end of his work, the less was the damage or injury that could be laid to his charge. The combustion of fuel did little harm to anyone; it was the imperfection of the combustion that was the main cause of injury to the amenities of populous centres. The time was not far distant when the direct burning of bituminous coal in open grates would be looked upon, not only as a source of serious harm, but as a culpably wasteful practice. Present indications pointed to the coming of a time in the near future, when the power and heat required for industrial and domestic purposes would be distributed electrically, in a perfectly inoffensive manner, from large central stations; and even at these stations there would be no pollution of the atmosphere. In his Presidential Address to the Institution of Electrical Engineers in November, 1910, Mr. Ferranti dealt in a most masterly way with this, which was undoubtedly the greatest of the many schemes at present before the engineering profession. That address read like a chapter from a Romance of Utopia, but unlike most of the forecasts that had been presented to us of ideal conditions in a world of the future, the system which Mr. Ferranti sketched out, and advocated with so much knowledge and convincing argument, did not depend for its reasonableness on the postulation of a perfected humanity. It would not only provide vastly improved conditions of life for the community as a whole, but it would satisfy the more selfish aims of the users of power and the makers of machinery, by increasing the economy of production and stimulating the demand for mechanical appliances.

But there were injuries which might be inflicted upon the community other than those to health and physical comfort. Every one had some sense of the beautiful and the comely, and the engineer whose works needlessly offended even the most fastidious taste was acting contrary to the spirit of his profession, at its best. There had been far too great a disregard of æsthetic considerations in the everyday work of engineers. A greater regard for artistic merit in their designs would not necessarily lead to extravagance, but, in many cases, would conduce to economy and efficiency.

There ought to be a closer connection than was usually recognised between the work of the engineer and that of those to whom the title of artist was usually restricted. The separation of the beautiful and the useful was quite a modern vice. A structure of any kind that was intended to serve a useful end should have the beauty of appropriateness for the purpose it was to serve. The attainment of the highest efficiency brought with it the greatest artistic merit.

(*To be continued.*)

Acton Transfer.—Mr. H. S. Schultess-Young, chairman of the local Ratepayers' Association, during whose chairmanship of the U.D.C. the transfer of the Council's electricity undertaking to the Metropolitan Co. was agreed upon, has issued a manifesto protesting against so important a matter as the completion of the agreement between the parties, as reported in the Review last week, being hurried through a vacation meeting, more especially as in view of the long legal vacation nothing could have been done till October 12th.

MINERS' ELECTRIC SAFETY LAMPS.

As announced in our issue of the 23rd ult., the judges appointed by the Home Secretary in the international competition for the best miners' electric safety lamp awarded the first prize of £600 to Mr. Farber, of Dortmund, Germany, for the "Ceag" lamp, which has been placed on the market in this country by the "Ceag" Electric Safety Lamp Co., of 19, St. Dunstan's Hill, London, E.C. Eight other competitors received £50 each, so that we may assume that the latter were equal in merit, but much below that of the "Ceag" lamp.

This lamp, which is shown in fig. 1, was designed at the instance of a German coalowner after one of the worst mining disasters in recent years, and is the outcome, therefore, of practical necessity; the want of such a lamp was felt in Germany, as it has been in our own country, and we understand that some 20,000 have been at work in mines on the Continent for some years. It is, therefore, beyond the experimental stage, and in the course of years has been improved since first manufactured until its present state of perfection, sound construction, simplicity, cheapness and, most important of all, safety and reliability, has been attained. The lamp consists of three parts—the accumulator and the "bottom" and "top" parts—and weighs a little over 4 lb. It is so strongly constructed that it may be thrown on to a stone floor without receiving any serious damage, and this experiment was repeatedly made during the practical trials carried out by the judges.

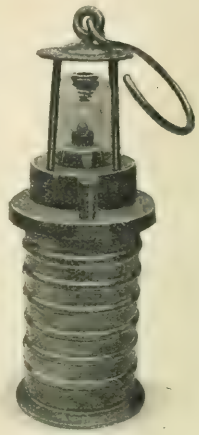


Fig. 1.—The Ceag Safety Lamp.

The accumulator consists of a strong celluloid casing and two lead electrodes, the latter being screwed into the lid of the casing. They are circular in shape, which prevents warping, and gives considerable capacity of resistance. The acid is prevented from spilling by a novel arrangement, which permits free escape of the gases. The lid is detachable, and so arranged that the electrodes may be easily changed. Both pole ends are fitted with two detachable contacts on springs, which form the contacts for conveying the current to the glow lamp; this device prevents oxidising troubles, as they may be easily cleaned by washing in warm water. The accumulator is separated from the outer steel casing by an intermediate space, and is thus protected against damage by rough usage or external force.

The bottom part of the lamp is a round, stout corrugated casing of heavily tinned pressed steel, the bottom of which is provided with a small furrow, which keeps the accumulator in position.

The top part of the lamp containing the glow lamp is secured by a bayonet joint to the bottom casing, and is locked by a magnetic lock, which can only be opened by a strong magnet. The connection between the loose contact and the glow lamp is effected through a brass segment which is insulated from the body of the lamp, and makes it possible to switch the light on and off by simply turning the top part while the lamp is locked. The glow lamp is a metal-filament lamp of 1·5 c.p., and burns after charging—which takes 4-5 hours—continually for a period of 16 hours. The lamp bulb is protected by a thick glass dome in a cage of four iron rods, and is placed between spiral springs, which take up any shock due to a knock or violent vibration, and hence it is not so liable to damage as bulbs rigidly held in position. The chief advantage, however, of this arrangement is that it ensures absolute safety against igniting fire-damp, as should this protecting bulb become broken the electric circuit breaks automatically.

Some of the advantages claimed by the makers of this lamp, as compared with oil lamps, are :—(*a*) It gives a good, well-distributed, steady light approximately twice that of an ordinary safety lamp, burns in any position, does not flicker, and the glass never gets dull or clouded ; (*b*) the bright and steady light makes the miner's work easier, and enables dangerous breaks in the sides or roof to be more easily discovered ; (*c*) nystagmus and other eye troubles are not so liable to be contracted ; and (*d*) there is absolute safety from ignition of fire-damp.

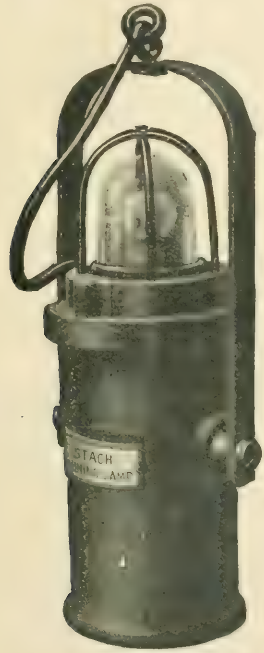
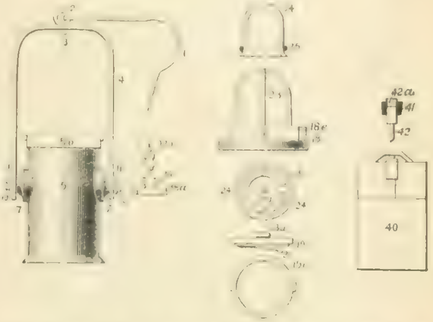


Fig. 2.—The Stach Safety Lamp.

With regard to the cost of installing these lamps, the makers have not supplied any figures to support their statement, which is to the effect that careful calculations made during several years at a number of mines which are equipped with these lamps show that the cost is not higher than with an oil lamp installation. If the makers can substantiate this statement to colliery owners by practical demonstration, it practically removes the one objection that can be laid against providing miners with electric lamps in place of the uncertain and, we may say, even dangerous so-called "safety" oil lamp. It is, at any rate, satisfactory to note that a modern lamp cabin, to hold 3,000 "Ceag" lamps, is now under construction at Bull Croft Colliery, near Doncaster.

The "Stach" lamp, which obtained a prize of £50, is shown in fig. 2. This lamp is being put on the market by the Electrical Co., Ltd. As will be seen, it consists of a cylindrical wrought-iron welded case, carried on trunnions in a stirrup handle, which is at the top provided with the usual spiked iron hook for the purpose of suspending the lamp by driving the hook into a wood prop during work.

On top of the iron case there is fitted a brass ring, rendered water-tight by means of a rubber seating. The ring and the case are arranged to fit together, and are locked by means of an iron pin worked by a spring, which can only be withdrawn by the use of a powerful magnet, and it is impossible for it to be opened except in the lamp cabin. On the upper part of the lamp is a stout brass wire cage or guard protecting the glass globe and the glow lamp. The former is of considerable thickness, and rests upon a rubber ring, which renders this part of the lamp water-tight and gas-tight. The metal-filament lamp is of the Aegma type, of 2 c.p., 2 volts. It is of the screw pattern, and is specially designed with a view to securing the maximum of safety. It has no tip, but is sealed off so that the bulb is quite smooth. Between the leading-in wires there is placed a little wall of glass, so that even if the lamp were destroyed by breaking the bulb and the filament, the leading-in wires could not be brought together so as to cause a short-circuit and a dangerous spark. The method of lighting the lamp is to turn the upper part in a clockwise direction relatively to the lower part. This causes the contact springs to slide over the terminals of the accumulator, thus ensuring a good rubbing contact. Switching off is performed by reversing this operation. There is no perceptible spark at opening or closing the circuit, and lengthy experiments have been carried out which have proved that the ignition of inflammable gas, either inside or outside the lamp, is impossible.



1, Carrying hook; 2, Eye with rivet; 3, Washer for same; 4, Hoop; 5, Pot; 5b, Fitting ring; 7, Side springs; 10, Side screws; 11, Washers for same; 16, Upper ring; 18, Magnetic lock; 18e, Covering plate for magnetic lock; 19, Drilled ebonite disk; 19e, Bayonet ring; 21, Contact springs; 23, Bent brass rods for guard; 23a, Contact spring for glow lamp; 24, Screws for contact springs; 24a, Lamp contact screw; 34, Patent bell glass; 35, Round rubber fitting ring for same; 36, Lampholder; 38a, Nickel reflector; 39, Patent glow lamp; 40, Accumulator; 41, Rubber plug; 42, Gas outlet cartridge.

Fig. 3. Stach Lamp, Type R.

The accumulator consists of a 2-volt, round, semi-dry lead accumulator, in a celluloid case. It is so constructed that it not only always fits down into the proper position in the case, but it cannot be put on the charging board in the reverse direction. This is very simply effected by means of a celluloid projection fixed eccentrically on the bottom of the cell. The electrodes are wrapped in glass wool, which absorbs some two-thirds of the sulphuric acid used as electrolyte, and the plates are so prepared that they are able to stand rapid discharge, and can also be left for many months in a discharged condition without being seriously damaged. In consequence, they may be charged and discharged over 200 times before their useful life is exhausted. A special stopper is provided to prevent the escape of acid, even if the cell be inverted, and to render harmless any gas evolved during discharge, and should any very small drops of acid come through with the gas, they are taken up by a small and easily-replaced piece of absorbent material. The terminals consist of substantial lead blocks properly marked "positive" and "negative," and the celluloid case is hermetically sealed, with the exception of the special stopper above described.

The lamp gives 2 c.p., and after charging will burn for a period of 14 hours. The accumulator should be charged with a current of $1\frac{1}{2}$ amperes for 12 hours.

A concave nickel or aluminium reflector may be provided if desired, so as to project the light in any direction, or to shield the eyes during use. The lamp is already in use in considerable numbers, and the cost of operation has been proved to compare favourably with that of the ordinary safety lamps.

Its weight, however, when ready for use, is about 6 lb., which is a serious objection, and we would strongly advise the makers to have the weight reduced if this can possibly be done.

AN ELECTRICAL SEWAGE DISPOSAL PLANT.

An article by C. L. Edholm, which appeared recently in the *Canadian Engineer*, describes some American adaptations of the electrolytic process of sewage treatment. Two plants are in operation in the West, and a third, of three times the capacity, is being contructed at a cost of $15,000. These plants may be seen in service at Santa Monica, near Los Angeles, California, and in Oklahoma City, and in the latter town a second plant was ordered after a thorough trial of the one now operating.

The purifying of water by electrolysis has been known for some time, but it was only in late years that experiments were successfully made with the view of destroying the disease germs in sewage and eliminating offensive odour by the use of electrodes.

The process may be described briefly as follows: The raw sewage is allowed to flow through wooden flumes having a length of 30 ft., a width of 22 in. and a depth of 18 in. Ten sets of electrodes are placed in each flume, being composed of cast-iron plates set ½ in. apart and having the dimensions of 9 in. × 24 in. and a thickness of $\frac{3}{16}$ in. These electrodes receive a current of 700 to 800 amperes at 2 to 3 volts. and as the sewage flows slowly through the flumes, it is speedily purified. The odour is instantly "killed," so that there is no offence to the nostrils, even to one standing directly over the flumes. But this is not all; the liquid is clarified as well, and practically all the germs are destroyed, preventing further putrefaction and making it possible to discharge the sewage into a river or upon land for irrigation purposes, without danger to health. This is not a case of the germs being electrocuted, but is due to chemical changes brought about by the decomposition of the metal in the electrodes. Just how this is done has been determined by chemical analysis, but the results are plain to the most casual observer.

The electrical equipment of the Oklahoma City plant consists of a 7½-H.P. alternating-current motor direct connected to a 3-KW. multipolar direct-current generator and exciter, all resting on a single bedplate. The combination delivers to the copper cable conductors 800 to 900 amperes at a voltage of 1½-3, these being the limits between which the desired results are obtainable, varying somewhat with the character of the sewage. A double-pole double-throw knife switch allows the reversal of the current at pleasure, and a knife switch at the upper end of each flume cuts on or off the current for that flume. Owing to the high amperage, as compared to the low voltage, the switches and conductors are necessarily heavy. If only one flume is used, the ammeter is set at 270 or 300.

The Santa Monica plant has, in addition, a centrifugal pump, which is operated by electricity and used for raising the sewage from a reservoir to the level of the flumes, but this is caused by local topographical conditions, as elsewhere it might be convenient to construct the plant on a lower level than the basin.

The cost of current will vary in different cities, but the electrodes need but little (the bill for an entire year at Santa Monica was only $152·95), and the expense of repairs and replacement of plates is slight. One attendant can care for the plant, or even two or three if they are conveniently located for going back and forth between them, as they require hardly any work.

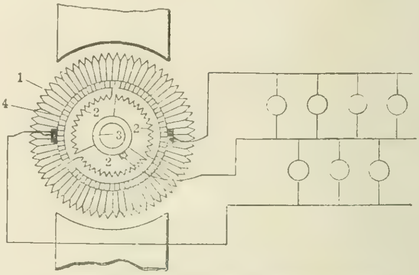
Cleaning of the plates is done by means of reversal of the current, while the use of a garden hose a few minutes each day cleans out the flumes and washes off the plates.

Very limited space is sufficient to house such a plant. In Oklahoma City, a building 18 ft. × 50 ft. and 10½ ft. high encloses a system of three flumes that handles three-quarters of a million gallons a day. In Santa Monica, no ground surface is required, the plant being installed under Colorado Avenue, at the head of the pleasure pier owned by the city. This pier is a popular resort, in spite of the fact that the city's sewage is treated right below it and discharges into the sea at its outer end. Most people are unaware of such a plant being in the vicinity, indicating that it is in no sense a nuisance. To show what it accomplishes, it may be stated that, for a few days, the plant was closed and the raw sewage discharged into the ocean. Protests were heard at once from visitors and residents, but when it started again, all complaints ceased. In Oklahoma, the conditions were quite different, as the outfall was in a dry gulch, which was shunned, and its vicinity rendered useless for any purpose. Now that the discharge has been electrolytically treated, the air is not contaminated. In fact, such water could be used for irrigation, and its great proportion of fertilising content put to good use.

The two plants described can be reproduced for $15,000 each. Many costly features have been eliminated since the first one was installed. The heavy and expensive magnets, once considered necessary, have been discarded, and an elaborate system of cleaning the electrodes by high-pressure steam was abandoned when it was found that the reversal of the current would give better results. The cost of the plates has been greatly reduced by the substitution of cast-iron for the aluminium which was first tried. The aluminium plates gave good results, but they were very costly, and decomposed so rapidly that their expense was prohibitive. The cast-iron was substituted, and by sheathing the upper edge of the plates with copper, excessive decomposition was prevented.

A NEW THREE-WIRE DIRECT-CURRENT GENERATOR.

In a note in the *Electrical World*, Mr. C. L. Pilger, jun., describes a form of three-wire generator now on the market which deserves attention on account of its excellent characteristics as regards efficiency, stability of voltage and simplicity. This machine is similar to the ordinary two-wire generator, except that it has an auxiliary winding so distributed over the face of the armature that the average field in which it moves is always uniform. Any tendency toward flickering is therefore reduced to a minimum. Furthermore, the auxiliary winding forms a circuit in parallel with part of the main winding and generates useful energy all the time, even when the load is balanced. Hence, the overload capacity of such a machine is considerably increased. When balance coils are used there is considerable loss while the machine is in operation, whether the load is balanced or not.



Double-Winding Three-Wire Generator.

When it is considered that the machine with the auxiliary winding has only one collector ring and no additional apparatus of any kind, its simplicity and efficiency as compared with other systems will readily be understood. The relative arrangement of the armature and auxiliary winding is shown in the accompanying diagram, where 1 is the main winding, 2 the auxiliary winding, 3 the slip-ring, and 4 the commutator. For the sake of simplicity only three windings are shown, but in practice there are usually more.

The voltage of the neutral wire is always the sum of the voltages generated in the coils that are in series between the collector ring and one of the brushes, and this voltage is just one-half the voltage generated by the main winding.

PROCEEDINGS OF INSTITUTIONS.

Electric Cooking.

In the course of a paper read by Mr. Albert Vaux before the Institution of Electrical Engineers (Cape Town Local Section), on June 19th, 1912, the author said, with regard to extended tests in his own household:—

Two years ago we carried out tests with what apparatus was then in town, and taken, so to speak, off the shelves, and our costs, excluding boiling water for washing-up and such-like purposes, worked out at an average of 26s. 3d. per month. Taking the previous 12 months of gas cooking supplemented by all hot water required for such purposes as washing-up or baths, it worked out at an average of 19s. per month exactly; or, in other words, if all oil, gas and outside coal or wood fires had been taken into consideration, I have no doubt the cost would have approached within 2s. or 3s. of electricity.

But even supposing the very worst case, and that electricity is 25 to 30 per cent. dearer than gas, the advantages are so great that it will pay the ordinary householder to install it, apart from any consideration of saving in meat (our own butcher's bill has been reduced quite appreciably since we used nothing but electricity for cooking purposes, and this appreciable saving amounts to 25 per cent.). Coming to more recent tests, we have been using electricity exclusively, with no oil, gas or coal to supplement it—that is to say all water required for washing-up and kitchen purposes has been boiled on the "Tricity" stove, and our bill is about 26s. per month (at 2½d. per unit).

One ought to add here that all washing and ironing is done at home, and all the ironing is done on a "Tricity" stove. Moreover, all cakes and pastry are baked in the electric oven, and when comparing with the low figures put forward by some people for gas and oil cooking the questions should always be asked How much cake is bought and how much is paid for ironing (as part of the washing) per month?

This reduction is due partly to the much greater efficiency of the hot plate or disk-stove system, and partly to a reduction in price of electricity from 3d. to 2½d. per unit, as otherwise our bill would have been increased, due to using electricity exclusively.

There is one other point to touch upon, and that is one which appeals to us all—partly to the ladies, because of their servants, and to us (as engineers) for the upkeep, and that is the ease of handling and safety from burning or shock. You may say, "It all seems very nice, and if you are handling it yourself it will be economical, but the moment my servants use it it will go all wrong, and they will leave on the switches, &c." Now, I ask you to examine this apparatus, and say what can a servant do to harm it, except, perhaps, throw a bucket of cold water over it—and even that I should question, although I have not tried it—and let the apparatus get dirty? This is very easily remedied, and it is so easy for the housewife to occasionally supervise and see that everything is kept bright and clean. This is so far as the womenfolk are concerned. I now turn to the menfolk and ask, can anything be more mechanical and a better job than the flexible connections to the stove? Examine the joints of the flexible with the stove, and with the plug, and I think you will agree with me that it is a first-class and thoroughly reliable job.

Finally, please don't think that electrical cooking is for the wealthy or well-to-do only. The cost of operation is within reach of most of us, and it is so simple and cleanly to operate, that nine out of ten ladies will prefer to do their own cooking, or, at any rate, a great part of it—particularly the pastry and fancy cooking—rather than leave it to the servants, and the initial cost can be got over by hiring the apparatus from the Corporation.

Steam Regenerative Accumulators.

By D. B. Morison.

(*Abstract of paper read before the* Institution of Engineers and Shipbuilders in Scotland, *March* 19th, 1912.)

The practical result of the development of exhaust and mixed pressure turbines has been that, on land alone, nearly two million horse-power of electrical energy is being generated by means of exhaust steam which had been previously wasted.

A number of pits are served in the West of Fife district with overhead transmission lines from generating stations situated at Aitken Pit and Mary Pit. The equipment of the latter consists of a 750-kw. mixed-pressure turbo-alternator, the system adopted being three-phase alternating-current at a pressure of 3,000 volts, and a periodicity of 50 cycles. The turbine is of the "Curtis" impulse type, and is supplied with live steam at an absolute pressure of 125 lb. per sq. in. at the turbine stop-valve, the exhaust steam being delivered at a pressure of 16 lb. absolute. This exhaust steam is derived principally from a pair of 38-in. by 72-in. winding engines, making 33 revolutions per wind and about 500 winds in 16 hours. The diameter of the drum is 20 ft., the depth of the shaft 340 fathoms, and about two tons of coal are raised at each wind. The engine makes 33 revolutions per wind. The first six revolutions of the engine, during acceleration, are made on steam at a pressure of 125 lb. per sq. in. absolute without cut-off; the following 18 revolutions, at full speed, are made on one-third cut-off, and the remainder, during retardation, with no steam; therefore, approximately 322 lb. of steam are delivered during the first seven or eight seconds, and 323 lb. during the following 18 seconds, making a total of 645 lb. of steam per wind. This quantity of steam is delivered into the accumulator about 31 times per hour, making an average of 20,000 lb. of steam per hour delivered into this apparatus, which is 9 ft. in diameter by 30 ft. long. The turbine carries a steady average load of about 75 per cent. of the total, and during the winding period the power is derived entirely from exhaust steam. The only exhaust steam supplied to the accumulator, in addition to that supplied by the winding engines, is obtained from a small electric-power engine carrying an average load of about 80 kw. In connection with the regenerative effect of the accumulator, and the use of exhaust steam at the lower ranges of absolute pressure, it is of interest to note that, when the winding engine is not at work, and there is a load of about 100 kw. on the turbine, the exhaust steam from this reciprocating engine maintains the load at an inlet pressure of between 9 and 12 lb. per sq. in. absolute.

Experience has shown that the cost of production, including 12½ per cent. interest and depreciation on the capital outlay for the complete station equipment, has been as low as ·18d. per unit, and rarely exceeds ·2d. per unit.

Fig. 1 is a heat-balance diagram showing the distribution in the various parts of an installation utilising exhaust steam from an intermittently-running reciprocating engine. After deducting the losses, the useful energy generated by the exhaust-steam turbine is equal to that of the reciprocating engine, or a gain of 100 per cent.

Prof. Rateau's original accumulator consisted of a reservoir comprising a series of metal trays containing water, placed vertically above one another, or as an alternative a large quantity of old rails piled together so as to provide space for the free circulation of the steam. This was very costly, by reason of its size and weight. Prof. Rateau then employed water as the heat-absorbing medium and effected the condensation of the steam by passing it through submerged apertures.

An accumulator of this type consists of a cylindrical vessel about half filled with water. Four oval tubes longitudinally disposed in pairs below the water level are perforated on their adjacent sides with rows of small holes. The tubes being connected to the steam supply pipe, the steam on entering passes through the holes into the water by which it is entirely or in part condensed, and the issuing streams by causing an active circulation of the water tend to equalise its temperature.

Fig. 1.—Heat Balance Diagram.

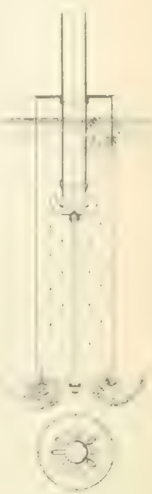


Fig. 2.—Circulating Unit, Rateau-Morison System.

The heat absorbing capacity of this type of accumulator depends on the quantity of water it contains and the temperature range through which it works. As an illustrative example, suppose the safety valve on the accumulator is loaded to 2 lb. above atmospheric pressure, and the exhaust-steam admission valve on the turbine shuts off when the pressure in the accumulator falls to 13 lb. absolute, or 3½ in. of vacuum; then the temperature range is from 218° to 206° F., and the number of heat units which can be theoretically absorbed per ton of contained water is equal to 26,880. This is equivalent to 730 cb. ft. of steam at atmospheric pressure, and on this assumption 1 cb. ft. of water can absorb 19·5 cb. ft. of steam. The action of the apparatus depends on the physical principle according to which a body of water having taken up heat will give off steam when the pressure is reduced.

In the working of a colliery winding engine, the period of acceleration is about one-fifth of the total period, so that during acceleration the amount of exhaust steam may be many times the average and tail off to nothing before the wind is completed. In rolling mill work the effect is similar, but the periods are shorter.

The duration of the stops to be bridged varies for different services, but in the majority of cases may be taken at 60 seconds in colliery work, and from 30 to 45 seconds in rolling-mill work. Exhaust-steam turbines are usually designed for an average admission pressure of 16·5 lb. per sq. in. absolute, and it has hitherto been customary to provide for a pressure range from 18 to 15 lb. per sq. in., or a corresponding temperature range of 10° F. There is, however, no reason why a lower range should not be adopted, and there are a number of plants at work in this country in which the back pressure never rises more than ½ lb. above atmospheric pressure, and in which the pressure in the accumulator drops to 12 lb. per sq. in. absolute, or 5½ in. of vacuum. In such cases it is advisable to fit a self-acting valve in the exhaust main, between the accumulator and the exhaust of the engine, which closes as soon as the flow of exhaust steam stops and prevents a vacuum reaching the reciprocating engine. This is of importance in the case of winding engines, as their regular manipulation is not interfered with, and air leakage into the system is avoided.

The factors which determine the size of a heat accumulator, for any given proposition, depend on the quantity of contained water, its range of temperature, the time available for regeneration, the area of water surface and its efficiency.

Let W = lb. of steam to be regenerated per second; w = lb. of water contained in the accumulator; T = period of regeneration in seconds; L = latent heat per lb. of steam regenerated; t = temperature difference of the water in the accumulator at the beginning and end of regeneration. The latent heat L is nearly constant, and, assuming it to be so, the total heat of steam regenerated above the temperature of the water is $W \times T \times L$ in B.TH.U., and the quantity of heat energy stored in the accumulator available for regeneration is $w \times t$ B.TH.U. Hence $W \times T \times L = w \times t$, which determines the size of the accumulator. From this equation it is seen that the capacity is independent of the time of absorption; also that, in order to obtain maximum efficiency, it is necessary for the whole body of contained water to be at a uniform temperature when regeneration commences. Therefore, in order closely to approach this ideal result, a very effective method of circulating the whole mass of water must be adopted. After a very exhaustive series of tests, the arrangement of nozzle placed within a vertical circulation tube, fig. 2, was found to give by far the best results.

In plan the nozzle is in the shape of a star having radial arms, each of which is provided with a narrow slot on its upper surface, through which the steam passes in films, thereby exposing a large surface area to the upwardly-induced streams of water that flow between the arms. It is placed about 9 in. below the water level, and the steam supply is by a tube connected to the main steam supply pipe which is situated in the steam space of the accumulator. The nozzle is fixed centrally within a circulating tube which extends from the bottom of the accumulator up to the water level. There can be no short circuiting of the water with this arrangement, as the entire volume within the effective range of the tube is compelled to travel from the bottom to the top. Having decided what shall be the normal resistance of steam flow through the nozzle, each unit is so proportioned that the kinetic energy of the steam jets is practically wholly absorbed in circulating through the guide tube the greatest volume of water. Circulation by multiple units in the manner described has been proved to be extremely efficient in practice, and the merits of the arrangement are fully recognised by Prof. Rateau. The velocity of the ascending column of water is so quickly established that the difference of temperature between the top and bottom is within 2° F. at the end of a normal period of absorption.

After a period of regeneration, and when the pressure in the steam space of the accumulator is at a minimum, any sudden rush of steam causes undue back pressure on the primary engine by reason of the very high speed of steam through the nozzles, and as the circulating efficiency is at a maximum at the normal pressure for which the nozzles are proportioned, it follows that any excess of pressure is very disadvantageous. But if a by-pass valve is fitted between the discharge pipe from the primary engine and the supply pipe to the turbine, and is loaded at a pressure slightly above that for which the nozzles are designed, then the predetermined back pressure on the primary engine will never be exceeded, and will always be associated with the best conditions for effective circulation. Such a combination of apparatus, by effectually overcoming a difficulty which has often been experienced in practice, greatly enhances the value of accumulators of this type.

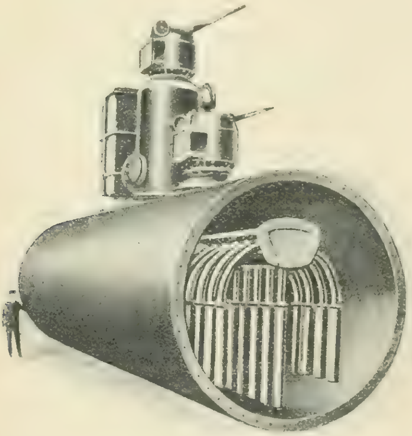


Fig. 3.—Accumulator with End Cover Removed.

In the practical working of accumulators, the presence of oil has been found to have a very degrading effect on efficiency. By far the most serious effect is on the regeneration, as the time lag is so great that the pressure has to fall $1\frac{3}{4}$ lb., or 60 per cent. of a total range of 3 lb., before the normal regeneration is established. An accumulator with clean water is 100 per cent. more efficient than one in which a film of oil covers the water surface.

A device which is completely successful in overcoming this very serious practical difficulty has been evolved. The top of each circulating tube terminates in a cowl, and as all the cowls discharge longitudinally in the same direction, a surface wave or current is set up which continuously and effectively forces oil, scum, and all floating impurities towards one end into a quiescent collecting chamber, from which they are drained away periodically or continuously as may be desired. The oil is guided into the chamber by plates extending above and below the water line, the entrance being through a port which may be covered by a non-return valve. The cleansing action is continuous and the scumming automatic.

The multiple-unit circulator is also very valuable as an exhaust-steam feed-water heater when the heating steam is delivered intermittently, and the feed reservoir is of considerable capacity. A heater on this system fitted in a forge effected a saving of 10 per cent. in the cost of coal over a year's working.

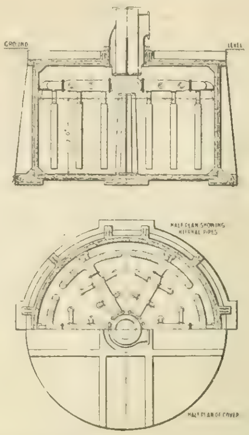


Fig. 4.—Ferro-Concrete Construction of Accumulator.

The great desideratum in a heat accumulator is rapidity of absorption, especially at periods of abnormal supply, so that as much steam as possible is condensed. If, during the period of absorption, the pressure in the steam space in the accumulator is maintained above the pressure corresponding to the temperature of the water, it follows that ebullition will be delayed, and condensation, and, therefore, rapidity of heating will be promoted. This relative increase may be secured by arranging a by-pass connection between the steam supply pipe to the nozzles and the steam supply pipe to the turbine, the connection being provided with a throttle valve which may be automatic, but which can be so adjusted or set as to meet the condition of any particular installation satisfactorily.

It is sometimes convenient to convert old boiler shells into accumulators, but the old boiler proposition is advisable only if the boiler is in good condition, as if it is defective, the natural sequel will be costly repairs, continual annoyance, and ultimate replacement. A construction of accumulator which has the merit of strength and simplicity consists of curvilinear cast-iron sections built together by flanged joints. Cast-iron is less susceptible to corrosion than steel, whilst the requirements of manufacture prevent any undue liberties being taken with the thickness of shell.

A very recent design of accumulator is shown in fig. 4, and consists of a ferro-concrete tank, the steam inlet and outlet being by concentric pipes. The arrangement of interior fittings is very simple, and the entire construction offers considerable possibilities.

In all exhaust-steam plants there are times when the steam supply from the primary engine is greater than can be taken by the turbine and absorbed by the accumulator; under such conditions the surplus escapes either (1) to the atmosphere; (2) is by-passed to the condenser; or (3) may be utilised for feed heating. The first two represent highly wasteful practice; the third alternative results in maximum efficiency.

A regenerative accumulator is under consideration, which will contain 500 tons of water, and will supply a 1,500-kw. turbine for a bridge period of 15 minutes.

Carnegie Hero Fund.—At the monthly meeting of the Carnegie Hero Fund Trustees on August 29th, a case was considered in which David Roberts, labourer (45), in the employment of Messrs. Renton & Fisher, Ltd., steel founders, Bathgate, on July 8th last was killed while going to the assistance of a fellow-workman who had been injured by an electric shock at the works of Messrs. Renton & Fisher. The electric current had set a crane on fire, and made "live" the earth about the same, and in attempting to extinguish the flames by throwing water on the crane, a moulder, named John Drake, received a severe shock and fell on the opposite side of the crane. He was carried aside and artificial respiration was resorted to. Roberts volunteered to assist, and started at once to run across. He was warned to keep clear of the crane, but Roberts in his haste to rescue either did not hear or declined to heed the warning and ran the shortest way, which took him into the danger zone. When passing the crane he touched the handle and fell. He was immediately pulled aside and first aid treatment was applied, but all efforts to restore him failed. Roberts has left a widow and six children. His widow is to receive an interim grant of £10 pending the result of her claim for compensation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Landlord and Tenant.

In your issue of February 23rd last you replied to an interesting query of a correspondent regarding a tenant's powers as to removal of electric fitments, and as this matter is one which is continually cropping up, there are several other points which would be helpful if they were elucidated.

Lordlords frequently wire their houses and maintain that it is the tenant's part to provide the switches, distribution boards, fittings, &c., and, in cases such as these, would not the tenant be entitled to remove them at the end of his tenancy? Again, where he fixes his own transformer, surely he can remove the same? As a matter of fact, I have generally found they have done so without query.

Regarding the question of ceiling roses, in most houses the greater number of the fittings have metal ceiling plates, which, as they are ornamental, I presume remain the property of the tenant, but as ceiling roses may be part of an ornamental pendant or fitting also, surely the landlord cannot lay claim to even these. If he can do so, why the difference between porcelain and metal ceiling plates?

Generally, if a tenant installs the electric light throughout a house, could any action be taken against him if he—on finding the landlord refuses to pay anything towards it—deliberately cut or damaged the wires on leaving, providing he did not deface the decorations? Would not he be within his rights if he unscrewed the switches, ceiling roses, &c., from off the blocks, on condition that he left the latter to avoid damaging the walls, papers, ceilings, &c.?

It is generally understood that where cupboards, &c., are fixed by means of screws, they remain the tenant's property, but if nailed, the landlord's.

I think you will agree that the matter referred to is one of considerable interest to all contractors, as they are frequently called upon to advise in such cases.

Fixtures.

[Some information on this subject was given by a legal contributor in our last issue. We take it that custom would be the chief guide in deciding the points raised by our correspondent. It is usual for the tenant to remove all his gas brackets, fittings, cookers, &c., when terminating his tenancy, and by analogy he could legally remove his electric lighting fittings, transformer, radiators, cookers, &c.; but, as explained in the reply referred to by our correspondent, switches, ceiling roses, fuseboards and wiring are fixtures, and must not be removed, whether installed by him or not. Nor would he be justified in wilfully damaging any of these items, which as fixtures would have become the property of the landlord.—Eds. E.R.]

Municipal (?) Trading.

In view of the various discussions which occur at intervals, and the sad case in Sheffield, could we draw your attention to the fact that a certain large city has an official who is at present engaged in trying to sell cheap metal-filament lamps on behalf of his department, we presume, as a side line. The individual in question has approached several contractors, and probably consumers as well, stating that he can offer exceptional terms. As the town in question in the past gave a free lamp supply, possibly this statement is correct. Untrammelled as we are at present by professional etiquette, it would be useless to approach this side of the subject; but it might be interesting to know if his Committee have so far fulfilled the law, as to obtain for this gentleman a pedlar's licence.

It seems to us that in neglecting to sell Lipton's sausages and Pink Pills for Pale People, he is obviously neglecting his duty, and we would point out that a larger discount can be obtained off Pocket Flash Lamps, and that this point of view might be placed before the Council.

It seems to us that the E.C.A., or even metal-filament lamp manufacturers, might take some interest in this case, one of the most serious aspects of which is, that it is not done by a small man, but by a responsible official, who pretends to a position of some eminence in his profession, and from whom better things might be expected.

J. E. Schofield.

Bradford, *August 31st*, 1912.

Indirect Lighting.

Further to my letter of June 21st, referring to "Indirect Lighting," I was recently looking over Messrs. Josiah Wedgwood's china showrooms in this town, and was pleased to notice that they are making a china bowl suitable for one or more incandescent lamps. The bowl is of a beautiful design, stamped with their well-known figures. I commend this fitting to the attention of dealers.

Resident Engineer.

Electricity Works, Stoke,
September 2nd, 1912.

Curious Coincidence.

Last Thursday, the 30th inst., during a heavy thunderstorm we had here, there was one very vivid flash of lightning. Coincident with this, the cut-out on the earth indicator of our three-wire system came into action on a 10-ampere earth. Later in the day, three consumers (one private, one business, and one mill), in three different districts of the town, informed us that they could get no light. On investigation, we found that the main fuse in each case, and one sub-fuse in the case of the private consumer, had blown simultaneously with the flash. Can any of your readers explain this phenomenon, as none of the consumers had any outside overhead wiring?

Our middle wire is earthed to the town water supply.

Some little time ago, one consumer complained of his metal-filament lamps breaking during a thunderstorm; is this due to static discharge on the lamps, or to atmospheric vibration?

Junior Assistant.

August 13st, 1912.

Re Contracts in India.

In last week's issue I notice a letter from Mr. Marshall and another. I would like to mention that I have just returned from Bombay, and have for the past three years been in touch with contracts in Bombay, both Government and otherwise. From my experience, I should say there are not more than six firms in Bombay capable of carrying out Government contracts, although there are about a hundred or more electrical contractors who are capable of putting up electric lights and fans, but are not capable, owing to their Indian training in practical work and not having any staff of trained workmen, but only a small office, of carrying out a Government contract.

I have handled several Government contracts in Bombay, but not without being first asked to tender, and on many occasions have missed a contract by a small margin. Probably Mr. Marshall will verify my statements.

W. Bramall.

Birmingham, *August 28th*, 1912.

Insulation v. Earth in Mines.

May I once more raise the point of the relative value of insulation, good insulation, as against earth, good earth, for protection from shock in mines where electrical apparatus are used? I am induced to raise the question once more, from a perusal of your leading article in this week's issue.

For something like 30 years I have been consistently attacking this question of the use of earth. I think it must be nearly 30 years ago that an article from my pen, under the title "What is Earth?" appeared in the technical Press. I have repeatedly pointed out the great difficulty there is in obtaining good earth anywhere; and particularly so in mines at the face. I believe it was in response to urgent suggestions of mine that the late secretary of the Institution of Mining Engineers, who was also secretary of the North of England Institute, and of the Northumberland Coal Owners' Association, with which the Durham College of Science was at that time closely affiliated, that some very important measurements of the relative resistance of the different strata found in mines, were carried out in the laboratory of the Armstrong College.

About six years ago I read a paper before the Institution of Mining Engineers, at their Manchester autumn meeting, in which I brought out very clearly the great difficulty of the problem involved in obtaining earth at the face in mines, making use of the measurements of the resistance of the different strata that had recently been obtained at Newcastle-on-Tyne.

The ground I take up is, that while insulation can be made certain, absolutely certain, if a sufficient amount is spent on it in the first instance, and if sufficient care is taken in testing the insulating material from time to time; earth at its very best is more or less of an accident. There is no difficulty whatever in obtaining good earth on the surface, or at the pit bottom; but good earth there is a positive danger, if earth is relied upon as a protection, unless there is also good earth at the face, or wherever any apparatus that any man can by any means touch, is placed. My paper read before the Mining Institute pointed out how difficult it was to ensure this good earth; and it also pointed out, what I wish to re-emphasise here, that unless the earth path is of very low resistance, from every apparatus "in-bye" that is connected to earth, right to the main earth on the surface at the generating plant, earth is more than useless, it is a danger. I gather from the report of the recent Committee, that this fact is realised, and is provided for in the requirements that any armour or earth wire or cable must conform to. The new rule in question is undoubtedly a step in the right direction, and a good one, but my point again is, that it is far more difficult to carry out, and far more difficult to ensure that the return earth path shall be of low resistance from every apparatus that may be a source of danger, then to ensure that all such apparatus shall be insulated, and that the insulation shall be maintained at a high standard.

If the cases where men have been killed by electric shock in mines are examined, it will be found that without exception, the cause has been defective insulation. No amount of earthing has protected them; and it is very doubtful indeed whether the greatest care in the provision of earth, and in the maintenance of earth, such care as can be employed in mines, would have protected them. Better insulation in the first instance, more careful and more frequently repeated examination, more frequent tests of the insulation, would have ensured the prevention of nearly every one of the shocks that have led to fatal results.

I need hardly refer to the question of armour. I have repeatedly pointed out, and I believe that there are now a large number of able electrical men who have experience in mines, who agree with me, that armouring is a mistake. It is only in certain cases that the armour really protects the insulation: and in the majority of those cases it could be protected quite as well by non-metallic substances. It is now thoroughly understood, also, that the armour is a danger, unless it is continuous throughout; and anyone who has even a moderate acquaintance with coal mines knows how difficult it is to ensure this. Take the case of a three-phase cable, for instance. It is broken by a fall of roof, and has to be jointed. The joints in the three cables have to be made as far apart as possible to avoid contact between them, and with the materials available for jointing underground, the finished joint is necessarily more or less of a clumsy mass. The difficulty of efficiently jointing the armour across the cable joint proper is almost insuperable under the conditions ruling. It must be remembered that any joint made in iron armour would add considerably to the resistance of the armour as a whole, and that the clumsily made joint described above must add a very large amount indeed, and seriously reduce the protective value of the armour beyond it.

Again, supposing that earth is obtained at the face, where coal-cutting machines are working, where conveyors are working, where gate boxes are fixed; it must be remembered that the coal face is constantly moving; and, again, the difficulty of maintaining good earth connection, is almost insuperable. On the other hand, though the maintenance of the insulation resistance of every insulator at a high value, is not an easy problem; it is by no means an insuperable one; it depends upon the intelligent expenditure of a certain amount of money. Bearing in mind the cost of killing a man, under the Workmen's Compensation Act, the cost of providing good insulation, and of maintaining it, should not be prohibitive.

But, beyond all this, there is an even more serious objection to the use of earth. A case was given in a paper read before the Newcastle Section of the Institution of Electrical Engineers, in which a shock was obtained from the case of a three-phase motor, working near the face, the motor being earthed, and the author of the paper claimed that the shock was due to the earth connection.

Sydney F. Walker.

Bath, *September 2nd*, 1912.

REVIEWS.

Central Station Heating. By Byron T. Gifford. New York: Heating and Ventilating Magazine Co.

This book deals with a class of public service of which we in this country have up to the present had little or no experience. Central station steam and hot-water heating is essentially an American idea, and has been brought to great perfection in that country, where climatic conditions render very thorough methods of warming imperative. In Great Britain and a large part of the European Continent the need does not exist to the same extent; and, further, a conservative attachment to the coal fire has stood in the way of acceptance of the American system except in such situations as public buildings, works and offices. Nevertheless, the book is of interest and value to the British engineer, not only by reason of the information on heating practice it contains, but also because there are unmistakable signs that hot water and steam heating are gaining increased popularity. Whether this will ever lead to the installation of extensive heating stations and mains on American lines is a moot question. There are not wanting experts who maintain that it will, and the mention of the subject by Mr. G. Wilkinson, in his presidential address at the recent I.M.E.A. Convention, is significant and illustrative of the tendency in progressive quarters.

The author deals broadly with the whole subject of heating from central stations by both steam and hot-water systems. He classifies these under four heads: the vacuum steam system, in which there is a low pressure on the steam main and a vacuum on the return main; the pressure steam system, in which there is no return main, the condensed water flowing to the sewers; the open hot-water system, open to the atmosphere at one point and providing for reheating of the return water by mixing with exhaust or live steam; and the closed hot water system, which employs a closed circuit throughout, the return water being reheated by economisers or some other form of heater. The choice of system will depend entirely upon local conditions, and the author deals thoroughly with this important point.

A distinction is very rightly made between systems installed specially for heating, and those in which the heat distribution is merely a by-product scheme. Writing of the latter, he says: "In combining any steam generating plant, such as an electric plant, the financial benefits derived by the primary plant are large. . . . . . Where the electric plant is located so that it can serve a good heating territory, it can make a kilowatt of electric energy for considerably less in conjunction with a heating plant than it can by running alone condensing. It is a problem that should be worked out for each situation, but, as a general rule, the revenue from the heat sales will more than pay the coal bills after deducting interest, maintenance and depreciation on the heating investment from the heat income."

There is no exaggeration in this, as a thorough investigation of the subject will prove. There are in America abundant data which show that in a favourable case of a combined electric and heat power house the entire works costs may easily be covered by revenue from the sale of exhaust steam heat. From the point of view of those interested in the by-product or combined undertaking a fault of the book is that it does not give sufficient detail of what can be and has been done in this direction. There are some 400 central heating stations in the United States, and there is no scarcity of information in that country. A considerable amount was collected and published by the reviewer in the Electrical Review of September 8th, 1911, and a reference to this will show that Mr. Byron T. Gifford is modest in the financial case he makes for well-designed combined electric and heating undertakings.

Of the ten chapters of the book, Chapters II and III are particularly important since they deal respectively with pipe line losses and pipe line design. So much of the success of heat distribution turns upon the pipe line that too much attention cannot be afforded it. The auther appreciates this, and enters very thoroughly into the subject, giving illustrations of both good and bad practice which should be very useful. These two chapters are the best in the book; full of valuable information clearly and concisely expressed. Chapter IV on the subject of rates discusses all the usual methods of charge, and shows that a truly equitable arrangement is by no means an easy one to arrive at. The author has a decided tendency towards rates based upon the maximum demand system. The chapter dealing with the heating station is somewhat disappointing in its brevity. The author states at the outset that only those principles that have to do strictly with central heating will be considered, but the reader who knows little or nothing of the subject would welcome more thorough treatment, particularly if, as in this country, he cannot obtain information on details of lay-out, &c., by the inspection of actual plants. Operation, maintenance and management are more fully dealt with in two chapters and much sound practical information is given.

Chapter VIII dealing with Franchises is, of course, largely inapplicable to British conditions, but at the same time it should prove of value as indicative of the general lines upon which such matters should be handled. To the American engineer it would certainly be of service, especially as typical franchises are given in full.

There is a good chapter on building equipment, and many figures are given which should be of use and interest to any heating engineer. The effect of the material composing the building, the necessary changes of air, effect of wind and the position of radiators are all dealt with, and it is noticeable that in the latter case the author has his doubts whether the time-honoured "under the window" position is the best for a radiator.

The final chapter of the book is devoted entirely to a collection of miscellaneous data covering 50 pages. It is one of the best of its kind, being both clear and inclusive, but free from the unnecessary matter which often creeps into such compilations.

On the whole, the book is an excellent dissertation on an interesting subject, and can be thoroughly recommended to any engineer who wishes to gain a good insight into both the practical and the commercial aspects of the business. In this country we have not the scope for central heating that America possesses, owing chiefly to climatic conditions, but the fact remains that there are numerous British electricity supply undertakings well situated for such a project, and time will probably show developments in this direction. It is worth the while of most central station engineers to read this book, which, if they have not studied the subject, will put before them possibilities that should not be longer ignored.—F. H. D.

Heat Engines. By H. A. Garratt. London: Edward Arnold. 1912. Price 6s.

The author wrote this book as a sort of review of a favourite subject and with the intention of making his book a not too mathematical exposition of it, and he has succeeded fairly well in his aim. Like many others, he has included the matter of entropy. We can only recollect one good definition of entropy—namely, entropy is an abscissa on a diagram of heat energy, of which the ordinates represent temperature. The ordinary indicator diagram is a diagram of energy, in which ordinates represent pressures and abscissæ represent volumes.

We note, first, that the author uses the pound-Centigrade unit. We do not like this unit. Indeed, we are quite in sympathy with the author in wishing there were but one heat unit: we do not care much if this is the calorie or the B.TH.U., but the mixed unit is bad, and may be put to bad uses. Indeed, it has already been employed to state the calorific capacity of a fancy fuel in such a way as to make this appear as good as best Welsh coal. Especially in statements of tests engineers should make plain the units they employ, even when they are to appear in a public-persuading prospectus.

In his treatment of fuel and combustion, the author is best in the laboratory part, the parts bearing on practice appearing almost as acceptations of statements made in catalogues. But in any case, the space allotted to steam raising would not suffice for any reasonable treatment of the subject, and this section might have been made even shorter, if it could not be much longer.

Chapter IV deals with the properties of steam and gases, with statements of the laws of expansion, of specific heat and explanation of entropy. The author attempts an explanation of the efficiency of the ideal engine, as expressed by the recognised formula, [illegible], but this explanation is not a happy one, and will not help most students much. It is unfortunate that the academical man can usually afford little help on these difficult points.

But the author is only academical at times; parts of his book are excellent, as when he deals with condensation in pipes, cylinder condensation, engine friction and its relation to continued expansion, steam jackets, superheat, and compounding. We find none of the persistent or wilful errors of the new Manchester school of theorists. And the author is not afraid of saying that the expansion curve of the actual engine is very near to the hyperbola. It is so, but only by accident, but the fact is useful and convenient to work to. The author knows the fact, but is not under any misapprehension about it, and knows that the diagram curve is really a million short lengths of as many other curves, just joined together into an approximate hyperbola.

The author is good, too, on the mechanism of engines, and on valve movement gears, though, perhaps, this is a subject for a separate book. We should like to see a little clearer explanation of hunting where governing is described. The latter part of page 155 is not clear in its language.

Necessarily, the steam turbine is treated somewhat fully, and let us say very clearly, but not on the lines of the engine room. This part remains to be written by some station engineer who has ere this discovered that the quondam simplicity of the turbine has developed into a great complexity of detail, and that a steam turbine is no longer simple either in construction, or to run or maintain, nor is it without its own class of wear and tear.

The remainder of the steam section treats of auxiliary plant in one chapter, and there is considered the internal-combustion engine and gas producers. The Humphrey pump brings this chapter up to date.

There is a closing chapter on the refrigerator or reversed engine which converts work into heat.

This book is an excellent preliminary guide for students and for the practical man who is a student, but it is not an engine-room book.

Studies in Terrestrial Magnetism. By C. Chree, M.A., F.R.S. 1912. London: Macmillan & Co. Price 5s. net.

Magnetism is a branch of physics to which very little attention is devoted in these days of technology and "applied" science. Familiarity with what we are pleased to call the fundamental principles of magnetism has bred in us so great a contempt for this science that we have almost ceased to study it for its own sake, choosing rather to attend to its glorified offspring—electromagnetics.

The study of terrestrial magnetism is now left to about a score of men who, in various observatories scattered over the earth, arrange for the keeping of continuous records of the magnetic elements by means of magnetographs. The maintenance of such records and the proper interpretation of them is obviously of vast practical importance in navigation, while the study of these continuous magnetograms affords a sure means of advancing the knowledge of the complicated phenomena of terrestrial magnetism.

These "Studies in Terrestrial Magnetism" include most of Dr. Chree's contributions to the subject during his long connection with Kew Observatory. Although the author modestly remarks in his preface that the contributions made by one individual "must form but a small fraction of the whole," it is evident from the scope of this monograph that either Dr. Chree's modesty has betrayed him into unduly undervaluing his own work or his generosity has magnified the work done by his contemporaries. There can be no doubt but that these "Studies" comprise most of the standard work on magnetism, and it is largely to the data collected by Dr. Chree that we have to look for that detailed knowledge of the magnetic elements upon which we may hope to found any general theory, or base our forecasts of the future.

The chief subjects dealt with are Secular Change, Non-Cyclic Change, Diurnal Inequalities, Magnetic Storms and Sunspot Relations.

A special chapter is devoted to the consideration of Arctic and Antarctic disturbances, and this subject is illustrated by curves taken on the Antarctic Expedition of 1901-4 and at four Arctic stations in 1902-3. The special types of disturbances characteristic of the Polar Regions receive full treatment, and are made evident by the curves taken simultaneously in the Arctic and Antarctic Regions and at Kew. To quote the last words of this chapter: "It is to investigations of how the phenomena at different parts of the earth are related, and how they depend on the time of day, on the season of the year, and on sunspot frequency, that we must look as the most hopeful way of advancing knowledge."

On the subject of Sunspots and their Effect on Terrestrial Magnetism Dr. Chree gives numerous tables and valuable data, but is content to wait for still more observations before committing himself to any hypothesis. On the relation between sunspots and magnetic storms, the author is still more reticent, remarking that the solution of some magnetic anomalies may possibly be found in the recognition of different types of sunspots, but advising in the meantime the maintenance of an open mind.

The book has been written with Dr. Chree's characteristic thoroughness and attention to detail, and cannot fail to interest all who would learn something of the magnetic work which is now being done at Kew.—P. H. S. K.

A Short Course in the Testing of Electrical Machinery for Non-Electrical Students. By J. H. Morecroft and F. W. Hehre. London: Constable & Co. Price 6s. net.

In order to make clear the rather special purpose for which this book has been compiled, it may be well to quote the authors' own explanation of their object. "At Columbia University practically all of the engineering students are required to take courses in the electrical laboratories, testing both direct-current and alternating-current machinery. Students in mining, mechanical, metallurgical, chemical, civil engineering, &c., do not have those courses in the theory of electrical machinery which are really necessary for a proper comprehension of the machines with which they work in the laboratory; it is unreasonable to expect them to consult various text-books to prepare themselves in the theory involved in the tests, and it is with the intention of filling the needs of these men that the notes have been compiled."

The term "notes" describes the nature of the contents of the book. They bear strong evidence of being the result of collecting together the instruction sheets used in the laboratory, with some additions to the introductory matter, and of a rather scanty amount of "editing."

It is difficult to criticise the general scheme of the book without at the same time passing judgment on the course of instruction of which we have just quoted the authors' account. It is a question, which we shall not attempt to answer, whether it is wise for "non-electrical" students to spend the very limited amount of time which they have to spare in hurrying through a small number of "tests" embracing such a wide range of machinery, and involving for their just comprehension such a wide field of knowledge as those contained in the book before us. We may say at once that the authors do not attempt to limit the field covered by their experiments to that which is likely to be at all fully understood by their students. The purpose in view seems rather to be to give an opportunity for handling machines of the principal types in commercial use, and not to insist on a comprehension of their principles, except, perhaps, in the case of the continuous-current machines considered in the first part of the book.

The selection of the experiments to be described is well made, and embraces ten experiments on continuous-current generators and motors, illustrating the methods of starting and controlling machines with shunt, series and compound field windings, and of determining their efficiency. A second part deals with properties of the alternating circuit, the alternator, the transformer, the induction motor, the synchronous motor, the rotary converter and polyphase circuits. Particularly in the second part, the introductory text is quite insufficient to give a student any useful idea of the principles involved in the working of the machines which he is instructed to "test." For instance, the whole amount of text devoted to the principles of the induction motor and to the description of the experimental run amounts to five pages. For the ordinary "non-electrical" reader, the book must be regarded as only suitable as a companion to a course of instruction obtained from other sources. It would be quite a mistake to think that any clear idea of alternating-current phenomena or machines is to be obtained from this book alone. As a suggested outline for a very brief course of experimental work, for students who have already gained a fairly sound, though superficial, knowledge of electrical machinery, the book may be recommended.

Proceeding to a more detailed examination, we find the instructions for carrying out the tests to be sound, though they are interspersed with the theoretical portions of the text in a manner which is rather confusing, and which makes a ready reference difficult. It is difficult to find out how much electrical knowledge is assumed on the part of the reader. For instance, the first experiment is a sort of experimental proof of Ohm's law, but the student is expected to use a Wheatstone bridge in the process. In later pages we find some very elementary facts explained in detail, while, at the same time, familiarity with more difficult terms is taken for granted. Certainly, no one without a fair knowledge of the elementary principles of alternating currents could derive any help from the first two pages dealing with that part of the subject, nor could he be expected to understand this introduction to the phenomena of a simple A.C. circuit: "The reactions which are offered to the flow of the current are of two general types—conservative, or non-dissipative, and non-conservative or dissipative. The product of the current into the dissipative reaction gives the rate at which power is being used in the circuit; the conservative reaction causes no energy loss."

In some of the descriptions, it is evident that the instructions are framed with special reference to pieces of apparatus in the authors' own laboratory. It is not always made clear what the nature or purpose of an experiment is to be, before the instructions for carrying it out are given. Finally, the reviewer has to complain of a fault which he has only too often met with in text-books by American writers. The writers seem to be either too hurried, or too careless of such matters, to study the art of writing good English, or even good American.

Laboratory Exercises in Physical Chemistry. By J. N. Pring, D.Sc. Manchester: University Press. Price 4s. net.

This book appears to fulfil a want, as the reviewer is not aware of any other English work covering the same ground. On the whole, the exercises appear to be judiciously selected and calculated to give any student who carries them out in their entirety a fair grounding in the elements of experimental physical chemistry. Considering the title, the omission of any work on optical properties, such as determinations of optical activity and refractive index, and on emission and absorption spectra, appears curious, and more space might well have been devoted to a description of some type of thermostat and thermo-regulator. The greater portion of the book is devoted to electrochemistry and to pyrometry, and on the whole these portions are well carried out. In the discussion of voltameters on pp. 45 *et seq.*, the time factor is almost ignored, and it is only by very careful reading that a student would gather that the determination and readings given are per unit of time. Here and there the value of the book is marred by great carelessness, as on p. 117, where axoxybenzene is twice referred to as azobenzene (in one case actually underneath the formula). The punctuation is also faulty in places to a degree which materially affects the clearness of the text, and the author's English has a curious German cast, all too common in works of this kind, and suggesting recent residence abroad.

The Development of the Incandescent Lamp. By G. Basil Barham, A.M.I.E.E. London: Scott, Greenwood and Son. Price 5s. net.

To those interested in the manufacture and sale of incandescent electric lamps, there is no doubt that this work will be very useful. The first chapters dealing with early history are almost thrilling, but when one reaches those pages dealing with the tungsten lamp interest begins to flag, owing to the monotonous repetition indulged in by the author. Had the blue pencil been more freely used, we believe that an even better book would have been evolved, for in one or two instances pages are utilised to enlarge upon a process or processes most pithily described in a previous paragraph. Such padding as this reduces the efficiency of the book, and leaves an unfavourable impression. As things are, however, Mr. Barham's work fills a distinct gap, and will be very greatly appreciated.

The manufacture of the carbon lamp and its filament is passed over somewhat cursorily, and little is said of the metalised filament, but the account of the tantalum lamp is treated in a very able manner. Very fully does the author describe the various methods of making tungsten filaments: in fact, the title of the book might well have been "The Development of the Tungsten-Filament Lamp."

On page 85 the following paragraph appears:—"The tungsten filament is not a clean metallic wire as in the tantalum, but it is, in the majority of instances, a filament consisting of minute particles of metal sintered into coherence by the passage of an electric current after it has been squirted and dried." During the last twelve months the "drawn-wire filament" has made such extraordinary strides that the above hardly applies, for the tungsten filament is now a clean metallic wire far surpassing in life the tantalum filament, which rapidly disintegrates.*

After a chapter relating to the osmium lamp, one is allowed a glimpse of the latest developments, chief reference being to the silicon and helion lamps. In this, the last chapter, are also given hints relating to improvements that may be expected. Had the author included a chapter or so of technical and life data, together with some curves, he would have evolved a book that all electrical engineers would desire to have upon their shelves.

Storage Batteries. By H. W. Morse, Ph.D. London: Macmillan & Co. Price 6s. 6d. net.

The chemistry and physics of the lead accumulator form still a subject which demands some share of attention, although the lead cell has long ceased to be a real factor in the problem of prime power sources. The storage cell is a mere assistant to be called on for temporary aid in time of need, either to tide over an ugly peak in the load on the prime source, or to serve as a stand-by when the main source is disabled for a short time, and its aid is often quite invaluable under these conditions. The book before us is by one who *believes* in the primary cell. He candidly admits his belief in the possibility of constructing a primary cell more efficient and more flexible as a prime source than any of our present prime movers, and so we expect him to lose no opportunity of exploiting the claims of cells even at the expense of some of the recognised power sources. But in this we are disappointed; for, instead of allowing his faith to run away with him, Dr. Morse has provided us with an able exposition of the limitations as well as the possibilities of lead cells, and has discussed the industrial applications of the different types of accumulator with commendable honesty.

No attempt has been made to write a text-book of storage battery engineering, but the peculiarities of cells, their physical characteristics, capacities and efficiencies are dealt with very thoroughly.

Sufficient of the elementary theory of cells is given in the early part of the book to render it useful even to that fast-disappearing type—the engineer with no knowledge of chemistry. To his more happily situated brethren the chapter on "Energy Relations" presents the whole thermodynamic theory of cells in a nutshell, together with valuable data concerning the temperature and dilution coefficients, with deductions as to the most efficient conditions for charge and discharge. The reactions at the electrodes are treated with some degree of thoroughness, reference being made to the two most important theories of Le Blanc and Liebenow.

The three chapters on charge and discharge, capacity and internal resistance should be read by everyone who has the care of accumulators. Indeed, we had almost dared to say that they should form part of the general knowledge of every station engineer. It is truly remarkable what profound ignorance on these subjects reigns in the minds of many people who have to do with lead cells. Many men who could define with ease the capacity of a condenser—seldom, if ever, seen in practice—would be nonplussed if asked to estimate the capacity of the cell on their motorcycle. And how many electrical engineers appreciate the fact that it is possible to obtain a difference of over 100 per cent. in the capacity of a storage battery for a 20° change of temperature?

The formation of plates of the Planté type is explained, as well as the pasted-plate manufacture, and the commercial applications of the two types are discussed. Diseases and troubles are also dealt with in detail. The book, as a whole, cannot be praised too highly. It is well illustrated with photographic reproductions and clearly-executed curves and diagrams, and should prove useful to a large number of students and practical men.—P. K.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Holophane Reflectors.

We are informed by Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, that eight entirely new patterns of residence Holophane reflectors are now being placed on the market. Some of these patterns are moulded in designs which closely resemble the best quality cut-glass shades, and therefore will be very suitable for fittings of ornate design. We illustrate in fig. 1 one of the new designs.

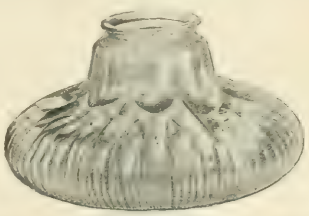


Fig. 1.—Siemens "Household" Holophane Reflector.

The company have issued a list which contains all the new patterns now being introduced to the market.

A G.E.C. Electric Toaster.

The General Electric Co., Ltd., have just placed on the market an electric toaster at a greatly reduced price. This toaster is constructed of nickel-plate metal, mounted on a white porcelain base. The heating element is made of a calorite ribbon strip, firmly held in the nickel framework, and mounted on mica seats. There are two doors, fitted with handles, and worked on hinges, which open downwards and outwards, to allow the bread to be turned or removed. The weight of the bread pressing on the bottom of these hinged wire doors holds it in position tightly against the bars near the heating element. The porcelain base never gets hot, even should the toaster be used continuously for hours, so it would not damage a highly-polished table. The handles fitted to the doors also remain cool. The doors themselves, being fairly open, allow the moisture from the toasting bread to escape, and thus the outside of the bread is sure to be crisp. The popular toaster is 8 in. long × 4 in. wide × 7¼ in. high, and the power consumption is 500 watts. Sufficient toast can be prepared for an average breakfast in less than 10 minutes.

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* We understand that the book was greatly delayed in the press; when it left the author's hands the drawn-wire lamp was not on the market.—Eds. E.R.

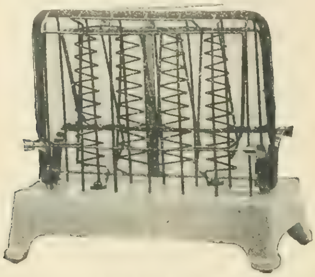


Fig. 2.—New G.E.C. Electric Toaster.

Stage Arc Lamp.

We illustrate in fig. 3 a special hand-feed economic flooding-type stage arc lamp, supplied by Messrs. Austin Walters & Son, of 57, Lower Mosley Street, Manchester.

The box has been designed to prevent stray light, and at the same time has perfect ventilation; it is constructed of heavy-gauge planished steel, with a thick asbestos lining. The back is entirely enclosed, and all regulating adjustment is made from underneath.

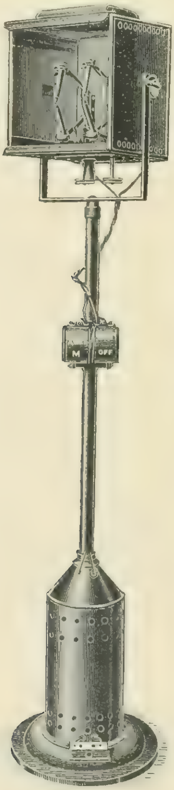


Fig. 3.—Flooding Type Stage Arc Lamp.

The current consumption is only 8 amperes, and a light equal to that of a 16-ampere arc is claimed for it.

Two hand-feed arcs in series are fitted on to one base, and a specially-constructed resistance is built on the stand, together with a D.P. ironclad switch.

New D.C. Motors.

The Electrical Co., Ltd., of 122-124, Charing Cross Road, W.C., have just brought out a series of D.C. machines of new design, embodying the use of auxiliary poles, fan draught, improved brush gear, and the ability to stand 100 per cent. overload without sparking. The accompanying illustration, fig. 4, shows the louvred shutters on the end shields, which provide ventilation, together with protection against the entry of water or other foreign bodies, and the guard over the terminal block. Fig. 5 is a longitudinal section, showing the construction of the machine; the fan is of the radial type, to run in either direction, and the air is distributed over the whole of the interior of the machine. The brush gear is ingeniously devised, so that the position of the brushes for either direction of rotation is fixed by the maker, and no mistake can be made. The machines comply fully with the specifications of the Engineering Standards Committee, and the efficiency is maintained at a high figure, at from 50 to 150 per cent. of full load.

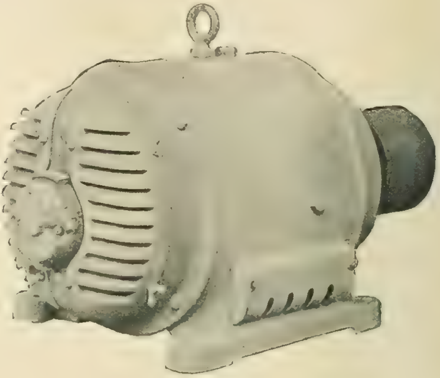


Fig. 4.—New Type d.c. Motor.

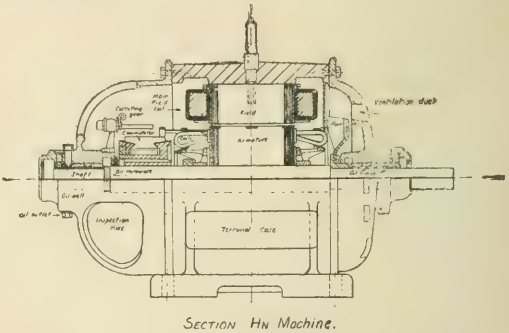


Fig. 5.—Sectional View of New d.c. Motor.

B.T.-H. Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., are introducing a variety of Holophane reflectors, of which one of novel design is shown in fig. 6, suitable for the lighting of domestic interiors.

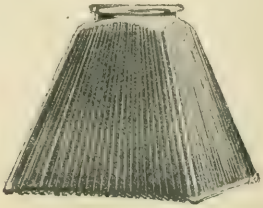


Fig. 6.—B.T.-H. Holophane Reflector.

SUB-STATION WORKING.

By A. T. BULLEN.

There are few definite laws relating to sub-station practice owing to its dependence on local conditions. The varying demands, the construction, and the situation, each in turn require special consideration, but a little time can be well spent in studying the deficiencies of some sub-stations and those connected with them.

With the heavier machinery and plant installed in sub-stations the writer finds no fault, but he proposes to raise several interesting points and discuss some of the more prominent features of the question of the control of the plant.

Sub-stations can be placed in two primary divisions, viz.: Rotary and Static sub-stations; although it is proposed to refer briefly to the former, attention will be mostly directed to static sub-stations. It is the author's idea in this article to deal with plant that has to be left unattended for lengthy periods, and consequently the rotary sub-station, which always has someone in attendance, will hardly come into the question.

Moreover, those in charge in a rotary sub-station not only should understand the machines and switchgear for which they are responsible, but also the nature of the load which is really the determining factor in the method of procedure in sub-station working. Thus, while for instance, the tripping of an automatic switch in a traction sub-station may mean practically nothing at all, a similar occurrence in a lighting sub-station may spell disaster if not treated in a proper manner. It is true that the ordinary sub-station attendant merely replaces the switch in either case, but in such circumstances the action of the attendant does not add to, or take from, the seriousness or otherwise of the excess current that has been the cause of the tripping of the switch.

However, we shall see that even with the special knowledge they possess, the attendants in a rotary sub-station do not always do the correct thing. The following is an instance:—

Some months ago the writer was in a sub-station in which a single 300-KW. rotary converter was running, when suddenly, without any warning whatsoever, the H.T. switch on the A.C. side came out. The attendant got flurried, stood and looked at it for a few seconds, and then "promptly" proceeded to put the switch in again. Fortunately, the writer was just in time to prevent him, and then he (the attendant) realised for the first time the mistake he had almost made. The difference in volts between the machine and the bus-bars at the precise moment was about 800, while the machine must have been running at something like 200 R.P.M. below its proper speed. The writer wondered why the D.C. switch did not come out, and on examination found that it had been tied in with a piece of cord.

Now, the tying in of the D.C. breaker may, under exceptional circumstances, be quite legitimate, but it is not a thing that should be done indiscriminately. True, machines such as the above are designed to withstand very heavy excess currents for a short period; but when it is necessary to tie in a breaker, it should be released immediately after the overload has fallen off.

Such contingencies as these do not, however, have to be dealt with in a lighting sub-station, in which case the breaker can be set to a definite limit, the exceeding of which means something wrong.

We will now turn to static sub-stations.

As a contrast to the last example, the following is interesting. It occurred in a static sub-station, in which the practice was to leave one transformer only on circuit during the night. As the load went off each evening, so the attendant switched off his transformers one at a time. On this special occasion he was in the act of releasing his first transformer, when, by accident (or carelessness) he tripped the H.T. feeder switch instead of the H.T. transformer switch, which was next to it. Curiously enough, the lighting of the sub-station was taken off that phase, and the place was left in darkness. Instead of acting promptly and immediately replacing the switch he had tripped, the attendant proceeded to meditate after this fashion:—

"Good heavens! What have I done!"

The writer did not wait for him to find out what he had done, but, after restoring the light, very "carefully" explained.

Among sub-station attendants, the craze for experimenting is as prevalent as among many other classes, and often leads to some amusing incidents. The following is a sample:—

Two worthy attendants in a certain static sub-station were one evening discussing the advantages of earthing the whole system on which they were engaged, and proceeded to join up all the outers of the distributors leaving that sub-station (in number about 30), with a piece of copper wire, and were in the act of connecting them to the lead covers of the cables when they were unfortunately disturbed by the mains engineer, who happened to drop in. This gentleman expressed his opinion of them in no uncertain terms. There is a rumour that they have yet to learn the advantages of earthing a system that was never intended for that purpose.

Static sub-stations in outlying districts are sometimes a source of great annoyance, as they are in a great many cases visited but once a day, sometimes less often, and this fact has been responsible for some unfortunate occurrences and awkward positions.

The practice of using automatic switches which have no time lag is, in such cases, open to criticism. The switches installed usually come out quite easily, and, on occasions, much delay and inconvenience has been caused to consumers who depend on the supply for their living.

A few weeks ago an instance of this kind was brought to the notice of the writer. A sub-station which had not a great load on it was one day called upon for a supply for a 40-H.P. motor.

The motor did not start any too well, and just at starting took rather an excessive current, which, however, fell rapidly once the motor had got away, and which, while leaving the L.T. fuses intact, brought out the H.T. automatic switch. The delay caused by this mishap was something like 1½ hours, due to the fact that the men responsible were at the other end of the borough, and could not be immediately located. Had fuses been installed on the H.T. as well as on the L.T. side, or a switch with a time lag, this trouble would have been avoided, for the excess current was of but two or three seconds' duration.

It is the practice in some sub-stations to use H.T. bridge fuses which take the place of a double-pole switch.

These bridge pieces, while claiming the advantage of being quickly replaced in emergency (for spares are always in readiness), are liable to be the cause of curious accidents.

A message was received at the works recently stating that the current was off at one of the consumers' premises.

Investigations showed that it was only too true, and as it was not readily accounted for, a visit was made to the sub-station supplying that particular consumer, when it was found that the fuses had been inserted on the inner of one transformer and on the outer of another. Such an accident as this would have been impossible had proper switches been used. It may be claimed that carelessness was responsible, and not a deficiency in the type of controlling gear, but it must be allowed that the engineer has to contend against such unreliability as this on the part of his assistants.

The question of instruments is interesting, and demands attention. A frequent practice in sub-station working is to have simply an ammeter and a voltmeter fixed (one on each phase, if polyphase), in the station, but the following two incidents will show clearly that these instruments, unless they are of the recording type, are often of little value:—

In the first case the sub-station contained simply one transformer, and was, as a rule, visited only during the day. As the instruments were not of the recording type, the real load on the station was not known to the mains department, and haphazard guesses only could be made. One evening in November the works received a message from the district in which the transformer was installed, stating that the pressure was very low. On examination it was found that the H.T. fuse had blown in the sub-station, and the district, which was purely residential, and consequently gave a purely night load, was being fed back from another sub-station. The first thing the attendant did was to replace the fuse by a larger one. Not long after the transformer broke down completely through overload. Now, had the instruments been of the recording type, the mains department could not but have noticed that the transformer was being persistently overloaded.

The second instance is of a different nature, but serves also to show the value of recording instruments.

In one of the single transformer (per phase) sub-stations the H.T. fuse failed, but was not noticed by the attendants, although they made a daily inspection. As a consequence, the load was transferred to two other sub-stations in the district; one evening a heavy temporary load came on, which proved too much under the circumstances, but which would have been quite alright had not the two sub-stations been already overburdened by the load of the third. A transformer in one of the two broke down, due to the overload, and the whole of the load being then transferred to the other one, the H.T. fuse there failed, leaving practically the whole of one large district in darkness. The attendants who visited the first sub-station during the day did not have any grave suspicions on finding there was nothing going out from it, but had recording instruments been installed the case would have been quite different.

It will be seen that automatic switches in out-of-the-way sub-stations are often a deal of trouble, and that although ordinary fuses are much preferable, they are, unless handled very carefully, likely to be just as troublesome and cause quite as much inconvenience. It will also be seen that recording instruments should invariably be installed in sub-stations that have not an attendant always in charge; and that one must be most careful in the selection of attendants. There are, of course, many excellent men doing sub-station work, but there are others not so desirable, such as the man who could not imagine what became of the 3,000 "lost" volts in his sub-station, and it is these men one would prefer to see in a different groove.

THE ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT DURING 1911.

By EDWARD S. HODGSON.

The following notes have been compiled from the annual report of the Institution: this report may be found in the "Zeitschrift für Instrumentenkunde," Nos. 4, 5 and 6, 1912.

The usual tests were carried out on machines, instruments, accessories, &c.

At the request of the Commission on Insulating Materials an extensive investigation was commenced on insulating materials with a view to forming a basis for rules concerning the tests of these materials. Sixteen types of insulating materials were supplied by nine firms for the purposes of the experiments. The investigation covered surface resistance, breakdown voltage, change of insulation resistance owing to chemical reactions, exposure to light and weather, liability to combustion under the electric arc, also the behaviour of materials at high temperatures. The results of the investigation have been communicated to the German Society of Electrical Engineers.

In 1909 the Reichsanstalt carried out an investigation into the behaviour of electricity meters on varying loads, both theoretically and experimentally. It was assumed in this investigation that the constant of motor meters is independent of the load. This assumption does not, however, hold in the case of Ferraris meters, and the earlier tests were supplemented in this direction. It was found that in the case of Ferraris meters, fluctuations in load and consequent appreciable differences in the indications of the meters occur only under conditions seldom met with in practice.

A set of decade air-condensers from 0·001 to 0·01 microfarad was constructed, in which the capacity of the connections need not be specially considered. The condensers are comprised of horizontal circular plates: one system being connected to the casing, and the other insulated. The plates were built up in essentially the same manner as in the condensers already mentioned by Giebe (Zeitschr. f. Instrumentenkunde, 29, 1909, pages 269, 301). In the centre of the cover and the bottom of the cylindrical case is a hole; from the hole in the bottom a spring contact pin projects, which is connected with the insulated plate-system. In the inside of the case, under the hole in the lid, is a small contact-plate connected with the same system. When the condensers are placed on each other (the feet acting as a guide), the contact pin of the upper and the contact plate of the lower condenser establish connection between the insulated systems, the other system being connected by the contact with the casing. The set has a baseplate of the shape of the lid of the case, this base having also a hole in the centre, and underneath this an insulated contact plate, from which a wire leads laterally through a tube to the outside. The following sizes were constructed:—0·001 microfarad, 0·001, 0·002, 0·005 microfarad, and a rotary condenser of similar construction of a capacity to 0·002 microfarad.

The 21 standard wire resistances which had been kept in the hygrostat (cupboard for a constant degree of humidity) were only measured once in 1911—viz., on the occasion of the annual comparison in May. It was found that assuming coil 1_D is constant, a small rise took place in all the wire resistances as compared with the values measured in 1910, this rise attaining 0·001 per cent. in the two 100,000-ohm coils, but being of less magnitude in all the other coils. Since the 0·1, 0·01 and 0·001 ohm resistances which were not kept in the hygrostat showed a slight increase by about the same amount (mean, about 0·0005 per cent.), it may be assumed that a considerable part of the changes observed is not attributable to the individual coils, but to a slight decrease of the resistance value of the standard 1_D.

A brief description, with illustrations, is given of a new machine constructed by Hans Boas, of Berlin, for calibrating alternating-current meters.

The differences between the comparisons made at the National Physical Laboratory, the Bureau of Standards (Washington), and the Reichsanstalt, and the methods used in these various institutions for determining the watt-loss in dynamo sheets have in the main been explained. They are chiefly attributable to the fact—which only came to light afterwards—that the strips sent from the National Physical Laboratory to the Reichsanstalt for measurement were all cut parallel to the direction of rolling, and not, as is the recognised practice in Germany, half parallel and half perpendicular to the direction of rolling. The differences left after taking this factor into account lie within the limits of error of observation.

An investigation has been undertaken on the influence of the chemical composition and heat-treatment on the magnetic and electric properties of iron alloys. A report on these tests has been sent to the firms concerned, but the results will not be published until later.

In accordance with the steady displacement of carbon-filament lamps by those having metal filaments, the number of the former tested for life has considerably decreased. For the tests on metal-filament lamps alternating current was generally prescribed.

Special mention is made of a series of four 400 (Hefner) candle, 110-volt lamps, which initially consumed 0·85 watt per Hefner candle, and, after burning for 1,000 hours, consumed 0·92 watt per Hefner candle perpendicular to the axis of the lamp. Under these conditions the C.P. fell by only about 8 per cent. after running 1,000 hours. Further mention is made of a series of five metal filament lamps (11·2 volts 70 Hefner candles) for series use. These lamps remained nearly constant up to 1,500 hours. Of course the manufacture of tungsten lamps has progressed a great step in that it is now possible to manufacture drawn filaments for the lamps, the consequence being increased cheapness and greater resistance to shocks. It is also possible by employing the drawing process to produce thinner filaments of good durability, so that in Germany both 220-volt 16-C.P. and 110-volt 10-C.P. lamps are now on the market. A large number (72) of these lamps were tested for life.

The Reichsanstalt was represented at the International Photometrical Commission, at Zurich, July, 1911. The ratios of the three standard lamps in general use have undergone a change since the last conference, in that the National Physical Laboratory has fixed the standard value for atmospheric humidity for the 10-c.p. Vernon Harcourt lamp at 10 instead of 8 litres per 1 cubic metre of air. The Commission accordingly accepted the following conversion values :—

1 Carcel = $10{\cdot}7_5$ Hefner candles ;
1 Harcourt = $11{\cdot}1_0$ Hefner candles ;
1 Harcourt = $1{\cdot}03_5$ Carcel.

The Reichsanstalt has recently been invited to take part in the movement promoted by the Illuminating Engineering Society (New York) for the introduction of uniform values and designations in photometry.

Some additional researches, &c., which may be mentioned are the following :—An investigation into the eddy current brake and the electromagnetic rail brake ; potential drop in three-phase generators ; the absolute determination of the ohm ; the thermal expansion of marble (carried out in connection with the last-mentioned research) ; measurements of high-frequency currents ; electrometrical measurements on high-frequency circuits ; electrolytic valvular action : electrolysis of glass, &c.

In all, 19 official and private papers were published by the members of the staff during the year, and a detailed list of these is given at the end of the report.

BUSINESS NOTES.

Consular Notes.—Argentina.—The American Consul at Buenos Ayres, in a recent report, points out that the tramway statistics of that city during the last few years, gave evidence of the efficiency of the service. There has been an enormous development of the city traffic, a development which is surprising, not only when compared with that of other cities, but also when the position now is compared with the position in Buenos Ayres a few years ago. In 1873, when the greatness of the city began to be realised, the tramways carried 13,156,350 passengers. 10 years later (in the period of the horse cars) the total number of passengers was augmented to 17,965,437 ; a decade later, due to the increased population of the city, 57,799,362 passengers were carried. With the change from horse cars to electric cars came a great improvement and extension of the system in all directions, and the number of passengers carried multiplied beyond the most sanguine expectations. During the year of 1911, just past, 355,531,182 passengers made use of the facilities offered, the companies receiving $14,969,446 (United States gold) in fares.

Corea.—The American Consul at Seoul reports the announcement by the Seoul Press that the Japanese firm of Okura & Co., of Tokio, has made arrangements under Government permission for installing on the Chongchon River an electric plant to supply the demands of the mining district of North Pyongan Province. The scheme contemplates the supply of motive-power, tramway service, and lighting, and contracts have been already entered into with the Oriental Consolidated Mining Co., the Chosen Mining Co. (both American), and others for the supply of over 2,000 H.P. The Consul is informed by representatives of these companies that this arrangement is considered of great advantage, in view of increased cost and growing scarcity of wood for fuel. The coal to be used in the work will be supplied from Manchuria, where Okura & Co. control the output of the Penshu Colliery. The machinery required will be obtained from Germany. Okura & Co. are the sole agents for Japan of the A.E.G. of Berlin.

Canada.—The American Consul at Fredericton, New Brunswick, reports that the hydroelectric station which is to utilise the power of the Eel River and its tributaries in Cartleton County, is to be constructed in a short time. When completed, the station will be in a position to supply cheap power to all the neighbouring towns, including Fredericton. Letters of incorporation were secured in 1911. A company, capitalised at $98,000, is applying for letters of incorporation to do business under the name of the Welsford and Hamstead Telephone Co. It proposes to carry on a general telephone business in Queen's County, with a head office in Welsford.

China.—The American Consul at Shanghai, reporting recently on general conditions in China, writes as follows :—"China is at the dawn of an era of industrial development, and the demand for implements for this expansion should continue to increase for many years to come. The following are ideas and views gleaned from local representatives for machinery and electrical appliances from time to time. The British and German firms are obtaining more business than their competitors because they study the requirements of the market more carefully than manufacturers of other countries and have far superior organisations in China. They also grant special terms of payment which Americans are not often willing to give. This is particularly true of the Germans, in whose country the banks amalgamate with manufacturers' syndicates, with the result that any scheme presenting a reasonable prospect of success is financed through this combination and German capital purchases the German materials with which the plant is fitted. There is usually a first partial payment and a lien taken on the plant so erected as security for the balance. In equipment of a municipal or public nature, the guarantees of local officials are often added to the security. The American technical representative of a well-known company writes with reference to electrical machinery that at present there is excessive competition indulged in by foreign firms, and any American exporter desirous of obtaining a foothold in the market must be content with small returns as long as present conditions last. Great emphasis in many instances is placed on price which puts not only electrical but other American machinery at a disadvantage, except in the case of the apparatus of the largest manufacturers. This is true for the reason that technical knowledge is lacking in China on the part of all but an extremely limited number of purchasers. Consequently few customers are in a position to judge the relative merits of machines offered and price becomes to a large extent the standard by which suitability is determined. This is directly responsible for the keen, low-priced, small-profit condition of the present day. Education will do much in time to alter this. Foreign competitors seek in this low-priced campaign to secure a footing against the time when development is more general, demand more generous, and education such as to render small margins unnecessary. One thing is certain, the industrial machinery business in China cannot be carried on without local representation of some sort. Catalogues alone are useless. Some of the important American houses are already in the field with technical experts operating independently or in conjunction with locally established firms, and these, I am told, have made headway. Personally, I have faith in American organisation, alertness and general ability to get business, if gone after properly. For this reason I believe firmly in the co-operative scheme for houses having lines not sufficiently important as yet to warrant individual direct effort, but certainly entitled to the fair trial that only such representation can give. This is peculiarly applicable to houses producing industrial and other machinery, and such an organisation supported by bank affiliations should be in a position to secure a larger proporation of this expanding trade than the United States is getting at present. It is the plan of the competitors, and is at least worth the most thorough investigation if not a trial."

Brazil.—The British Consul at Santos, reporting on the dock works there, states that electric cranes to the number of 14 have already been erected on a new stretch of quay, and an installation of electric conveyors for the loading of coffee has also been fitted up. On April 16th, 1911, the Dock Co.'s hydro-electric installation at Itatinga, about 20 miles from Santos, the transmission cables and central station at Outeirinhos (Santos) were completed. The large surplus of power which the Dock Co. is prepared to supply at a very moderate price for industrial purposes would seem to afford a good opening for the establishment of factories, suitable building land with railway facilities being available. In the town of Santos the tramway system comprises about 38 miles of line, of which 15 miles were electrified in 1909. The electrification of the remaining 23 miles was taken in hand in 1911, and should be completed by the end of 1912.

Finland.—The British Consul at Helsingfors, in a recent report, states that all goods connected with electrical machinery, &c., are supplied by Germany in far greater quantities than by the United Kingdom, with whom Sweden also competes in this trade. There does not appear at present to be any means by which the British import trade can be improved in such articles as telephones (received exclusively from Sweden), lamps, bells and other apparatus ; but in electrical machinery, motors, &c., the United Kingdom might well compete, and is doing so to some extent, although the import is as yet insignificant. It should be noted in this connection that Finland is a country with great wealth in water power, and that turbines and electrical machinery must needs be used in large quantities. It therefore appears extremely probable that the importation of the latter goods will improve, as it is considered that the local factories will not be able to meet the demand. There should thus be an opening for a thorough study of the Finnish market in this trade, and for an attempt to supply, if possible, the particular article required.

The British share of the import trade in suction gas and other engines is important, and, it is considered, might be improved. It is difficult to say whether the import trade in this line developed in 1911, as no separate statistics are available, but it should be mentioned that engines of all kinds are largely employed in Helsingfors for boats, cars, building works, &c. As regards machinery in general, imports from the United Kingdom decreased. In order to further British commercial interests in Finland, the system of establishing local agents for the different branches of trade should be continued. The best manner of obtaining suitable agencies for any particular class of goods is to advertise in a local journal.

Much can be done for British trade in Helsingfors, and in the other Finnish towns by sending out representatives of British manufacturing firms to push the sale of the various commodities. Much good has, no doubt, been already accomplished by this method, but much still remains to be done. The representatives in question should possess a knowledge of Swedish, though, as an alternative, German would also be useful in a minor degree. It is perhaps unnecessary to add that such representatives should possess good manners and tact—qualities which experience shows go a very long way in obtaining the footing required. As time goes on a knowledge of Finnish will probably become necessary.

but at present Swedish is the principal language required in commercial circles.

The British Vice-Consul at Viborg states that the extension of the electrical plant of that town has been practically carried out. The electric tramway will shortly be inaugurated by the municipality, and is expected to be ready for public use by the end of 1912.

For Sale.—Mr. G. E. Corfield, the Receiver, is inviting offers for the sale, by tender, of the business of the Davis Electrical Co., Ltd. (in liquidation), 17, Moor Street, Cambridge Circus, London, W.

The Dundee Town Council has 50 arc lamps for sale. See our advertisement pages to-day.

Book Notices.—"Memorandum and Articles of Association of the I.E.E." "*Journal* of the I.E.E.," Vol. 49, No. 214. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for July, 1912, contains the following papers:—"High-Voltage Tests and Energy Losses in Insulating Materials," by E. H. Rayner; "Self-Contained Road Vehicles and Locomotives," by J. C. Macfarlane and H. Burge; "Tariffs for Electrical Energy," by W. W. Lackie; "Specifications," by Fred. S. Sells; "Power Station Working," by J. W. Jackson; "Porcelain Line Insulators," by J. Lustgarten; "An Instrument for the Detection of Combustible Gases and Vapours," by Louis J. Steele; "The Determination of the Efficiency of a Polyphase Asynchronous Motor from the Current (circle) Diagram," by John Nicholson; "The Tungsten Filament Lamp on Alternating Current," by Lancelot W. Wild.

"*Telephony's*" *Directory of the Telephone Industry.* Chicago, U.S.A.: *Telephony* Publishing Co.—This manual, now in its 17th year, gives a complete list of the telephone companies operating in the United States, Canada, Mexico and the American dependencies—amounting in the aggregate to no fewer than 21,952 (21,048 in U.S.A., 855 in Canada, and 49 in the other countries). Of this remarkable total, 11,518 are returned under the head "number of subscribers unknown," 4,087 with under 50 subscribers, and 2,087 from 50 to 150: at the other end of the scale there are 35 companies with over 10,000 subscribers, 66 with 5,000 to 10,000, and 510 with 1,000 to 5,000. The State of Iowa alone possesses 3,787 companies, and two other States confess to more than 1,100 each, showing that the conditions obtaining in the American telephone field present a striking contrast with British practice. A list of foreign telephone companies and buyers, occupying 2¼ pages, is followed by an account of the "Bell" organisation (the American Telephone & Telegraph Co.) and its associated companies, filling nearly 20 pages, and a section is devoted to the telegraph, cable and wireless companies of the world. Part II of the volume is a "Buyers' Guide," and is provided with maps of the United States and Canada. Nothing could give a more striking impression of the vast development of the telephone industry across the Atlantic than this work, which deals with conditions absolutely unknown in Europe. The magnitude of the industry is also well illustrated by the lengthy list of manufacturers and dealers whose names and advertisements are printed in the second part, forming about half the volume

"British Standard Specifications." A new edition of the British Standard Specification for Structural Steel for Bridges and General Building Construction (Report No. 15. Revised August, 1912) has recently been issued. The new issue is of importance in view of the fact that the London County Council (General Powers) Act, 1909, requires that all rolled steel used in the construction of skeleton frame work for buildings shall comply with the requirements of this specification. The price of the specification is 5s. 2d. post free, and it may be obtained from any bookseller, or direct from the offices of the Committee, 28, Victoria Street, Westminster, S.W.

"*Calendar* of the Royal Technical College, Glasgow, 1912-13." Glasgow: The College.

"Electrical Injuries: Their Causation, Prevention and Treatment." By Charles A. Lauffer. 1912. London: Chapman & Hall, Ltd. Price 2s. net.

"The Constituents of Coal Soluble in Phenol," by J. C. W. Frazer and E. J. Hoffmann; "The Factor of Safety in Mine Electrical Installations," by H. H. Clark; "The Status of the Gas Producer and of the Internal Combustion Engine in the Utilisation of Fuels," by R. H. Fernold; "The Slagging Type of Gas Producer," by Carl D. Smith; "Government Coal Purchases under Specifications," by G. S. Pope and J. D. Davies. 1912. Washington: Government Printing Office.

"*Bulletin* of the American Institute of Architects." Vol. XIII, No. I. April, 1912. Washington: The Institute.

"Wireless Telegraphy." By Alfred T. Story. 1912. London: Hodder & Stoughton. Price 1s. net.

"*Proceedings* of the Incorporated Municipal Electrical Association, 1912." London: Wyman & Sons, Ltd. Price 5s.

We have received from Mr. J. Sutherland Warner a reprint of correspondence in the *Times* of March and April, 1910, relating to "Mono-rail Fallacies," in which the relative merits of the mono-rail and the ordinary permanent way were discussed.

Catalogues and Lists.—The Electrical Co., Ltd., 122-124, Charing Cross Road, W.C.—Lists Nos. 1 and 2, dealing with electric motors; list No. 1 relates to D.C. machines, from ¼ to 100 H.P., which are built in three standard types according to size; it contains very full information regarding the motors and their capabilities, as well as particulars of small motor-generators, starters, &c. Useful notes are given as to the management of the machines, and tables of dimensions are provided. List No. 2 deals with A.C. motors of slip-ring and squirrel-cage types, in several ranges, from ¼ to 500 H.P., and for one, two or three-phase supply. Commutator machines are also listed, together with starting switches and transformers and spare parts, and a number of diagrams of connections. Running instructions and dimension tables are given. Both lists have been compiled with a special eye to the requirements of contractors, and are very conveniently arranged.

The Cable Accessories Co., Ltd., Britannia Street Works, Tividale, Staffs.—Catalogue No. 6 of electric light "Sceaco" water-tight fittings; the company specialises in cast-iron fittings, and the list shows a great variety of these for use on board ship, in docks and factories, mines, &c., and for street lighting, with one or more incandescent lamps. Ironclad D.P. switches and fuses for street lighting, and ornamental brackets of numerous patterns for use with the fittings, are included, as well as hand-lamps complying with the Home Office Regulations, and a variety of accessories.

The I.T.E. Electric Co. (1907), Ltd., 72, Finsbury Pavement, E.C.—Card showing the Midget Senior I.T.E. circuit breaker for five to 300 amperes, and the L.L. traction type, of which hundreds are used by the L.C.C.

Deutsche Gasgluhlicht A.G. (Auergesellschaft), Berlin O 17.—Catalogue of reflectors, fittings, and installation materials for use with Osram wire lamps.

Allgemeine Elektricitats - Gesellschaft, Berlin.—Brochures giving particulars and illustrations of generating plant and of electrically-driven pumps, air-compressors and fans, installed by the company in numerous gas-driven power stations for mining, ironworks, &c.

C. W. Hunt Co., West New Brighton, New York, U.S.A.—Pamphlet describing the Hunt Automatic Railways for handling materials in bulk; some of these installations have been working satisfactorily for 40 years.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Price list No. D6, dealing with Holophane fittings, reflector-bowls and spheres, with a variety of fittings for use with Holophane glassware. Also a leaflet illustrating nine of the newest patterns of household Holophane.

The Universal Electrical Manufacturing Co., 14, Station Parade, Peckham, S.E.—Calendar card with prices of porcelain tubular fuses with protected ends. The company has built a foundry for brass, gun-metal and aluminium castings, and is now prepared to supply rough or finished castings to pattern or to drawing.

The Langdon-Davies Motor Co., 110, Cannon Street, E.C.—Price list of standard A.C. motors of the slip-ring and short-circuited rotor types, from ⅛ to 100 B.H.P., conforming to the Engineering Standards Committee's specification; also geared motors, starters, motor-generators, &c.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.W.—Leaflet relating to the E.A.C. high-torque meter.

Messrs. Seear, Page & Co., 16 and 17, Devonshire Square, E.C.—Pamphlet describing the Swedish system (Löfquist patents) of electric heating apparatus—laundry, domestic, &c.

Messrs. Wailes, Dove & Co., Ltd., 5, St. Nicholas Buildings, Newcastle-on-Tyne.—Booklet about Bitumastic solution for coating ironwork.

The Sloan Electrical Co., Ltd., Conradty House, 12, Golden Lane, E.C.—Price lists relating to "S. L." shades and reflectors, of glass, metal and silk, in great variety; and "S. L." cartridge fuses, "pyrotin" fuse wire and strip, "bi-metal" fuse wire, &c. These can be had on application to the company.

Messrs. Schaffer & Budenberg, Ltd., Whitworth Street, Manchester.—Price list of indicators (Catalogue Section 19) of the Thompson type, with a variety of modifications and recent improvements, as well as the Richards indicator, explosion recorders, electrically-controlled indicators, and a variety of reducing gears, tools and accessories.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflets relating to aluminium domestic fittings, such as door handles, &c., and aluminium ventilating fans for attachment to electric motors.

Messrs. Samuel Denison & Son, Ltd., Leeds.—Pamphlet describing the "Blake-Denison" weigher, which automatically and continuously weighs and records the quantity of material passing over any type of conveyor, within ½ per cent. A semi-automatic weigher and various other types of machine are described, and a new time tonnage recorder for secret control, electrically operated at any distance from the weigher, is introduced. An explanatory statement regarding these devices is given in a separate pamphlet.

The Brimsdown Lamp Works, Ltd., Kingsway House, W.C.—We have received a copy of a large showcard advertising "Wirum" lamps for 1912; the card measures 15 × 20 in., and is printed in eight colours, with striking effect. It is for general distribution to the trade.

Austria.—According to the *Electro. und Masch.*, the imports of electrotechnical products into Austria-Hungary in the first five months of the year amounted to 16,124,000 kronen, against 11,168,000 kronen in the same period in 1911. The exports were 5,134,000 kronen, against 4,530,000 kronen. Of dynamos the imports were 5,934,000 kronen, against 4,192,000 kronen, and the exports 491,000 kronen, against 206,000 kronen. Compared with the previous year, the growth in the aggregate imports, and more particularly in dynamos and electrical apparatus, was maintained, although compared with the preceding month's imports, a noteworthy falling off was observable. The exports, also compared with those of the previous month, showed a decline, although they were 25 per cent. greater than in the same month last year. The advance in the exports of glow lamps was less marked than in the previous year, but cable and wire both showed considerable improvement. The United Kingdom figured in the imports, principally in dynamos, transformers, &c.; telegraph, signalling and safety railway apparatus; telephones and microphones; cable and insulated wire; accumulators; and electrical meters, the bulk of Austro-Hungarian trade being with the German Empire. Of the exports, the United Kingdom were the recipients of small consignments of dynamos, telephones and microphones, electrical meters, glow lamps (153 quintal), armoured cable and insulated wire (91 quintal), rubber or gutta-percha covered wire (33 quintal), paper, &c., covered (208 quintal), carbons (1,113 quintals) and electrodes. Moderate exports were made to British India, but Egypt apparently is a good customer for Austro-Hungarian electrical products.

Liquidation. Lahmeyer Electrical Co., Ltd.—A general meeting of the company will be held at the office of Messrs. Slaughter & May, 18, Austin Friars, E.C., on October 1st, to receive the report of the liquidator on the winding up of the company's affairs.

Bankruptcy. G. E. Hervey, gas and electrical engineer, of 24, Susans Road, Eastbourne. Last day for receiving proofs September 13th, 1912.

Trade Announcements.—The Diesel Engine Co. announce that in consequence of the expansion of their business they are removing from Queen Victoria Street to more commodious head offices at General Buildings, Aldwych, Strand, London, W.C. All communications should be sent to the new address.

The Consolidated Diesel Engine Manufacturers Ltd., also announce that their registered office is now removed to General Buildings, Aldwych, London, W.C.

Messrs. W. T. Glover & Co., Ltd., announce that the telegraphic address of their London office will henceforth be "Phonoscope, Vic., London." The indicator word, "Vic," will not be charged for in inland messages.

LIGHTING and POWER NOTES.

Accrington.—The electricity department has just commenced the work of laying a new high-pressure cable towards Clayton-le-Moors in preparation for the supply of current to the township. It is also probable it will be requested to quote for the supply of current to Great Harwood

Arnside.—By arrangement with the Traders' Association, the first section of the promenade electric lighting scheme has been brought into use. The work has been undertaken by the traders, in the hope that the P.C. may see its way to take over the scheme eventually.

Barrow-in-Furness.—At the T.C. meeting on September 2nd, the Electricity Committee reported that the engineer had submitted terms by which, subject to approval, he agreed to give the Furness Railway Co. a supply of electricity for the whole of their locomotive works at Barrow, for a period of 10 years. It was decided to grant approval, subject to the company entering into an agreement to the approval of the town clerk. The Council also endorsed the engineer's proposal to authorise the contractors to proceed with the work in connection with the buildings for the extension of the electricity works, and the town clerk was instructed to write the L.G.B., informing it of the proposal.

Belfast.—The site for the new electricity station, which the Corporation proposes to erect, will probably be that known as Glentoran, on the Ravenhill Road. The Tramway and Electrical Committee has recommended the Council to accept this site (which covers between five and six acres), at an annual rental of £65 per acre. A meeting of the Council in committee has been called to consider the recommendation, and also the reports of the electrical engineer, and the consulting engineer on the electrical extension question generally. The Glentoran property has a frontage to the Lagan. Another site which was examined by the sub-committee of the Tramways and Electrical Committee was at Queen's Bridge.

An experimental installation of arc lighting has been introduced in Donegall Street, this being an extension of the system which has already been in use for about three years in Castle Place and High Street. We gather that centre lighting has been adopted by poles and span wires.

Bettws-y-Coed.—With reference to the Council's proposal to borrow £9,700 for water supply and £3,720 for electric lighting schemes, an inquiry has been held by the L.G.B. Regarding the latter, it was stated that Lord Ancaster had agreed to lease to the Council the well-known Swallow Falls, so that the Council, by making a small charge for admittance, could secure at least £100 annually towards the estimated deficit of £212. His lordship had also offered to contribute £100 a year until the deficit was wiped off. Opposition to the scheme was raised by a member of the Council, the latter objecting to the Swallow Falls, which had always been open to the public, being saddled by a charge which would result in harm to the district.

Birkenhead.—Arising apparently out of a discussion on the borough electrical engineer's expenses at the last T.C. meeting, the following notice of motion has been given by Councillor Campbell for consideration at the forthcoming T.C. meeting:—"That the number of days in attending conferences under authority of the resolution of the Special Committee confirmed by the Council on October 6th, 1909, be limited to not more than four days in one year, including day of going and day of returning; and that all proposed attendances at conferences, other than those sanctioned by the Council on October 6th, [illegible] the committees concerned."

Bolton.—The annual report of the electricity department shows a total output sold of 11,676,937 units, of which motor supply and tramways accounted for 5,540,319 and 4,468,764 units respectively. The gross profit on the year's working was £32,123; interest, sinking fund and depreciation charges absorbed £26,992, sundry contributions amounted to £1,709, and the balance of £3,422 went to the rates, this figure comparing with £6,837 in the previous year. The calculated depreciation for the undertaking amounted to £19,169, and a sum of £3,943 was therefore transferred to the depreciation account to supplement the loan instalment, which only amounted to £15,226. The depreciation account now stands at £27,673. The decreased net surplus is attributed to the coal strike, which added some £3,000 to the coal bill for the year, and will also affect the present year's working. As the Corporation has unfortunately delayed the construction of the new power station, so that the existing plant will be overloaded during the year, this will still further affect the present year's working—despite the assistance of the 1,000-KW. battery which has been installed for the purpose of getting over the peak loads of the coming winter. This is partly explained by the fact that the Bolton undertaking supplies both single and three-phase alternating current as well as direct current for both lighting and traction. It is interesting to note that 483 consumers used 1,167 motors, of 11,794 H.P., and that a total of 3,108 consumers were supplied.

The Electricity Committee has approved the plans and estimates prepared by Mr. A. A. Day (borough electrical engineer) for the proposed new power station on a site at Back-o'-th'-Bank, for the purpose of meeting the increased demand for current in Bolton. The site is regarded as particularly advantageous, as coal can be delivered from the railway direct on top of the boiler house, and on the other side of the site is the River Tonge, the water of which will be available for condensing purposes. There is ample room on the site for putting down a generating station of very large dimensions. The initial capacity of the plant will probably be two 4,000-KW. turbo-alternators generating three-phase current, 50 cycles, at 6,500 volts. In addition to the river, there will be extensive reservoir capacity for condensing water. The scheme only awaits the sanction of the L.G.B. to be proceeded with.

The L.G.B. has sanctioned the borrowing of £19,000 for electricity purposes.

Carlisle.—The annual report of the electricity department shows total sales of 2,317,435 units, as compared with 1,649,211 units in the previous year. The gross profit, £9,971, was £1,202 higher, and the net balance amounted to £3,340, or a trifle less than the previous year. The report points out that various additional expenses were met during the year, but for which the balance would have been greater. The works costs has steadily decreased, and stood at approximately ¾d. per unit. We note that the balance of the net revenue account, after meeting loan charges, &c., amounts to £[illegible]57.

Continental Notes.—Austria: The favourable progress of the constructive works of the Vienna municipal station on the Leitha-Fischa, gives ground for the belief that the station will be completed in the course of next year, instead of in 1915. The station will be equipped with eight steam turbo-alternators. These will generate three-phase current at 5,000 volts, which will be raised to a pressure of 38,000 volts. The transmission to Vienna will lead through Pottendorf, Oberwaltersdorf, and Mödling. A second line is contemplated to run through Pottendorf, Münchendorf, and Vösendorf. In Oberwaltersdorf, and Mödling transformer stations will be erected, to supply various neighbouring localities. In Vienna the current will be stepped down to the normal Vienna pressure. The final cost is estimated at 6·4 million kronen, but the immediate expenditure figures at 850,000 kronen.—*De* [illegible]

Russia.—St. Petersburg.—A fresh element of competition is proposed to be introduced in connection with the supply of electrical energy in St. Petersburg. At present the business is in the hands of (1) the St. Petersburg Electric Lighting Co., of 1886, in which German manufacturing firms are indirectly interested through their association with the Zurich Bank for Electrical Enterprises, and the Berlin Electric Light and Power Investment Co., both of which are large shareholders in the Russian company; (2) the Belgian Société d'Eclairage Electrique; and (3) the latter's subsidiary the Compagnie Auxiliaire, which acquired in 1909 and subsequently, the majority of the shares in the St. Petersburg (Helios) Electrical Installations Co. The Electric Lighting Co., of 1886, as was mentioned in this journal a short time ago, recently secured control over a portion of the Little Imtra Falls in Finland, with the object of establishing hydro-electric works, partly for the purpose of supplying light and power in Finland, and partly for creating a reserve for the increasing requirements in St. Petersburg. It is proposed to form a special Finnish company to carry out the undertaking, which is stated to have already involved an expenditure of over £200,000 for the purchase of the water-power rights. In the meantime, Belgian and other interests have been at work in a similar direction, as it is announced from the Russian capital that Imperial sanction has just been given to the St. Petersburg Electrical Transmission of Power Co., which is also to utilise water power in Finland. The promoters of the new company are headed by the Brussels banking firm of MM. P. & S. Mottar, and the company has acquired water falls in Finland and the rapids of Volkhow, together with adjacent sites, and is also declared to have assured itself of the right of way for the erection of mains to St. Petersburg. Five leading Russian banks have participated in the scheme, including the Russo-Asiatic Bank, whose director—Excellency Putiloff—has been elected chairman of the new company. The announcement omits to state whether the transmission company has obtained a concession to supply electrical energy in St. Petersburg in competition with the three existing companies. At any rate, it is calculated that the execution of the scheme would necessitate the expenditure of £2,500,000. At the same time it is known that the Russian Ministry of Communications is inquiring into the question of the transformation of the railways in the neighbourhood of the Russian capital to electric traction, although there is nothing at present to connect this matter with the new scheme for the utilisation of Finnish water powers.

The British Vice-Consul at Omsk has forwarded a copy of a pamphlet (in Russian) giving particulars of a proposed electric lighting and tramway system for Omsk. The pamphlet may be seen by British contractors at the Commercial Intelligence Branch of the Board of Trade.

Belgium.—Under the auspices of three colliery undertakings in the Liége district, a company has just been formed in Brussels with a capital of £24,000, and the title La Société d'Electricité de Genck, with the object of establishing a central station for the supply of the electrical energy required for lighting and power purposes at the collieries interested.

La Société des Produits de Flenu is reported to be about to establish an electric lighting and power plant at its collieries at Jemappes.

Norway.—A capitalist group represented by Director Blakstad, of Lillehammer, intends to erect a power station on the Aur Elf, and to build a dam 40 m. high across the Aur Lake. Local officials have lodged a protest against the scheme, as being likely to prejudicially affect the fisheries, the wood and moor industries, and cattle raising; on the other hand, the district representative is in favour of it owing to the dues which, according to the new water law, will fall to his office. It is intended to build a tunnel from Lake Aur to Sundal, by which some 200,000 h.p. will be provided. An alternative plan is mooted whereby a total of 250,000 h.p. will be provided. When completed, this station will be the largest in Norway, and one of the largest in the world, larger than the Rjukan Falls station in Sweden. The cost is estimated at 38,000,000 kronen.—*Elek. und Masch.*

It is also reported in the Press that a Norwegian company is to be formed to work a French electro-chemical patent for the manufacture of "a new product connected with the nitrogen industry, which has practically not been manufactured for sale before, but which has been produced experimentally for some years." It is said that this new industry will require a large amount of water power and capital, a sum of about £556,000 being mentioned in this connection.—*Board of Trade Journal.*

Cuba.—The *Gaceta Oficial* (Havana) publishes decrees authorising Senores Rovira y Hermano to install a hydro-electric plant in Trinidad, intended for lighting and other industrial purposes; and the Compania Cubana de Alumbrado de Gas, of Cienfuegos, to install in Cienfuegos, a central power station for the purpose of generating electric energy for lighting and industrial purposes.—*Board of Trade Journal.*

Darwen.—The T.C. has proposed to make application to the L.G.B. for sanction to borrow £450 for electricity works extension, and for a new cable from the electricity works to the Circus.

Dorking.—The U.D.C. has consented to Edmundson's Electricity Corporation, Ltd., laying a new cable along London Road, at an estimated cost of £250, to more effectually serve the extended area of supply at Westhumble.

Llandudno.—On the Electricity Committee's recommendation the U.D.C. has decided, for the sake of uniformity, to light the promenade extension to the foot of the hill in the direction of Craigside, at an estimated cost of £134.

A recommendation has also been made that six electric columns be placed on the west shore immediately the scheme for the levelling and turfing of the promenade there has been agreed upon.

London.—Shoreditch.—The accounts of the Electricity Department, to be submitted to the B.C., show that 7,890,973 units were sold in the year ending March 31st last, as against 6,994,710 for 1910-11. The net surplus on the year's working was £5,326, although the department had to pay £1,000 more in rates than in the previous year.

Maidenhead.—On Wednesday the 6-ton fly-wheel of a Diesel generating set in the electricity works burst, the pieces of the fly-wheel being hurled through one end of the building. One man was injured, and it was feared that the supply would be interrupted, but, fortunately, the staff were able to meet the whole of the lighting requirements of the town, except street lighting, by means of the steam generating plant.

Mexico.—The Mexican Northern Power Co. is making an investment of $80,000,000, which will cover the construction of dams, erection of buildings, installation of machinery, provision of transforming stations, stringing of wires and the creation of auxiliary plant. It is estimated that the company will be able to develop 30,000 h.p., and so good is the progress being made that it is expected power can be delivered next summer.—*Financier.*

Maidstone.—The B. of T. has granted the T.C. an Order authorising it to supply current to Allington Castle and the Castle Quarries, Allington, which are outside the borough.

Mansfield.—At a meeting of the Mansfield Board of Guardians, last week, the Building Committee recommended that tenders be invited for installing electricity in the house, the estimated cost of which was £500. It was stated that the approval of the L.G.B. had been given for the work to be carried out.

Newcastle-Emlyn.—The Urban Council having disagreed to the electric supply company increasing its charges for street lighting since the number of lamps was increased, has decided to replace the old oil lamps. This was necessary, as the electric supply to the lamps has been cut off.

Newmarket.—The question of public lighting, tenders for which have been received from both the Electricity and Gas companies, has been under consideration by the U.D.C. The gas company, which at present lights the streets, has hinted that the price (3s. 8d. per 1,000 cb. ft.) to ordinary consumers will have to be increased by 3½d. in the event of its losing the public lighting.

New Zealand.—It appears that a proposal is under consideration for the substitution of electricity in place of gas for the lighting of the town of Oamaru, at an estimated cost of £10,000. It is proposed to utilise the excess water supply in connection with this scheme.—*Board of Trade Journal.*

Northampton.—A serious failure in supply, which is attributed to flood water getting into street boxes, occurred one day last week, when numerous factories in the east end of the town were compelled to wholly, or partly, close down for one morning.

Peterborough.—The T.C. has applied to the L.G.B. for a loan of £500 for services. The engineer has been instructed to prepare reports and alternative estimates for extensions to the generating plant by a high-tension alternating-system and low-tension continuous-current system, at the discretion of the Committee.

Stretford.—At the generating station at Longford Bridge controlled by the Council, the storage battery has been replaced by one of larger capacity, comprising 268 cells of 738 ampere-hours' capacity, to deal with the requirements of the Old Trafford district, especially during the football season, and it has been found necessary to install a three-wire booster to deal with a maximum load of 1,200 amperes for private lighting in Old Trafford. Further projected extensions include a negative feeder booster and switchboard, together with five miles of ·8 lead-covered cable, all this being required to meet the demands of patrons of the Manchester United Football ground at Old Trafford.

Talgarth.—The Talgarth Electric Supply Co. has contracted to light the town lamps, and has already put in a number of installations.

Wallasey.—On August 30th a L.G.B. inquiry was held by Mr. Ekin into the application of the T.C. for sanction to borrow £6,980 for purposes of electricity, &c. The town clerk stated that the amount required for the electricity undertaking represented the cost of the provision of a Diesel oil engine and alternator to be placed in the electricity works, which was rendered necessary owing to the extremely rapid growth of the supply of electricity. There were now 3,115 consumers, and the number was rapidly increasing. Mr. Crowther, electrical engineer, said that by the use of oil fuel they would save 1,500 tons of coal per annum.

TRAMWAY and RAILWAY NOTES.

Barking.—According to the statement of accounts for the year ended March 31st last, there is a deficit of the working of the tramway undertaking of £5,242. After allowing for £4,500, voted out of the district rate in anticipation of this deficit, there remains a sum of £742 still to be met from the same source. The total revenue for the period under review amounted to £6,785, £4,737 of which was derived from passenger traffic. The total capital expenditure up to March 31st last totals £81,369, while that for 1911-12 is put down at £1,321, this amount being spent on cars.

Chester-le-Street.—An attempt is being made to induce the Gateshead and District Tramways Co. to extend its service through to Chester-le-Street, with branches into the thickly populated areas around. The Chester-le-Street Rural and Urban District Councils and Birtley Councils are bringing all possible pressure to bear on the company, and practically all the other local authorities are in favour of the proposal. Generally it is suggested that either railless traction, or even motor-'buses would meet the requirements of the district.

Continental Notes.—Turkey.—The engineers of the Berlin firm of Lenz & Co., who obtained a concession last February for the construction and working of a Bosphorus electric railway from Galata *via* Pera, and the villages on the European side of the Bosphorus to Rumeli-Kavak, are actively employed on the survey of the route and the preparation of the detailed plans, which are expected to be completed early in October. It is then proposed to form a Turkish company, with a capital of £1,600,000 to carry out the work, and one half of the money will presumably be raised by German interests, and the other half by two French groups and one Belgian syndicate. The Constantinople Tramways Co., which is at present engaged on the conversion of its lines to electric traction, will shortly call up the remainder of the share capital for this purpose. It is intended to provide further capital by the issue of a debenture loan.

AUSTRIA.—The Austrian State Railway authorities are considering a scheme to put down a plant near Knittelfeld, Styria, to utilise the water-power of the River Mur in the generation of the electrical energy required in connection with the electrification of the railway between Leoben and Knittelfeld.

The preliminary surveys have been authorised for an electric network of railways extending from Sebrowitz to Jundorf, and along the Schwarzawa River to Brünn Konigsfeld Rzeczkowitz and Schimitz, with various branches. Consulting Engineer A. O. Samohrd, of Brünn, is the expert member of the Representative Committee, concerned with the scheme.—*Der Elektrotechniker.*

GERMANY.—It is proposed to adopt electric traction on the Gleiwitz-Ratibor Light Railway in Upper Silesia.

A scheme for the construction of an electric tramway between Mannheim and Lampertsheim is at present under consideration.

RUSSIA.—The Belgian Compagnie des Tramways et de l'Electricité en Russie intend connecting Riga with the seaside resort of Majorenhoff by an electric tramway. For this purpose a subsidiary company, with a capital of 15,000,000 fr., has been formed, and a beginning of the constructive work is about to be made.—*Elek. und Masch.*

Elland.—The Halifax and Huddersfield Corporations are proposing to make extensions of their tramway systems to Elland, in the former case *via* Woodside, and in the latter case from Birchencliffe to Elland Town Hall. The Huddersfield proposal has received the support of the Elland District Council, and a public meeting of the ratepayers is to be held shortly to consider the matter.

Hebden Bridge.—The U.D.C. has decided to ask the Halifax Corporation to extend its tramway service from the centre of Hebden Bridge to Whiteley Arches. The Halifax Corporation, it was stated, had previously given a verbal guarantee to run its cars to the place named.

Leeds.—Important developments of the tramway system are to be considered by a special sub-committee of the Corporation Tramways Committee. The continuation of the Pudsey line to meet that of Bradford and the extension of the York Road route to Seacroft and Crossgates, and a probable branch to Shadwell, are amongst the suggested developments. Another suggestion deals with the extension of the railless traction system from Farnley to the present terminus of the Morley tramways *via* Drighlington.

Liverpool.—The general manager has been instructed to report on the desirability of establishing a motor-'bus service on the dock road and vicinity.

Manchester.—According to a Manchester paper a a deadlock occurred at the last meeting of the Tramways Committee over the tenders received for the supply of special track work. A motion was made that the tender of the Lorain Steel Co., of U.S.A., amounting to the sum of £10,231, be accepted, whilst an amendment was proposed that the Committee adhere to its previous resolution of July 23rd, accepting the tender of Messrs. Edgar Allen & Co., Ltd., amounting to the sum of £11,038. The amendment was carried by a majority of one, but on being put as the substantive motion seven voted for it and seven against. The chairman declined to give a casting vote, and it was, therefore, decided to leave the matter to be further discussed by the City Council. On Wednesday, the latter decided to award the contract to the Lorain Co., only one dissentient voice being raised against the proposal.

Preston.—The elective auditor's report on the tramways shows an increase of £2,581 in the receipts from the electric cars compared with the previous year. The earnings per car-mile are 10·34d., against 9·91d., whilst the working expenses per car-mile are the same as the previous year, viz., 5·96d. The cost of repairs of cars has gone up £524. The cost of fitting up the new offices was £527. The surplus for the year was £6,241, which had been added to reserve, thereby increasing that fund to £31,466. The sinking fund amounted to £37,199 whilst expenditure on capital account stood at £187,269. Reserve and sinking funds were now equal to over one-third of the capital outlay—a very sound position. Loans had been reduced by £4,110, and the amount in the bank had increased £7,316.

Quarry Bank.—The B. of T. has confirmed the Quarry Bank and District Light Railway Transfer Order, 1912. A London company has taken over the order, and undertakes to construct the lines within three years.

Stainland.—The U.D.C. has decided to petition the Huddersfield Corporation to include in its forthcoming Parliamentary Bill provision for an extension of the tramways to Stainland. It was also decided to ask the Halifax Corporation to bring its tramways to Stainland, so that the district could be connected up both ways.

Stalybridge.—The local Trades and Labour Council has forwarded a resolution to the Joint Board protesting against an increase in workmen's fares, which is to come into operation on October 1st. It appears that ½d. fares are to be abolished, and that return tickets will cost more; also that only cars leaving before 8 a.m. instead of 8.30 will be available for such tickets.

West Hartlepool.—The scheme of the T.C. for the municipalisation of the tramways in the borough was completed on August 30th, when the Seaton Carew section, and that part of the West Hartlepool and Hartlepool route situate in West Hartlepool, came into the possession of the Corporation. It is two years since the scheme was started, a commencement being made by the purchase of the Foggy Furze and Park sections at a cost of about £13,000. The purchase price of the Seaton Carew line was about £22,500, and that part of the Hartlepool line situate in the borough of West Hartlepool, including power station, sheds, &c., cost about £23,000, which, with £4,000 expended on relaying the Park route permanent way, makes the cost of the entire system roughly £62,500. The lines in the borough of Hartlepool are being leased at an annual rental of £500 a year. The West Hartlepool Corporation has recently obtained power to extend the present system, the extent of which is 7 miles.

TELEGRAPH and TELEPHONE NOTES.

Atlantic Cable Rates.—Modified rates for Atlantic cable Press dispatches came into operation on the 1st inst. The new tariff provides for rates varying from 3½d. to 6½d. for ordinary messages, and from 2d. to 4d. per word for deferred messages. The Deferred rates will be applicable as from America between the hours of 1 and 4 p.m., and midnight and 6 a.m., New York time, and from England between midnight and 6 a.m. London time.

London Telephones.—It is intended to open six new telephone exchanges in the London area. Since the Post Office took over the working of the telephones last January, 18,000 new orders for installations have been received.

The reduced rates for the use of trunk telephone lines during the slack hours of the day have now come into force. The hours in question are before 10 a.m., between 1 and 2 p.m., and between 4 and 7 p.m., and the reduced charges for conversations longer than the customary six minutes are as follows:—

First and second quarter-hour periods, three-quarter full trunk charges.

Third and fourth quarter-hour periods, half trunk charges.

Each additional hour, quarter full charges.

The minimum time allowed under these charges is 15 minutes, and each subscriber taking advantage of the facilities will be obliged to sign an agreement for a period of at least a month.

South Africa.—The Government has just completed the equipment of a new telephone exchange in Cape Town on the central-battery system. In all a sum of about £75,000 has been spent in Cape Town and the suburbs on the exchange equipment and underground conduits and wires for subscribers' connections. It is intended to inaugurate the tariff system of payment for calls.

The U.S.A. and the German Trans-Atlantic Wireless Scheme.—It has previously been reported that the High Frequency Co., of Berlin, or rather the international company to be formed by it, proposes to erect a wireless station near New York for communication with a similar station now in course of construction in Germany. It would appear, however, that difficulties in the matter have arisen across the Atlantic. According to a German commercial newspaper published in New York, the attention of the United States Government was drawn to the project by a prominent member of a New York club. As the station is intended to be built at no great distance from similar stations belonging to the navy, the naval authorities dispatched officers to Sayville to make an inquiry, and the Department of Commerce also sent representatives to the same place. The result of the investigation probably influenced the text of the law recently adopted by the House of Representatives, which is intended to put an end to the evils and abuses which have resulted from the establishment and working of wireless stations by unauthorised persons, and which were specially brought to public knowledge on the occasion of the *Titanic* catastrophe. Nevertheless, the German newspaper submits that it is a peculiar coincidence that, whilst the United States Congress should be occupied with legislation which permits the working of wireless stations only by those persons who have obtained a concession from the Federal Department of Commerce and Labour, German interests should be entering upon such an expensive and far-reaching enterprise in the United States without being able to reckon with certainty on receiving a concession from the Federal Government.

Trans-Pacific Wireless.—With regard to reports of long-distance wireless communication across the Pacific (between San Francisco and Honolulu), which the Federal Wireless Telegraph Co. claim to have established by means of the Poulsen system, we are informed that Marconi's Wireless Telegraph Co., Ltd., are erecting at these places stations of the same type as those which it is proposed to construct for the British Imperial scheme. The new Marconi station at Honolulu has been so designed as to enable wireless communication to be established at a little later date, with similar stations to be erected by the Marconi Co. at Yokohama and in the Philippine Islands. We are also informed that the Marconi Wireless Telegraph Co. of America have commenced proceedings for infringement of patent against the Federal Wireless Telegraph Co.

Wireless for Boy Scouts.—Mr. Godfrey C. Isaacs, managing director of the Marconi Wireless Telegraph Co., has presented the British Boy Scouts with a complete portable knapsack station. The Marconi Co. are anxious that every Boy Scout should have a practical knowledge of wireless telegraphy, and have offered to present a complete outfit to the troop which provides the first Scout capable of passing the examination of a second-class Marconi operator.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberaman.—September 11th. Electrical fittings, for the Powell Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. Stores Manager, Aberaman, near Aberdare (Form No. 26)

Australia. — New South Wales.—September 25th. Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney

October 16th. — N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" August 23rd.

October 1st. — Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—September 17th. — One fuel economiser, for the Melbourne Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" August 16th.

October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Belgium.—September 9th. The municipal authorities of Plainevaux (province of Liége) are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Brighton.—September 10th. Electrical fittings for the B.G. Mr. Horace Burfield, Clerk, Parochial Offices, Prince's Street

Bulgaria.—September 9th. The District Administration of Finances, in Sofia, is inviting tenders for the supply of a number of electrically-operated cranes for the Bulgarian State Railways.

October 17th. The District Administration of Finances in Sofia is inviting tenders for the supply and erection of the mechanical and electrical plant required in connection with the power transmission installation to be laid down at the State collieries at Pernik.

Costa Rica. — December 9th. Tenders are invited for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Grimsby.—September 16th. Automatic balancer for the Corporation. See "Official Notices" to-day.

Leeds.—September 9th. Paper-insulated cables, for one, two or three years, for the City electric lighting department. See "Official Notices" August 9th.

October 7th.—The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. J. B. Hamilton, general manager.

London.—L.C.C.—September 24th. Electric spark gaps in brick cells for sub-stations. See "Official Notices" August 23rd.

Lossiemouth.—September 28th. Gas producer plant, engines and dynamos, battery, crane, overhead mains and public lamps, for the T.C. See "Official Notices" to-day.

Manchester.—September 10th. One 12,000-kw. three-phase high-pressure turbo-alternator, with condensing plant, &c., water-tube boilers and superheaters, economisers and coal chutes, for the Corporation. See "Official Notices" August 9th.

September 18th.—Electric lighting of Crumpsall Workhouse, for the B. of G. See "Official Notices" to-day.

Middleton.—September 11th. One 300-400-kw. steam dynamo, for the Corporation. See "Official Notices" August 30th.

Newport (Mon.).—September 17th. Coal for the Corporation electricity department for a year. Mr. N. J. Young, general manager, Town Hall (returnable deposit of 10s. 6d.).

September 18th.—Extension of plant at the Corporation electricity works: Railway weighbridge, ash conveyor and bunker, water-tube boiler, flues, and forced and induced draught plant. See "Official Notices" to-day.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Warrington.—September 11th. Electrical sundries, for six months, for the B.G. Mr. A. Bottomley, clerk, Bewsey Chambers.

West Ham.—September 12th. Electrical fittings for six months, for the B.G. (Form 15). Mr. Thos. Smith, clerk, Union Road, Leytonstone, N.E.

West Hartlepool.—September 14th. Steam, exhaust and other pipework, for the Corporation Electricity Department See "Official Notices" to-day.

CLOSED.

Admiralty.—The Admiralty has just placed their new contract for fuses with the British Electric Calibrated Fuse Co., Luton, Beds., who have been successful in obtaining the whole of the order for every size required.

Australia.—A large number of "Metroflam" arc lamps has been ordered from Messrs. Johnson & Phillips, Ltd., for the street lighting of Hobart, Tasmania.

Bacup.—We understand that an order for 416 loom motors for the new weaving shed of Messrs. Hoyle Bros., Ltd., Olive Mills, has been placed with the Schorch Electrical Co., London, which firm is also carrying out the necessary wiring for the power and lighting installation.

Burnley.—The Tramways Committee has ordered 10 top-covered cars at an estimated cost of £7,800. In connection with this the following tenders have been accepted:—

United Electric Car Co., Ltd.—10 top seat bogie car bodies and top covers, to be supplied in accordance with the Corporation specification, £555 each, and 10 pairs of Burnley maximum traction trucks, to be supplied in accordance with the Corporation specifications, £120 per pair.

British Thomson-Houston Co., Ltd.—10 electrical equipments (two G.E. 58 four turn motors and other apparatus, £480 14s. each.

Messrs. Siemens Bros.' tender for 1,160 yards of cable of three sizes has been accepted, as also has the contract of the Tudor Accumulator Co. for the maintenance of the lighting battery at the electricity works for ten years, for £140.

Dundee.—Messrs. Nicoll & Co., Dundee, have secured the contract for installing the electric light in Stanley Parish Church.

France.—The French Post and Telegraph authorities in Paris have just given out some large contracts for bronze and copper wire. La Compagnie Française des Métaux, of Paris, are to supply 75 tons of bronze wire, 1½ mm. diameter, at 5,335 fr. per ton, and 200 tons of high-conductivity copper wire, 3 mm. diameter, at 2,650 fr. per ton; La Compagnie Générale d'Electricité, Paris, 75 tons of bronze wire, 1½ mm. diameter, at 3,340 fr. per ton; M. Grammont, of Pont-de-Cheruy, 200 tons of high-conductivity copper wire, 2½ mm. diameter, at 2,660 fr. per ton; La Société des Tréfileries du Havre, 800 tons ditto, at 2,670 fr.; La Société d'Electro-Métallurgie de Dives, 100 tons ditto, 3 mm. diameter, at 2,645 fr. per ton; La Compagnie Française du Bi-Metal, Paris, 100 tons ditto, 4 mm. diameter, at 2,635 fr. per ton: and La Société des Mines et Fonderies de Pont-Gibaud, 100 tons ditto, at 2,640 fr. per ton.

In connection with the adoption of electric traction on the Paris suburban system of the French State Railways, orders have just been given out for 400 electric motors. The Thomson-Houston Co. are to supply 100, the Westinghouse Co. 100, La Société des Ateliers de Jeumont 100, La Société Alsacienne de Constructions Mécaniques 50, and La Compagnie de l'Electricité de Criel 50.

Glasgow.—Some months ago the General Electric Co., Ltd., received an order from the Glasgow Corporation for over 200 magazine flame arc lamps, to be used for street lighting in the city; the Corporation has now placed a further order with the company for 225 of these lamps, all of which are to be used in place of open-type lamps.

Messrs. Johnson & Phillips, Ltd., have received a further order from the Glasgow Corporation for 400 of their 130-hour non-interval "Metroflam" magazine flame lamps, this being the third order for these lamps received from the Corporation during the past year.

Halifax.—The Tramways Committee has accepted the following tenders:—

Brush Electrical Engineering Co., Loughborough.—Six tramway car bodies, with top covers, £2,640.
Siemens Bros. Dynamo Works, Ltd., Stafford.—Six pairs of 40 H.P. motors, £1,032.

Manchester.—Referring to the contract for time switches mentioned in our last issue, we understand that, while our note was substantially correct so far as it went, it should be added that Messrs. Venner Time Switches, Ltd., received a large part of the order—the whole of the order, in fact, for such types as they make, with the exception of some small relay switches.

The T.C. has accepted the tender of the Lorain Steel Co., for special track work, at £10,231. This matter is referred to in our "Tramway Notes."

Peterborough.—The T.C. has accepted the tender of Messrs. Pritchetts & Gold for battery plates, &c., at £397, and for the maintenance of the battery for 10 years, at £50 per annum.

Salford.—The T.C. has accepted the tender of Messrs. E. M. Evans & Son at £82, for installing electric light in a portion of the Town Hall. The tender of the Clifton and Kersley Coal Co., Ltd., has further been accepted for the supply of 1,300 tons of No. 4 washed steam nuts to the electricity department, at 12s. 11d. per ton.

FORTHCOMING EVENTS.

British Association.—Wednesday, September 4th to Wednesday, September 11th, inclusive. Meeting at Dundee.

North Eastern Counties Electrical Exhibition.—Saturday, September 7th to Saturday, September 28th inclusive. At the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne.

NOTES.

Electrolytic Hypochlorite.—The annual report for 1911 of the Medical Officer of Health for the Borough of Poplar (Dr. F. W. Alexander) gives full particulars of the production of electrolytic hypochlorite by the borough plant and of the purposes to which the fluid has been applied. The output for the year was 53,063 gallons, of an average strength of 5 grammes of available chlorine per litre, at a total cost for electricity and materials of £108 9s. The original installation was made some six years ago; and the total manufacture, of the strength named, now amounts to about 200,000 gallons, at a cost of less than £380 for current and materials. Including wages, rent of depôts, cost of bottles, distribution and all incidental charges, the average annual expenditure for five years amounts to £727. All the difficulties which have arisen in operation seem to have been effectually dealt with; and, in consequence of the recent extension of the borough electricity works, the plant has been removed to another site and re-erected on an enlarged scale to meet the increased demand for the disinfectant. The use of the fluid in the public baths has been continued; and the superintendents say that no slime now forms in the water, nor is any slime found on the bottoms of the baths when they are emptied; and there is, moreover, no offensive smell during cleansing the baths as was formerly the case. The solution is used in such quantity as will give one part of chlorine to two million parts of water.

In his "comments on adverse criticisms," Dr. Alexander anticipates that the cost of chlorine manufactured in other ways will be worked out to show that the Poplar process is extravagant; but it is not probable that such an objection will be raised by anyone who has had experience of the difference between working out results on paper and practical production. Whilst the price of bleaching powder remains at its present figure, it would appear to offer a cheaper means of producing chlorine than the electrolytic process; but, as the report indicates, when rapid depreciation, greater expenditure for labour—with the necessary skilled supervision—and the disposal of the residual lime-sludges and other inseparable disadvantages are taken into account, it is not likely that there would be any appreciable saving of cost, and quite possibly there might be an increase. The fluid prepared at Poplar is a solution of sodic and magnesic hypochlorites, which is not poisonous nor caustic, and possesses a much higher degree of stability than sodic hypochlorite alone. During the year 1,626 rooms and a total of 41,143 various articles, a considerable proportion being bed and bedding, were disinfected with the hypochlorite solution, which has entirely displaced carbolic acid in the Corporation services, and is supplied without charge to the managers of the sick asylums and to the Boards of Guardians in unlimited quantity. The Admiralty has recently installed at Osborne a plant similar to that put down by the War Office for the Victoria Hospital at Netley, which is on the Hermite system, and is capable of electrolysing 500 gallons of seawater per hour.

Municipal electrical engineers might well give this matter some attention.

The Zurich Electrical Bank Report.—The summary survey contained in the report for 1911-12 of the Zurich Bank for Electrical Enterprises points out that the demand for electrical energy is constantly increasing, and states that notwithstanding the Italo-Turkish war and the great strikes which have brought about a rise in the price of coal and shipping freight rates, most of the electrical undertakings which are closely associated with the bank, have made progress. Apart from the growing use of electricity for cooking and heating purposes, technical improvements have now rendered it profitable to employ electrical working in large industrial establishments. The use of current in agricultural operations is, unfortunately, often opposed by local government measures which do not conduce to the economic success of the installations. As far as the erection of overland central stations is concerned, the report gives a warning against the construction of stations in thinly-populated districts unless it is simultaneously possible to secure a connection with large works which serve for the supply of industrial localities. Dealing with the transformation of main lines to electric traction, it is mentioned that progress is taking place in Germany, Italy and Sweden, whilst the Swiss Federal State Railway authorities have adopted preparatory measures for the introduction of electrical working. The Rhatian and Lotschberg railways are also equipping their new lines with electricity, a system which has already proved its value in the case of individual Swiss railways of average importance. In contra-distinction to Germany and Italy, Switzerland seems disposed to produce the requisite power in its own works, whilst those nations which have had experience for some time, are increasingly obtaining their supplies of power from private undertakings, because the latter are able to furnish it cheaper by reason of the greater utilisation of their works, as they also serve for other purposes. The report, in referring to the extraction of atmospheric nitrogen, states that the industry has made considerable progress, and expresses the opinion that within a certain time European agriculturists will be much less dependent upon the nitrate deposits of Chile than is the case at the present moment.

Telephone Transmitter as Speed Indicator.—An original use is made of the telephone transmitter in connection with four direct-current motors driving water pumps for heating and water supply in the general office building of the Fort Wayne Electric Works. The motors are controlled from a general switchboard remotely situated, and it was desirable that the engineer in charge at the switchboard should have some way of knowing whether or not the motors were working properly, without going all over the building to the location of each one to find out. To accomplish this, each of the motors was provided with a telephone transmitter, the mouthpiece being placed quite close to the commutator of the machine; each transmitter had its individual telephone circuit terminating in a plug receptacle at the switchboard. When the engineer wishes to place a motor in service or adjust the speed, he plugs a telephone receiver into the terminating receptacle on the board and is able to tell if it is operating properly by the pitch of the humming sound of the motor, the pitch of the sound becoming higher as the speed of the motor is increased. Every motor used in connection with the water, heating and ventilating systems in this modern office building is equipped with a telephone transmitter. By this method the speed of the large exhaust fan motor fixed on the roof of the five-story building is quite as easily noted and controlled as is that of those which operate the pumps in the basement. In fact, the experienced engineer can control the speed of any of the motors as accurately and as easily as if the dial of a mechanical speed indicator were registering the speed directly before his eyes.

Annual Outings.—On Saturday, 24th ult., the annual outing of the staff of the Urban Electric Supply Co., Ltd., Carn Brea Station, took place. This year the venue was Newquay, where the morning was spent in sight-seeing. After lunch had been partaken of, the cricket team fulfilled their fixture with Newquay, and although the latter had the assistance of Mr. H. C. Mason, brother to the famous Kent player Mr. J. R. Mason, as well as the brothers O'Callaghan of Cambridge University, the U.E.'s were only defeated by 7 runs.

On Saturday last the annual outing of the employés of Messrs. A. W. Penrose & Co., Ltd., took place. The party, numbering close upon 100, journeyed by train to Chertsey, arriving about 11 o'clock. In the morning a football match was arranged and held in the grounds of the Cricketers' Hotel. After dinner, toasts to "The King" and "A. W. Penrose & Co., Ltd.," were honoured, and Mr. Gamble (who occupied the chair in the absence of Mr. A. W. Penrose), speaking of the firm, warmly alluded to the fine progress of the electrical and lift departments. In the afternoon the whole party had a pleasant trip up the river, returning in time for tea The weather was beautifully fine, and helped to make the outing one of the best in the history of the firm.

Diesel-Electric Ship for Canada.—There is building at Wallsend-on-Tyne for the Montreal Transportation Co., a vessel for Canadian canal work which will have a D.W. capacity of 2,400 tons gross on a draft of 14 ft. The machinery consists of two 300-H.P. high-speed Diesel engines each with its own alternating-current generator and exciter. On the propeller shaft just ahead of the thrust block, there will be fitted a special compound wound squirrel-cage induction motor, turning the usual form of lake propeller at about 80 R.P.M., as compared with the 400 R.P.M. of the Diesel engines. A simple arrangement of switches enables the movements of slowing or reversing to be effected much more speedily and accurately than with a direct Diesel engine drive. The electrical equipment is on the Mavor system.

Educational.—The new course at the Crystal Palace School of Practical Engineering commences on September 11th.

The new session at the East London College will shortly commence. See "Official Notices" to-day.

Particulars are given in our advertisement pages to-day of the courses provided at the Northampton Polytechnic Institute.

Appointments Vacant.—BIRMINGHAM.—Shift engineer (£150 to £250 per annum). ERITH.—Switchboard attendant (20s. to 25s.). YORK.—Engineer to take charge of the installation department (£120 per annum). CIVIL SERVICE COMMISSION.—Assistant engineer, Engineer-in-Chief's Department, General Post Office. NORTH METROPOLITAN E.P.S. Co.—Power house shift engineer (£12 per mensem). See "Official Notices" to-day.

"Cable Discounts"—Correction.—The author informs us that an unfortunate error occurred in the last formula ("Non-Association"—pence per yard) on p. 323. It should read: "Add half the list price to a half of that, divide by 10, and subtract one-fiftieth of the result." The corresponding formula should read:—

$$D \text{ per yard} = \tfrac{1}{10}(L/2 + L/4) - \tfrac{1}{500}(L/2 + L/4).$$

Institution Notes.—INSTITUTE OF METALS. — The autumn meeting will be held in London on September 25th and 26th at the Institution of Electrical Engineers, and the programme has now been issued. Amongst the papers to be read are the following:—

Prof. F. Carnevali, Ph.D., on "Autogenous Welding by means of Oxygen and Acetylene of Copper and its principal Alloys, and of Aluminium."

Prof. A. K. Huntington, Assoc.R.S.M., on "The Effect of Temperatures Higher than Atmospheric on Tensile Tests of Copper and its Alloys."

F. Johnson, M.Sc., on "The Influence of Impurities in 'Tough-Pitch' Copper, With Chief Reference to Antimony."

E. F. Law, Assoc.R S.M., on "The Influence of Oxygen on the Properties of Metals and Alloys."

Alexander E. Tucker, F.I.C., on "The Joining of Metals."

Prof. T. Turner, M.Sc., on "Oxygen in Brass."

Visits will be paid to the works of Messrs. Fraser & Chalmers, Ltd., Erith, the National Physical Laboratory, Teddington, Woolwich Arsenal, and the Brooklands Motor Race Course and Aviation Ground.

A special Council meeting will be held in London on September 10th, for the purpose of considering applications for membership of the Institute. All applicants for membership whose forms are in the Secretary's hands before noon on September 10th will be entitled to take part in the proceedings at the London Meeting. The Secretary is Mr. G. Shaw Scott, Caxton House, S.W.

INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).—At the meeting held on August 28th, Mr. J. C. Rennie was elected chairman for the coming session, Mr. D. Betts, vice-chairman, Mr. J. Mould, hon. secretary, and Mr. G. W. P. Page, hon. assistant secretary, 24, The Ridgeway, Enfield.

The British Association at Dundee.—Our representative at Dundee informs us that the proceedings opened with every prospect of a very successful meeting. The arrangements made locally are such that even the high record for hospitality attained by the citizens on the former occasion is likely to be surpassed, and the attendance will be well over 2,000, including an unusually large proportion of distinguished visitors from abroad. The programme of work before the various Sections is varied and interesting, and the meeting bids fair to be well above the average in the matter of the "advancement of science." The accommodation available has been taxed to the utmost, but with the aid of a large passenger steamer moored to the Quay the difficulty has been overcome. The handbook of Dundee and district prepared by the local committee forms a valuable work of interest both to visitors and to residents. Social entertainments have been organised on a scale of lavish hospitality, and include this time a ball. After the presidential address on Wednesday, a gift of £10,000 was presented to the Association by Mr. J. K. Caird, of Dundee.

London Tube Railway Collision.—As we go to press we learn that a collision occurred on the Piccadilly Tube Railway on Wednesday night, resulting in injuries to 15 people. This is the first collision that has happened on a London tube railway, and it is surmised that it is due to a fault in the automatic signalling arrangements.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. — MR. W. CHURCHYED, station engineer at the Bridlington Corporation electricity works has resigned.

We regret to learn that MR. A. A. DAY, borough electrical engineer of Bolton, was suddenly taken ill on Saturday last while proceeding to Scotland for a holiday. It appears that Mr. Day had only travelled as far as Chorley when he had to be removed from the train and conveyed back to Bolton in an ambulance. He is understood to be recovering.

MR. G. W. ESSEX has resigned his position with the Cleveland and Durham Electric Power, Ltd., having been appointed assistant mains engineer to the Corporation of Sunderland.

MR. L. S. CARR, of the staff of the British Thomson-Houston Co., Ltd., of Rugby, has been appointed by the Birmingham Electricity Committee, at a salary of £400 a year, as constructional engineer for the erection of the electric power station at Hechells. The salary is to advance to £500.

MR. CECIL D. FALCKE was on Friday last presented with a handsome 400-day clock, by the staff of the Stratford-on-Avon Electricity Co., as a token of respect and esteem on the occasion of his retirement. Addressing the staff, Mr. Falcke expressed his thanks for the magnificent present they had given him, and hoped that they would give every assistance they could to his successor.

Tramway Officials.—MR. FRANK BUTLER, chief assistant to the manager of the Salford Corporation Tramways, has this week been appointed tramways traffic manager to the Wigan Corporation. There were 42 applicants for the post.

General.—MR. G. H. VAUGHAN, an engineer of the British Post Office, has been loaned to the Government of the Argentine Republic for a period of six months, in order to investigate and report upon the working of the telegraph system of that country.

The marriage took place at Denbigh, on August 27th, of MR. CHARLES DAWSON, electrical engineer at the Bettisfield Colliery, Bagillt, son of Mr. S. Dawson, of Mansfield, and Miss Ada Jones, daughter of Rev. Peter Jones, of Llys Meddyg, Denbigh.

The marriage took place at Barnstaple last week of MR. JOSEPH ROGERSON GANDY, electrical engineer, of Newcastle-under-Lyme, and Miss Ethel M. Grant, eldest daughter of Mr. E. W. Grant, of Barnstaple.

MR. H. E. M. KENSIT, who during the past four years has been occupied in investigating and reporting on various undertakings and projects in Canada and the United States for Messrs. Smith, Kerry & Chace, of Toronto, has now received an appointment with the Water Power Branch of the Department of the Interior, Ottawa.

On August 27th, at Llanddarog, Carmarthenshire, the marriage took place of MR. N. D. BLAGDON PHILLIPS, of Messrs. Siemens Brothers' railway signalling staff, and Miss Catherine T. Gabe, of Ammanford.

MR. WILLIAM H. LOWTH, of Underwood (Manchester), Ltd., has accepted an appointment with Messrs. Carney & Pearn, Ltd., of Manchester, as manager of the supplies department.

MR. J. F. WATTS is leaving Messrs. Siemens Bros. Dynamo Works, Ltd., after nine years' service, to take up a position with the Electrical Apparatus Co., Ltd.

NEW COMPANIES REGISTERED.

H. W. Smith & Co., Ltd. (123,953).—This company was registered on August 26th, with a capital of £5,000 in £1 shares, to carry on the business of electrical wire and cable manufacturers, carried on at Lydbrook, Glos., by H. W. Smith and F. W. T. Brain as "H. W. Smith & Co." The subscribers (with one share each) are:—H. W. Smith, The Beeches, Lydbrook, Glos., wire manufacturer; F. W. T. Brain, Huntnorth, Stoke Bishop, Bristol, colliery proprietor. Private company. The first directors are H. W. Smith and F. W. T. Brain. Solicitors: David Johnstone & Co., 31A, Corn Street, Bristol. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

Electrical Improvements, Ltd. (123,950).—This company was registered on August 23rd, with a capital of £5,000 in £1 shares, to carry on the business of generators, storers, sellers and suppliers of electrical or other energy for motive power, light, heat or other purpose, and gas and water in any part of the world, electrical, mechanical and chemical engineers and contractors, &c. The subscribers (with one share each) are:—L. H. Booth, Milburn House, Newcastle-on-Tyne, solicitor; J. W. Miller, Milburn House, Newcastle-on-Tyne, chartered accountant. Private company. The first directors, to number not more than four, are to be appointed by the subscribers; qualification, one share; remuneration as fixed by the company. Solicitor, L. H. Booth, Milburn House, Newcastle-on-Tyne.

Turbine Gears, Ltd. (124,000).—This company was registered on August 28th, with a capital of £5,000 in £1 shares, to carry on the business of manufacturers and sellers of gear-cutting machines, gear cutters, founders, mechanical and electrical engineers, tool makers, manufacturers of and dealers in machinery implements, rolling stock and hardware of all kinds, &c., and to adopt an agreement with J. Ogden. The subscribers (with one share each) are:—F. Tinker, Thornlee, 80, Lodge Lane, Hyde, boiler maker; J. Ogden, 192, Mottrom Road, Hyde, engineer. Private company. The number of directors is not to be less than three or more than seven, the subscribers are to appoint the first; qualification, £50; remuneration as fixed by the company. Solicitor: T. G. Russell, 78, King Street, Manchester. Registered office, Daisyfield House, Newton Moor, Hyde, Cheshire.

Transvaal Mica Co., Ltd. (123,910).—This company was registered on August 24th, with a capital of £30,000 in £1 shares, to carry on the business of miners, prospectors, explorers, metallurgists, refiners of and dealers in, and preparers for market of ores, metals and mineral substances, &c., to acquire any mines, mining rights, and metalliferous land in the Transvaal or elsewhere, and to adopt an agreement with S. Mann. The subscribers (with one share each) are: A. C. Drayton, 56, Moorgate Street, E.C., secretary; S. Mann, 21, Palace Road, S.W., merchant; A. L. Smith, 94, Portstown Road, W., secretary; J. Shaw, 29, Cyprus Street, N.E., clerk; F. E. Ranson, [illegible], River Avenue, Palmer's Green, N., clerk; A. Bowen, 51, Danvers Street, Paulton Square, Chelsea, clerk; M. Verstaevel, 1, Coram Street, Russell Square, W.C., clerk. Minimum cash subscription £7. The number of directors is not to be less than two or more than seven; the first are not named; qualification, £100 shares or stock; remuneration £100 each per annum (£150 for the chairman). Registered office, Cross Keys House, 56, Moorgate Street, E.C.

Creed, Bille & Co., Ltd. (124,986).—Registered August 28th, by Maddison, Stirling, Humm & Davies, 33, Old Jewry, E.C., capital £100,000 in £1 shares, to carry on the business of telegraphic engineers, manufacturers of telegraph or telephone receivers, transmitters or other instruments, apparatus or machinery, erectors and maintainers of telegraphic or telephonic stations, &c., to acquire the business of Creed & Co., telegraphic engineers, of 156, St. Vincent Street, Glasgow, and 266, Selsdon Road, Croydon, and to adopt an agreement with F. G. Creed, W. A. Coulson, and H. Bille, trading as Creed & Co. The signatories (with one share each) are:—F. G. Creed, 266, Selsdon Road, Croydon, telegraph engineer; W. A. Coulson, 156, St. Vincent Street, Glasgow, electrical engineer; H. Bille, 266, Selsdon Road, Croydon, telegraph engineer. Private company. The first directors (to be not less than three or more than six) are F. G. Creed, W. A. Coulson and H. Bille; qualification, 500 shares; remuneration as fixed by the company. Registered office, 266, Selsdon Road, Croydon.

Road Indicator, Ltd. (123,998).—This company was registered on August 28th, with a capital of £5,750 in 5,000 preference shares of £1 each and 15,000 ordinary shares of 1s. each, to acquire any invention relating to automatic route indicators, in particular to acquire the patent and other rights referred to in an agreement with Don Victoriano Casajus y Chaubel and A. Vitry, and to carry on the business of manufacturers of machines or instruments for automatically indicating or registering speed, distance, description of roads or other information for use with motor-cars, cycles and vehicles of all kinds, mechanical and electrical engineers, surveyors, map makers, &c. The subscribers (with one share each) are:—H. O. White, Leith Villa, Long Ditton, Surrey, clerk; C. Jauralde, 28, Danvers Road, Hornsey, N., clerk. Private company. The number of directors is not to be less than two or more than five; the first are Don Victoriano Casajus y Chaubel, Senor Santiago Laborda y Lopez and G. C. Bingham. Registered office, 54, New Broad Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Madras Electric Supply Corporation, Ltd. (87,109).—A memorandum of satisfaction to the extent of £70,800 being amount issued on August 7th, 1912, of debentures dated December 12th, 1910, securing £200,000, by the issue to the holders thereof of debentures for a similar amount, secured by a trust deed dated August 7th, 1912, has been filed. Amended particulars of £200,000 debentures, created July 20th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £70,800. The original particulars gave the amount of present issue as £100,000. Particulars of £200,000 debentures created August 7th, 1912, and secured by trust deed of even date, filed pursuant to same section, the amount of the present issue being £188,675. Property charged: The company's undertaking and property, present and future, including uncalled capital, certain licences granted by the Madras Government authorities, and the undertakings constituted thereby, with buildings, land and plant, &c., and all purchase moneys payable by local authorities, and 11,452 ordinary shares of £5 each in Madras Electric Tramways (1904), Ltd., and all future holdings in that company. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Dargue, Griffiths & Co., Ltd. (48,858).—Particulars of £6,000 debentures, created February 17th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,760, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. A memorandum of satisfaction to the extent of £2,300 on July 18th, 1912, of debentures dated July 17th, 1909, securing £3,000, also notified.

British Empire Lighting and Construction Co., Ltd.—Mortgage dated August 16th, 1912, to secure £300, charged on certain land and premises, &c., in King's Cliffe, Northamptonshire. Holder: M. J. Johnson, Swineshead, near Boston, Lincolnshire.

Naylorgraph, Ltd.—Debenture dated August 14th, 1912, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. M. Hunt, Fairlawn, Park Road, Southborough, Kent.

Foreign and Colonial Lighting, Ltd. (99,020).—Charge on company's outstanding book debts, patents, rights and other property, dated August 14th, 1912, to secure £805 17s. 2d. Holder: A. B. Reckett, Kenmore, Highlands, St. Leonards-on-Sea.

Shawinigan Water and Power Co.—At a special general meeting of this company, held in Montreal, authority was taken by the directors to issue $5,000,000 Common stock from time to time, and in accordance therewith notice is being issued offering to shareholders of record on September 30th $1,000,000 of stock at 120 per cent.

Stewarts & Lloyds, Ltd.—The directors have declared interim dividends for the half-year to June 30th at the rate of 6 per cent. per annum on the preference shares and at the rate of 10 per cent. per annum on the preferred ordinary shares.

Globe Telegraph and Trust Co., Ltd.—The directors of this company have declared a dividend of 3s. on the preference and 2s. on the ordinary shares, for the quarter.—*Financier.*

CITY NOTES.

Aberdeen Suburban Tramways Co.

Mr. George J. Walker, the chairman, in moving the adoption of the report at the half-yearly meeting of shareholders, said the profits earned for the half-year amounted to £1,484, and that with this there was a balance of £3,611 at the credit of the profit and loss account. At the close of the half-year ending July 31st last there was standing at the credit of the renewal and depreciation account a sum of £8,000. If the shareholders approved of the directors' recommendation to carry £2,000 of the sum standing at the credit of profit and loss account to the credit of this account, it would then stand at £10,000. That, although a substantial sum, and equal to close on one-third of the subscribed capital of the undertaking, would require to be augmented from year to year. The policy the directors had pursued in setting aside a substantial sum annually to meet renewals and extraordinary repairs would be continued. The whole of the mortgages on the company's undertaking had now been repaid. In short, the company since its inception had been able to set aside £10,000 to reserve, and to clear off £8,000 of borrowed money. This, on the whole, was satisfactory. The directors proposed that a dividend at the rate of 2½ per cent. for the past year on the paid-up capital of the company should be declared. This would require £780, and after providing for directors' fees there would remain £791 to be carried to the next account. Ex-bailie McKenzie expressed the hope that the directors had in view the doubling of the line so as to give a better service, at anyrate as far as Cults. The report was unanimously adopted.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for dividends, due August 31st, on the 7 per cent. cumulative first preference shares and 6 per cent. cumulative second preference shares, have been posted.

A French Carbon Works.—La Compagnie des Charbons Fabius Henrion is the name of a new company which has lately been formed in Paris, with a capital of £100,000, to acquire and carry on the arc-lamp carbon business of M. Fabius Henrion, at Nancy.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Primitiva Gas Co. of Buenos Ayres, Ltd.—£200,000 4 per cent. debenture stock (1911) (special application).

Puebla Tramway, Light and Power Co.—$3,000,000 prior lien 5 per cent. 50-year gold bonds, in lieu of the scrip.

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Further issue of £68,000 4½ per cent. Consolidated First Mortgage Debenture Stock.

Toronto Power Co., Ltd.—Further issue of £800,000 4½ per cent. Consolidated Guaranteed Debenture Stock.

"Z" Electric Lamp Manufacturing Co., Ltd.—A representative of the Electrical Review attended Orient House, New Broad Street, E.C., on Wednesday to report a meeting of the above company, announced to be held, but was refused admission on the ground that the company did not want any report of the proceedings taken.

Jandus Arc Lamp and Electric Co., Ltd.—The directors recommend the payment of a dividend for the year of 10 per cent. on the paid-up capital, the transfer of £1,000 to reserve fund, and the carrying forward of the balance of £3,408, subject to deduction of directors' remuneration.

STOCKS AND SHARES.

Tuesday Evening.

The feature of the past week in the Stock Exchange has been a remarkable boomlet in the stocks of the Underground Railways. Prices went up at a breathless rate. City and South London Ordinary led off, jumping up two points a day for three days in succession, but for the biggest rise Metropolitan holds the first place. The price reached 62, and at 59¾ is 4¾ up on balance: City and South London went over 40 and back to 39, still showing a jump of 4½, and Districts at 42 showed a gain of 3½ after being 43.

Rumours as to fresh linking-up developments between the Metropolitan District and City and South London started the movement. The Stock Exchange market bears grew fidgety and climbed in. Buying orders came from the provincial exchanges, and, the market being "all one way," as the Stock Exchange says, quotations went up to what in some cases looked like fancy figures. Central London Ordinary, hanging back at the outset, went up 4 points last Monday, and the Deferred at the same time gained 3. The whole of the Home Railway market has been firm (with occasional reactions), on the expectations of better traffics, and, possibly, increased dividends at the end of the current half-year, but the

Underground Companies have another reason for buoyancy in the wet August of unhappy memory. While markets were depressed, this consideration was ignored, as we pointed out here; it needed merely a change of sentiment, however, to throw such a factor into immediate prominence, and this combined with the rumours to create the boomlet.

Central London Preferences are a point or so better, but otherwise the pre-Ordinary securities are no more than steady, the fresh fall in Consols giving the "money" stocks a somewhat dull appearance. East Londons were taken in hand and put up to 9⅛, the company's junior Debenture stocks also benefiting from the little excitement.

The London Tramways issues are so far unaffected. London United Preference show a decline of the market turn, and the Metropolitan sextet did not change. Nor was there any pronounced activity in the Underground Electric Railways issues. A loss of a point in the Incomes was the only alteration, though it seems likely enough that if the Underground strength is maintained, the shilling "A" shares, at all events, will participate in the bullishness.

English electricity supply issues are inclined to harden, though were it not for a few prices being quoted *ex* dividend, the list would present a very stolid appearance. City Lights Ordinary and Preference are both marked 10s. lower, the dividend deductions in their cases being 6s. each, so that the net result is practically a fall of 4s. in the Preference and a rise of 6s. in the Ordinary. Kensington shares at 7½ are ⅛ higher, recovering part of the dividend. Charing Cross moved up to 4¾. Another month ought to see this market waking up, as the closing-in of evenings directs attention to illumination shares, while the electric supply market may have reasons for firmness special to itself.

By the way, a foolish slip (which cannot by any stretch of imagination be debited to the convenient printer) in our last week's Notes referred to the coming County of London interim dividend. The distribution had been, of course, already announced, but the company makes a new departure this year by notifying payment of the dividend in September instead of August.

The feature in the Latin-Canadian group is a fresh upward movement in Rio Trams, the price of the Common gaining 4 points. This brought it up to 154, and Sao Paulos at 263½ are 4 higher. Dealings in the market now take place in the "assenting" shares of these companies.

The news from Mexico is still unsatisfactory, and the market in Mexican Railway stocks continues to be depressed. This, however, has had no effect upon the prices of Mexican traction descriptions—in fact, the tramway shares are 1 up at 129½. Montreal Light and Power shed 10 points upon a seller appearing who was thought to have a fair amount to dispose of. British Columbia Electric Deferred rose to 143½; the other changes in this department are mostly occasioned by *ex*-dividend notices.

The telegraph market has enjoyed a fresh sensation in a big rise in Marconis. From 4⅝ the price rose a sovereign nearly straight away, easing off afterwards to 5⅛, at which the substantial improvement of 10s. is shown. The Preference advanced in sympathy. Canadians, Americans, and Spanish have all recovered. A short circular has been issued by the parent company, reference being made to the manner in which competition from the Federal Wireless Telegraph Company is to be met. The price of the shares was run up in anticipation of the statement, and when it was published, the reaction took place.

The Anglo-American group is disposed to harden, and rises have been secured by Anglo "A" and "B" and by Direct United States shares. Eastern stocks, too, are better, and Globe Telegraph Preference at 13 are ¼ higher. A rush to buy West India and Panama shares hoisted the price to 3⅞, from which it eased off to $3\frac{9}{16}$, the idea being, of course, that the Americans are endeavouring to get complete control. Most of the South American Telephone issues are steady to firm, and in the revival of Egyptian securities Telephone of Egypt Debenture stock rose ½. Business is quiet in National Telephone Deferred, the quotation maintaining its big rise of last week. Telegraph Constructions are 10s. higher.

Manufacturing Companies' stocks and shares are in steady demand, the principal rise being one of a sovereign in India-Rubber shares, which have improved to 11. Dick, Kerr Debenture is nearly par, and British Insulated Debenture shares show a small improvement. Babcocks regained their trifling decline. Rubber shares have fluctuated a good deal up and down, though on balance the tendency has been towards higher prices. Business in this market remains active, and on any set-back there is plenty of steady support.

Lima Light, Power and Tramways Co.—A dividend of 1¼ per cent. has been declared in Lima on the shares for the second quarter of the current year ended June 30th, 1912, payable, against Coupon No. 2, forthwith.

Brazilian Light and Power Deal.—At the request of numerous holders who have only recently had the circular of July 15th, 1912, brought to their knowledge, the board of the Brazilian Traction, Light and Power Co. have extended the time within which shares of the Rio de Janeiro Tramway, Light and Power Co., the Sao Paulo Tramway, Light and Power Co., and the Sao Paulo Electric Co., may be deposited for the purpose of exchange. Copies of the circular and the necessary forms for exchange may be obtained from the Bank of Scotland, London, the Caisse Générale de Reports et de Depôts, Brussels, and the Canadian Bank of Commerce, Toronto.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Aug. 28	3,366	+ 107	13	21,182	371	14·4	..
Ayr	„ 30	808	+ 44	15	7,057	+ 151	8	..
Bath..	„ 7	1,287	— 41	32	28,314	+ 1,558	..	..
†Birkenhead ..	..	..		..	..	..	..	..
Birmingham Corp.	„ 24	20,392	+3,374	21	231,637	+53,116	57·17	..
Blackburn	„ 28	2,274	- 132	22	26,996	+ 117	14·62	..
Blackpool Corp. ..	„ 29	6,560	+1,106	..	44,227	+ 5,447	11·87	..
Blackpool-Fleetw'd	„ 31	3,345	— 136	8	15,055	— 1,004	8	..
Bournemouth ..	„ 28	5,140	+ 351	21	43,121	+ 930	21·95	..
Bradford	„ 24	5,438	- 5	21	119,063	— 2,237	56	1·2
Brighton	Sept. 1	2,575	— 193	22	25,283	— 903	9·5	..
Bristol	Aug. 30	15,071	+ 442	..	210,819	+17,596	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 23	655	+ 194	34	9,999	+ 2,642	3·65	..
Barnsley	„ 23	486	— 7	„	5,955	— 302	..	..
Barrow	„ 23	960	+ 28	„	13,078	+ 2,819	5·37	..
Devonport ..	„ 23	1,071	— 144	„	18,327	+ 1,548	8·85	..
Gateshead ..	„ 23	2,166	— 83	„	35,011	— 215	11·25	..
Gravesend ..	„ 23	474	- 7	„	7,043	- 200	6·5	..
Greenock.. ..	„ 23	1,843	+ 61	„	27,332	+ 2,839	7·25	..
Hartlepool ..	„ 23	742	+ 45	„	9,061	— 178	6·72	..
Kidderminster ..	„ 23	279	— 23	„	4,147	+ 44	..	..
‡Leamington ..	„ 23	464	+ 20	„	6,443	+ 405	..	..
Merthyr	„ 23	431	14	„	6,726	— 405	2·9	..
Metropolitan ..	„ 23	16,706	—1,247	„	299,586	+ 1,958	22	..
Middleton ..	„ 23	467	332	„	11,455	— 879	8·5	..
Mid. Joint Com'tee	„ 23	6,944	+ 483	„	110,149	+ 5,055	..	..
Oldham—Ashton	„ 23	1,285	— 120	„	20,753	+ 1,391	9·18	..
Peterborough ..	„ 23	307	+ 11	„	4,675	+ 324	5·31	..
Potteries	„ 23	3,606	+ 99	„	63,624	- 1,466	29	..
Rothesay	„ 23	1,256	— 20	„	8,268	+ 231	2·75	..
Southport ..	„ 23	778	— 91	„	10,377	- 243	8·17	..
S. Metropolitan..	„ 23	1,984	— 223	„	29,118	— 660	..	..
Swansea	„ 23	2,542	- 25	„	39,047	+ 35	12·5	..
Tynemouth ..	„ 23	875	— 190	„	8,624	— 883	3·75	..
Weston-s-Mare ..	„ 23	798	— 207	„	5,110	— 965	3	..
‡Worcester ..	„ 23	692	+ 36	„	10,055	— 18	5·75	..
Wrexham ..	„ 23	243	+ 2	„	3,779	+ 345	..	..
Yorks. Wool. Dist.	„ 23	2,257	83	„	36,684	+ 914	17	..
Miscellaneous ..	„ 23	550	+ 53	„	7,918	+ 104	..	..
Burnley	„ 31	3,054	+ 242	..	..	.	12 44	·8
Burton-on-Trent ..	Sept. 1	495	- 83	22	6,108	366	6·6	..
Bury	„ 1	2,563	- 83	22	29,212	— 729	22·5	..
Cardiff	Aug. 17	5,440	- 129	20	49,126	— 3,056	17·35	..
Chatham and Dist.	„ 22	947	+ 34	24	28,927	98	14·98	..
Cork	„ 29	994	— 109	35	16,925	— 697	9·89	..
Croydon	„ 16	1,656	— 196	20	37,510	— 885	11·6	·75
†Darlington.. ..	„ 10	238	— 4	19	4,501	+ 45	4·87	..
Darwen	„ 30	560	..	22	6,212	+ 143	4·36	..
†Dover	„ 24	359	+ 24	21	5,613	— 385	4·75	..
Dublin	„ 30	12,642	313	.	54,220	- 9,503	54·25	..
East Ham .. .	„ 31	2,257	+ 116	22	23,686	- 317	7·87	..
Exeter .. .	.	.	.	.	.	.	..	..
Glasgow	„ 31	37,350	—1,100	..	211,942	— 2,202	98	..
Hastings	Sept. 2	3,064	85	..	..	— 2,048	19·8	..
Huddersfield ..	Aug. 31	4,083	+ 92	22	44,349	+ 514	29·5	·5
Hull	„ 31	5,963	+ 208	22	63 762	+ 293	13·5	—1
†Ilkeston	„ 28	126	1	22	2,360	624	..	..
Ipswich	„ 24	1,057	— 66	21	10,062	71	10·5	..
Kilmarnock.. ..	„ 31	325	- 2	15	2,627	230	4·25	..
Lancashire United	„ 28	2,841	— 163	35	46,527	495	39	..
Leeds	„ 24	15,409	— 102	21	16 525	+ 5,035	112·7	..
Leicester	„ 31	6,262	+ 886	35	88,870	+ 2,749	20	..
Leith	„ 31	1,486	+ 20	15½	11,270	+ 91	8·72	..
Liverpool	„ 24	24,035	+ 6,043	33½	405,642	+ 18,183	117	1
‡L.C.C.	„ 21	78,300	—5,182	..	881,816	—31,757	142	..
London United ..	„ 31	12,932	—1,240	.	222,983	—11,320	..	..
Lowestoft	„ 31	946	— 96	48	9,658	— 621	8·5	..
Manchester ..	„ 31	32,854	+ 848	22	371,303	+12,566	105	..
Newcastle	„ 31	8,443	+ 66	..	96,324	+ 293	31·3	..
†Newport	„ 31	733	+ 38	22	15,634	— 732	14·50	..
Oldham	Sept. 1	4 396	+ 716	23	48,059	+ 2,797	28	..
Pontypridd	Aug. 24	841	+ 58	21	7,982	— 858	5·5	..
Portsmouth.. ..	„ 24	5,152	— 622	21	44,006	— 4,040	15·75	..
Preston	„ 28	1,620	- 47	22	18 604	+ 873	10	..
Rotherham	„ 28	1,529	+ 138	21½	15,644	+ 806	12	..
Salford	„ 26	9,593	270	21	107,842	+ 2,061	41	..
Sheffield	Sept. 3	13,381	+ 868	.	151,552	+ 4,764	40	..
Southampton ..	Aug. 28	2,766	- 37	21	28,172	+ 59	11	..
Southend-on-Sea ..	„ 28	2,503	+ 213	22	19,749	+ 2,152	7	..
South Shields ..	„ 31	1,359	+ 26	22	14,272	— 218	10·25	..
Tyneside	„ 28	1,036	- 311	9	4,892	— 858	11	..
Wallasey	„ 31	2,454	+ 141	21½	25,894	— 577	8·72	..
Walthamstow ..	„ 31	1,468	— 111	22	17,544	— 465	9	..
West Ham . ..	„ 22	5,111	— 196	20½	55,545	— 1,975	16·45	1·2
Wolverhampton ..	„ 28	2,104	+ 163	23	22,441	+ 360	13·75	..
Cen. London Rly...	„ 31	8,727	+ 904	9	38,501	— 184	6·78	·46
City & S. Lon. Rly.	Sept. 1	5 787	— 210	9	25,677	— 1,617	7·26	..
Dublin-Lucan Rly.	Aug. 30	324	— 17	9	1,449	— 131	7	..
G.N. and City Rly.	„ 31	2,604	+ 27	9	12,002	+ 107	8·5	..
L'pool Overh'd Rly.	Sept. 1	3,322	+ 491	..	15,396	+ 1,616	6·6	..
Llandudno-Col. Bay	Aug. 30	1,521	+ 71	39½	12,355	+ 456	6·5	..
Lond. Elec. Ry. Co.	„ 31	23,000	+ 1,790	..	108,095	+ 8 890	21·25	..
Mersey Railway ..	„ 31	4 529	+ 1,205	9	18,144	+ 2,149	4·5	..
Metropolitan Rly...	Sept. 1	82,278	+ 916	9	149,957	+ 4,483	25·75	..
Met. District Rly...	Aug. 31	21,912	+ 2,145	..	106,820	+ 9,246	25	..
Anglo-Argentine ..	Sept. 2	96,578	+ 2,692	..	1,767,371	+ 63 813	..	..
§Auckland	Aug. 2	16 853	+ 2.154	5	21,858	+ 5,659	23·81	..
Bombay (B.E.T.) ..	„ 8	5,699	+ 128	31	92,569	+ 4,662	..	..
§Brisbane	..	..	..	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Aug. 31	7,889	+ 381	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	July	2,998	..	30	21,650	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Aug. 31	1,779	+ 815	..	26,570	+ 3,002	13·5	·6
§Montevideo ..	Aug.	26,249	+ 2,234	10	290,107	+ 39,834	..	..
Perth (W.A.) ..	Aug. 30	3,589	+ 498	..	65,008	+ 9,253	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Sep. 3rd.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5½	9¾— 10¼	..	5 2 4
Do. 4½ % Pref...	10	4½	4½	9¼— 9¾		4 12 4
Do. Second 6 % Pref. ..	10	6	6	10¼— 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	10†	8¾— 9		5 11 1
Do. 7 % Cum. Pref.	5	7	7	7¾— 8¼	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½— 5	+ ⅛	5 0 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼— 4¾	.	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4— 4½	..	5 6 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4½— 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	16 — 18 xd	[illegible]	4 6 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13¼	+ ¼	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	5	6	11 — 11½	..	5 1 1
Do. 6 % Pref.	10	6	6	11½— 12½	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	¼— ½		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾— 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	9	7½— 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	9	7¼— 7¾	+ ⅛	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1⅝ — 1⅞	..	4 0 8
Do. 6 % Pref.	5	6	6	5¼— 5½	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	3¾— 4	..	5 3 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼— 4¾	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	..	4 10 6
Newcastle on Tyne 5 % Pref., Non-Cum.	5	5	5	4⅝— 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill, 6 % Non Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5¾— 6¼	..	5 18 9
St. James' and Pall Mall, Ord.	5	10	10	8¾— 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 86	..	4 1 5
Smithfield Markets, Ord. ..	5	Nil	2	1⅜— 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½		5 14 8
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	.	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	[illegible]		5 14 9
Do. 4½ % First Deb. Stock ..	100	4½	4½	97 —100	..	4 10 0
Urban, Ord...	£3	5	..	½— ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½— 3	..	8 6 8
Do. 4½ % First Mort. Deb. ..	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord.	5	10	10	8½— 9	..	5 11 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	5 — 5½	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends 1910.	Dividends 1911.	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5¼— 5½ xd	..	5 4 4
Calcutta, Ord.	5	8½	8½	7½— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	5¼— 5½ xd	..	4 16 [illegible]
Calgary Power, 1st Mort. Bds.	100	5	5	95½— 97½	..	5 2 7
Canadian Gen. El. Com. ..	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 0
Cordoba Lt., Power and T., Ord.	1	8	8†	[illegible]	..	8 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	97 — 99 xd	..	5 1 [illegible]
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛— ¼	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1½— 2½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	96 — 99	..	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 —112		6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½— 98½	..	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87½— 89½	..	5 11 9
Montreal, Lt., H. and Power ..	$100	7	8	232 —237	—10	3 7 6
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	11 18 2
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	4	5†	151 —156	..	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107½—109½	½	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	Nil	11½d.	[illegible]	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	.	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends 1910.	Dividends 1911.	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	Nil	4†	7½— 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	95½— 97½	—1	5 2 7
American Telep. & Teleg., Cap.	$100	8	8†	147½—149½	1½	5 7 0
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	8¾	8	67½— 69½	.	5 7 11
Do. 6 % Pref.	Do.	6	6	113¾—114¼	..	5 5 0
Do. Def.	Do.	30/-	30/-	26¼— 26¾	..	5 12 8
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	+2	4 16 2
Chili Telephone	5	7	..	7½— 7¾	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83½— 85½	+ ½	4 13 7
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable ..	10	4½	5	7½— 8	+ ⅛	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	5†	129 —132	+ ½	5 6 1
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	78 — 80	+ ½	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	..	3 18 10
Eastern Extension	10	7	5†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	98½—100½	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97½—100½	..	3 19 7
Globe Telegraph and Trust ..	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12¾— 13½	+ ¼	4 10 7
Great Northern Telegraph ..	10	18	18	28¼— 29¼	..	6 3 1
Indo-European Telegraph ..	25	13	5†	57 — 59	..	5 3 5
Mackay Companies Common ..	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5 1/16— 5 3/16	+ ½	3 17 0
Do. 7 % Cum. Partic. Pref.	1	16	17	4⅜— 4⅝	+ ½	3 13 8
Monte Video Telephone, Ord...	1	6	6	1 1/32— 1 5/32	..	5 6 8
Do. 5 % Pref.	1	5	5	13/16— 15/16	..	5 6 8
National Telephone Def. ..	Stock	6	6	152½—154½	+ ½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100½—101½	+ ½	4 8 8
Oriental Telep. and Elec. ..	1	8	8	1¾— 1⅞	— ⅛	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 3/32— 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	10⅛— 10⅝	..	3 15 9
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	+ ½	4 8 8
United River Plate Telephone	5	8	8	7¼— 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5¼— 5½	..	4 10 11
West Coast of America	2½	2½	2½	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1¼	⅛	3 7/16— 3 11/16	+ 1/16	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾— 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17 7
Western Telegraph, Ltd. ..	10	7	6†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 3rd.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16— 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16— 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	..	..
Do. 5 % Perp. Deb. ..	100	5	5	98 —101	..	4 19 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	77 — 79	+3	3 16 0
Do. Pref.	100	4	4	82 — 84	+2	4 15 3
Do. Def...	100	2	2	77 — 79	+3	2 10 8
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
City & South London, Ord. ..	100	1½	1⅝	38½— 39½	+4½	3 18 6
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	103 —105	+1	4 15 3
Do. Do. 1901	100	5	5	103 —105	+1	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½— 11½	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅞— 2⅜	..	Nil
Hastings Trams, 6 % Pref. ..	1	Nil	6	⅝— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4½— 5½	— ⅛	..
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 3rd.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅝	1⅞	59½— 60	+4¾	2 14 2
Do. Surplus Lands	100	2¾	2⅞	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	41¾— 42¼	+3¼	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	3½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def...	1	Nil	..	3/16— ¼	..	Nil
Do. 5 % Pref.	1	5	5	13/16— 15/16	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	99 —102	..	4 19 0
Potteries, Ord.	1	2	..	5/16— 7/16	..	..
Do. 5 % Pref.	1	5	5	7/32— 3/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4 — 4¼	..	Nil
Do. "A"	1/-	..	..	⅝— 11/16	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	89 — 91	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼— ¾	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞— 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5	5½	4 15/16— 5 3/16	..	5 6 0
Do. 4 % Deb.	100	4	4	93½— 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	+ ½	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb. ..	100	5	5	103 —105	+1	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾— 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞— 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	8†	141 —146	+1	5 9 7
Do. Pref. Ord.	100	6	6	119 —124	..	4 16 9
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 1
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	102 —104	..	4 6 7
Calcutta Trams, Ord.	5	6	7	6⅛— 6⅜	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝— ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5½— 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35 — 43	— ½	6 19 6

La Plata Elec. Trms, Ord. ..	1	..	..	½— ¾	..	..
Do. Pref.	1	6	6	27/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7	128 —131	+1	5 6 10
Do. Gen. Con. 5 % Bonds ..	..	5	5	99½—101½ xd	..	4 18 6
Do. 6 % Bonds	100	6	6	102½—104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7 5/16— 7 11/16 xd	+ ¼	6 9 10
Do. 6 % Pref.	5	6	6	4⅞— 5⅜ xd	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/32— 1 5/32 xd	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½— 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	152 —154	+4	3 5 0
Do. 1st Mort. 5 % Bonds ..	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	100 —101	..	4 19 0
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	261 —266	+4	3 15 2
Do. 5 % 1st Deb.	$500	5	5	104½—106½	— ½	4 14 0
Singapore Trams, 5 % Deb. ..	100	5	5	84 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	6	7	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	6	4⅞— 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	+1	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝— ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3⅛— 3⅜	+ 1/16	4 2 10
Do. Pref.	1	6	6	1 7/16— 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	..	..	9/16— 13/16	..	..
Do. 6 % Cum. Pref.	1	..	..	⅝— ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 15 0
B.I. & Helsby Cables	5	10	10	7¾— 8¼	..	6 1 3
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	101½—103½	+ ½	4 7 0
British Thomson-Houston, Deb.	100	4½	4½	94 — 96 xd	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	..	9/16— 11/16	..	Nil
Do. Deb...	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55 xd	..	8 3 8
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¼— 11	..	6 16 4
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99—101	..	4 9 1
Castner-Kellner	1	17½	20	3 11/16— 3 13/16	..	5 5 3
Do. Deb...	100	4½	4½	102 —105	..	4 5 9

Crompton & Co.	8	Nil	Nil	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾— ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	97 —100	+ 2	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16— 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅝— 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	2½	3¾	¾— 1	..	7 10 0
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾ xd	..	5 17 8
Do. Pref.	5	4½	4½	4¾— 5 xd	..	4 10 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	10½— 11½	+1	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	20	10†	33½— 35½	+ ½	6 8 2
Do. Deb...	100	4	4	97 — 99	..	4 0 10
Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

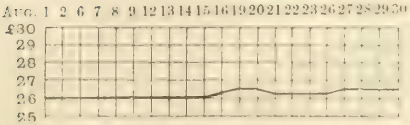
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

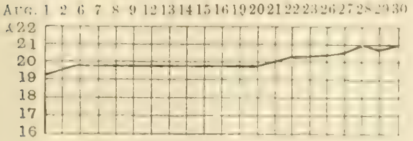
METAL MARKET.

Fluctuations in August.

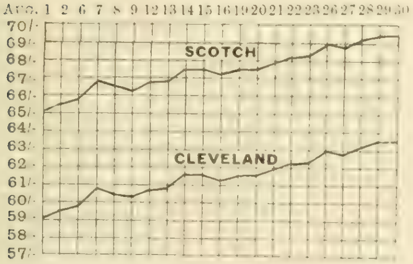
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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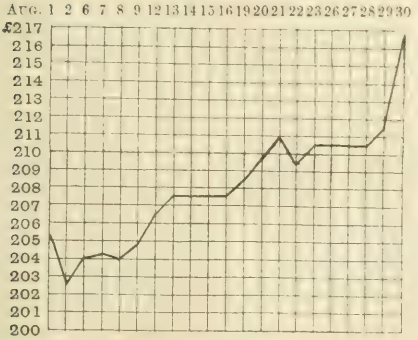
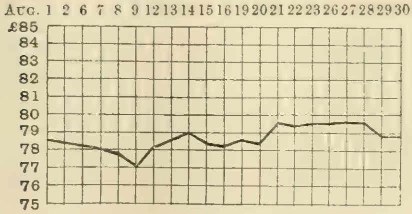


COPPER (G.M.B's.).



Hoylake Electricity Supply.—A L.G.B. inquiry was held on August 29th, relative to the U.D.C.'s application for power to borrow £1,300 for fitting a new boiler and pump, and making other improvements at the electricity generating works. The proceedings were formal, the Inspector observing that it was quite obvious that the extension was necessary.

COMPANY AND CONSUMER.

[FROM A LEGAL CONTRIBUTOR.]

(*Concluded from page* 337.)

11. *Who is Liable for Electricity Supplied?*—It next becomes important to consider who may be sued by the undertakers in the event of their being compelled to seek payment of their lawful charges by action at law.

The Electric Lighting Act, 1882, incorporates, by Sec. 12, Secs. 38—42 and Secs. 45 and 46 of the Gasworks Clauses Act, 1871, which relate to the recovery of gas and meter rents in order to ascertain the rights of a supply company to recover the price of electrical energy supplied; it is, therefore, necessary for us to refer to the incorporated sections of the Gasworks Act and the cases which have from time to time arisen thereunder. It is this unfortunate system of "legislation by reference" that has led to much of the difficulty which has been experienced in interpreting the Electric Lighting Acts.

The incorporated sections are to be construed, for the purpose of the Electric Lighting Act, 1882, as if "gas" meant "electricity," and as if "pipe" meant "electric line" and "works" meant works as defined by the Electric Lighting Act, 1882, and as if "the limits of the special Act" meant the area within which the undertakers are authorised to supply electricity under any licence, order or special Act.

It is provided by Sec. 21 of the Electric Lighting Act, 1882, that if any local authority, company, or person neglect to pay any charge for electricity, or any other sum due from them to the undertakers in respect of the supply of electricity to such local authority, company or person, the undertakers may cut off such supply, and for that purpose may cut or disconnect any electric line or other work through which electricity may be supplied, and may, until such charge or other sum, together with any expenses incurred by the undertakers in cutting off such supply of electricity as aforesaid are fully paid, but no longer, discontinue the supply of electricity to such local authority, company or person.

This power to disconnect is in addition to the right of the company to sue for the rent which is due. Thus it is provided by Sec. 41 of the Gasworks Act that whenever any person neglects to pay any rent or sum due and payable, the undertakers may recover the same with full costs of suit, in any court of competent jurisdiction; and the remedies of the undertakers under this enactment are in addition to, and not in substitution for, the recovery of such rent by other lawful means. Other lawful means include proceedings for the recovery of civil debts in a court of summary jurisdiction, as provided by the Summary Jurisdiction Act, 1879 (42 and 43 Vic., Cap. 49, Secs. 6, 35), which formulates the procedure under which penalties may be recovered.

The recovery of a judgment is sometimes an empty victory in cases where the defendant is unable to discharge his indebtedness by payment. In such circumstances the undertakers are compelled to go one step further. The judgment being recovered by what is technically known as a "civil proceeding," an order for commitment cannot be obtained until the debtor has been personally served with the judgment summons, and proof has been given to the Bench as to his means.

Change of occupancy, and the liability of an incoming tenant to pay the arrears accumulated by an outgoing one, have been specially provided for in the Acts. Thus it is provided by Sec. 39 of the Gasworks Clauses Act, 1871, which is incorporated, as we have seen, with the Electric Lighting Acts, that in case any consumer of electricity supplied by the undertakers leaves the premises where such electricity has been supplied to him without paying the electricity rent or meter rent due from him, the undertakers shall not be entitled to require from the next tenant of such premises the payment of the arrears left unpaid by the former tenant, unless such incoming tenant has undertaken with the former tenant to pay or exonerate him from the payment of such arrears.

This provision, which operates in protection of the consumer, exposes the supply company to a risk which can be overcome by the demand of security in accordance with the provisions of the Electric Lighting (Clauses) Act, which we have already considered. Further, it only applies to cases where the relationship of landlord and tenant exists. Thus, in a case where a receiving order had been made against a debtor, the gas company cut off the supply of gas to his premises, and refused to re-connect until the arrears of gas rent due from him were paid. The Official Receiver paid the amount under protest, the debtor having been adjudged bankrupt. In an action by the Receiver to recover back the amount so paid, it was held that, as the debtor continued to be the occupier of the premises, there had been no change of occupation, and therefore there was no obligation upon the company to supply gas without payment of the arrears. The fact that the debtor continued in possession is the essence of the above decision.

In a much later case (in *re* Flack, *ex parte* Berry, 1900, 2 Q.B. 32), a debtor having been adjudicated bankrupt, his trustee took possession of the business premises, and found that the water rate was in arrear. The company declined to continue the supply until the arrears were paid, and cut off the water. It was decided that he was an "incoming tenant" within the meaning of the section which applies to the supply of electricity, and that he was entitled to recover back the amount overpaid.

By Sec. 18 of the Electric Lighting Act, 1909, the undertakers may refuse to supply electrical energy to any person whose payments for the supply of electrical energy are, for the time being, in arrear (not being the subject of a *bonâ fide* dispute), whether any such payments be due to the undertakers in respect of a supply to the premises in respect of which such supply is demanded or in respect of other premises.

Before removing, a consumer must give notice to the undertakers. Thus, by Sec. 17 of the same Act, 24 hours' notice in writing shall be given to the undertakers by every consumer before he quits any premises supplied with electrical energy by the undertakers, and, in default of such notice, the consumer so quitting shall be liable to pay to the undertakers the money accruing due in respect of such supply up to the next usual period for ascertaining the register of the meter on such premises, or the date from which any subsequent occupier of such premises may require the undertakers to supply electrical energy to such premises, whichever shall first occur.

Notice to the effect of this section shall be endorsed upon any demand note for charges for electrical energy.

12. *Time for Proceedings.*—Proceedings for the recovery of an electric lighting rent must, it is submitted, be commenced within six months from the time when the matter of it arose. This seems to follow from a consideration of Sec. II of the Summary Jurisdiction Act, 1848, which provides that in all cases where no time is specially limited, a complaint or information must be laid within six months. The section has been applied to a summons for arrears of water rate (East London Waterworks Co. *v.* Charles (1894) 2 Q.B. 730), and in the absence of authority it is presumed that the principle would also apply to arrears of electric lighting charges.

13. *Notice to Disconnect.*—Probably the most effective way of obtaining payment of arrears is to threaten to disconnect the house from the mains unless the debt is discharged. The following is a convenient form of statutory notice to disconnect :—

The Electric Supply Co.
(Address)

NOTICE TO DISCONNECT.

We hereby give you notice, under Sec. 21 of 53 and 54 Vic. Cap. 56, that unless the sum of £ is, within seven days from the date of service hereof, given as security for the payment of all moneys which are and may from time to time become due in respect of the supply of electric energy the company may discontinue such supply, and will take action to recover all moneys due.

14. *Alteration in the Price of Electricity.*—In many cases the price charged for electricity is much below the maximum which the undertakers are entitled to charge by their provisional order. When they desire to increase their price, notice must be given to consumers, the length of notice being usually decided by the nature of the agreement under which the current is supplied. Thus, in the case of a quarterly agreement, a quarterly notice would be considered sufficient. This question has arisen in relation to the supply of gas. In the Commercial Gas Co. *v.* the Mayor, &c., of Stepney (the *Times*, January 24th, 1901) the defendants were summoned by the plaintiffs, who desired to obtain payment of the sum of £917 8s. for gas supplied. It appeared that by the Commercial Gas Co.'s Act of 1875, Sec. 53, the company were allowed to raise the price of gas if the rate of dividend were reduced. The defendant Corporation paid less than ordinary consumers, and when the company raised the price to their ordinary consumers, the parish price was increased. It was contended on behalf of the defendants that, inasmuch as they were under a quarterly agreement with the gas company, they were entitled to notice of any alteration in the price. The magistrate, in giving his decision, said, "I have come to the conclusion that, under the agreement, the company have no right to raise the price of gas without reasonable notice. If they want to raise the price, then they ought to give the local authority reasonable notice, in order to put an end to the existing agreement. All the sections which have been quoted, when taken together, point to a special agreement as to the sum which the company were to charge to the local authority."

The foregoing remarks as to change in price must always be subject to the terms of any agreement between company and consumer. So long as the maximum price is not exceeded, it is competent for the company to charge what they like as long as no undue preference is shown.

15. *Remedies of the Consumer for Failure of Supply.*—Failure to supply electricity in accordance with the terms of the Provisional Order renders the company liable to penalties. Thus, it is provided by Sec. 30 of the Schedule to the Clauses Act, 1899, that whenever the undertakers make default in supplying energy to any owner or occupier of premises to whom they may be, and are, required to supply energy under the special order, they shall be liable in respect of each default to a penalty not exceeding 40s. for each day on which the default occurs. When the default is due to the insolvency of undertakers, the Board of Trade may, after due inquiry, revoke the special order (Sec. 63 *ib.*). Penalties inflicted upon undertakers under this section must in no case exceed in the aggregate, in respect of any defaults not being wilful defaults on the part of the undertakers, the sum of £50 for any one day. Further, no penalty is to be inflicted if the Court are of opinion that the default was caused "by inevitable accident, or *force majeure*, or was of so slight or unimportant a character as not materially to affect the value of the supply."

The penalties provided for by this section may be recovered, not only where there is a neglect or refusal to supply energy under such pressure as is prescribed, but also where there is a neglect or refusal to supply energy at all; consequently the section applies in a case where the company have improperly cut off the supply. (See Commercial Gas Co. *v.* Scott (1875) L.R. 10 Q.B. 400.)

As to what constitutes *force majeure*, it was held in the case of Sun Insurance Co. *v.* Dublin Corporation (*Electrician*, December 9th, 1899, page 240), that where a cable laid down proved defective, and the supply of energy thus broke down, the plea of inevitable accident could be successfully urged in answer to a claim for penalties. In Marylebone Vestry *v.* Metropolitan Electric Supply Co. (*Journal of Gas Lighting*, January 2nd, 1900), the defendant company were summoned for making default in supplying electrical energy to the workhouse and vestry premises on certain days. The company admitted the default, but contended that the same was due to inevitable accident caused by the great increase in the demand for electricity, which had exceeded their expectations. The case was adjourned for three months, and was not heard of again. In a subsequent case, however, the same company were fined at the suit of the London County Council for making default in the supply of electricity, to the houses of certain individuals. (*Ib.*, January 23rd, 1900, page 212.)

The penalties referred to in this section are incurred by improperly cutting off or discontinuing the supply of electricity. The question whether proceedings at law would avail the consumer either in addition to, or in substitution for, the recovery of a penalty provided by statute does not seem to have arisen in connection with the supply of electricity, although it has been frequently discussed in connection with the gas and water supply. The result of the decisions may be said to be that where a duty is cast by statute upon a company or person, and penalties are imposed for failure on the part of the company to perform that duty, the company are only liable to pay penalties (Atkinson *v.* Newcastle Waterworks Co., 2 Ex. D 441). Now, it is clear that, under the Electric Lighting Acts, 1882-1899, an electricity supply company is bound to furnish current "without favour or distinction to all persons within their district," and it is also clear that they become liable to penalties in case of refusal. Hence the jurisdiction of the civil Courts appears to be ousted.

In another case, Mr. Justice Wills said: "The principle applies that where a duty is created by Statute which affects the public as the public, the proper remedy, if the duty is not performed, is to indict the company, or institute the prescribed proceedings." (Clegg *v.* Earby Gas Co. (1896), 1 Q.B., 592.)

If the above view of the law is correct, a plaintiff claiming damages in any Court for breach of contract on the part of the company would run serious risk of a non-suit.

16. "*Power Companies*" *and Consumers.*—There were formerly no special public statutes to specify, in general terms, the relationship between power companies and their consumers. It should be observed, however, that the Electric Lighting Act, 1909, makes ample provision on this head (see Sec. 18 *infra.*), and that while all the private Acts incorporate the Electric Lighting Acts, 1882-1899, to a greater or less extent, those portions of the public Acts which relate to "price," &c., are for the most part replaced by special provisions in each private Act.

Electric lighting companies supply energy in comparatively small quantities to private consumers. Power companies are only allowed to distribute electricity *in bulk* either to electric light distributing companies or to manufacturers who require a supply of energy to drive their machinery. The power company is prohibited from supplying energy for lighting purposes except to manufacturers who also take a supply of electricity for the purposes of power.

17. *Conditions of Supply by Power Company.*—The power company is not only obliged to provide a sufficient supply of electricity to consumers, but must lay mains for the purpose when required to do so. Moreover, there is no limit to the distance through which the necessary mains may be required to be laid, as in the case of the supply of electricity supplied under an Electric Lighting Order. Hence any factory proprietor in the company's district may obtain a supply of energy. For the protection of the power company the following proviso is generally inserted:—"Provided that the company shall not, except as provided by this Act, be bound to give any supply to any such authorised undertakers, unless such authorised undertakers shall enter into a written contract to take the *whole* of the supply required by them for the purpose of their undertaking from the company." If an increased supply is required, the same can only be had after due notice.

The above condition was inserted in the Durham Electrical Supply Act, 1900 (Sec. 8). The Lancashire Electric Power Act, 1900, Sec. 42, after providing that local authorities and companies should be entitled to be supplied, contained a proviso that they should: "Enter into a contract with the company (if so required) to continue to receive and pay for a supply of energy for a period of at least seven years of such an amount that the payment to be made for the same shall not be less than £20 per cent. per annum of the outlay (excluding expenditure on generating plant and any electric line then laid) incurred by the company in making provision for such a supply.

As it would in many cases be very inconvenient for manufacturers to bind themselves to take their whole supply from one source, a clause is generally inserted binding the company to give a partial supply on terms to be fixed by an arbitrator appointed by the Board of Trade. Such terms are to be fixed with regard to:—

1. The period for which the users are prepared to bind themselves to take energy.

2. The amount of energy required and the hours when required.

3. The capital expenditure necessary; and

4. How far the capital expenditure may become unproductive.

18. *Provisions of Electric Lighting Act, 1909, as to Supply in Bulk.*—By Sec. 4 of the Act, the Board of Trade, unless they are of opinion that, by reason of the character or magnitude of the proposed undertaking, the matter ought to be dealt with by a Private Bill, may, by Provisional Order, authorise any local authority or company to supply electricity in bulk; provide for any supply so authorised being compulsory; and make such other provisions as appear to them necessary for adapting the Electric Lighting Acts to any case where a local authority or company are authorised to supply electricity in bulk, including the application to roads, railways and tramways along the route along which lines are authorised to be laid for the purpose of giving the supply in bulk, of the provisions of those Acts which authorise or enable the Board to authorise the breaking up of any road, railway, or tramway. If the Board refuse to grant a Provisional Order, under these powers on the ground that the matter ought to be dealt with by a private Bill, then, subject to the Standing Orders of Parliament, and subject to the provisions for giving of certain additional notices, the notices published and served for the purposes of the provisional order are to be held to have been published and served for the purposes of a private Bill applying for similar powers, and the application for the Provisional Order is to be treated as a petition for leave to bring in a private Bill.

ELECTRICITY SUPPLY IN SHEFFIELD.

(*Concluded from page 326.*)

Earthing.—The interconnection of the three-phase and two-phase systems at Neepsend makes it unsafe to earth the neutral of the three-phase star in the ordinary manner (for it would then be possible for the small turbo-sets to go to earth through the 5,000-KW. feeders—probably resulting in a burn-out; further, the generators, feeders and bus-bars will withstand 11,400 volts to earth on test but not on load).

A special earthing transformer is therefore used in conjunction with Ferranti Field earth current devices, as shown in fig. 5. The earthing transformer is of 355 KW. capacity and is connected across the extra-high-tension bus-bars with the primary in star, and the secondary in delta connection It is thus ensured that the centre of the star shall normally be at earth potential. On the occurrence of a fault, the current flowing through the earth connection is limited by a series resistance to 25 amperes, and this current is sufficient to trip all the earth current devices, which operate on the main switches in parallel with the usual time-limit over-load and reverse current relays. The earthing device is connected directly and permanently to the bus-

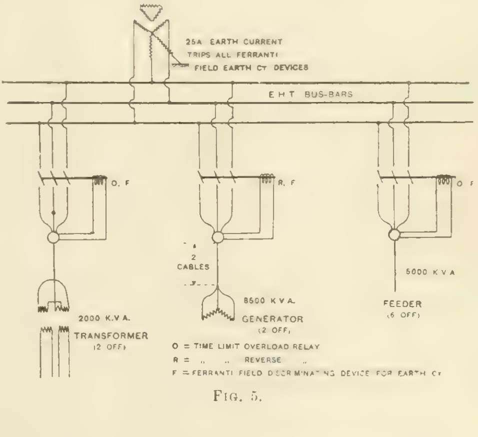


Fig. 5.

bars; the feeder systems are *not* interconnected, and the transformer secondaries are *not* in parallel. The protective system is similar to the Merz-Price, but is for simple instead of for ring main installations: it is alternative to the L.C.C. (Greenwich) earthing device (see Electrical Review, Vol. 64, page 785 *et seq).*

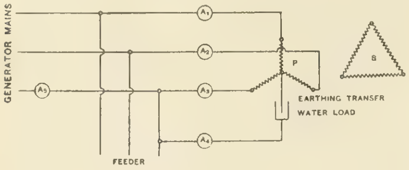


Fig. 6.

When tested through a water load, representing an earth on the feeder (fig. 6), it was found that the current distribution in the various branches of the earthing circuit was as follows: When $A_4 = 25$ amperes (sufficient to operate the Ferranti devices), $A_1 = A_2 = A_3 = 8{\cdot}33$ amperes and $A_5 = 16{\cdot}67$ amperes (out-of-balance current, flowing till the feeder is isolated).

Before passing from the plant to the supply conditions and results obtaining at Sheffield, attention must be called to the great improvement introduced by Mr. Fedden in the method of calling for tenders. Each contractor is instructed to tender *direct to the engineer* for such parts of the equipment as he is prepared to manufacture and supply. Cross tendering is thus prevented, and the task of preparing and analysing tenders is greatly simplified.

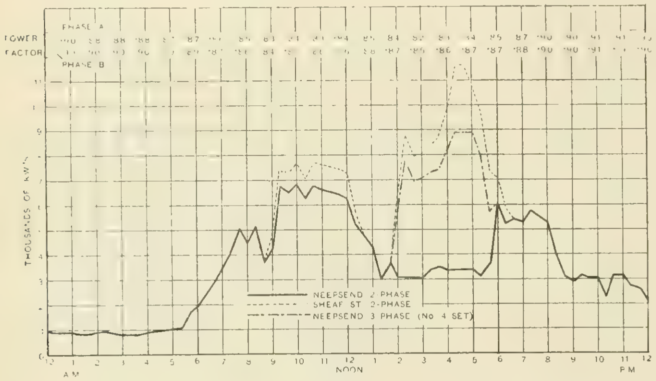


Fig. 7.—Typical January Day Load Curve.

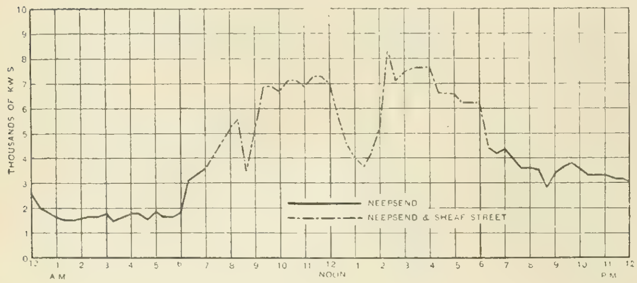


Fig. 8.—Typical June Day Load Curve.

Though the field for electrical development is admirable, the electricity department has by no means an easy task to reap its harvest. Gas is available for lighting at 1s. 3d., and for power at 11d. per 1,000 cb. ft., and the average citizen of Sheffield is particularly hard-headed and must be absolutely convinced as to the economic possibilities of a given proposition before he will take it up. It is obviously difficult to show any *direct monetary* economy in electric lighting with gas at 1s. 3d. per 1,000 cb. ft., and it is quite typical of the district that a number of shopkeepers have installed electric lighting outside and in the windows of their shops, while adhering to gas burners inside and in their living quarters. The tacit compliment to electric lighting would be more appreciated if the consumer would so far establish the courage of his convictions as to follow them completely. He would have no cause for subsequent regret.

Over 600 new services have been connected since last year, and, to cater for shop and domestic loads, the Corporation has established an energetic canvassing department and a handsome showroom.

During the past year there has been in vogue a 50 per cent. discount in the lighting tariff (nominal price 4d. per unit) for consumers who guarantee an average daily use of their lamps for 4½ hours. Since the application of this rebate the revenue has rapidly increased.

Heating and cooking supply is at 1d. per unit, and there are at present about 1,000 electric radiators and convectors in use, but very little has yet been achieved in the cooking field.

Fully 65 per cent. of the total sales are now utilised for power purposes, the rapid development in the actual and relative power sales being clearly shown by the following figures:—

Year ending March.	Units sold for— Lighting.	Power.	Heating.	Motors. Number.	Horse-power.
1910 ...	3,327,137	6,776,361	214,435	1,421	14,005
1911 ...	3,421,409	10,580,847	251,945	1,680	17,086
1912 ...	3,689,875	12,777,648	295,401	1,914	20,030

As one result of the coal strike, the Corporation gained a number of valuable power consumers, and under the favourable scale of power tariffs in vogue (ranging from 1d. per unit for consumers taking 5,000 units per annum, to 0·6d. for consumers taking 750,000 units per annum), the power demand is increasing at an extraordinary rate, with which the department is able to cope owing to its early extensions, large stand-by capacity and excellent system of distribution.

Load Curves; Load Factor; Power Factor.—Many of the individual demands supplied by the Sheffield undertaking are very severe in nature. Thus, the steel furnaces in a certain works throw a load of 600-1,000 kw. on and off the mains four or five times a minute during their operation, and a certain rolling mill is liable to take 600-800 kw. suddenly at any time of day or night. Thanks to the flexibility and overload capacity of the generators and the smart action of the Tirrill regulators employed, there is no difficulty in coping with these and similar load variations, but the Department is considering the advisability of introducing tariffs which shall take into account the load and power factor of the demand.

Typical load curves showing the variation in demand during a day in January, and one in June, are reproduced in figs. 7 and 8. The general shape of these curves is that typical of any station supplying chiefly a power load. The important service rendered by the Sheaf Street works during the winter is shown by fig. 7, where also the output of the No. 4 Neepsend set is isolated from that of the remaining Neepsend plant. The average annual load factor of the whole undertaking was 17·14 per cent. in 1910-11, but the average load factor of the Neepsend station alone is now in the neighbourhood of 40 per cent. (See also Table I.)

Power factor rectifiers are at present used, but the importance of high power factor is much less in the new e.h.t. than in the old two-phase system, and, as the supply system grows, no particular trouble is anticipated in this direction.

Fig. 7 shows the power factors on the A and B phases at Sheaf Street of the two-phase trunk mains from Neepsend. The average day power factor of supply is 0·65—0·75 at Neepsend and 0·8 at Sheaf Street, rising to 0·90—0·95 at night.

The capital burden on the Sheffield undertaking has been particularly heavy in the past, and now averages £85 per KW. On the Neepsend station, however, the investment averages only £12 10s. per KW., so that the overall figure should show a considerable decrease in the near future (fig. 9). The very heavy investment of £27 per KW. in mains is due to the scattered area supplied and to the fact that spare cable pipes are laid wherever necessary, to allow of future extensions without re-opening the streets.

The present capital sunk in the undertaking is close on £900,000, after deducting a liberal depreciation and obsolescence allowance (roughly, 10 per cent.), and including the loan of £61,000 raised last year for the Neepsend extensions. This loan forms a further instalment of the £250,000 provisionally approved by the Committee in July, 1908, and as the load supplied is increasing at the rate of 2,000-2,500 KW. per annum, there is no doubt that further extensions will soon be necessary.

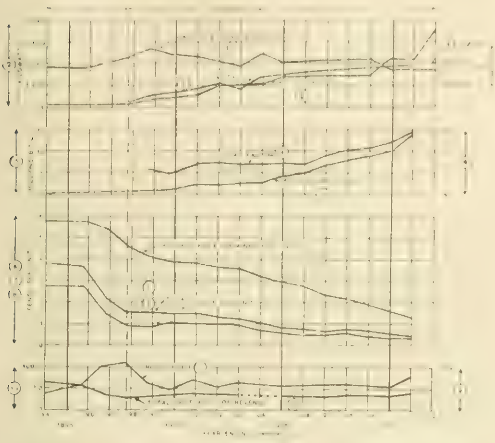


Fig. 9.—Financial Curves, &c., Sheffield Electricity Supply.

It will be seen from the curves in fig. 9, that consumers have consistently reaped the benefits of the forward policy of the undertaking. The rapid increase in sales and the exceptional provisions which have been made for future load developments should result in handsome profits in years to come. Already the tide has turned, and in 1911 the department obtained a surplus of £3,417, as compared with a deficit of £2,035 in the preceding year.

In concluding this review of a most important and enterprising undertaking, we must express our sincere thanks to Mr. S. E. Fedden, engineer and manager, and to Mr. H. A. Howie, deputy manager, for their most courteous and painstaking assistance.

OUTPUT OF MINERALS AND THE USE OF COAL-CUTTING MACHINERY IN 1911.

The annual reports of H.M. Inspectors of Mines for the eight districts into which the United Kingdom is divided for the year 1911 have recently been issued. These reports, as a rule, are full of interest not only to the mining profession but to other branches of engineering associated with mining machinery, and more especially electrical engineering which now enters so largely into mining work, as valuable lessons are to be learnt from the experience and investigations into the causes of accidents—unfortunately resulting too often in the loss of life—that are fully reported. We propose to deal with this phase of the reports in a future article, and at present confine ourselves to the output of minerals and the position of machine mining.

The total output of minerals for the year was 285,942,352 tons, being an increase of 7,332,403 tons over the year 1910, and of the total 271,878,244 tons are coal, and the remaining 14,064,108 tons other minerals chiefly ironstone and clays. The various outputs for the different districts, together with the increase or decrease compared with the year 1910, are shown in the following table :—

Output of Minerals.

	District.	Coal.	Other minerals.	Total.	Increase or decrease compared with the year 1910.
1.	Scotland ...	41,718,163	4,830,221	46,548,384	+ 342,832
2.	Newcastle ...	30,791,500	354,439	31,145,939	+2,183,440
3.	Durham ...	27,909,200	6,243,604	34,152,804	+1,670,747
4.	Yorkshire and Nth. Midland	66,976,877	553,562	67,530,439	+1,227,670
5.	Lancashire ...	11,020,695	148,499	11,169,194	+ 17,504
	Ireland ...	84,684	1,002	85,686	— 116
6.	Liverpool and Nth. Wales...	16,402,349	96,385	16,498,734	+ 233,526
7.	South Wales ...	50,200,727	156,049	50,356,776	+1,448,896
8.	Midland and Southern ...	26,774,049	1,680,347	28,454,396	+ 207,904
	Total ...	271,878,244	14,064,108	285,942,352	+7,332,403

In regard to machine coal-cutting, we find this to be steadily increasing year by year, though the same cannot be said of mechanical handling of the coal by means of conveyors. The total increase in the number of coal cutters over the number given in the year 1910 is 187, of which no less than 125 are electrically driven machines, and the total output due to machine mining was 18,667,346 tons, which is an increase of no less than 2,815,545 tons over the year 1910. In only one district is there any backward tendency, viz., that of Lancashire, where the number of machines decreased by 16, six of which were electrical, and the output of machine-cut coal was reduced by 36,144 tons.

The greatest development in machine mining took place in Scotland, the number of new machines installed being 95, and of these no less than 76 were electrically driven, and were responsible for an increase in the output of machine-won coal of 1,096,504 tons. On the other hand, as already mentioned, there was a reduction of 16 machines at work in the Lancashire district, six of which were electrical, and a reduction in the output of machine-mined coal of 36,144 tons. The Inspector expresses no opinion as to why this should be, and it is the more strange, in that, although a less number of coal cutters was at work, the number of conveyors increased from 37 to 79, or more than doubled.

In 1910, 11 electrically-driven coal cutters produced 96,812 tons, and 141 compressed air machines produced 405,549 tons, whilst in 1911 five electrical machines produced 43,684 tons, and 131 compressed air machines gave 424,833 tons, while in Ireland one electrical machine produced, in 1910, 4,000 tons, but, in 1911, only 1,700. It would seem, therefore, that the loss in output was due to the stopping of the six electrical machines, as it will be observed that the 131 compressed air machines produced more coal in 1911 than 141 did in 1910. Possibly a state of alarm was produced in this district after the terrible disaster at the Hulton Colliery at the end of 1909 regarding the use of electrical machines, as it may be remembered electricity was blamed — though absolutely without the slightest foundation—for causing the explosion.

In Scotland district there were 501 electrically-driven coal cutters, of which 336 were "disk," 149 "bar," and 16 "chain" type machines, which together produced 5,476,008 tons of coal, 234,186 tons of ironstone, and 3,197 tons of fireclay. There were 82 conveyors at work, which is 10 fewer than the previous year, and is "due to local conditions at the coal face, such as faults, condition of roof, &c., and the number, owing to these and other causes, is liable to fluctuate from year to year."

In the Newcastle district there were 46 electrical machines, of which 22 were "disk," 12 "bar," 11 "chain," and one a "percussive" type machine. The latter is included in the electrically-driven machines, for although the cutters are operated by compressed air, a small electrically-driven compressor coupled direct to the cutter by a pair of flexible tubes, is an inherent part of the machine. Altogether the electric machines produced 513,149 tons of coal. There were 35 conveyors at work, or two less than in the previous year.

In Durham district 55 machines were at work, being an increase of seven, and included of 21 "disk," 20 "bar," 13 "chain," and one "percussive" type machine, and they produced 453,071 tons of coal collectively. There were 23 electrically driven, and 11 compressed air-driven conveyors at work against 12 and two respectively for the year 1910.

In Yorkshire, the late Mr. Pickering, whose sad death in connection with the recent disaster at the Cadeby mine will still be fresh in the minds of our readers, reported that "great progress was made in machine mining during the year." . . . . "The number of electrically-driven machines increased from 235 to 268, but the machines driven by compressed air decreased from 246 to 243," an excellent testimonial to the superiority of electricity as the motive power. There were at work 47 "bar," 64 "chain," 154 "disk," two percussive, and a "rotary heading" type machine, making a total of 268, and they produced 3,020,222 tons. There were also 45 conveyors at work, being an increase of seven from the previous year. Mr. Pickering says, "The value of face conveyors in thin seams is being gradually recognised." This view is supported by reference to the conditions in the Lancashire district already referred to, where, although the number of coal-cutters decreased, the conveyors rose from 37 to 79.

In Liverpool and North Wales we find a net increase of nine coal-cutting machines, but there is a decrease of one electrical machine and an increase of 10 compressed-air machines, as compared with the year 1910. But we find on referring back to the 1910 report there were 10 *fewer* during that year than in the year 1909, and the output from 129 machines in 1910 was 983,224 tons, as compared to 1,033,237 tons in 1909 for 139 machines. Hence, it is very satisfactory to note that in the year 1911 138 machines, or one machine less, produced 1,182,828 tons, or an increase of 149,591 tons over 1909. We find there were 6 "disk," 10 "bar" and one "chain" type machines, or a total of 17, and these produced 142,704 tons. Seven conveyors were at work, which was the same number as the previous year.

In South Wales, too, we have a reduction in the number of electrical machines at work of 8, but an increase of 14 compressed-air machines, yet while 51 electrical machines in 1910 only produced 318,015 tons, 43 machines gave an output of 322,657 tons in 1911. This is surely evidence of the steady advancement in efficiency of machine mining. The 43 machines at work consisted of 11 "disk," 28 "bar" and 4 "chain" types, and together produced 322,657 tons. There were, however, seven less conveyors at work, there being only 43, against 50 in the previous year.

In the Midland and Southern District we find 62 electrical coal-cutters at work; 28 "disk," 20 "bar," and 14 "chain" type machines, which produced 637,509 tons of coal and 83,526 tons of ironstone. There was only one face conveyor at work.

Analysing further the records, we find that the percussive type machine, which must be fixed in one position, yields approximately an output of 3,000 tons of mineral per annum; as, for instance, 488 percussive coal-cutters gave an output of 1,431,327 tons, while the other machines of long-wall type each yield approximately 11,000 tons per annum, as 1,521 machines, which include the disk, bar, chain and rotary header types gave an output of 16,775,802 tons. Unfortunately, the whole of the figures cannot be given, as Mr. Gerrard, in his report for the Manchester and and Ireland District, does not give the actual production of each type of machine, but—though he gives the number of the different machines at work—merely gives the total mineral produced. However, the figures are quite near enough to show the great superiority of the long-wall machines, more especially when it is remembered that these machines, electrically-driven, only take from 20 to 30 H.P., while a compressed-air percussive machine would require about the same power, seeing that each percussive machine taking air at 60 lb. per sq. in. would consume from 100 to 120 cb. ft. of air per minute. Even with the percussive machine there is an enormous reduction in power consumption when a small motor-driven compressor is directly attached to the machine, and we are surprised that this type of machine has not made further progress. From the figures, however, it would seem that the percussive type of machine is gradually giving way to the long-wall type, which is entirely due to the higher all-round efficiency of the latter.

Altogether there was a total of some 2,146 machines at work, of which only 545 were percussive machines, which, of course, must be driven by compressed air, and, moreover, cost only about £70 each, against the cost of £300 to £400 of the long-wall machine. Of the remainder, we find 998 were electrically-driven, thus leaving 603 compressed air long-wall machines. Thus there are over one-third more electrically-driven long-wall machines in our mines than those driven by compressed air, in spite of all attempts to depreciate it and the tremendous opposition brought against it by miners' leaders and a lot of silly people, who know very little of either electricity or mining. We think, in fact, the day is not far distant when compressed-air coal-cutters will be relics of the past.

SWITCHBOARD FIRES.

[COMMUNICATED.]

An electrical fire is at all times a most awkward occurrence to deal with, but it attains its greatest danger when it happens at a switchboard or the connections immediately adjacent to it. An arc on a cable, whether inside a station or outside, can usually be eventually stopped either by the operation of a fuse or circuit-breaker, or if these are not in a position to operate on the particular section involved, the cable will probably burn itself out; but when the trouble occurs on a switchboard at a generating or sub-station, it is a very difficult matter to get things right without the entire interruption of the supply. Fortunately, modern experience has to a large extent abolished the poor apologies for switchboards which formerly could be found, although even now improvements might be made with considerable advantage in many cases. Due regard has, however, been paid in the majority of cases to the abolition of inflammable materials such as wood work about the switchboard, and the spacing of the terminals and conductors sufficiently far apart to prevent to a large extent the danger of arcing on the board. Even in these days, however, the ordinary spanner has been known to start an arc leading to an interruption of supply and a hospital case, and with the temptation to reduce as far as possible the overall dimensions of a switchboard, caused by the possibility of getting large amounts of power into a small amount of space so far as the generating plant is concerned, by the use of turbo-driven machines, there is still the chance that the clearances allowed are not sufficient in some instances. It is not, however, proposed to enter into this question in this note.

What should be emphasised, however, is the necessity for proper space, ventilation and insulation at the back of the board, especially where high voltages are adopted. With the advent of three-phase systems and high-tension work generally, the dangerous portion, that is to say the high potential gear, is usually placed behind a screen formed by the switchboard panels, on the front of which are the operator's handles, and under ordinary circumstances the operator need not go behind the board. At the back of the board there will often be found a narrow gangway traversed by cables, or worse still, by leads from dividing boxes to the switchboard, these leads, be it noted, being of inflammable material, and the temperature of this chamber is frequently pretty high. Moreover, in some cases the designer appears to lack a knowledge of mechanical design. For example, cases have been known where heavy cables have been led up an outside wall passing into the switch chamber by means of ducts into which they were secured by wooden wedges or collars, the dividing boxes being placed, of course, inside the building. The weight and drag of the cable outside came directly on the wedges. Imagine what would happen if the lead sheathing tore or the paper insulation became unduly compressed, or the wooden wedges shrank owing to the heat of the switch chamber. It is for reasons such as these that measures against switchboard fires should be taken by providing adequate ventilation. The electric fan is not a luxury in such cases. Again, some switchboard designers appear to forget that even in the most tightly-sealed chamber a certain amount of dust collects, and this dust has to be removed. The lot of the switchboard attendant who is told off on a high-tension job to go behind a cramped board with some form of feather duster or equally futile device, and attempt to get the dust off insulators carrying charged conductors, is not a happy one. Is it any wonder that in some instances such cleaning is more or less neglected; the result later on is a mysterious arc and a switchboard fire.

When the fire occurs it is, of course, useless to try the ordinary means of fire prevention: even fire brigades are beginning to understand this. Therefore prevention is better than cure. Supposing, however, that a fire does occur, for example, owing to excessive heat in the switch chamber volatilising the bitumen compound in the dividing box and allowing an arc to develop on the junction and spread along the cables, igniting anything inflammable. What is the best thing to be done? If the back of the switchboard is a constricted one, it is undoubtedly the best policy for the switchboard attendant to stay on the safest side of the switchboard, and no one can blame him if he takes care of his own life. A means which has been suggested is to have on the switchboard a box or bucket full of fine dry sand. If this is thrown on the arc and happens to strike it, and happens to stick, the heat of the arc will melt it, forming a film of insulating matter tending to interrupt the arc circuit. This, however, is analogous to the old method of putting out an ordinary fire by throwing small buckets of water on it. In other words, it is very good if it is successful. If the man who invented Cerebos salt cellars would come forward with an idea for projecting a well-directed stream of fine sand on to an arc he would probably confer a benefit upon the electrical industry, but at the present time such an invention still waits to make the fortune of the gentleman who brings it to a practical issue. Chemical extincteurs are, of course, of no use for this class of work, and therefore the thing which has usually to be done is to shut off the electric power from the arc, even at the cost of shutting down the station supply.

A word may be said in this connection with regard to secondary fires caused in the first instance by electric arcs. The heat of the arc is very liable to volatilise the constituents of bitumen and rubber insulation in the vicinity, with the result that this may catch fire. For this reason, a plan has been adopted on some switchboards of protecting all connections, which consist simply of bare copper arranged on porcelain insulators, by means of asbestos braiding, and this is very often of some considerable value. Even this, however, does not eliminate all trouble, and cases have been known where fires started by an electric arc have worked along the insulation of the cable consuming it, with the ultimate result that the fire has reached other portions of the structure. For this reason, the advantage of absolutely fireproof construction in the vicinity of the switchboard is obvious.

Another fact which tends towards spreading of a fire, should it be started by an electric arc, is the use of oil switches. These are undoubtedly of the utmost value in ordinary switching operations, and are now almost universally used for high-tension work. It is easily seen, however, that should the contents of such oil tanks catch fire there is every probability that it would be a most difficult matter to cope with the flames so produced. It is even more difficult when such switches are placed in a tunnel or chamber having a strong natural draught, as the rush of air caused by the fire is apt to fan the flames, and to make the trouble more difficult to deal with. For this reason the writer suggests that the type of switchboard which depends on natural draught for its ventilation at the back, and is closed at the ends by open-work grilles of expanded metal, should be modified by placing sheet-iron doors in place of the grilles, and using an electric fan to blow air through the chamber, which fan can be shut down if a fire develops inside, thus rendering the air stagnant, and assisting to quench the flames of a secondary fire.

A very good method which has been adopted on some switchboards is to enclose the incoming cables, and so far as possible, their connections even after leaving the dividing box in a sheet-iron trough or tray, which is then filled up with sand and a cover put on. This casing is then bound over with suitable clips, and the whole arrangement made fairly air-tight. The advantage of this is that should an arc develop, either in the cable, dividing box, or the leads, it will immediately melt some of the sand in its immediate vicinity, and this sand will form an insulating flux which will spread over the part affected by the arc, and tend to interrupt the circuit, thus quenching the arc. The disadvantage of this arrangement is that should it be necessary to inspect the cable or to make alterations, the casing is sometimes rather cumbersome to remove, and the sand is awkward to deal with, and such removal should not be attempted unless the portion of the switchboard in the vicinity is rendered dead. It will be seen, however, that the whole of the cable within the vicinity of the switchboard can be easily cased in in this way, and a means of protection against fire afforded at low cost, which goes far to eliminate fire risks. If, in addition to this, a wide earthed tray or trough filled with sand be placed all along the floor of the switchboard underneath the oil switches, it is evident that even should a switch tank catch fire and spill its contents, the burning oil will fall down into the sand and be soaked up by it, spreading only a short distance, and will burn itself out instead of allowing the stream of burning oil to spread itself over the floor of the switch chamber, and to drop off the switch gallery on to other apparatus.

The above notes do not cover this subject. They are only intended as indications of some of the means which can be adopted, and they are written with a view to promoting further discussion on a very important subject.

SOME NOTES ON CANVASSERS AND CANVASSING METHODS.

By "X. Y. Z."

A great deal has been written on the subject of Publicity in connection with the supply of electricity during the past few years—so much, in fact, that it might be considered that the subject has been well-nigh exhausted. The result of all this is that an efficient Publicity department is now considered a necessary section of every electricity supply undertaking. It is recognised that without this department the business of the undertaking will not increase at a satisfactory rate. The function of a Publicity department is two-fold; it has not only to demonstrate to the potential consumer that electricity can be advantageously used for a variety of purposes, but it has also to overcome the inertia of the individual, to persuade him to spend the necessary money and to make the requisite effort in order that he may avail himself of the advantages offered. This may appear to be so transparently true as to be hardly worth writing down, but, notwithstanding this, it is also likely to be overlooked in connection with Publicity work generally. In short, it is not sufficient that a person should know that electricity will do something or other for him—light his house, drive his shafting—but it is also requisite that there should be some influence or other to persuade him to allow it to do this. This is rendered particularly necessary in view of the fact that, from the point of view of the average person who reads the daily papers, and sees the gas company's canvasser as well as the electricity supply authorities' representative, there is not much to choose in point of cost between the two illuminants; indeed, there are not a few people who hold the exceedingly antiquated opinion that for ordinary inside lighting, at all events, gas is a good deal cheaper than electricity, having regard for quantity of light only. This persuasive force which is nearly always required, is, of course, only to be supplied and directed by personal interview; no advertising, however taking, or letter, however clever, will do it. It is with the methods of canvassing and the qualifications of canvassers that the writer purposes dealing in this article.

In the first place, a canvasser must be something more than an ordinary commercial man. Unlike the usual traveller, he does not sell a particular article, but his function is to persuade the prospective consumer to take a continual supply of that commodity in which the canvasser is interested. Again, although the consumer buys each quarter, and pays for, a quantity of electrical energy, as such it is of no use to him; to be useful it must be converted into light, mechanical power or heat. These considerations suggest that a first-class canvasser should not only be a man of good address and general education, but that he should be endowed with a good and sound technical knowledge. He should be absolutely *au fait* with figures relating to gas-lighting, having at his finger tips the gas consumptions of all the up-to-date gas fittings, and also an approximate figure for their cost of maintenance. In addition, he should have thoroughly analysed any schemes put forward by the local gas authority, and have calculated the costs of gas, maintenance, and renewals. With this information, and in this way, he will acquire a familiarity with gas lighting which will be invaluable, as the prospective consumer will have more confidence in a man who knows exactly what gas can do. Such a canvasser will also be able to quickly calculate the exact advantage offered in connection with any special proposition put forward by the gas authorities, and he will not infrequently find, and of course explain to the consumer, that these propositions are actually not as advantageous as they at first sight appear. A canvasser who lacks this intimate knowledge of the details of gas lighting will be at a great disadvantage in interviewing a shrewd business man who has gone thoroughly into the question of the relative costs of both illuminants. In such a case as this it is essential that the canvasser should be quite familiar with both sides of the question.

A canvasser should, of course, be able to give an approximate estimate of the cost of an installation; this should be sufficiently near the actual figure at which the work can be done for it to be called an estimate, and not a rough guess very much too low. A canvasser will be called upon to advise the consumer respecting his installation, and to suggest schemes of illumination. This should be considered as part of the actual canvassing work, and not as a little "extra" afterwards thrown in free of charge. If the former view be taken, the canvasser will conscientiously act for the consumer, and his object will be the satisfaction of his client rather than the swelling of his commission. To advise on these lines the canvasser will have to keep in touch with all developments and improvements in electric lighting. With regard to the canvassing of prospective power users, the requirements of the ideal representative are far more extensive; it is safe to say that such a canvasser should be an engineer. Especially is this the case with the small power user. The displacing of a gas engine by an electric motor will nearly always involve some small alteration in the arrangement of the factory; the canvasser should be able to see clearly what alterations have to be made, and be able to explain these to the consumer, and give him a good idea of the cost. It frequently happens, for instance, that the installation of a motor involves the fixing of a short length of countershaft. The canvasser should be competent to see precisely how this can best be done, and to explain this to his client by a respectable sketch. The determination of the size of motor required is frequently by no means a simple matter. Little assistance can be obtained by an inspection of the gas engine if this should be of obsolete pattern. It will be requisite for the canvasser to have sufficient knowledge of the actual machinery used by the consumer to determine the power required. In many cases the owner of a factory has no idea as to the power his machines absorb, but he will know precisely their output with regard to the commodity in which he is interested. It is from this information that the canvasser should fix the size of motor to be installed, and to be able to do this accurately and certainly, he must have an extensive knowledge of the power required by all classes of machinery usually met with. To collect and obtain this information is no easy matter, but there is no question as to its utility. In this connection it will be of great service for the canvasser to visit the various trade exhibitions, where he will be able by a little diplomacy to obtain quite a quantity of information of a most valuable kind.

Canvassing methods will naturally vary with the disposition of the person being dealt with, and the canvasser must be a man possessing sufficient tact to determine clearly the attitude which it will be most advantageous to assume. In all cases, however, the prospective consumer should be regarded as a distinct personality, and not merely one of a huge collection of out-of-date beings who have yet to be instructed in the inestimable benefits of the use of electricity. In other words, it is not sufficient for the canvasser to be a kind of portable phonograph, who can reproduce glibly the information contained in circulars and smart advertisements. The use of the statement that electricity is x per cent. cheaper than gas—x being intended to vary with the apparent credulity of the man dealt with—is getting to be of less and less use. Information of this kind is imparted very much more cheaply, and almost as effectively, through the medium of circulars, and so forth. What is wanted is that a business proposition should be submitted to the prospective consumer, an offer to light his premises for so much per week. To treat with people in this way requires some amount of technical skill as well as sound business ability, but in these days, when most of the easy business has already been obtained, it is the only way to conduct successful canvassing.

The business to be obtained by canvassing, however skilful, depends necessarily on the resources of the canvasser in the way of special schemes and rates, as well as the prices of electricity and gas in the locality. These last are, presumably, governed by circumstances outside the scope of this article, but in the matter of special schemes, it is desirable to mention that these will very much assist the progress of the use of electricity. It is only right that those consumers, the nature of whose load will be beneficial to the supply authority, should share in this benefit, and it is with this object that the schemes for outside lighting are arranged. One of the great advantages of a good scheme of this kind is that it includes maintenance. The canvasser should know the proportion of the charge that is allocated for this item, and also the price per unit of current under such scheme. It is a further assistance to the canvasser, when installation work is undertaken by the supply authority, to be able to come to terms at once with regard to the price of the wiring and fittings. This should certainly be done by the canvasser, who should in ordinary circumstances do all business with his client. A further point that may be mentioned is the question of special rates to consumers who will guarantee a considerable minimum consumption. In all towns there will be premises which, lighted electrically, would take a sufficient supply to justify the consumer entering into an undertaking of this kind; and if this be the case, a special discount, in addition to that to which the consumer would be ordinarily entitled, could be arranged.

The subject of this article is too comprehensive to be effectively treated in a small space, and the aspects of the matter touched upon here have been few. The question of canvassing becomes increasingly important as time goes on, especially in those districts which are not capable of extending in habitable area. In any town there are, roughly speaking, three classes of premises: Those in which electricity will be used as soon as it is available, such as theatres, and the best class of residential property; those in which electricity will be used with a little persuasion and by the aid of a little circularising, such as better class shops; and, thirdly, those premises whose occupants who can only be obtained as consumers by skilful canvassing. The remainder, which is hopeless or impossible, need not be regarded; except perhaps to say this, that it is not so large as might be imagined. As publicity work has been a good deal to the front of late years, business of the second or easy class has almost disappeared, and that remaining is only to be obtained with difficulty and patience. People representing this third class receive the usual advertising statements with stony indifference, and are absolutely unaffected by the smartest publicity literature, or the cleverest circular letter, even though it be typewritten and signed.

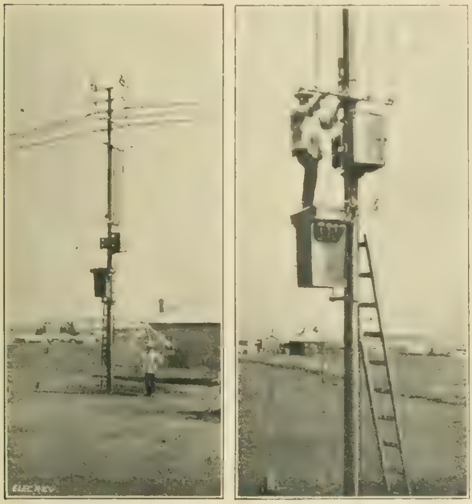
The canvassing of such people is really difficult, as not only has ignorance to be dispelled, and prejudice to be overcome, but a keen business instinct has to be met by one no less keen and, perhaps, a trifling amount more subtle.

ELECTRIC SUPPLY AT ROODEPORT, TRANSVAAL.

Since the Victoria Falls and Transvaal Power Co. got to work, the electricity supply of the various townships along the route of their mains has been undertaken by the company. It may be of interest to briefly describe the installation at Roodeport and adjacent townships which come under the Roodeport municipal control.

At the municipal boundary a mast switch is provided controlling the H.T. supply, which is three-phase at 3,300 volts, 50 cycles, and from here it is led direct to the main transformer house, centrally situated.

This transformer house contains two 50-KW. three-phase oil-cooled transformers, reducing the pressure to 400 volts between phases, 230 volts to neutral, and suitably controlled by a four-panel cellular pattern switchboard fitted with various meters, releases, oil switches, &c., on the H.T. side, and a three-panel board on the L.T. side, with the usual instruments; from this L.T. board the distributors are taken overhead to all the consumers, as well as for the public lighting, which is controlled from this point. From here also a H.T. main is taken out overhead to supply the adjoining townships of Roodeport North, Hamburg and Maraisburg.



Pole Line Construction, Roodeport, S.A.

At each of these townships a mast pattern single-phase oil-cooled transformer is fixed for reducing the pressure to 230 volts, and is suitably protected by H.T. and L.T. fuses.

At Florida township a sub-station is provided, which is practically a replica of that in Roodeport, except that it is of a smaller capacity. The overhead mains consist of bare copper wire supported on steel tubular poles, the cross-arms being of galvanised tubing, and wherever it is possible to arrange it, the H. and L.T. wires are carried on the same poles, with a carefully earthed guard netting between them.

The public lighting consists of artistic brackets carrying 60 and 100-C.P. "Fortiter" metal lamps, and in view of the fact that the townships of this municipality lie some five miles apart, great appreciation has been expressed at the lighting on the lonely veldt roads.

Some 500 poles were used in the carrying of the mains, and over 2,000 insulators, and owing to the rocky nature of the ground, many of the holes had to be blasted to set the poles in.

The whole of the plant was put into operation at the end of January, and though at that time of the year lightning storms are most severe, the precautions taken to avoid disturbances have been very effective.

The H.T. lines are protected by horn and Wurtz arresters, and the L.T. lines by disk arresters provided with graphite resistance. A large number of consumers are already connected, and extensions are now being carried out by the municipality.

The consulting engineer was Mr. H. W. Clayden, the work being carried out by Mr. W. A. Hodge, the town engineer, who was responsible to the electrical contractors, the Union Electric Co., of Johannesburg, of which company Mr. H. W. Curling is manager.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

DENMARK.—The Danish Customs authorities have decided that electrical apparatus made up of different component parts, such as alternators, switches, fuse boxes, &c., which cannot from their nature and composition be referred to any other number of the tariff, will be included under Tariff No. 301 (unspecified goods), dutiable at the rate of 7½ per cent. *ad valorem*, provided the Customs examiners are in any doubt as to what can really be said to be the characteristic components of the article, *i.e.*, in all cases in which an immediate decision cannot be arrived at.

FIJI.—An ordinance revising the Customs tariff has recently been passed. The following are the chief items of interest to our readers which are affected by the revision, and the new rates replace those published some time ago in our columns:—

	Old rate.	New rate.
Boilers, steam, and component parts thereof, and boiler plates	Free	7½ % ad val.
Earthenware, chinaware, glass and glassware, not elsewhere specified	15 % ad val.	12½ ,,
Fuses...	15 ,,	12½ ,,
Lamps and lampware	15 ,,	12½ ,,
Machinery and component parts thereof which the Governor in Council may from time to time specify, including agricultural, mining, electrical, paper-making, sawing, sugar-making, steam engines, oil engines, gas engines, hot-air engines, &c.	Free	7½ ,,
Rails, fishplates, switches, crossings, turntables, railway sleepers of iron or steel ...	Free	7½ ,,
Parts of iron and steel railway materials	Free	12½ ,,
All articles not specified in the tariff and not included in the free list	15 % ad val.	12½ ,,

CORSICA.—A law has recently been passed providing that foreign products on importation into Corsica shall in future be dutiable at the rates set out in the French tariff, with one or two exceptions that do not interest the electrical trade.

BOLIVIA.—The Board of Trade is informed that the duty of 2 per cent. recently imposed by law on articles which had previously been free of duty is assessed, so far as concerns articles subject to appraisement (*i.e.*, articles the value of which is not fixed by the official valuation tariff, but taken from the invoice), on the price in the country of origin, increased by 20 per cent. The following articles, however, are free of all duties:—Merchandise imported for the use of the different Government departments, under authorisation of the Minister of Finance; that which is imported for the personal use of members of foreign legations; importations for railroad undertakings in virtue of existing contracts; material destined for the Lighting and Power Co. of Cochabamba; merchandise freed expressly by international treaties; articles destined for hospitals and charitable institutions; materials for public works imported by the municipalities; articles which are imported for educational establishments; mining and agricultural machinery, and accessories for the same.

AUSTRALIA.—The Commonwealth Customs authorities have recently decided that binders or tapes of copper for electrical purposes, being copper strip merely cut to length, shall be admitted free of duty, whether of British or foreign origin.

NEW ZEALAND.—The Customs authorities have recently issued the following decisions as to the duties to be levied on certain electric appliances :—

Conduit piping junction boxes of iron, fitted with vulcanite disks (claimed as fittings for iron pipes)	20 %, ad val.
Disks, vulcanite, bored, for conduit piping junction boxes	20 ..
Electric garage lamps, being portable hand-lamps	10 ..
Glass accumulator jars	20 ..
Starting compensators, hand operated, for alternating-current motors	20 ..
Electric eye magnets to remove metal from the eyes	Free

Note.—The duties quoted are in all cases those levied on goods of British origin, under the preferential tariff.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,908. "Electric flame arc lamps of the magazine type." H. E. Angold. August 19th.

18,913. "Dynamo-electric machines." B. Brooks and W. Holt. (Addition to 26,880, 1910.) August 19th.

18,914. "Dynamo-electric machines." B. Brooks and W. Holt. August 19th.

18,922. "Mercury vapour lamp." W. R. Wallsey. August 19th.

18,980. "Electric switches." A. Page. August 19th.

18,990. "Thermo-piles." J. Marschall. August 19th. (Complete.)

19,000. "Means for converting a current." A. R. Bullock. August 19th. (Complete.)

19,038. "Ignition systems for starting explosion motors." R. Magondeaux. (Convention date, March 20th, 1912, France.) August 20th. (Complete.)

19,053. "Construction of electric kettles." C. R. Belling. August 20th.

19,054. "Construction of heating elements for electric radiators and the like." C. R. Belling. August 20th.

19,064. "Electrically-heated cooking ovens and the like." H. J. Piper and R. A. Bridgwater. August 20th.

19,069. "Igniting current-distributors for internal combustion motors." Siemens & Halske Akt. Ges. (Convention date, August 26th, 1911, Germany.) August 20th. (Complete.)

19,073. "Electric snap switches." C. J. Klein. August 20th. (Complete.)

19,099. "Hand-regulated electric arc lamps or projectors." R. Rigby. August 20th. (Complete.)

19,102. "Means for telephonic communication with mine cages." J. H. Reineke. (Convention date, August 29th, 1011, Germany.) August 20th. (Complete.)

19,103. "Means for telephonic communication with mine cages." J. H. Reineke. (Addition to 19,102/12.) August 20th. (Complete.)

19,113. "Apparatus for measuring the electric conductivity of liquids," M. Coplans. August 21st.

19,118. "Electricity meters." S. H. Holden and Chamberlain & Hookham, Ltd. August 21st.

19,134. "Controllers for electric motors and the like." Electrical Control, Ltd., and J. H. Cowell. August 21st.

19,164. "Automatic electric cut-out switches." R. Winterhalder. August 21st. (Complete.)

19,172. "Electric furnaces." G. Massip. (Convention date, August 22nd, 1911, Germany.) August 21st. (Complete.)

19,174. "Miners' electric lamps." O. Oldham. August 21st.

19,199. "Cinematograph gas or electric lamp and attachment." A. Kendrick. August 22nd.

19,203. "Apparatus or appliances for electrically operating and controlling valves." A. Bryan and L. F. Mountfort. August 22nd.

19,213. "Enumeration of telephone calls." S. D. Williams. August 22nd.

19,249. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,250. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,251. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,252. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,253. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,254. "Telephone systems." Automatic Telephone Manufacturing Co,, Ltd. (Automatic Electric Co,, United States.) August 22nd. (Complete.)

19,255. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) August 22nd. (Complete.)

19,257. "Electrical winding gear for clocks and the like." L. J. Aron, C. Werner and X. L. Electric Co., Ltd. (Addition to 9,154 of 1912.) August 22nd. (Complete.)

19,264. "Electric arc lamps." N. H. Balfour and A. B. Hitchin. August 22nd.

19,267. "Electrically-heated blankets and other coverings and appliances." J. de Bernard and J. Ebbsmith (trading as Marie Earle). August 22nd. (Complete.)

19,287. "Electric furnaces." L. Gonnet. (Convention date, March 15th, 1912, France.) August 22nd. (Complete.)

19,301. "Electric safety and regulating-current switches." E. M. Bailey, W. Taylor and B. Bailey. August 23rd.

19,310. "Electric lampholders." J. W. Townsend. August 23rd.

19,318. "Self-contained portable electric lamps." S. Stern and British Ever-Ready Electrical Co., Ltd. August 23rd.

19,341. "Circuits for establishing a connection between subscribers connected to different telephone exchanges." Siemens Bros. & Co., Ltd., and E. A. Laidlaw. August 23rd. (Complete.)

19,345. "Means for lighting vehicles by electricity." S. L. Price. August 23rd.

19,405. "Series-parallel electric lighting or power circuits." A. P. Lundberg, G. C. Lundberg and P. A. Lundbbrg. August 24th.

19,425. "Feeding mechanism for the electrodes of electric arc lamps." F. Steinert. (Divided application on 1,755 of 1912, January 22nd.) August 24th. (Complete.)

19,429. "Electrically-controlled clocks." N. Friedmann and I. Friedmann. August 24th. (Complete.)

19,432. "Electrically-operated driving systems." Crompton & Co., Ltd., C. Macfarlane and H. Burge. August 24th.

19,448. "Electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 24th.

19,451. "Switches for electric hand lamps.," S. Stern and British Ever-Ready Electrbcal Co., Ltd. August 24th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford ; price, post free, 9d. (in stamps).

1911.

Controller and Regulating Resistance for Electric Motors. W. W. French. 6,997. (Convention date, September 21st, 1911.)

Means for Regulating Electric Lamp Circuits. H. Leitner. 17,791. August 4th.

Electrical Heating Apparatus, particularly Vulcanisers. W. H. Welch and Harvey, Frost & Co., Ltd. 17,810. August 4th.

Registering Device for Telephone Systems. Western Electric Co., Ltd. (Western Electric Co.) 17,874. August 5th.

Magneto-Electric Apparatus. W. Douglas. 17,932. August 8th.

Wireless Telephony. H. G. Matthews. 18,284. (Cognate application, 25,718 of 1911.)

Automatic Starters for Electric Motors. M. B. Field. 18,611. August 17th.

Ignition Systems for Internal-combustion Engines. L. J. Flint. 18,699. August 19th.

Electrical Appliance for Transmitting Messages, with Provision for taking a Record of each Message and notifying the Record to the Sender of the Message. D. S. Davies and C. H. Mason. 19,210. August 28th.

Ignition Plugs. H. G. Longford, W. W. Longford and W. A. Clark. 20,207. September 12th. (February 29th, 1912.)

Arc Lamps. W. R. Ridings. 21,795. October 3rd.

Controllers for Electric Motors. W. B. Bennitt. 21,800. October 3rd.

Vapour Electric Apparatus. P. C. Hewitt. 21,904. October 4th.

Distribution of Electrical Energy. P. V. Hunter and W. L. Shand. 22,624. October 13th.

Electrolytic Apparatus. A. E. Knowles. 22,759. October 16th.

Apparatus for Actuating Conduit Covers and Collector Ploughs of Electric Railways. D. D. Samaia. 23,495. October 24th.

Electric Lighting and Heating of Railway or other Vehicles. Pintschs Patent Lighting Co. and C. H. Vidal. 24,552. November 4th.

Automatic Telephone Systems. G. A. Betulander. 25,216. (November 16th, 1910.)

Electric Heating Appliances and Electrodes for Electro-Medical and other Purposes. G. Jahr. 25,477. (November 15th, 1910.)

Process for the Electrical Welding of the Seams of Tubes. Ges. fur. Elektrotechnische Industrie. 26,440. (December 7th, 1910.)

1912.

Electric Igniters. J. Born. 8,327. April 6th. (April 7th, 1911.)

Speed Regulation of Alternating-current Induction Motors. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) 9,134. April 18th.

Electromagnetically-controlled Gas Valves. Compagnie du Gaz Electrique. 14,466. June 20th. (April 17th.)

Telephone Systems. Derriman. (Automatic Electric Co.) 15,135. (Divided application on 15,133 of 1911. June 28th.) June 28th.

Incandescent Electric Lamps. R. H. Singley. 3,348. February 9th.

Electro-mechanical Device for Recording and Reproducing Sounds and Optical Impressions. M. E. Thomas. 4,185. February 19th.

Control of Variable-speed Dynamos, such as those employed for Train Lighting. Electric and Ordnance Accessories Co., J. Etchells and E. W. Price. 6,269. (Addition to 6,611 of 1911.) March 13th.

Electric Incandescent Lamps. A. C. Hyde. 6,487. March 15th.

Frequency Indicator for Alternating Currents. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 7,658. March 29th.

Construction of Electric Resistance Devices. G. Cooper. (Boelling.) 9,861. April 25th.

Submarine Cables Artificially loaded with Self-induction. Siemens and Halske Akt.-Ges. 10,053. (April 28th, 1911.)

Process for the Electro-deposition of Zinc. E. Ballegeer. 11,271. May 11th.

Driving Arrangements of Ignition Magnetos. W. A. Hill. 12,193. May 22nd.

Arc Lamps. Harle & Cie. 13,358. (June 15th, 1911.)

Electrolytic Apparatus. A. E. Knowles. 15,103. (Divided application on 22,759 of 1911. October 16th.)

Barking Electricity Supply.—The income of the electricity undertaking for the year ended March 31st last amounted to £13,185, as compared with an expenditure of £9,480, which leaves a gross trading profit for the year of £3,704. The units sold to the tramways undertaking amounted to 319,500, which, at 1½d. per unit, brought in a revenue of £1,997. The total quantity of units generated during the year amounted to 1,943,307, and of this amount 1,569,164 were sold (960,793 for private lighting and power, 288,871 for public lighting and 319,500 for traction); 269,642 were used on works, and 104,501 used in distribution. The maximum demand on the feeders during the year amounted to 680 kw. ; £6,218 of the total expenditure for the year went towards generation expenses, while £1,208 represented the cost of distribution. The total expenditure on capital account during the year amounted to £466, while the expenditure since the commencement of the undertaking amounts to £63,055.

THE

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LABOUR UNREST.

UNDER the heading "Drastic Proposal" an article appeared in the *Westminster Gazette* a few days ago from the pen of "A Working Man," putting forward what is claimed to be the working man's case for an all-round advance of 5s. a week, and a working week of 48 hours. It is proposed that all Trade Unions shall join in a national demand for the above conditions, and, if the demand be not complied with, shall enforce compliance by means of a general strike.

It might be thought by those outside the Unions that past experience of the results of great strikes would have taught the lesson that this weapon is a very unsafe one to play with, for it generally, one might say invariably, does more damage to the workmen than to the employers.

West Australia is sometimes spoken of as the working man's paradise, and successive Labour Governments have, by class legislation, raised workmen's wages and reduced the hours of labour, all with the idea of improving the position of the workman. The net result is that the Australian Labour Party has now to admit that the purchasing power of the weekly wage has actually fallen: due, of course, to the inevitable rise in prices which shorter hours and higher wages must produce.

Without following "A Working Man" in his argument that "the responsibility for all high prices, low wages and long hours rests upon the shoulders of the manufacturer," let us turn to his reasons for assuming that the effect of a five-shilling rise, coupled with a 48-hours' week, "will be one of universal advantage." His argument is given in the following sentence:—"The more goods there are consumed, the more will have to be manufactured; the more goods there are manufactured, the more people will be employed in the manufacture (for a time, at least); the more people there are engaged in the manufacture of consumable goods, the more wages will be paid; the more wages that are paid, the more will be spent; the more wages spent, the greater will be the return to the employers by the increased demand for goods."

It seems almost too cruel to cast a shadow over so sublime a picture by calling attention to the words which the author has placed in brackets. "*For a time at least.*" How painfully, how pathetically obvious that the wish which was father to this beautiful thought, was not backed by any conviction. "*For a time at least.*" Let us leave it at that.

There are many points in the article that might be referred to, but let us, for the sake of argument, grant the author's premiss that the effect of a 5s. rise and a reduction in working hours all round would be a universal advantage. If 5s., why not 10s.? and if 48 hours, why not 38? It is obvious that if we push the argument far enough, we shall arrive at the conclusion that the hours of labour might, with advantage, be reduced to zero, and the wages increased to infinity. This is obviously absurd, because nothing would be produced but starvation. If, on the other hand, we push to its limit the idea that longer hours and lower wages would be an advantage, we arrive at the conclusion that infinitely long hours (that is, continuous work) and minimum or zero wages would be the best all-round solution, a conclusion as absurd as the other. Nor can it be said that the one method would benefit the worker and the other the employer; both would suffer.

It is obvious, therefore, that there are other considerations to be taken into account, and the problem is a much bigger one than "A Working Man" would have us believe.

It is interesting to notice that the more thoughtful and sober of the Labour leaders show a disposition to deprecate the use of the strike as an everyday weapon—probably influenced by the unfortunate experiences gained in recent strikes. Mr. Ramsay MacDonald, for instance, dealing with the question of the "minimum wage" at the British Association, said he had come to the conclusion that the best means of attaining the desired end was voluntary arrangement between employers and workmen. Compulsory arbitration, in his opinion, was impracticable in this country, owing to the impossibility of enforcing the awards. The difficulty in the way of voluntary arrangement was that one or two employers might decline to be parties to the agreement, and by paying lower wages would be able to undercut their rivals; this could be overcome by imposing the terms, when drawn up by the best employers and workmen in a given trade, upon the whole of that trade. Sir C. Macara indirectly supported these views, stating that the inquiry conducted by the Industrial Council, of which he was a member, into the observance of industrial agreements had conclusively proved that when perfect organisation existed on both sides, disputes were usually settled without a stoppage of work, and that the recent industrial unrest originated with trades that were not well organised.

As bearing on the "drastic proposal" outlined above, we may also quote the view of Mr. Ramsay Macdonald, who laid down the general principle that the reward of labour must have some relation to the mechanism and system of industry under which the wage operated. They must not make demands for minimum wages or for the workers' share of industry that would paralyse the industrial system and create chaos.

The reckless use of the strike was condemned at the Trade Union Congress last week, and the Syndicalists, who advocate a general strike as a means of bringing the community to its knees, were crushed by an adverse vote of more than 30 to 1. We trust, therefore, that calmer and wiser counsels will prevail, and that conciliation and agreement will take the place of strikes and intimidation in the future.

Superheat and Cylinder Power.

In a recent article in the *Engineer*, Mr. C. R. King has much to say on the effects of superheat. Unfortunately, he bases his article on a misconception, and appears to be arguing on the basis that steam engineers generally proceed on the assumption that the bulk of steam matters, and that, therefore, a pound of superheated steam will do more work than a pound of saturated steam because, being more bulky, it will fill the cylinder to cut-off point more often. This notion is held by some people, and, indeed, it has been put forward editorially in the very journal in which Mr. King's article appears, if memory correctly serves. But the assumption thus made is not universal. Steam men of experience know that the first thing to be done on applying superheat to a fixed cut-off engine is to make the cut-off take place later. Automatic engines do this for themselves. The steam engine is a heat engine, and works by virtue of heat, not by virtue of steam. Steam is but the agent by which the heat performs work. Bulk in steam is not in itself valuable; it is only heat that counts. Now, per cubic foot of space occupied saturated steam contains more heat than superheated steam, and will do more work. The only good which superheat effects is to maintain the steam in the free molecular state—*i.e.*, not in the form of hot water. Water molecules possess no automatic translatory movement by virtue of the heat in them. Such heat is lost for purposes of work. Only when the molecules are so hot that they will travel in space by their heat-generated power of automobility can they do work.

When steam is superheated its increment of heat is less than its increment of volume, and less heat can enter a given cylinder at any given cut-off. The cut-off must therefore be put later. In the saturated steam engine the admission space contains so much steam and so much water. This hot water has been formed by cylinder metal action during admission; it is killed steam. But as the pressure drops behind the moving piston, this hot water begins to boil and produce steam to do more work, though at a great expense of heat, the ebullition being so late and the cylinder being a bad place in which to raise steam, for well-known reasons. From an engine with an unchangeable cut-off, the most work can be got by exceedingly wet steam, but the economy will be very poor.

The most economical engine will be that which carries its steam dry for a certain undetermined distance between the cut-off and the exhaust point. The further the superheat or absolute dryness is carried, the larger must be the cylinder. Large cylinders are necessarily less economical than small cylinders, losing more heat by radiation and other causes. Some engineers are content if the steam will start its expansion just superheated. Others like it to carry superheat up to exhaust point, and others, as Mr. King points out, would even exhaust at 11° of superheat. So let the point be somewhere shorter than the maximum cylinder would demand, *i.e.*, somewhere along the curve of expansion. Mr. King is quite wrong when he states that it is "universally accepted theory" that "superheated steam increases power in the cylinder." The contrary has been put forward in these columns for 20 years. Indeed, superheat has never been put forward in these columns as productive of economy because of any thermodynamic reason. Thermodynamics and entropy have nothing to do with practical superheat. Only engines of the very extreme order, demanding more care than the economy warrants, can gain from superheat anything but that indirect but valuable asset, absence of excessive cylinder condensation.

It has been a misfortune for steam engineering that the academical view of superheat, viz., that its economy is measured by the raising of the T_1 of the thermodynamic equation of efficiency, has been supported by the curious coincidence of Rankine's calculated thermodynamic gain and the actual secured economy. Rankine appears to have accepted the coincidence as a proper occurrence, though he had something to say which showed he had some idea there was cylinder condensation. But he did not get outside the thermodynamic field in "The Steam Engine." Except that saturated steam entering a cylinder implies 20 per cent. or more of water also when expansion begins, saturated steam would not show more power than superheated steam which only carried superheat to the cut-off point. Most moderate men on superheat advocate that the expansion shall start fully dry, which means that, as in all engines, the boiler does all the work up to cut-off point and the steam in the cylinder does all the work during expansion.

Superheat will undoubtedly give economy, but not from thermodynamic causes. We fear Mr. King is only tilting at a windmill that has long faced no wind, for only a few cranks ever did place any credence in the bulk theory of superheat action. The reduced work per unit volume of superheated steam has almost invariably been met by later cut off. Higher pressure is not usually possible in converted engines; and only in plants new *ab initio* is it usually practicable to put in a bigger cylinder or use a higher pressure than is usual in current practice with saturated steam.

THE BRITISH ASSOCIATION.—II.

On Thursday last week Section G joined Section A to hear Prof. Callendar's presidential address, which was abstracted in our last issue. At the conclusion of the address Lord Rayleigh, proposing a vote of thanks, said that Prof. Callendar's references to Sadi Carnot were perfectly justified; it was impossible to value Carnot's work too highly. He doubted whether in using the word "caloric" Carnot intended to convey the same meaning as that which could at this date, in view of subsequent discoveries, be attributed to it. Nevertheless, Carnot's work held good to-day. In speaking of the X-rays, it was worth remarking that even now, 15 years after their discovery, it was doubtful whether they were undulatory or corpuscular in their character.

On Friday the joint discussion (Sections A and G) on wireless telegraphy took place; this was regarded—at any rate, by the engineering profession—as the principal feature of last week's proceedings, and we have, therefore, devoted much space to the report of Prof. Fleming's introductory remarks and to the contributions of other authorities to the discussion. There followed a paper by Dr. Eccles and Mr. A. J. Makower on "The Production of Electrical Oscillations by Spark-Gaps immersed in Running Liquids," and one by Prof. Kennelly and Mr. G. W. Pierce on "The Impedance of Telephone Receivers as affected by the Motion of their Diaphragms;" and Prof. J. T. Morris read a paper on "A Method of Measuring Wind Velocities by Means of Wires Heated by Electricity and Exposed to the Wind." By measuring the temperature of the wind as it strikes the wires, and the current required to maintain exactly constant the temperature of the wires, an exact measure of the velocity of the wind is obtained.

In Section A, on Thursday, several electro-physical papers were read, including one by Prof. R. A. Millikan on "The Discharge by Ultra-Violet Light of High-Speed Electrons."

On Thursday evening there was a reception by the Lord Provost, which was attended by most of the members.

On Friday evening Prof. Bragg, of Leeds University, delivered an "Evening Discourse" on "Radiations Old and New," which was well illustrated with experiments and lantern slides; amongst the latter, photographs by Mr. C. T. R. Wilson, showing by means of condensed moisture in the atmosphere the path of the Alpha rays, were much appreciated.

Saturday was wholly devoted to excursions in the neighbourhood of Dundee.

At a meeting of the General Committee on Friday, Sir W. H. White, K.C.B., F.R.S., was elected President for next year's meeting at Birmingham.

In his address to Section F (Economic Science and Statistical Section), Sir Henry H. Cunynghame, K.C.B., said that Auguste Comte was one of the earliest writers who maintained that the social and political sciences were subject to laws just as exact, though more complicated, as the laws which govern the physical sciences; and he formulated the celebrated principle of the three phases of thought. According to this view all sciences commence with a theological stage, pass through a metaphysical stage, and end by becoming positive.

"One of the signs that a science has passed into the positive stage is that it has been subjected to the laws of mathematics. Mechanics, physics, chemistry and electricity have long since been treated mathematically. Biology has only recently begun to receive mathematical treatment. . . . But all the social sciences are for the most part still in the metaphysical stage. The doctrine of the divine right of kings has only disappeared in order to be replaced by the doctrine of the divine right of majorities. Yet from a positive point of view neither of these stands on a footing much firmer than that of the other. The 'duty of obedience to authority' and the 'right of resistance' are in the same condition. The 'right to work,' 'the right to live,' 'the right to a living wage,' 'the right to the vote' are all metaphysical propositions assumed as axiomatic by various energetic writers and speakers, and are usually advanced with a dogmatism proportioned to the uncertainty of their foundation. Yet on what basis do they rest? One might with equal cogency declare for 'the right of the stronger to destroy the weaker,' 'the duty to improve the race by permitting and encouraging the forcible elimination of the unfit.' . . . Another example is the metaphysical aphorism that every right involves a corresponding duty, so that if I have a right to do a thing it is the duty of others concerned in the action to let me do it. This axiom seems at first sight to have a certain amount of plausibility. But does it follow, from the fact that I have a right to kill my ducks, that it is their duty to come and be killed? . . . Thus also the right to individual property, the right to an equality of enjoyment, the right to an equality of opportunity, the right of an individual to be considered as an end in himself, the duty of an individual to be considered only as part of an organised society, are all metaphysical assumptions having no firm positive basis. Equally baseless is the axiom that wherever the State enjoins a duty, as on a parent to educate his children, the State ought to pay for it; or that a local authority contributing funds to an object has a right in every case to interfere with their administration. Yet these are mere chance specimens of the political dogmas that have for years been flying about, and which emphasise the undoubted fact that politics and social science have not yet entered the positive stage of thought."

"In what stage is Political Economy? It appears still to be the battle-ground of opposite schools. Some there are who tell us that it has 'gone to Saturn.' . . . Is it meant that the so-called laws of economics are not laws at all, and that the whole pretended science is built on false foundations? Or is it meant that those engaged in the practical politics of the country have resolved to legislate in defiance of the laws of economics, and to settle the problems of free trade and protection, the taxation of fixed and movable property, and the regulation of wages, as though these problems were not subjected to any natural laws at all? The latter position would, of course, be particularly dangerous if it turned out that there were laws, and that those laws were being ignored."

"I suppose most economists would agree that (provided suitable meanings are given to the words) 'wages in a free market depend upon the demand and supply of labour.' A legislature, wishing to remedy social inequalities and evils, might resolve to render the market no longer free—to impose a minimum wage, or to put a tax upon wages, or in other ways to regulate them by statute. And legislation might go so far as to render wages wholly dependent on scales fixed by authority or by custom. Or, again, a powerful combination, either of employers or of workmen, might unite to fix rates of wages and render it impossible in practice for any other rates to be paid. Systems established by these means might be wise or foolish, beneficial or injurious. But could it be said that the authors of them had succeeded in sending Political Economy to Saturn? Certainly not. They might have rendered inapplicable that chapter of Political Economy which deals with price as fixed by exchange in a free market, but only to bring the case under the next chapter, entitled "Price as Fixed under Conditions of Monopoly." The Political Economy would be there surely enough, with its laws, and with their consequences for those who ignore its teachings."

"If political action be taken in the field of economics such action will, whether the authors of it wish it or not, be governed by the laws of economics, and those who purpose such action must consider what effect it will have on the flow and investment of capital, the demand for commodities, and, in fact, duly take into account the whole problem. For, if they do not, it is not the laws of supply and demand that will go to Saturn. Again, before setting a scheme of taxation we ought to study the cases in which a tax levied on one class falls on another, as, for instance, a tax intended to be paid by landlords, which really falls upon their tenants; taxes levied on tenants which fall on their landlords; taxes levied on producers that can be shown ultimately to fall on consumers, and taxes levied upon commodities that can be shown to fall on the workmen by whom they are produced. For a tax often resembles an arrow shot into the air; though apparently aimed in a definite direction it may fall one knows not where, obedient to the laws of the incidence of taxation, just as an arrow in its flight is subject to the inflexible laws of air resistance, friction and gravity."

The President proceeded to establish his claim for economics to come among the exact sciences by the surest test that can be applied—namely, its capability of being demonstrated by means of geometry and mathematics, and affirmed the truth that national economics is subject to laws as exact and unfailing as the laws of physics, chemistry or engineering, which, if neglected by political engineers, will as certainly bring the State to ruin as the miscalculation of a mechanical engineer in designing a boiler, or of a civil engineer in designing a bridge.

On Thursday, September 5th, after the Presidential address to Section G, by Prof. Archibald Barr, a note by Prof. Thornton on the "Ignition of Gaseous Mixtures by Momentary Electric Arcs," was read and briefly discussed, and also the report of the Committee on Gaseous Explosions.

Prof. Thornton's note described an investigation of the least currents, direct and alternating, which were required to ignite gaseous mixtures at different voltages and frequencies. The lower and upper limits of mixture within which ignition was possible were found to be 4·25 and 14 per cent. for fire-damp in air, 6 and 40 per cent. for coal gas. There was a well-defined maximum of sensitiveness to ignition at 7 per cent. in the former, 8·5 per cent. in the latter. With direct voltage the least igniting current was approximately proportional to the reciprocal of the voltage; with alternating voltage the frequency was of more importance, and the current remained constant over a long range of voltage, being higher for methane than for coal gas. The energy of spark which would just ignite the most sensitive mixtures was about 0·10 joule, corresponding to the combustion of 37 c.c. of an 11 per cent. mixture of coal gas. Single sparks therefore gave relatively poor ignition.

It would appear from the results that when alternating current is used for signalling or when there is no continuous sparking at a contact, the risk from electrical signalling in coal mines is extremely small. Where there is sparking as at a vibrating contact the bells must be enclosed in flame-proof cases, or be situated in places which cannot be reached by fire-damp in mixtures approaching 4 per cent.

One of the most important events of the meeting was the joint discussion on Friday, in Sections A and G, on the scientific theory and outstanding problems of wireless telegraphy, of which we give a report.

Prof. J. A. Fleming, D.Sc., F.R.S., presented the subject, of which he is, of course, a master, in a very complete address, which was a summary of the printed paper, and was concluded by a set of queries as to the points which require elucidation, and a strong appeal for a competent committee to arrange experiments (which would, of course, extend over thousands of miles) to investigate them.

The Scientific Theory and Outstanding Problems of Wireless Telegraphy.

By J. A. Fleming, M.A., D.Sc., F.R.S., Professor of Electrical Engineering in the University of London.

(Sections A and G. Abstract.)

Experts in radiotelegraphy are well aware that many of the scientific phenomena are imperfectly understood. If we are to overcome present difficulties and limitations and make fresh advances, it can only be by a thorough comprehension of the physics of wireless telegraphy. Hence it will be more to our advantage to bring combined scientific thoughts to bear upon the matters on which even leading experts differ or are ignorant, rather than let our symposium resolve itself into a discussion on apparatus or systems or the recitation of performances and the record of results.

With the exception of a small number of stations using the Duddell-Poulsen arc generator, nearly all the practical wireless telegraphy in the world is at present (1912) conducted by the following apparatus:—

At each station there is a transmitter which comprises three elements:—

1. A source of high electromotive force which may be a continuous current dynamo and storage battery, an alternator and transformer, or a battery and induction coil giving continuous, alternating or interrupted high-tension electromotive force.

2. A condenser in which the generator stores an electric charge to be suddenly released when a certain potential is attained across a spark gap in the form of an electric discharge passing through a coil in series with the condenser.

3. An open or radiative circuit coupled to the condenser circuit, comprising an antenna or arrangement of elevated air wires, a balancing capacity or counterpoise often buried in the earth, the two being connected through an adjustable inductance coil.

At the receiving station we have also three elements:—

1. An absorbing antenna by which the radiation from the transmitter is picked up, creating in it high-frequency oscillations.

2. A condenser circuit having variable capacity and inductance coupled to the antenna and syntonised to it.

3. Some form of oscillation detector connected in series or parallel with the above condenser which is affected by the oscillations and sets in operation a recording or indicating device which makes a visible or audible signal.

Generally speaking, at any one station the radiating and absorbing antennæ are one and the same, and used for both purposes alternately, and each station has both transmitting and receiving apparatus. The functions are, however, not identical. What is required in the transmitting antenna is a certain height and also free or insulated ends. In the receiving antenna, not only height but surface is required, although this antenna can be laid parallel with and close to the earth and earthed at both ends; but provided it is half a wave length in length it will still absorb a considerable amount of energy from electric waves arriving in its own direction.

The antenna consists of a large number of hard-drawn copper wires, which are upheld by masts or towers in such fashion that the wires form a sort of fan elevated in the air; or they may rise up for a certain height and then be bent downward on all sides, like the ribs of an umbrella. In the case of our battleships, they are groups of parallel wires kept separate by wooden stars and stretched between the masts and then led downwards to the bow and stern of the ship. In the high-power Marconi stations, they rise up vertically for a certain distance and are then stretched horizontally for a distance about five times greater, parallel with the ground.

In long-distance stations the wooden or steel lattice towers or tubular masts required to sustain these wires are elaborate structures 100 to 400 ft. or more in height, and have to be well stayed to resist wind.

Associated with the antenna is a counterpoise or balancing capacity, which may consist of insulated wires stretched a little way above the earth, or radiating wires or metal nets laid in the earth, or sheets or nets of metal laid on the ground, or even the metal hull of a ship.

This counterpoise is connected to the antenna through a variable inductance coil. In virtue of the capacity of the antenna with respect to the earth or the counterpoise, the whole system has a natural time period of electrical oscillation. It may be compared with an elastic steel strip held at the bottom in a vice and loaded at the top, which can be set in vibration by small blows administered to it at the proper rate.

There are certain rates of antenna oscillation reserved for certain purposes. Thus, for ship or coast signalling, antennæ are used having natural time periods of one-millionth or one half-millionth of a second, and for large power stations the time period may be as large as one hundred-thousandth or one fifty-thousandth of a second.

In nearly all cases these oscillations are excited in the antenna by the intermittent discharge of a condenser. They are therefore damped or decadent trains of free oscillations, separated by intervals of silence. The group frequency as it is called, or number of the trains of oscillations is now usually 500 to 1,000, since when using the telephone as a receiver the group frequency is preferably that frequency for which the telephone is most sensitive. Each train of oscillations may comprise 30, 50 or 100 oscillations having the antenna frequency. The antenna is, therefore, set in electrical vibration, so that trains of electric currents run up and down it intermittently, say, 500 times a second, each train consisting of 50 or more decadent oscillations, whilst each oscillation or single current occupies a time between one fifty-thousandth of a second and one two-millionth of a second for its complete to and fro cycle.

These high-frequency currents in the antenna are created by the induction of a nearly dead-beat or else an oscillatory discharge of a condenser. In small installations the condenser is a collection of Leyden jars, or, more conveniently, glass plates coated with thin sheet zinc or tin, the plates being immersed in a metal or stoneware box of oil. In the case of some high-power stations, Mr. Marconi employs large air condensers consisting of sheets of metal hung up on insulators in a room. At Nauen and at the Eiffel Tower stations tubular or plate-glass condensers are used.

The condenser is charged by the source of electromotive force to a high potential, and then discharged across a spark gap, with or without oscillations, and this discharge passes through a coil which may be one coil of a two-coil transformer, the secondary being inserted in the circuit of the antenna, or else a single-coil transformer, then called an auto-transformer, may be made to do duty for the two separate coils in the circuits of the antenna and the storage condenser.

An important element is the spark gap. In early days when only small powers were employed, this consisted simply of two stationary brass balls. When large power first began to be applied as at the Poldhu Station in 1901, it was soon found that the oscillatory discharge started an electric arc across the balls which had to be extinguished before the condenser could again become charged. Also the balls became rapidly worn away. To remedy these defects various inventions were introduced. An air blast was applied to the spark gap to quench the arc.

I devised for the Marconi Co. in 1902 a discharger with revolving balls or disks driven by an electric motor which overcame some of the difficulties, and this type of slowly rotating disk discharger using low-frequency sparks was used for some considerable time at Poldhu. Later on Mr. Marconi invented his high-speed studded disk discharger, which is far more efficient, and creates a quenched musical spark of the required character. In this discharger a steel disk having studs on it revolves at a high speed between two other revolving electrodes and the passage of the studs starts a condenser discharge in which any true arc is instantly quenched. The kind of discharge required for effective work is one in which rapidly repeated, strong, highly damped discharges take place in the primary condenser circuit, and these excite prolonged trains of free oscillations in the antenna. This is only possible if any true arc discharge in the primary circuit is entirely prevented.

This is also achieved by the Wien or Telefunken, the Peukert and Von Lepel dischargers consisting of flat metal plates in close proximity. In these dischargers the discharges succeed each other with great regularity and at the rate of several hundred per second. When the condenser circuit is properly tuned to the antenna circuit and coupled to it not too strongly (with about 20 per cent. coupling), we have powerful intermittent oscillations set up in the antenna, each group being very feebly damped and of uniform oscillation frequency. These rapidly succeeding groups of oscillations are cut up into groups of groups in accordance with the signals of the Morse alphabet by means of a key placed in some part of the circuit. Although nearly all the radiotelegraphy in the world is now conducted by means of these intermittent condenser oscillations, great efforts are being made to perfect suitable high-frequency high-power alternators, and the advent of a commercial machine of this kind will no doubt make it a formidable rival to the existing methods.

In the sending antenna we have very powerful high-frequency currents at the base and high potentials at the free or upper end. Even in small stations the sending antenna current may have a value of 5 to 10 amperes, whilst in large stations the antenna current at the earthed end is 50 to 100 amperes and large enough to raise to incandescence quite large rods of arc light carbon.

There is, therefore, a considerable expenditure of power on the antenna. Part of this is spent in heating the antenna, but a large proportion is radiated. Nevertheless the over-all efficiency of the usual wireless telegraph transmitter using the ordinary unquenched condenser spark, meaning by that the ratio of power radiated from the antenna to power supplied by the operating dynamo or battery, is at present probably not more than 20 per cent. to 25 per cent. in actual practice, though much higher efficiencies, even up to 75 per cent., have been claimed for the quenched-spark system. But the evidence for these high efficiencies is somewhat imperfect.

An extremely small fraction of the whole radiated energy is picked up by the receiving antenna. In the latter we have currents created which are measured in micro-amperes, or, at best, in fractions of a milliampere. If the receiving antenna is properly tuned to a closed condenser circuit inductively coupled to it, the energy picked up by the receiving antenna accumulates in the associated condenser circuit.

In this last we then have feeble currents circulating which imitate in mode of variation those of the distant transmitting antenna. To detect them, it is now most usual to employ a telephone in series with some form of current rectifier, which is shunted across the condenser in the closed secondary receiving circuit, or else some form of current-operated detector, such as Marconi's magnetic detector which is placed in the condenser circuit.

If we merely connect a telephone across the condenser circuit, no sound will be produced in it, because the frequency of the current oscillations in the receiving condenser circuit is too high to affect a telephone. If, however, we insert some device in series with the telephone which acts like a valve, it will rectify the groups of oscillations into prolonged gushes of electricity in one direction, which, coming at the rate of the much lower spark frequency, say, about 500 or 1,000 per second, create in the telephone a shrill sound. As these groups are interrupted at the sending station in accordance with the Morse signals, the receiving operator hears long or short musical sounds which he can interpret into the letters of the alphabet.

Amongst the rectifiers much used my own oscillation valve invented in 1904, or glow lamp detector, is an interesting example. It consists of a little electric glow lamp, having a metal plate or cylinder sealed into the glass bulb. When the filament is incandescent the space between the filament and the plate has a unidirectional conductivity, and will allow negative electricity to pass from the filament to the plate but not in the opposite direction.

Another large class of oscillation rectifiers, are the crystal and contact rectifiers, the first of which, viz., carborundum, was discovered by Dunwoody, others by Pierce and Pickard. Thus, for instance, a copper point pressed against a small mass of molybdenite is a good rectifier. Also the minerals chalcopyrite, zincite, bornite, anatase and hessite possess similar properties, and a very sensitive rectifier is made by a slight contact between two small masses of zincite and bornite. Another rectifier is the galena-plumbago rectifier Also a gold point pressed very lightly against an artificial surface of iron pyrites (ferric disulphide) makes an excellent detector.

In spite of much valuable work done by Prof. G. W. Pierce, G. W. Pickard and others the action of these crystal rectifiers is by no means fully elucidated. It appears not to be thermoelectric, since in general the rectified current is in the opposite direction to the thermoelectric current produced by heating the junction.

In addition to these glow-lamp and crystal rectifiers another much used detector is Marconi's magnetic detector in which a slowly moving band of iron wires passes across the poles of a pair of horseshoe magnets. The wire at that place is embraced by two other coils of wire—one in series with the oscillating circuit of the receiver and the other with a telephone. When trains of oscillations are set up in the receiving antenna a listener at the telephone hears a sound due to the sudden change in the magnetic state of the iron. The simplicity and absence of any difficult adjustments make this magnetic detector one of the most useful for general purposes.

The wireless message is thus picked up at the receiving station by hearing telephonic sounds due to a greater or less number of trains of high-frequency oscillations in the transmitting antenna corresponding to *dashes* or *dots* in the Morse alphabet.

These long or short groups of oscillations in the transmitting antenna create similar groups in the receiving antenna, which when rectified cause gushes of electricity in one direction through the telephone, and therefore make sounds like ticks or musical notes of long or short duration. The pitch of this note is the frequency of the spark at the sending station.

One of the practical difficulties not yet quite overcome. is the invention of a suitably simple and sensitive *call* signal. At present the operators have to sit with the telephone on their heads waiting for any message which may begin, and this is expert work which cannot be deputed to anyone else.[*] Another requirement is a simple and yet sensitive relay by which the messages may be printed on paper tape. The photographic method employing the Einthoven galvanometer is effective but rather elaborate.

The recently invented alternating-current resonance relay of Dr. Kapp and Mr. H. Von Kramer is sensitive, and can be operated with an alternating current having a frequency of about 100, and one-fifth of a milliampere in value. What is required is a relay sensitive to currents of a frequency varying between 50 and 500 or so, and a strength of about one-tenth of a microampere.

Having thus outlined the manner in which the radiotelegraphic message is sent, I now pass on to propound for your discussion certain imperfectly solved scientific questions. The first of these is

By what mechanism or process are the signals conveyed across the intervening space between the transmitter and the receiver? Most persons would say, at once, by electromagnetic or Hertzian waves, produced in the æther, and the answer is no doubt correct as far as it goes. The action of the sending antenna on the receiving antenna is not merely an instance of one electric current inducing another in a secondary circuit as in the magnetic induction form of telegraphy. In radiotelegraphy the energy sent out from the sender, no doubt, departs from it entirely and exists for a time in a medium before it reaches the receiver. The question is what is that medium? The whole of the actions in the sending antenna by which the distance effect is produced are consistent with the assumption that electromagnetic waves are sent out from it. But are these waves, strictly speaking, Hertzian waves or space waves? What part, if any, does the earth play in the process? Are the very long distances which can be covered by modern radiotelegraphy consistent with the properties of pure Maxwellian or Hertzian waves produced in the æther? These are the first unsettled questions I wish to throw down for discussion. As soon as transatlantic signals had been received by the means already described, physicists began to ask how such waves, if they are true electromagnetic waves, are propagated one-eighth of the way round the earth. Since then Mr. Marconi has achieved the feat of receiving signals in South America from his Clifden station in Ireland at a distance of 6,000 miles. The problem now is to explain how this effect travels one-quarter of the way round the earth. It suggests at once the query, could it go half-way round? Can wireless signals be received in New Zealand from England, and may we look forward not merely to transatlantic or transpacific, but to transterrestrial wireless telegraphy to the Antipodes as a practical possibility? The answer to these questions is necessarily connected with that to the more general question, how does the sending antenna affect the receiving antenna at any distance? In a year or more, when the Imperial wireless scheme comes into operation and the long-distance stations are completed, London will speak to Aden; Aden to Bangalore and Pretoria; Bangalore to Singapore; and from thence the step will be easy to Australia and New Zealand. It is possible that we may yet communicate from London direct to Melbourne without the intermediate stations. In text-books and lectures it has been usual, for the sake of simplicity. to treat the problem of radiotelegraphy as if the earth were a perfectly conducting sphere immersed in free æther. A very little practical experience showed wireless telegraphists that the electric condition of the atmosphere greatly affected it, and that the receiving apparatus, so sensitive to waves intelligently sent out from transmitting stations, picked up in addition all manner of vagrant waves set going by atmospheric discharges. Also early attempts at long-distance radiotelegraphy led Marconi to the discovery of the great influence of daylight upon the distances attainable. If, however, we leave out of account for the present these atmospheric and daylight disturbances, to which we shall return presently, we have still to face the fact that the nature of the terrestrial surface between the sending and receiving station affects the result very appreciably.

Very early in the practical experience of radiotelegraphy it was found that it could be conducted more easily over sea than over land, and more easily over ordinary wet soil than over very dry sandy soil.

But apart altogether from this last effect, it has always been felt that there was something surprising in the fact that it is possible to detect electromagnetic waves created at a distance of one-eighth to one-quarter of the way round the world. It has been generally assumed that this was wholly due to an abnormally large diffraction effect. The first question of importance is, then, whether diffraction can occur to an extent sufficient to account for the observed facts. The determining factor as regards diffraction is the ratio of wave-length to the earth's diameter.

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[*] The Marconi Co. have recently introduced a call instrument, in which a signal equivalent to a prolonged *dash* on the Morse code deflects a galvanometer, which in turn closes a bell-battery circuit and rings a bell. The difficulty is, however, to prevent atmospheric discharges from making a false call, and to render it sensitive only to a prearranged signal.

In the early attempts at long-distance wireless telegraphy wave lengths of 2,000 to 3,000 ft. were used, but at the present time wave lengths from 10,000 to 20,000 ft. are employed, or say one-thousandth of the earth's radius.

Consider for one moment an optical analogue. The mean wave length of visible light is about 1/50,000th of an inch. Suppose a luminous point of infinitely small magnitude were placed at the pole on the surface of a smooth sphere ¼ of an inch in diameter or about the size of a pea, in a region otherwise not illuminated. This corresponds to the case of electric waves 1,000 metres in wave length sent out from a radiotelegraphic station on the earth's surface. Would there be any light due to diffraction at the equator or even at 45° latitude of this small sphere? It is essentially the province of the mathematical physicists to give us a solution of the above question, but the answer would I think be in the negative. To make the case comparable with that of the longest electric waves used for terrestrial radiotelegraphy, the sphere would have to be only one millimetre in diameter. The answer is then not quite so obvious.

The first attempt at the problem in the case of radiotelegraphic waves was made by Prof. H. M. Macdonald in 1903 and 1904.

Last year he published another paper in the *Transactions* of the Royal Society on the same subject.

The same problem has also been discussed by Prof. H. Poincaré, whose recent decease we have so greatly to deplore, in a series of interesting lectures and papers. His work agrees with one result of practical experience, viz., that to effect radiotelegraphy over long distances large wave lengths are necessary. But it is difficult to extract from his conclusions means to enable us to predict the exact extent to which diffraction really exists for waves 2 to 4 miles in length.

The problem of the bending of electric waves round the earth has also been discussed by Dr. J. W. Nicholson in a series of able and critical papers.

If his result is confirmed for wave lengths of 4 miles, or one-thousandth part of the earth's mean radius, then it will follow that ordinary diffraction is incapable of explaining long-distance radiotelegraphy, and we must look to some other cause. Mathematicians who have dealt with the problem under the assumption of a perfectly conducting earth and a Hertzian oscillator entirely disconnected from it, have assumed conditions which do not hold good in practice. Hence the attempt to explain long-distance radiotelegraphy by the aid of diffraction may be a quite unnecessary effort. The actual earth has a crust composed of materials which chiefly owe their conductivity to water. When free from water these materials composing the igneous and sedimentary rocks are very fairly good insulators. Although sea water is a conductor, it has a dielectric constant ($\kappa = 80$) very far from infinite. Moreover, at no very great depth in the crust the temperature is sufficiently high to exclude the presence of liquid water, and therefore of any conduction due to it.

The problem of the propagation of electric waves over the earth's surface involves, therefore, three important factors which greatly influence the result, first the imperfect conductivity and rather high dielectric constant of the earth, making it a semi-dielectric. Secondly, the effects of atmospheric ionisation, natural electrification and sunlight, and, thirdly, the earth's curvature. The German mathematical physicists have of late years considered the first of these factors very carefully, and arrived at some interesting results. Prof. A. Sommerfeld published in 1909 a very able paper on the propagation of the waves in wireless telegraphy over the earth's surface.

He shows that part of the radiation is a surface or cylindrical wave which follows round the surface, and is quite analogous to the electromagnetic waves produced on wires. These waves are very rapidly damped in a downward direction, and they suffer damping in a horizontal direction or in the direction of propagation.

The other quantities correspond to space waves, and the amplitudes of the forces derived from this part of the total potential vary inversely as the square of the distance.

It is, of course, not new to suggest that the waves involved in radiotelegraphy resemble electric waves on wires or are surface waves. It was long ago surmised that the sending antenna, the earth and the receiving antenna might be regarded as one single oscillator in which oscillations were set up. This view has been held, amongst others, by A. Blondel, E. Lecher, and F. G. Baily.

Prof. Baily pointed out in 1903 that the energy of surface waves would decrease only inversely as the distance, and therefore at large distances survive when space waves would have vanished. The strict mathematical proof of their possibility has, however, only lately been given.

The space waves are subject to diffraction, and are hindered by obstacles. On the other hand, the surface waves pass round, and are unhindered, apart from damping, by the curvature of the surface. Also, owing to the surface waves decreasing in amplitude less fast with distance, the surface waves survive when the space waves are extinguished. If, then, Sommerfeld's investigation is valid, we need no longer seek for an explanation of such achievements as the detection of electromagnetic waves one-quarter of the way round the earth in any abnormal diffraction. If Sommerfeld is right, diffraction has nothing to do with the matter. The effect at such distances is entirely due to these "Oberflächenwellen," or surface waves, which, like electric waves on wires, are propagated along the surface, no matter what the curvature may be. There is a certain analogy between these space and surface electric waves, and corresponding effects in the case of earthquakes. From the time of Poisson, it has been known that a shock communicated to an elastic solid created in it two waves, one of dilatation and one of distorsion, travelling at different speeds through the mass.

In 1885, Lord Rayleigh showed that, in addition, there was a surface wave dependent on the fact that the surface can be distorted, and resists distorsion with a different elasticity to that of the interior of the mass.

These effects are recognised by seismologists as represented in the preliminary tremors and main shock in an earthquake.

In this case, two kinds of disturbance are found to be propagated through the earth, with velocities of 10 and 5 km. per second respectively. Also another main shock arrives later, which moves with a speed of about 3 km. per second. The latter is a surface wave travelling along the surface crust of the earth, and the two former are space waves travelling through the mass.

In the same manner we can say that in wireless telegraphy we are concerned with three waves—one travelling through the air above the earth, the second through the crust of the earth, and the third a surface or cylindrical wave, which is confined to a limited region at the boundary of the two dielectrics.

The conclusion drawn from Sommerfeld's work is that for the achievement of long distances in radio-telegraphy, waves of long wave length are necessary, as shown by experience.

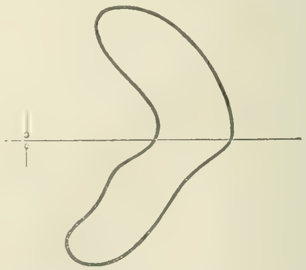
On the other hand, the radiation from the antenna decreases with increasing wave length. Hence there is probably a certain maximum wave length which is most effective for signalling over a given distance and surface.

It is suggested, however, that long-distance radiotelegraphy is chiefly effected by means of the surface waves or "Oberflächenwellen" of Sommerfeld, which fall off in amplitude inversely as the square root of the distance and are not limited by diffraction as they follow round the surface. The earth's curvature limits the range of the space waves seriously but does not so limit the surface waves.

One difficulty in reading Sommerfeld's paper is that he does not sufficiently translate his mathematical analysis into physical concepts. Hence it is desirable to consider a little in general terms how these surface waves arise.

If we have two media of different dielectric constants in contiguity, and if a line of electric force crosses the boundary, then it is well known that the conditions to be fulfilled are that the tangential component of the electric force on either side of the boundary must be continuous, and also the normal component of the electric displacement or flux must be continuous. This involves a refraction of the line of electric force in crossing the boundary. It is bent away from or towards the normal, and if κ_1 and κ_2 are the dielectric constants and θ_1 and θ_2 the angles the line makes with the normal, then $\kappa_1 \cot \theta_1 = \kappa_2 \cot \theta_2$. The law of refraction of light is $\mu_1 \sin \theta_1 = \mu_2 \sin \theta_2$. Hence, in the case of light, the velocities of the rays in the two media respectively are proportional to the sines of the angles of incidence and refraction. In the case of the electric force, the velocities are inversely as the square roots of the tangents of the angles of incidence and refraction of the lines of electric force.

If, then, we consider a Hertzian oscillator which is partly in one medium and partly in another of greater dielectric constant, there will be a distortion at the boundary of the loops of electric force which are thrown off at each oscillation. If the upper medium is air and the lower medium is a material of greater dielectric constant, then corresponding to a normal semi-loop of electric force or air, there will be a completing semi-loop in the other material which is sheared backward, as shown in the diagram. If in the air at the boundary surface, the force is normal to the surface, it will not be normal just below that surface in the medium of greater dielectric constant. It will have a longitudinal component. As the oscillations take place, these longitudinal components of the force are periodic in space and time, and constitute the surface wave which is similar to the electric waves produced on wires.



If the earth were a perfect conductor, say, a ball of copper at the absolute zero of temperature, these surface waves would be confined merely to the surface skin. In the case of the actual earth, even sea water is a sufficiently poor conductor to allow the penetration of the surface wave to some little depth in it.

The objection has been raised that no experimental proof has been given of the actual existence of Sommerfeld's surface waves. Against this it should be noted that Sommerfeld has carefully explained that the surface waves are not separated sharply from the space waves, and may be regarded merely as a particular distribution of the moving electrostatic field near the common surface of the air and earth and accompanying electric currents in the earth. It is easy to prove that we can have surface electromagnetic waves on a *sheet*, similar in nature to electromagnetic surface waves on wires, of the existence of which we have abundant experimental proof. An argument in favour of the existence of these surface waves may perhaps be derived from the experience that high antennæ do not seem necessary for the *reception* of signals, even over long distances, thus indicating that there is a concentrated electric and magnetic field near the surface of the earth.

P. Epstein has delineated from Sommerfeld's equations a portion of the field of electrostatic force round an oscillator placed first over a perfectly conducting earth, and, secondly, over an earth of finite conductivity. In the first case the loops of lines of electrostatic force are seen to terminate perpendicularly on the earth, and are divided symmetrically by the surface plane. In the second case they are distorted so that the lines at spaced intervals do not terminate perpendicularly. If, however, they have a component parallel to the earth's surface this is equivalent to a combination with a true space or Hertzian wave of a surface wave, similar to the electric waves on wires, which latter can travel along the guiding surface, irrespective of curvature of that surface.

If these conclusions are valid there is nothing to prevent the surface waves going half round the earth. It may, therefore, be quite possible to communicate by radiotelegraphy direct from England to New Zealand. There is one matter which may be of importance. Since the surface waves started from any one point reach an antipodal point by different paths it may be that unless the position of the receiving station is rightly selected, interference will arise between surface waves reaching it by different lengths of path, and hence extinction of signals for some places but not others in the same region. According to this theory, then, we need not endeavour to explain long-distance radiotelegraphy by diffraction, because true space waves are very little concerned with it.

We pass on then to consider the next question, viz., the influence of the nature of the surface in radiotelegraphy. Why, for instance, it is conducted with certain wave lengths so much more readily over sea than land.

This matter has been particularly considered by Dr. Zenneck in an interesting paper. Assuming for the sake of simplicity a plane earth and plane electromagnetic waves, he discusses the effect of the conductivity and dielectric constant of the earth's crust on the wave propagation.

Starting from the same equations as Sommerfeld, he arrives at an expression which enables him to calculate the damping of the waves along the horizontal boundary surface. He shows that this damping is determined by the dielectric constant and conductivity of the earth's crust. He calculates the distance the plane wave must travel before its amplitude is reduced to $1/\epsilon$ of that at the transmitter, and exhibits the results for various values of the dielectric constant and conductivity in the form of curves. Waves 1,000 ft. in length over a sea surface would travel 10,000 km. before reduction to $1/\epsilon$ in amplitude, but over very dry soil only for 10 km. or less. The analysis shows that there is a considerable penetration of the wave into dry soil, but into so good a conductor as sea water the penetration is at most a metre or two. Moreover, Zenneck shows that over sea surface the lines of electrostatic force terminate nearly perpendicularly to it, but over a dry surface this is not the case. Zenneck's results have been extended by F. Hack, who has shown that underground moisture has the same effect as surface moisture in preventing degradation of amplitude.

The general result of these investigations, compared with practical experience, is to show that we can by no means consider the earth to be a perfect conductor in the case of radiotelegraphy, but that it has an extremely influential action in degrading the amplitude of the waves deforming the travelling electrostatic field, and creating a type of surface wave which attenuates much less fast than a pure Hertzian wave and can travel round the curvature of the earth quite easily.

On the whole, we may say that the theory, as given by Zenneck and Sommerfeld is a valuable attempt to bridge over the very serious gap in our knowledge of the reasons for certain well-ascertained facts in radiotelegraphy. Nevertheless, there are still unexplained difficulties.

Another unsolved problem in radiotelegraphy is the explanation of the effects of the atmospheric conditions and daylight upon it.

The suggested explanations are in many respects imperfect. In the earliest days of radiotelegraphy it was found that atmospheric electric discharges produced irregular and false signals, which sometimes greatly interfered with working. These were more objectionable at the time when the receiving instrument was a coherer of some kind associated with the Morse printer. Nowadays, when the reception is by telephone, it is usual to have the spark frequency at the sender high enough to give a shrill note in the telephone. The receiving operator can then distinguish, to a great extent, between the clear musical note of the right signals and the lower squeaks or grunts in the telephone, due to atmospheric discharges. Nevertheless, at certain times and in certain regions the so-called atmospherics present serious obstacles to radiotelegraphic communication.

When we turn to the effect of sunlight on the propagation of radiotelegraphic waves which was discovered and described by Mr. Marconi in 1902, we find that even after 10 years we are still intellectually speaking very much in the dark as to the reason for this daylight effect.

The first observation made by him in 1902 was that by night signals could be received over sea from the Poldhu station at a distance of 2,099 miles, whereas by day the same kind and type of signal ceased to be detectable at about 700 miles. Also that at the time when the sun rose over the sending station the signals at 700 miles' distance quite quickly became very weak.

Of recent years he has noticed that in the morning or evening when the boundary between light and darkness occurs about half-way across the Atlantic, signals sent across become weak. Also he has noticed that in sending with a coupled transmitter radiating waves of two wave lengths, whereas the longer wave length is the one generally received, there are certain periods at sunrise and sunset when the shorter wave gives the best signals.

It has also been pointed out, both by Mr. Marconi and Mr. G. W. Pickard, that soon after the time of sunrise at the sending station there is a very pronounced decrease in the strength of the signals received a few hundred miles, or at some considerable distance from a power station, but that after sunrise there is a partial recovery of strength. There is also a gradual rise in the strength of the signals soon after sunset, and a very pronounced maximum value after or about midnight. An interesting curve has been given by Prof. Pierce in his book on "Wireless Telegraphy," p. 135, taken from Pickard's observations showing the general variation of the strength of received signals at a distance of 600 miles from the Marconi station at Glace Bay during the hours of the day and night. It appears that the current in the receiving telephone at midnight was about 30 times greater than by day. Confirmatory observations have been published by the Telefunken Co.

Two theories have, so far, been proposed to explain this effect :—

1. The original suggestion of Mr. Marconi (which has been tentatively adopted by Prof. Zenneck) was that it is due to the effect of light in discharging the sending antenna, so that it does not reach at each oscillation such a high potential by day as in darkness.

2. The theory that the daylight effect is due to the ionisation of the air by sunlight, giving it increased conductivity, and so producing absorption of the electric waves.

Neither of these theories seems to meet all the facts. If the daylight effect were an action of light on the sending antenna alone, it should be produced independently of the distance of the receiving station, whereas it is essentially a cumulative or long-distance effect.

Again, so far as measurements of the electric conductivity of air have been made, they do not give support to the theory that the daylight effect is due to air conductivity produced by ionisation, because measurements of this conductivity show it to be too small to account for the observed wave attenuation.

Prof. G. W. Pierce has made calculations which show that the air conductivity would have to be 100,000 times greater than it actually is to account for even a part of the observed effect at 3,000 km. distance.

Prof. Zenneck also agrees that atmospheric conductivity by ionisation cannot account for the phenomena.

It is possible that some part of the effect may be due to actions taking place quite close to the sending antenna. This view may be supported by the interesting observations made during the nearly total solar eclipse on April 17th last, on the effect of the temporary diminution of daylight on the strength of radiotelegraphic signals.

Whilst visiting the Eiffel Tower station at Paris, Commander Ferrié, who is in charge of this station, informed me that a slight increase in the strength of the signals at distant receiving stations had been noticed at the time of greatest obscuration of the sun at Paris. Also in Denmark, Mr. H. Schledermann stated in a letter to the *Electrician*, that observations made between the Royal Dockyard station in Copenhagen and the Blaavands Huk Lighthouse on the North Sea, at 300 km. distance, showed that during totality the signal strength was increased.

Also in England, Dr. Eccles noted an increase in the strength of atmospheric strays and signals from Clifden, observed in London during greatest obscuration. These observations show that even a partial diminution of the sun's light is sufficient to increase the strength of radiotelegraphic signals, possibly by an action on the air between the station and especially on that near the transmitting station.

Another possible explanation of this daylight diminution has, however, occurred to me which I should like to submit to you. It is well-known that sound is better heard when the wind is blowing from the source to the observer than when it blows in the opposite direction. It is also known that there are curious vagaries in sound transmission whereby loud sounds are heard sometimes better at great than at short distances. These effects were explained by Sir George Stokes as due to the fact that the velocity of sound is greater when moving with the wind than against the wind. Now, owing to friction and other causes, the velocity of the wind is generally greater at a height above the earth's surface than at the ground level. Hence, if a sound wave is travelling outwards from a centre against the wind, the upper parts move more slowly than the lower parts of the wave front, and hence the ray direction is tilted up and the sound passes over the observer's head.

The suggestion I venture to make is that when the upper layers of the air are ionised, the ions act as condensation nuclei for water vapour, and the presence of these numerous water spherules gives the upper air a larger dielectric constant. Therefore an electric wave moves more slowly in it than in non-ionised air. Hence, if a plane wave is moving parallel to the earth's surface and the upper layers of air are ionised by light, the greater velocity of the wave front at the lower levels causes it to slope backwards and the direction of the ray is elevated, so that it may pass above the receiving antenna and not affect it.

This tilting-up of the ray will occur when the ionisation of the upper air has taken place over a part of the interval between the stations. It will be most pronounced when the greatest difference exists between the dielectric constant at the earth level and that at a level a few miles up in the air. At very large distances, say 2,000 miles, an extremely small difference in the dielectric constant of the air at low and at high levels would be sufficient to give the wave front a sufficient tilt to make the waves pass far above a receiving antenna 200 ft. high, and so weaken immensely the received signals because the effect is cumulative and noticeable therefore only at very great distances. As an experimental contribution to the subject I have made some preliminary observations on the dielectric constant of air, filled more or less with damp steam or warm mist. A tubular condenser was constructed of such kind that steam from a small boiler could be blown between the tubes, and the tubes were so supported that the condensation of the steam could cause no loss of insulation. The electrical capacity of this condenser was determined carefully by the Fleming and Dyke capacity bridge, using a telephone as a detector, and alternating currents having a frequency of 2,760. Employing all necessary precautions, and comparing the dielectric constant taken as unity of air nearly saturated with water vapour, with air having water globules or damp steam in it, we found that the dielectric constant of air filled with water spherules varied from 1·026 to 1·004, according to the amount of damp steam present in the space. In other words, an electric wave would travel more slowly in the steam-impregnated air than in the ordinary saturated air in the ratio of 980 to 1,000, or 998 to 1,000, or anything between these limits.

If, then, we consider a plane electromagnetic wave travelling with plane vertical and its lower end in ordinary air and its upper end in air containing minute water spherules, the upper end would travel more slowly than the lower, and the wave front would acquire a backward tilt sufficient, in a distance of a few hundred miles, to carry the wave right above an ordinary receiving antenna. If the ionisation of the upper air by ultra-violet light results in the production of condensation nuclei, which condense water vapour round them, then it is highly probable that the upper levels of the air have a slightly greater dielectric constant than the lower, and a difference of even a very small fraction of 1 per cent. will be cumulative in its action on the wave in giving the wave front a backward tilt in travelling over long distances.

Mr. Marconi states that over the Atlantic he has found the maximum daylight effect to occur when the shadow boundary was about halfway across the Atlantic, the sending station being in daylight and the receiving station in darkness. I think the well-known "sunrise nick" in the signal intensity curve is due to the fact that the effect is at a maximum when the greatest difference exists between the state of the upper air as regards ionisation and that near the earth. Later in the day convection currents arise to churn up the air and bring it more into a homogeneous condition, which, whatever may be the state of ionisation, is unproductive of any tilt in the wave front.

It has been frequently suggested that an explanation of long-distance radiotelegraphy may be found in the reflection of the electromagnetic waves at the under surface of a layer of ionised air in the upper atmosphere. No proof, however, has been given that this hypothetical layer of ionised air has a sufficiently defined surface to cause wave reflection. Hence, it is improbable that anything like copious reflection of long electromagnetic waves could take place at the under surface of a layer of ionised air. This point, however, is one open for discussion. It is true that refraction may produce a change of ray direction which simulates reflection as in the case of the phenomenon of the mirage. In this case the intense heat of the earth expands the layer of air next to it, and lowers its refractive index. Hence, the lower end of a plane wave of obliquely incident light, travels faster than the upper end, and may do so to an extent sufficient to swing the ray right round, as if it were reflected from the layer of heated air. For a similar effect to occur with radiotelegraphic waves, it would be necessary for the upper end of the wave front to travel much *faster* than the lower end. In other words, the upper end must be in a region of less dielectric constant than the lower end.

Since the above remarks were put in type, a valuable paper has been published by Dr. Eccles (see *Proceedings* Roy. Soc., Vol. LXXXVII A, page 79, 1912, on "The Diurnal Variations of Electric Waves occurring in Nature, and on the Propagation of Electric Waves round the Bend of the Earth") in which a theory is developed of electric wave propagation in ionised air. He gives a mathematical proof that under certain assumptions as to the mass of these ions the wave velocity would be increased as compared with that in unionised air, and hence that a plane vertical wave front travelling with lower end near the earth and upper end in air more or less ionised by sunlight, would be caused to lean forward by the increased velocity of its upper end. Hence he proves that, according to wave length and circumstances, the wave may be better able to follow round the earth's curvature, or may be prevented from doing it.

On this basis he has developed a theory of long-distance radiotelegraphy and of the inhibition of daylight upon it. The chief criticism to which I think his theory is open is that he assumes that the dielectric constant of the air is unaffected by the ionisation or condensation of water vapour on these ions. This is not absolutely certain. We know that in the case of solutions in a state of ionisation, such as dilute solutions of metallic hydrates in water, the dielectric constant of the solvent is considerably increased. As a rule, anything which increases conductivity in a dielectric increases also the dielectric coefficient. Hence ionisation may do so in the case of air. If the dielectric constant (K) is increased by ionisation, then in the expression given by Dr. Eccles for the wave velocity that velocity may be more reduced by this increase in K than it is increased by the presence of the ions.

It would seem, therefore, most necessary to settle by experiment whether the wave velocity is increased or diminished by the presence of the ions due to ultra-violet light before we can base a theory upon the constancy of the dielectric coefficient.

There is no doubt, however, that the earth's atmosphere contains something which acts at times towards radiotelegraphic waves like a fog or mist towards light waves.

There are also occasions of unusual transparency when waves 300 or 600 metres in length seem to travel round the world in an extraordinary manner. Ships provided with the ordinary ship transmitters and receivers occasionally pick up signals sent 1,000 miles away. This is not due to special operative skill but to a temporary transparency of the atmosphere to radiotelegraphic waves.

The next question to which I should like to direct attention is to the present state of the theory of directive antennæ. I need not go very fully into the early history. Mr. Marconi pointed out in 1906 the special qualities of an antenna, consisting of a long wire arranged so that part is vertical, but the greater part horizontal, and that radiation takes place most energetically in the opposite direction to that in which the free end of the horizontal wire points. Also by the law of exchanges a bent antenna which radiates unequally absorbs unequally in different azimuths. The question is as to the explanation of the action of this bent antenna.

In 1906, starting from a suggestion by Sir Joseph Larmor, I gave a theory based on the view that the bent antenna is equivalent to a combination of an open and closed circuit and assumed the earth to be a perfect conductor. The objection has been raised to this theory that it implies that the directivity should fall off with distance.

Experiments have not yet been made as far as I am aware on a sufficiently large scale and at sufficiently great distances to settle this point, and the experimental problem is undoubtedly complicated by the effect of the nature of the soil surface over which the waves travel in different dielectrics or regions. Nevertheless, Mr. Marconi's experiments show that the directivity persists for several hundred miles. Recently the problem has been discussed by H. von Hoerschelmann. According to his theory, the effect of a bent antenna is entirely due to vertical electric currents which are produced in the earth just under the horizontal part of the bent antenna. Hence the directivity depends on the conductivity of that region of the earth. He points out that as a consequence of his theory a bent antenna situated over a sea surface should not have the same degree of directivity as one situated over a poor conducting soil. These conclusions could easily be checked experimentally.

The general result of all the theoretical investigations of Zenneck, Sommerfeld and Hoerschelmann is to show that the function of the earth in radiotelegraphy is by no means confined merely to guiding a space wave, but that it fulfils a most important function in assisting to create surface waves and in permitting earth currents which have directive effect. Recent experiments with antennæ laid on the ground or under the ground by Dr. Kiebitz have turned attention afresh to the matter, although many of Kiebitz's results seem only a repetition of those obtained by Marconi in 1906 with antennæ laid on the ground or a little above it.

Kiebitz used as receiving antennæ wires carried on insulators placed in ditches about 1 metre deep. The ends of the wires were earthed through condensers. The receiving appliance was at the centre. By such antennæ properly oriented he found he could receive signals from all the principal radiotelegraphic stations in England, France, and America.

There is no need to assume that these received waves are propagated through the deep strata of the earth. The effects are exactly what might be expected from waves travelling over the surface.

The chief interest of Kiebetz's experiments lies in the confirmatory proof they give that an elevated antenna is not necessary for *reception*. On the other hand, for long-distance *transmission* an elevated aerial wire or one raised above the earth is requisite.

The chief problem yet to be faced in connection with sending antennæ is to find a form of antenna which will radiate a large power, say, 100 to 500 KW., at a relatively low frequency or long wave length consistently with high antenna efficiency.

There is room for an immense amount of research yet on improved forms of antenna. When we consider that the function of a sending antenna is something like that of a gas mantle or gas-fire radiator, viz., to transform into radiation of desired wave length as large a fraction as possible of the supplied energy, and remember what has been done in the corresponding luminous problem, it is easy to see that countless questions of great practical value in connection with antennæ for radiotelegraphy remain unsolved.

The ingenious methods of directive telegraphy due to Bellini and Tosi deserve mention, and suggest that, in the case of wireless plant erected on ships, means for instantly locating the direction of the arriving waves is a matter of the greatest importance. Although the practical problem is to some extent solved, there is abundant room for further invention in connection with it.

We can hardly leave this discussion without some mention of the state and prospects of wireless telephony.

The essential condition of success in transmitting speech is the possession of means for creating undamped oscillations or alternating currents with a frequency not less than 20,000. When the Poulsen arc generator was first introduced it was hailed as a solution of the problem, but practical experience has shown that it has not the simpilcity and ease of manipulation required for commercial work. The modification recently introduced by Mr. E. L. Chaffee consisting of a copper-aluminium arc in damp hydrogen, the arc being formed between two closely adjacent plane surfaces, appears to be an improvement. The practical solution seems, however, to be in the perfecting of some simple easily-managed form of high-frequency alternator. The ingenious inventions of Goldschmidt in utilising the properties of the polyphase motor to increase frequency have been developed by the Lorentz Company of Berlin, and seem likely to result in the production of a practical form of extra-high-frequency alternator.

In addition to the generator, inventors have wrestled with the difficulties of making a microphone transmitter which shall be able to carry a large current without heating. To conduct wireless telephony over any distance we have to modulate in accordance with the wave form of the speaking voice a very large antenna current. The problem has to some extent received solution in the liquid microphone of Majorana, the relay microphone of Dubilier, and a recently invented heavy current microphone of Rühmer. Wireless telephony is therefore even now a practical matter for a few hundred miles of distance. It is quite within possibility that it may yet be conducted across the Atlantic.

As regards other inventions, we are still in want of more simple means for recording telegraphic messages. Since the coherer fell out of use the reception has been mostly conducted by ear. Somewhat elaborate photographic methods, suitable for large land stations which employ the Einthoven string galvanometer, have been introduced, but what is still required is a means of calling up the operator and of recording the message on board ship, which is at least as sensitive as the telephone plus the human ear, for ordinary shipboard communication.

The receiver current is, however, very small and the available power is at most a few microwatts in the form of a current of a few microamperes.

There are, therefore, innumerable practical and scientific problems in connection with radiotelegraphy which await solution. These require mathematical, physical, and radiotelegraphic knowledge of a high order to overcome them.

Captain H. Riall Sankey said his first duty was to apologise for the absence of Mr. Marconi, who fully intended to be there that day, but at the last moment was called to the Continent.

The questions up to No. 17 were more or less mathematical and theoretical, and he could not say much about them. He would point out, however, that theories must be based on experiments, and that no doubt was what Dr. Fleming had in his mind when he suggested a committee. The Marconi company at the present moment were carrying out a great number of experiments on long-distance transmission in all sorts of conditions, in different parts of the world and in different directions. There was a great difference between the ease of transmission north and south or south and north, and east and west or west and east. No doubt the daylight had something to do with it. Many of these questions were still obscure, but they hoped by those experiments to be shortly furnished with data which might furnish the answers to some of them. Isolated results were really of little use. It was the combination of experiments which would yield the results wanted. As regards the tuning of wave lengths, which was one of the methods of removing interference, this was by no means the only way. There was tuning by means of a musical note. The spark gap was so arranged as to give a certain number of signals per second ; 500 was the middle A on the piano, and it gave that particular note in the telephone. The pitch had been worked up to 1,000, but it appeared that although that note penetrated better than the lower notes, it produced a disagreeable sensation in the ear of the observer. Quite recently a new arrangement had been adopted of erecting the aerials. One was placed at right angles to the other, and in this way interference was reduced. They could also get duplex transmission. There was also another method. Suppose three signals were being received ; they wanted to hear one of them and do away with the other two. There was an arrangement by which the two signals they did not want to hear could be opposed and thus annulled. The one they did want to hear was reduced in strength, but it could still be heard. As regarded question No. 19, as to the probability of replacing the telephone, within the last few months a photographic arrangement had been evolved which could work up to 50 words a minute. But within the past few days a new arrangement (of which he was not at liberty to give details) had been devised which they believed would do away with the photographic arrangement. There was one great objection to these recording systems. They simply recorded everything, both the signals they wanted to hear and the signals they did not want to hear ; whereas the human ear could distinguish the signals they wanted to hear, and leave out those they did not want, very much in the same way as a bandmaster could distinguish one instrument when the others were also playing. This new arrangement would record everything, and yet have the advantage of the telephone arrangement and pick out the signals required. With regard to question No. 20, as to a suitable call signal, an arrangement was now being worked out, and was satisfactory, but had not yet been applied at sea. It was being experimented upon at the works. With regard to No. 21, if the Bellini-Tosi system could be read within one or two degrees of accuracy, this was quite as good as could be got from the compass, so that from a practical point of view the last word had been said. As regards the wireless telephone, they had succeeded up to a distance of 300 kilometres, and they did not think they had by any means reached the limit. At the same time, they thought it would be a long time before it came into use. The Committee which it was desired to appoint undoubtedly could do excellent work in many directions ; but it must be borne in mind that there was a great difference between receiving wireless signals and transmitting them. The apparatus for transmitting was simple and could be easily arranged by anyone, whereas the receiving apparatus required considerable knowledge and skill. From a practical point of view, wireless telegraphy up to ranges of 1,000 kilometres was quite easy, and the apparatus for the purpose was standardised. The real difficulties began with distances up to 2,000 kilometres. That was for commercial work—working day and night and without undue repetition. During the day the signals dropped right off, and no doubt this was the reason why great difficulties occurred at 2,000 kilometres. Hence, unless this Committee could command the use of apparatus for long-distance transmission and had practically unlimited capital, they could not hope to obtain data to answer all the questions put by Dr. Fleming. They would require the whole world as a laboratory and must work with all sorts of waves, and then find themselves in conflict with the commercial companies and all the different wireless stations over the world. At the present time, data of the kind required were being collected as far as practicable and would be published.

(To be continued.)

The Production of Electrical Oscillations by Spark-Gaps Immersed in Running Liquids.

By W. H. Eccles, D.Sc., and A. J. Makower, M.A.

(Section G. Abstract.)

The commonest method of generating electrical oscillations for the purposes of wireless telegraphy is by the discharge of a condenser through an inductance coil and air-gap in series. When a large amount of energy has to be handled, there is a tendency for a permanent arc to form between the electrodes, and this reduces the efficiency of the apparatus. In the present paper is described a series of experiments designed to determine whether the efficiency can be increased by making the spark occur in a flowing liquid. The liquids employed in the experiments were water and transformer oil. Although the results show that the efficiency attained is only of the same order as that which can be attained by the air-spark, the details of the experiments are of interest, and suggest methods that would be useful in certain contingencies.

The simplest form of discharger worked with consisted of an ebonite tube, through the sides of which the electrodes protruded to form a small spark-gap in the middle of the bore. When water was passed down the tube, very steady oscillatory currents could be obtained with voltages of about 1,000 volts across the gap. When oil was used the voltages had to be of the same order as those employed with air-gaps, in order to obtain the best results, and, at the same time, the gaps had to be smaller than air-gaps. Other forms of discharger were made which provided for the spark to take place under great hydrostatic pressures, but these showed no consistent electrical advantage over the dischargers operated with liquids at atmospheric pressure. In the paper damping curves are given for various degrees of coupling between the primary and secondary oscillatory circuits. These show that the water spark follows nearly the same laws as an air-spark, and that the spark in oil exhibits the phenomenon known as impact excitation. Dischargers of the type described possess the advantage over the open air-spark that their discharge can be made practically noiseless.

The Impedance of Telephone Receivers as affected by the Motion of their Diaphragms.

By A. E. Kennelly and G. W. Pierce.

Section G. Abstract.

The authors describe the results of a series of measurements of resistance, inductance, reactance and impedance, made by them on several telephone receivers of well-known types. The measurements were made over a wide range of alternating-current frequencies (430 to 2,400 cycles per second). The frequency was varied adjustably over this range, as the independent variable, and the measurements obtained were found to vary in dependance on the frequency.

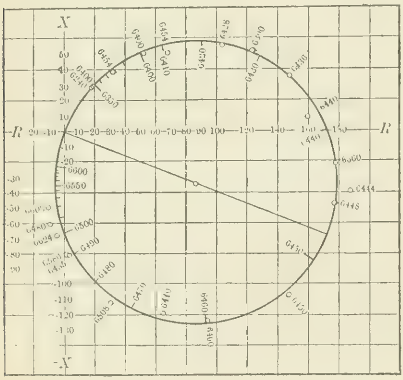
The measuring apparatus consisted of a Rayleigh modification of the Wheatstone bridge. The ratio arms were small non-inductive resistances and were equal. The telephone under test formed a third arm. An adjustable non-inductive resistance in series with an adjustable inductance formed the fourth arm. A pair of head telephones, in the balance wire of the bridge, enabled balance to be adjusted. The source of alternating currents supplied to the bridge was a Vreeland oscillator, which maintained constant voltage at the terminals of the bridge, and, therefore, at the terminals of the telephone under test, at each frequency—the different frequencies being obtained by variation of the electrical constants of the primary oscillating circuit of the Vreeland apparatus. The E.M.F. impressed on the bridge in this way was very nearly sinusoidal, and, at the telephone terminals, varied, in different series of tests, from 0·3 to 1·0 volt.

It was found that the resistance, inductance and impedance of a telephone receiver, measured in the above manner, differed when the receiver diaphragm was free to vibrate, from the values obtained when the diaphragm was damped, or arrested, say, by pressing the finger on the centre. The values with the diaphragm free, differed very markedly from the values with the diaphragm damped, when the frequency impressed on the bridge was at or near the natural fundamental frequency of the diaphragm. In other words, when the impressed frequency was much above or below the natural vibration frequency of the diaphragm, the difference between the "free" and "damped" resistance, inductance or impedance of the receiver was relatively small; but when the impressed frequency was brought into consonance with the natural vibration frequency of the diaphragm, the latter was thrown into powerful vibration, emitting a loud sound, and the E.M.F., induced by the vibrating diaphragm in the coils of the receiver, caused the free resistance, inductance and impedance to differ markedly from the corresponding damped values. The damped values were thus the true values with the diaphragm inert, and the free values were the values as apparently altered by the E.M.F. induced in the receiver, regarded as an alternating-current motor of the reciprocating type.

Considering first the damped values, it was found, as was already well known, that the resistance of any receiver increased with the frequency, while the inductance diminished. The results obtained on the instruments measured showed, what was apparently new, that the product of the resistance and the inductance remained substantially constant over a wide range of impressed frequency, or that the resistance was inversely proportional to the inductance. Moreover, it was found that the resistance was very closely a quadratic function of the frequency, containing, therefore, a constant term—the resistance to continuous currents—plus a term proportional to the frequency, plus a term proportional to the square of the frequency.

Considering the free values, it was found that whereas the damped impedance of a receiver was a vector magnitude, which, when plotted to resistance abscissæ and reactance ordinates, moved over a nearly straight line as the frequency was increased, the free impedance, on the contrary, moved around a loop, so that, at the neck of the loop, one and the same free impedance corresponded to two widely different impressed frequencies. In other words, whereas the damped impedance of a receiver is a steadily advancing single-valued vector, the free impedance is a vector that runs around a loop at a certain place in its general line of advance, so as to present one double value of frequency for a single value of impedance. This loop of free impedance embraces the range of frequency at and near the natural vibrational frequency of the diaphragm.

If the damped impedance is subtracted from the free impedance, throughout a series of such measurements at increasing frequencies, the differences are vector quantities, which may be called "*motional impedances*," since they are the changes of vector impedance effected by the motion of the diaphragm, for the particular frequency and terminal voltage considered. It was found that the motional impedances of any receiver, when plotted vectorially for a succession of frequencies, formed a *circular graph* through the origin. That is to say at a very low, or very high, frequency, the motional impedance is substantially nil; but as the frequency advances from the low to the high value, through the natural frequency of the diaphragm, the vector motional impedance traces out a circle in the negative direction, such as that shown in the accompanying figure, which gives the motional impedance for a certain experimental monopolar telephone receiver. Here, — R R is the axis of "motional resistance," or difference between free and damped resistance, — X X is the axis of "motional reactance" or difference between free and damped reactance. The small circles in the diagram are points of observation, and the numbers attached to them are the corresponding "angular velocities," sometimes called "pulsations," which are 2 π times the corresponding frequencies. The circle is seen to pass very fairly through the observed points. The radial strokes and attached numbers, lying along the inner rim of the circle, are computed values, arranged for reference.



The first approximation theory of the phenomenon has been duly worked out by the writers. It shows that such a circular graph of motional impedance is to be expected with change of impressed frequency at constant impressed voltage. It shows, moreover, that the frequency at the free end of the principal diameter of the circle is the frequency of resonance, or the natural fundamental frequency of the diaphragm. In the case represented by the figure, this resonant frequency was 6,449/2 π = 1,026·4 cycles per second, at which the motional resistance was + 172 ohms, the motional reactance — 67 ohms, and the motional impedance 180 ╲21·5°, or 180 ohms dipping 21·5°. This frequency of 1,026·4 cycles per second is, therefore, the natural frequency of the diaphragm. The angle of dip, 21½°, is computed to be twice the angle of lag of the magnetic flux behind the alternating current in the coils.

It is shown in the paper that the "damping coefficient' of the receiver diaphragm can also be obtained from an inspection of the circular graph. In the case presented by the figure, the logarithmic decrement of the damping is found to be approximately 20; so that the diaphragm, if set in independent vibration, would allow its amplitude of vibration to fall to 1/ε, or to 36·8 per cent., in $\frac{1}{20}$th of 1 second. The circular graph of motional impedance is thus shown to be an index of important mechanical and electrical constants for any receiver. The diameter of the circular graph does not vary rapidly with the value of the impressed terminal voltage, as far as the measurements have shown; but it varies greatly for different receivers. It was greatest in the measurements reported for the case presented in the figure. In very weak receivers, the motional impedance becomes so small as to be barely perceptible.

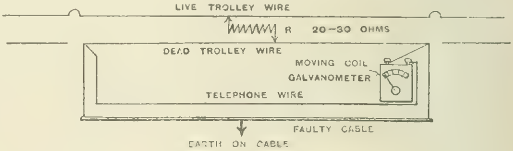
CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Fault Finding.

I note in the current issue of the ELECTRICAL REVIEW an article on fault finding, in which mention is made of the use of one trolley wire as a temporary conductor to complete the "bridge."

I have devised a method similar to the above, in which all calculations are eliminated. In the case of an earth on a traction feeder, use is made of the trolley wire nearest the footpath, all cars using the other wire during operations.



The trolley wire, feeder, and a telephone wire are connected as per sketch above, and the moving coil portion of a D.C. ammeter, or voltmeter, is connected across the ends of the system, as shown.

The resistance R is carried on top of the tower wagon, and the ends are placed in contact with the live and dead trolley wires; the resulting current of, say, 20 amperes, divides, part flowing each way to reach the earth. The point of no deflection of the galvanometer is directly over the fault, as will be seen by comparing the connections with those of a slide wire bridge with the trolley wire as the slide wire.

If the fault is near the ends the mean of two positions is required, one with the galvanometer across the trolley wire, and the other with the galvanometer across the faulty cable ends.

In the case of a fault on a lighting main a length of ordinary bell wire is run exactly over the main, and a second length as a galvanometer connection in place of the trolley wire and telephone wire respectively. Current is led from a live main through a resistance to various points along the bell wire, and the point of no deflection is directly over the fault. I have found both methods very accurate in actual practice.

W. Redmayne.

Rotherham, *September 2nd*, 1912.

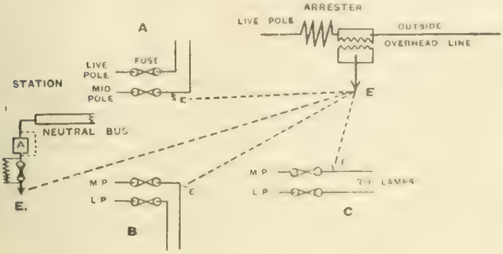
A Curious Coincidence.

A little comment on the accompanying sketches will, I think, lead to a satisfactory explanation of the phenomenon under mention. The overhead line, of which a portion in proximity to the lightning arrester is shown, is assumed to be situated *somewhere* on the supply system, and is, say, rather heavily fused, or is protected by a circuit-breaker set fairly high.

A lightning flash discharges itself by way of this overhead line, and in traversing the comparatively small arrester air-gap to earth, establishes an arc which is maintained by the supply after the discharge has spent itself, and develops possibly into a heavy "earth": assume it does.

A, B and C are consumers who have leaks on the neutrals of their installations, which, under ordinary circumstances, may pass unnoticed; apply this to the cases in question, since no leaks appear to have been recorded prior to the disturbance.

The heavy earth-current has, therefore, four passages available to, or from, the station, shown, for the sake of illustration, by straight dotted lines; or, looking at the matter from a somewhat different standpoint, the fact of a live pole being brought temporarily to near earth-potential, results in the mid-wire now, in all probability, automatically connected to earth through a resistance, becoming alive, or otherwise, shuts down a portion of the supply.



Consequently, any fuses between the neutral-poles and the earth-faults in these installations blow, with the result that the lamps connected thereto may, for the time being, get almost double pressure, burst, and blow the live fuses (depending, of course, on which side of the system they are connected) and the neutral faults be simultaneously burned out.

All this may, and in all probability would, occur independently of the mid-wire earth-panel arrangement at the station, but perhaps to a greater or lesser degree, according to the efficacy and soundness of the system in vogue.

The foregoing also explains the latter portion of "Junior Assistant's" query in reference to the breaking of lamps coincident with a lightning flash.

Any further debate on the question will lead up to a lengthy leak *versus* fuse argument, applicable to certain instances of three-wire distribution, incidentally of interest to the writer.

One thing more may be noted: in the event of any neutral fuses having blown without removing the faults, the lamps will, provided they and the live fuses are sound, continue to light to earth after the disturbance has spent itself, and a leak will be apparent at the station.

Mains Superintendent.

Aberdare.

Central Station Appointments.

The following appears in a certain local newspaper :—

> The Electricity Committee of the Bridlington Corporation have recommended that a "station" engineer be advertised for at a salary of £160 per annum, and for a "charge" engineer at a salary of £80, rising to £100 per annum. It was explained that it was only intended to make one appointment.

No doubt those who have applied for either or both of these positions will be anxiously awaiting reply, but when one considers that the two invitations might draw 500 applications, it will be consoling to all to know that his (supposed) chance will work out at 1 : 500.

The idea seems to be to (1) advertise the undertaking; (2) secure applications from all classes now in receipt of any salary below, say, £150; then (3) probably make the one appointment at the magnificent salary of £80 per annum.

The fortunate one will be first assistant. He will have charge of the whole show, repairs, &c., and will have no charge engineer other than himself. Years ago an engine driver received £91 per annum.

In case this appears before the appointment is settled, my advice to those concerned is "beware"; understand the duties before accepting the appointment offered.

Knobstick.

Impregnation of Wooden Poles.

It is somewhat unfortunate that Mr. Manktelow has made no mention of the Powell process in which saccharine matter is absorbed, or digested, into the wood without the use of pressure or vacuum. Sugar being crystalised, sap is an amorphous form of wood, and therefore a much more suitable material than creosote and other mineral matters.

This process has been a great success in Australia, and with its aid the white ant difficulty is practically overcome. The mention of the electric seasoning experiment in Melbourne is interesting, but to refer to that and not mention the large works at Sydney and West Australia where the Powellising process has been carried on for the last six years is a grave omission.

E. Kilburn Scott.

Bromley, Kent, *September 6th*, 1912.

Earthing in Collieries.

I note the reference in your issue of August 30th, to the action brought by Mr. Atkinson, representing the Home Office, against Mr. Imrie, the manager of the Consett Iron Co., and I venture to think that if you had had all the facts before you, your criticisms would probably have been less severe.

There is no doubt that the members of the Advisory Committee, and also the majority, at any rate, of the coal owners in the United Kingdom, believe that the Exemption Clause, which was obtained after considerable discussion, is a clear exemption in connection with installations erected prior to June 1st, 1911, assuming that such installations complied with the requirements of the old Rules.

A great deal of doubt still exists in the minds of not only electrical men, but also mining engineers, as to the advantages of armoured cables, and also earthing as called for by the new Rules, and I note in your last issue a letter from Mr. Sydney F. Walker on this subject; I am not at all sure myself that the method of earthing prescribed or recommended by the Home Office is one which can be adopted in all cases, as those acquainted with the installation of electricity in mines are well aware that there are insulating strata, and the existence of such would render earthing to one point on the surface of no avail.

There is no doubt that for mechanical protection the armouring of cables is of considerable value, but one has to consider the risk of corrosion, and if the armouring is used for earthing purposes, the whole earthing system becomes one requiring the greatest skill and attention in erection, and also requires constant attention if it is to be relied upon as a safeguard; at the same time, I believe that such a system properly looked after combines mechanical protection and efficient electrical safeguard.

In your article one would gather that the Consett Iron Co. were neglectful of the lives or safety of their workpeople, and that this accident occurred because they, as a company, wished to shelter themselves under the Exemption Clause and avoid the expense of meeting the requirements of the new Rules. Such, however, is far from being the truth, as the Consett Iron Co. had in this particular installation adopted armoured cables throughout, and in five of the conveyors out of seven they had already introduced earthing arrangements constructed and adapted to the requirements of the new Rules, and the other two conveyors would have been altered except for the coal strike, which prevented them completing the work, and I feel sure that your well-known desire for fairness will prompt you to give prominence to this statement.

Speaking as the representative of the coal trade, not only in the position which I held as electrical expert to the Mining Association of Great Britain, but also as a member of the Advisory Committee for Northumberland on both inquiries, I can honestly state that there is no body of men more anxious for the safety of their workpeople than the colliery owners, managers and officials, but one must bear in mind that whilst any reasonable expense is not objected to, there is a limit : it might interest you to know that in the recent inquiry I took out the cost of bringing 11 installations in the Midlands, all of which had been erected in accordance with the old Rules, up to the requirements of the new Rules, and I found that the expenditure was £49,000, and in not one of these collieries had there been an electrical accident, fatal or otherwise, during the whole period the installations had been running.

As you state, this case is *sub judice*, so that beyond a mere statement of what I know to be the facts of the case, we cannot enter into its merits, and I thank you very much for the opportunity of replying to your leading article on this subject.

W. C. Mountain.

Newcastle-on-Tyne, *September 9th*, 1912.

[We are pleased to publish this letter, which throws a good deal of light on the subject. The deduction is obvious that, although the Consett Iron Co. asserted its claim to exemption from the requirements of the new Rules, it was taking active steps to comply with them. We have pleasure in recording the fact, which was not brought out in the report received by us—otherwise our criticism, as Mr. Mountain suggests, would certainly have been milder. We trust that the company's praiseworthy example is being followed by other colliery proprietors, without regard to the question of exemption.—Eds. E.R.]

Municipal (?) Trading.—We regret to say that the writer of the letter published under this heading in our last issue proves, on inquiry, to have given a false name and address. Mr. J. E. Schofield, commercial assistant to the Bradford Corporation, of course, was not the writer : on the contrary, he appears to have been the person aimed at, and we are sorry that by this despicable trick he has been subjected to a cowardly attack.—Eds. E.R.

ELECTRICAL EXHIBITION AT NEWCASTLE-ON-TYNE.

The second North-Eastern Counties Electrical Exhibition was opened in the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne, on Saturday, the 7th inst., and will be continued until the 28th inst.

The present Exhibition differs from the first in one broad principle : the first was primarily to illustrate the advances in the application of electricity as a mode of power in connection with manufactories, works, railways, collieries, &c., while the chief aim (although by no means the sole object) of the present exhibition is to bring home to the general public the enormous development in the application of electricity for domestic purposes, and to demonstrate the great variety of uses to which it can be put. The value of the invention of the metal-filament lamp and the reduction that it has effected in the cost of lighting : and the comparative perfection of the methods of heating and cooking are shown in a hundred different forms, at once attractive and useful.

The advisory board of the Exhibition is constituted of the following : Messrs. A. S. Blackman (borough electrical engineer, Sunderland) ; C. S. Vesey Brown (chairman, Newcastle Section, Institution of Electrical Engineers) ; L. E. Buckell (Newcastle Electric Supply Co., Ltd.) ; H. W. Clothier (hon. sec., Newcastle Section, I.E.E.) ; W. Cross (vice-chairman, Newcastle Section, I.E.E) ; Harry S. Ellis (borough electrical engineer, South Shields) ; C. W. Fairweather ; W. Fletcher (secretary, Newcastle branch, Electrical Contractors' Association Incorporated) ; T. J. Grainger ; A. B. Gridley (Cleveland and Durham Electric Power, Ltd.) ; W. D. Hunter (Newcastle and District Electric Lighting Co., Ltd.) ; Ernest Hatton (general manager, Newcastle Corporation Tramways) ; Chas. H. Merz ; J. W. Morley (Electric and Ordnance Accessories, Ltd.) ; W. C. Mountain ; J. Pigg (electrical superintendent, North-Eastern Railway) ; J. M. Robb (superintendent, Electric Telegraphs, G.P.O., Newcastle) ; Allan Robson (Simplex Conduits, Ltd.) ; Robert Robson (Chairman, Newcastle branch, Electrical Contractors' Association Incorporated) ; Herbert Shaw (secretary, Newcastle Chamber of Commerce) ; R. P. Sloan (Newcastle Electric Supply Co.) ; H. M. Taylor (borough electrical engineer, Middlesbrough) ; Prof. W. M. Thornton (Armstrong College), and C. Turnbull (borough electrical engineer, Tynemouth).

Under the ægis of this board a highly interesting exhibition has been arranged, each item of which helps to ensure that all the different uses to which electricity can be put in lightening domestic labour, in reducing expense, and promoting health in home life shall be demonstrated under actual working conditions. The utilisation of electricity as a mode of illumination is now well established ; but in the matter of cooking the same cannot be said, at all events, to the same extent. The position in regard to cooking has been materially altered as a result of the cheap production of energy and the immensely enhanced efficiency of the cooking apparatus. This is shown by demonstrations of cooking twice or thrice daily. In this connection, also, are shown the most modern forms of ovens, grills, saucepans, frying pans, kettles, &c. But the domestic section extends beyond this, and includes potato-peeling machines, washing machines, mangles, irons, sewing machines, &c. To heating by means of the electric current much attention has been given to make the exhibits thoroughly representative and convincing, and the luminous lamp radiator and the semi-luminous quartz type radiators and convectors are shown in actual use. Lighting, most naturally and properly, has devoted to it much space, and all forms of lamp are shown, as well as indirect lighting.

In addition to the domestic side of the Exhibition, there are many stands of a different, but not less attractive, character. Amongst these are the Ozonair apparatus, switchboards, cables, brazing hearths, water heaters, storage batteries, electrical testing and measuring instruments, signs and radiators, suction cleaners, portable batteries, carbon dynamo and motor brushes, electric impulse clocks, &c. A system of electrical cab signalling for railways, as devised by Mr. Raven, of the North-Eastern Railway, is shown by a working model, and another very attractive display is that by the Marconi Wireless Telegraph Co., Ltd. The latter exhibit consists of two Marconi wireless telegraph ship plants, one of the standard ½-kw. pattern, suitable for cargo steamers or liners, where long ranges are not so necessary as on the large liners ; the other of the induction-coil pattern, suitable for lightships or fishing smacks, where even a shorter range is required. The cargo ship set is divided into two parts ; the transmitting plant is mounted in a silence cabinet, and the receiving and operating apparatus is mounted on an operating table. The ½-kw. cargo set is a small power installation designed to produce transmitting waves of 250 and 600 metres, or any intermediate wave length with a simple change over from one to any other. The working range depends on the height, length and shape of the aerial. The receiving apparatus provides for tuned reception of all waves between 250 and 1,600 metres. The working receiving range is also dependent on the aerial. This exhibit is intended to bring home to the carge shipowner the ease and economy with which the invaluable wireless system can be adapted to his purposes, and the appeal in a district like Tyneside, where so many vessels are built and owned, should not prove unavailing.

The formal opening took place in the presence of a large company, over which Mr. J. Pigg presided.

The Chairman, in introducing the Deputy Lord Mayor (Councillor Herbert Shaw) to open the Exhibition, said they hoped that the success of the opening pressaged the success of the undertaking in spreading a wider knowledge of the adaptation of electricity in the service of the public.

The Deputy Lord Mayor said it was undoubtedly a very important exhibition, and it would stand out in the annals of electricity, especially from the point of view of domestic economy. Whilst it was true there had been larger electrical exhibitions in various parts of the country, he believed he was correct in saying that that was the largest one applied to domestic economy that had ever been held in the United Kingdom. The Exhibition was intended to promote a knowledge of electricity as applied to the home, and if one of the results of the venture was to save a great deal of time and worry by the extended use of electrical appliances, then it would have done a great deal of good and would have earned the gratitude of many householders.

Votes of thanks to the Deputy Lord Mayor terminated the formal proceedings.

The following is a list of the electrical exhibitors taken in the order of the stands: we shall deal with some of the exhibits in a later issue.

Robert Bowran & Co., Ltd., Newcastle. (Electric propeller fans, Ozonair apparatus, wires, cables, &c.)

Marconi's Wireless Telegraph Co., Ltd., London. (Ship installations.)

Newcastle Electric Supply Co., Ltd. (Cooking demonstration stand.)

C. S. Vesey Brown, Newcastle. (Electric water heater.)

Provincial Launderies, Newcastle. (Electrical laundry in operation.)

Electrical cab-signalling on railways (patented by Mr. Vincent L. Raven, chief mechanical engineer, North-Eastern Railway Co.)

Scholey & Co., London. (Domestic and industrial applications of electricity.)

Simplex Conduits, Ltd., Birmingham. (Appliances for domestic purposes—kettles, irons, grills, toasters, &c.)

Chloride Electrical Storage Co., Manchester. (Storage batteries for lighting, power and traction.)

Johnson & Phillips, Newcastle and Charlton, Kent. (Electric cooking apparatus, radiators and convectors, lamps.)

F. T. Hanks, Newcastle. (Electrical testing and measuring instruments.)

The Herbert Frood Co., Ltd., Chapel-en-le-Frith. (Ferodo for brakes and clutches.)

Edward Weatherley, Newcastle. (Reflecta electric signs.)

Newcastle Retail Exhibitors' combined stand (including Messrs. R. W. Cairns; Falconar, Cross & Co.; Fletcher Bros.; S. Gillitt; Reid, Ferens & Co.; Robson & Coleman; Thos. G. Usher & Co.). Electric measuring instruments, medical apparatus, switches, electric fans, signs, lamps, cooking apparatus, clocks, &c.

Veritys, Ltd., Newcastle branch. (Aston cooking and heating apparatus, signs and radiators.)

Carnegie & Co., Ltd., Newcastle. (Designs for decorating bazaars and ball-rooms, heated and lighted electrically.)

British Electrical Manufacturers' combined stand. (Arranged by the Adnil Electric Co., Ltd.; British Westinghouse Electric and Manufacturing Co.; British Electric Transformer Co., Ltd.; the Dowsing Radiant Heat Co., Ltd.; Electric and Ordnance Accessories Co., Ltd.; Efesca Electrical Works; Ferranti, Ltd.; The General Electric Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.). Laundry appliances, radiators, medical appliances, lamps, heating and cooking, hot plates, signs, &c.

Magic Appliances, Ltd., London. (Vacuum cleaner.)

Pokorni & Co., Newcastle. (Tobacconist's shop window as a specimen of electric lighting.)

Edison Storage Traction Co., London. (Electric vehicles.)

British Vacuum Cleaner Co., Ltd., London. (Cleaners—Booth's patents.)

Newcastle-on-Tyne Electric Supply Co., Ltd. (Electric nursery, drawing room and lounge; cooking devices.)

The Float Electric Co., Ltd. (Portable batteries and lamps.)

Le Carbone, London. (Carbon dynamo and motor brushes.)

G. Edward Carr, Newcastle. (Current transformers, compensators, armatures.)

Gent & Co., Ltd., Newcastle. (Electric impulse clocks.)

THE HARDWARE AND OIL ENGINEERING EXHIBITION AT OLYMPIA.

This Exhibition, the first of its kind, was opened on September 7th, and remains open until the 17th. The chief exhibits were well-drilling plants of various types in the form of models showing the machinery for drilling with ropes as so usual in America, or with light rods as in the Canadian system, as distinguished from the stiff square rods of the English system. As in other matters, each country has developed its drilling methods to suit its own conditions.

The steam or power user will be interested in the numerous samples of oil shown by the Petroleum Institute and others, and the instrument maker will examine with interest the Holland Drilling Co.'s exhibit of a compass for taking the dip direction of the strata pierced as well as the angle and direction of the deflection of a borehole from the vertical by means of a compass needle which can be released or clamped from the surface, and a pendulum. The same company also show a clockwork recorder which shows graphically the rate and depth of boring in any period of hours. They also show a compound core drill for soft strata so arranged that soft and friable cores are protected in a closed core barrel from the action of the wash water.

Oil engines are shown by the Westinghouse Brake Co., Ltd., Blackstone & Co., Ltd., Tangyes, Ltd., Crossley and Co., Ltd., and others.

It is disappointing to find no exhibit of oil-burning appliances by way of furnaces, firebricks, atomisers, pumps or anything to interest the electrical engineer who may be considering the question of oil fuel in relation to its use for surmounting sudden fog demands. In the exhibition which, we believe, it is intended to hold next year, we would suggest that a furnace should be equipped so that different systems of atomisation could be shown in operation in turn. This could be very simply arranged by the provision of an oil, an air and a steam pipe, every exhibitor furnishing his apparatus ready to be connected to these terminals and his own door to fit the furnace, of which each intending exhibitor would have supplied him a fully dimensioned drawing. We feel sure such an exhibit would attract and would be educational and effective. No Diesel engine was shown, which is also to be regretted, for the future of oil fuel seems likely to be as closely allied with the engines to burn liquid fuel as with furnaces for steam raising. The tendency of the day is towards direct applications rather than towards the methods of the steam engine.

Though outside the oil range, a very excellent exhibit is shown by the British Oxygen Co. in the shape of their oxygen cutting-flame. This is a development of the oxy-acetylene welding blowpipe. There is the usual blowpipe jet of oxygen and acetylene mixing the gases near the point of combustion, but in the centre of this annular flame a fine jet of oxygen is passed into the heart of the heating flame and plays upon the metal, which is heated by the blowpipe outer flame. The metal, iron or steel, rapidly oxidises, and the oxide is blown away by the oxygen jet, and armour plates as much as 12 in. in thickness can be cut through at the rate of 13 linear ft. per hour, using 50 cb. ft. of oxygen per ft. run of cut, and about 5 cb. ft. of acetylene for thick cuts. For 1-in. plates about 2·2 cb. ft. of oxygen are consumed per ft. run. The rate is about 40 linear ft. per hour, and the consumption of acetylene about a fourth the volume of oxygen. With coal gas the volumes of gas are double the volumes of acetylene, and coal gas is considered more suitable for light work.

On Stand Nos. 101 and 102, a selection is shown of the Ozonair Co.'s apparatus. Ozone, owing to its adoption on the Central London Railway and in many important public buildings, has come to be generally known as a great aid to ventilation, purifying and freshening the air; it is also employed for the purification and sterilisation of drinking-water supplies, whilst its industrial applications are very numerous. Ozone is now being employed in various therapeutical applications, and is prescribed for consumptive patients who have to reside in towns instead of in the open air of the country.

The apparatus exhibited are examples of the principal portable types of ozone generators made by the company. An important feature of it is that, in producing ozone, no nitrous oxides are formed, and consequently there is no liability to harmful effects. Small machines are also exhibited, adapted for fixing permanently on to the wall, and larger apparatus is also on view. A full-sized plant is shown in operation, as used in the ventilation of large buildings. Messrs. Ozonair, Ltd., have now installed several hundreds of such ventilation plants, which both purify and filter the air, heat or cool it as required, and charge it with a proper proportion of ozone.

The exhibit of the India-Rubber, Gutta-Percha & Telegraph Co., Ltd. (the Silvertown Co.), of Silvertown, London, E., includes one Silvertown-Crossley oil-engine set (the dynamo being a standard Silvertown machine of 5·5 kw.) and two Silvertown petrol or paraffin-electric sets. All three sets are specially designed for private house, hotel and ship lighting and power. In addition, there are a three-wire dynamo of 25 kw., 460-480 volts, a high-speed revolution counter, a ceiling fan, various small motors, and a hose of special construction for use with petroleum, all of Silvertown make.

The Silvertown patent electrically-controlled revolution counter is designed to count with perfect accuracy the revolutions of a shaft in a given time, and is suitable for speeds as high as 8,000 r.p.m. It is controlled by a clock-driven electric contact, and an arrangement is provided for re-setting the pointers at zero for each reading.

Barnet Lighting.—Owing to the bad lighting of the district by the Gas Co., Councillor Ford has intimated his intention of moving at the next Council meeting, that the Council at once approach the North Metropolitan Electric Power Co., asking if it will be possible for it to lay mains throughout the district by October, 1913, and, if so, at what cost it would light the roads.

LEGAL.

Sale of Primary Cells.

In the City of London Court, on Friday, Mr. Frederick Hodgson, 24, Queen Street, E.C., electrician, sued Mr. William Boa, 39, Windmill Road, Gillingham, Kent, for £16 14s. 10d., being 15 guineas damages for breach of contract and 9s. 10d. for carriage. His case was that defendant offered him 280 primary cells at 1s. 1½d. each, saying that they were quite new. Plaintiff paid for them in advance at defendant's request, and then found that many had been used before, as the batteries had salammoniac in them, and others were not equal to sample submitted. The majority were practically useless. Defendant said that was not true; the cells were quite good and not defective. He did not sell by sample. He bought them from the Government, as they came from the Royal Military Engineering School, Chatham. He paid nine guineas for them, and their original cost to the Government was 5s. each or £70. Could plaintiff expect absolutely perfect goods for 1s. 1½d. each? Judge Rentoul inspected all the cells, and said some of them were good, but not many. He did not think the authorities knew their condition, and the Government might meet the defendant. He must find for the plaintiff, but it would be without costs.

A Scottish Case.

The record has been closed, in the Dunfermline Sheriff Court, in an action at the instance of John McDonald, farmer, Inverness-shire, against Messrs. Balfour, Beaty & Co., tramway contractors, Dunfermline, in respect of the death of his son Alexander, who was employed as a plumber by the defendants.

The pursuer sues for £500 at common law, or, alternatively, £236 under the Employers' Liability Act.

The deceased was electrocuted on December 14th last at the East Wemyss sub-station through touching an exposed portion of a cable which was being tested. The pursuer avers that the cable ought to have been protected by a fence. The defenders state that there was no need for a fence, and that the deceased had no need to be near the cable, or to interfere with it in any way.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Large Simplex Toaster.

The accompanying illustration, fig. 1, shows an interesting piece of electrically heated apparatus, which Messrs Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have just supplied to a large catering establishment. It represents a cast-iron nickel-plated toaster, capable of producing 720 full sized slices of toast per hour; the loading is 6 kw., controlled in four sections.

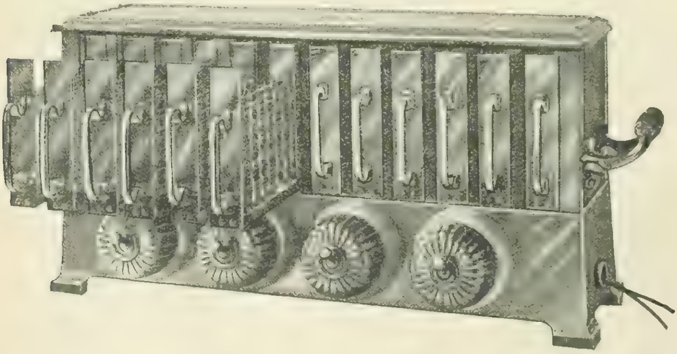


Fig. 1.—Large Simplex Toaster.

The Simplex Wedge Continuity System.

Messrs. Simplex Conduits, Ltd., have also introduced a simple patented device to enable Simplex unscrewed conduits to comply with regulations as to earthing and continuity where such are called for, without any extra charge. It consists of a short T section piece of aluminium or other suitable material, with the upper part curved slightly so as to fit the surface of the tube closely. All fittings for use on the system have a narrow saw-cut in each outlet, into which the wedge is placed, so that the curved top is inside the fitting. The wedge is made of light-gauge metal so that it is possible to insert the conduit without filing, an exceedingly tight fit is obtained, and the action of socketing the conduit compresses the aluminium and gives the conduit a surface of the metal affording an efficient and lasting contact. This scraping effect is increased if the tube be twisted slightly when being inserted into the fitting; the jamming effect produced by the insertion of the wedge, gives a tight union of considerable mechanical strength. As will be seen from the illustration, fig. 2, there are no unsightly projections, the wedge being hardly noticeable when in position, and the actual operation of inserting it does not occupy an appreciably longer time than erecting ordinary unscrewed conduits.

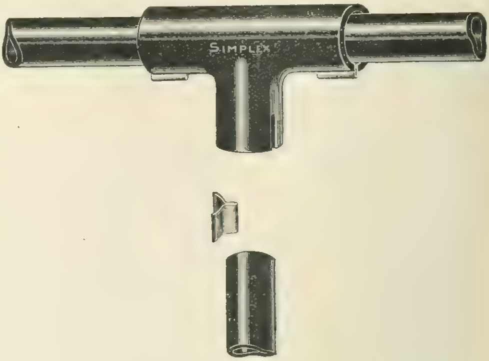


Fig. 2.—Simplex Patent Wedge Continuity System.

The "Troika" CO_2 Analyser.

A simple device for measuring the percentage of CO_2 contained in flue gases is the "Troika" analyser, fig. 3, which is being introduced by Messrs. Thermo and Pressure Instruments, Ltd., of 60, Salusbury Road, Kilburn, N.W. As shown in the accompanying figure, it consists of a single glass instrument, with two large bulbs and a graduated stem. The lower bulb is filled with absorption liquid, which costs a trifle: one charge suffices for 200 tests. The flue gases are passed through the upper bulb and stem with an aspirator while the instrument is immersed in water at atmospheric temperature; the stopcocks are then closed, and a portion of the fluid is shaken up with the gas in the instrument. On opening the upper stopcock while the apparatus is submerged, water enters to take the place of the CO_2 absorbed, and its amount is read off on the graduated scale, which gives at once the percentage of CO_2 contained in the flue gases, without any calculation. The results, it is stated, can be relied upon to 0·5 per cent., and the manipulation is quite simple.

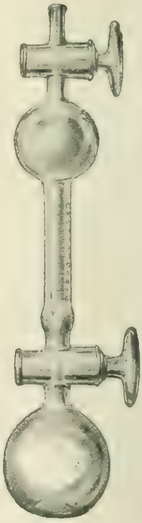


Fig. 3.—"Troika" CO_2 Analyser.

Semi-Indirect Fittings.

The British Thomson-Houston Co. have recently issued a folder dealing with their new line of semi-indirect fittings, by which most of the light is thrown on to the ceiling, and a small portion trans mitted through the reflector in the form of direct illumination. The fitting consists of a semi-transparent bowl suspended by a brass ring, chains and ceiling plate. The bowl is made of a specially prepared opal glass which gives beautiful lighting effects.

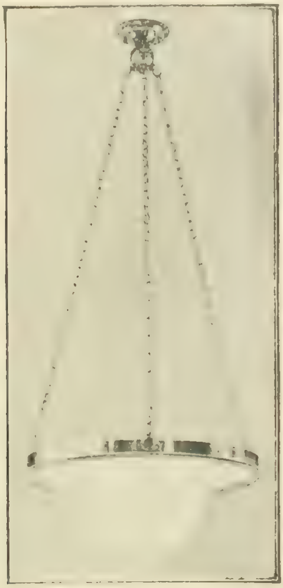


Fig. 4.—B.T.-H. Single-Lamp Fitting for Semi-Indirect Lighting.

These fittings are supplied in two types, one for clusters of lamps up to six in number, and the other for single lamps. Both types are made in several sizes for total lamp wattages ranging from 40 to 600 watts.

Improved Drilling Machines.

Our view, fig. 5, shows four R 5 type drilling machines of the Witton-Kramer type in operation on a large casting at the Witton works of the G.E. Co. In this particular case the inner machines are used for drilling holes $1\frac{9}{32}$ in. in diameter, 8 in. deep, while the outer machines make a counter-bore 5½ in. in diameter, 1⅛ in. deep. The former operation takes 15 min., while the latter is accomplished in 10 min.

The features of Witton-Kramer drilling machines are their portability and sound construction. The armature as well as the field coils is carefully and thoroughly insulated throughout with the best materials. Aluminium is used largely to keep the weight of the machine as light as possible, the end shields and switch box being of cast aluminium.

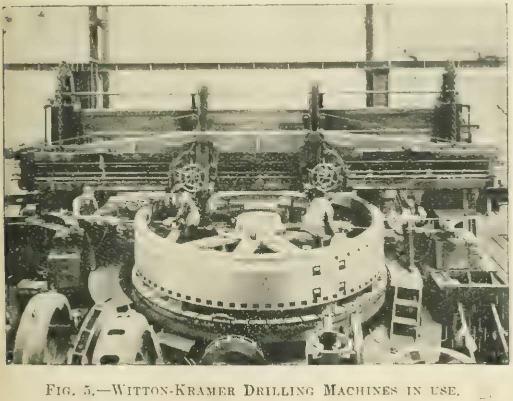


Fig. 5.—Witton-Kramer Drilling Machines in use.

We understand from the General Electric Co., Ltd., that they are prepared to send these machines on approval to *bonâ fide* customers, provided that they pay the freights, and undertake to retain the machines if they are kept any longer than seven days.

In a recent test of the Witton-Kramer drilling machines against German and American machines of similar type, they proved much more satisfactory both in temperature rise after the test had been completed and also in the time taken to do certain boring. The actual figures are as follows:—Diameter of hole 1¼ in., depth 2⅛ in., material, cast-iron, voltage 220 D.C.

The American machine drilled 32 holes, average time 1 min. 45 sec., current consumption 6 amps.

The German machine drilled 23 holes, average time 3 min. per hole, current consumption 4·2/10 amps.

The Witton-Kramer machine drilled 38 holes, average time 1 min. 35 sec. per hole, current consumption 4·5/10 amps.

The fastest time in which the German machine drilled a hole was 2 min., the American machine took 1½ min., and the Witton-Kramer machine 65 sec.

BUSINESS NOTES.

Consular Notes.—Brazil.—The British Consul at Pernambuco reports that that city is regularly visited by a large number of travellers, British and foreign, representing high-class firms and dealing in almost every kind of goods. Competition is very keen, and little is to be done by means of correspondence on the part of exporters at home.

Consular officers receive letters by every mail from British firms asking for the names of responsible agents. Agents as a rule have their own particular lines, and if they are successful, already represent a sufficient number of first-class firms or manufacturers. Beautifully illustrated and elaborate trade catalogues are also constantly being sent out; these are invariably written in English and prices are quoted in English money. To be of any use they should be written in the Portuguese language and prices given in milreis. The metric system should also be used. Occasionally a catalogue in Spanish is received with the prices given in pesetas, which the would-be exporter appears to think will serve equally well, forgetting that in Brazil Spanish is as bad if not worse than English both as regards language and currency. Payments for goods are usually made by bills drawn at 90 days' sight after the delivery of the goods. The best way to open up business and introduce goods on to the Brazilian market is either through one of the large British exporting houses who have their agents on the spot, or with the aid of a first-class traveller who regularly visits Brazilian ports, and who knows the language and people thoroughly. Trading by correspondence or without a representative on the spot usually leads to disputes, unsatisfactory business and bad debts. In doing business with Brazil much depends on the choice of the traveller and on his personality. He should carry a full and carefully selected line of samples, and have a thorough knowledge of his business and the language and customs of the country: in these points it is to be feared foreigners often excel, as one frequently finds foreign travellers successfully representing British manufacturers. The principal imports from the United Kingdom comprise:—Machinery, cutlery and hardware, all classes of cotton textiles, linen goods, drills for suitings, lace, &c.; china, glass, jams, preserves and groceries, thin woollen goods for suits, &c. On the whole, British goods seem to be holding their own fairly well, the most noticeable falling-off being probably found in Manchester goods.

German South-West Africa.—The British Consul at Luderitzbucht reports that telegraphic communication has been established with the Union of South Africa *via* Warmbad Steinkopf. The charge of 3d. per word is made for telegrams from the Union of South Africa to German South-West Africa, while in the reverse direction the charge is 30 pf. (about 3¾d.). The Eastern Cable Co. has a station at Swakopmund, which is linked up with the cable between the United Kingdom and South Africa. Wireless stations have been erected at Luderitzbucht and Swakopmund. The latter station began operations in the beginning of February, 1912, and the former was to be ready to send messages on April 1st, 1912. The charge per word is 9d., with a minimum charge of 7s. 6d. per message. The Protectorate can boast of an excellent telephone system, which embraces nearly 50 towns and villages. The town of Luderitzbucht is now lighted by electricity, which is obtained from the electrical works of the Kolonial Mining Co. Swakopmund is also lighted by electricity.

Madeira.—The British Consul at Funchal reports that the installation of telephones under the Government has at last become an established fact. They were erected and ready for use early in October, and by the end of the year some 104 were in working order. There appears to have been some discussion with the Lisbon authorities as to the annual cost, but this point has at last been settled and is fixed at £3 per annum, together with a charge of about £1 5s. for first installations. The system up to the end of the year was working fairly well, but there were complaints as to the inefficiency of the plant erected; this will no doubt be remedied in the future.

Italy.—The British Consul at Rome reports that one of the causes which in the past has retarded the industrial development of that city has been the want of fuel which had to be imported from a distance, and its price consequently hampered would-be manufacturers. Of late years, however, the water resources of the district have been largely utilised. It is calculated that about 65,000 electric H.P. is at present available for private consumption. The aggregate quantity is 85,000 H.P., of which 70,000 H.P.

is hydro-electric, and the remainder produced by steam. The tramway company uses 6,000 H.P., private consumption 14,000 H.P., leaving over 60,000 H.P. available for general industrial purposes. The advocates of the progress of the Italian capital expect that as soon as conditions will permit it, the Act granting certain fiscal exemptions to new industrial concerns in the Neapolitan districts will be extended to Rome.

The British Vice-Consul at Civitavecchia reports that the contract for lighting the city by electricity, and the supply of electric motive power has been taken over by a new company, and it is stated that fully 2,000 H.P. will be available.

Costa Rica.—The British Consul reports that the hydro-electric power plant of the Costa Rica Electric Light and Traction Co., at El Brazil (5,000 H.P.), was completed during the year 1911, and the power from this source was put into service in December.

Spain.—The British Consul at Seville states that it was reported last year that the monopoly hitherto held by the Compania Sevillana de Electricidad, a Spanish company with German capital, was likely to be invaded by competition. The Sociedad Catalana de Alumbrado por Gas, a powerful Spanish company, till now producers of gas only, have decided to supply electric current for lighting and power purposes. Their work in this direction is making very satisfactory progress.

The British Vice-Consul at Cadiz reports that the wireless telegraph station at Puntales, connected by wire with the telegraph office at Cadiz, was inaugurated in November last, together with those at Barcelona and Santa Cruz de Tenerife. In connection with this service, there will soon be opened other stations at Vigo, Aranjuez, Alicante and Palma de Mallorca. The headquarters of the company—Compania Nacional de Telegrafia sin Hilos—floated in Spain at the initiative of the Marconi Co. with British and Spanish capital, are established at Madrid. The Puntales station has rendered good service by taking over messages during the breakdown of the cable to the Canary Islands. The Eastern Telegraph Co. has submarine cables connecting Cadiz with Gibraltar and Villa Real de San Antonio. The French Government has a cable between Cadiz and Tangier and the Spanish Government one to Tenerife.

Later in his report, the Vice-Consul states :—

Bad debts are by no means so frequent as is commonly supposed, and there are a large number of well-to-do families and very good firms with whom British houses can deal with safety. It is very necessary for the British merchant to guard against wounding the susceptibilities of his clients, since there is no doubt that the unfortunate reputation often undeservedly given to firms in southern Europe renders those whose commercial honour is unassailable particularly sensitive to the treatment frequently meted out to them.

Book Notices.—"The Una-Flow Steam Engine." By Prof. J. Stumpf. Price 10s. 6d. net. "Toll Telephone Practice." By J. B. Thiess and G. A. Joy. Price 14s. net. 1912. London : Constable & Co., Ltd.

"Atti della Associazione Elettrotecnica Italiana." July 31st, 1912. Milan : Stucchi, Ceretti & Co.

"*Bulletin* of the Association des Ingenieurs Electriciens." May, 1912. Liége : The Association. Price 5 fr.

"Handbook of Standard Telephone Construction Methods." By Frank B. Hall, Newton Falls, Ohio, U.S.A. London : S. Rentell and Co. Price 17s. net.

"Science Abstracts." Vol. XV, Part 8. August 26th, 1912. Sections A and B. London : E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Examples in Applied Electricity." By C. G. Lamb. 1912. Cambridge : University Press. Price 2s. 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 6. August, 1912. New York : The Society.

Messrs. Grafton & Co., of 69, Great Russell Street, W.C., are publishing a full-title catalogue arranged under subject headings of all British and American books on engineering, metallurgy and allied topics published during the five years 1907-11, with their English and American prices and publishers' names. The work has been complied by Mr. R. A. Peddie, librarian of the Technical Library of the St. Bride Foundation.

A Charge of Embezzlement.—At Prescot (Lancs.) Petty Sessions, on Tuesday last week, Thomas Hanlon, formerly in the service of the British Insulated and Helsby Cables, Ltd., at the Prescot Works, was committed for trial at the Liverpool Assizes on charges of embezzlement. From the opening statement of Mr. Hutchens, solicitor for the prosecution, it appeared that the defalcations discovered amounted to about £1,000, though the charges were limited to much smaller amounts. When the prisoner went away on his holidays, the deficiencies ceased. When he returned they began again. He gave wrong totals to wages sheets and pocketed the differences, and he entered bonuses to which men were not entitled, and took these too ; and had a clever system of hiding it up. Bail was refused.

Lead Protective Coating for Iron and Steel.—Messrs. Hayward Bros. & Eckstein, Ltd., have been granted a sole licence for coating iron and steel sash bars with lead by the Cowper-Coles process, and a plant is being equipped at their works in London for the purpose.

Liquidation.—District Electric Co., Ltd., Birmingham.—A meeting of creditors will be held on Friday next. Creditors should communicate with Mr. J. W. Hinks, liquidator, 115, Colmore Row, Birmingham.

Private Arrangement.—Fletcher Jackson & Co., Ltd., electrical and mechanical engineers, 89, Halmet Court Road, Westcliff-on-Sea.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors was held recently at the offices of the company. A meeting of the shareholders had previously been held, when a resolution was passed to the effect that it had been proved that the company could not, by reason of its liabilities, continue its business, and that it was advisable to wind up the concern voluntarily. A further resolution was passed appointing Mr. A. Pensam, of 89, Halmet Court Road Westcliff-on-Sea, to act as the liquidator of the company. A statement of affairs was submitted by Mr. Pensam, which disclosed total liabilities of £1,230. The indebtedness to the trade was only £400, while there was an overdraft at the bank of £30. The balance of the liabilities of £800 represented an amount due on debentures. The assets consisted of stock-in-trade at cost, £400, fixtures and fittings £64, machinery £42, and book debts £400, estimated to realise £350. The assets, therefore, totalled £856, or a deficiency of £374. It was reported that the business was originally carried on in partnership by Messrs. Fletcher & Jackson. The company was registered to take over the concern a little more than two years ago, and had a nominal capital of £600. Subsequently the two vendors each found a sum of £300 in cash, and in return received debentures for a like amount in the company. Debentures for a further £200 were issued during the present year for cash advanced. It was pointed out that the assets only amounted to £856, and were subject to debenture charges of £800, so that there was really only a balance of £50 odd for the unsecured creditors. The liquidator said that there was a desire to continue the business, as there were several important contracts in hand. The directors had not drawn anything from the company, and they hoped in a few weeks to be able to make an offer to the unsecured creditors. It was decided by the creditors to leave the matter in the hands of Mr. Pensam.

Electric Time Service.—We are informed that the Synchronome Co., Ltd., of 32 and 34, Clerkenwell Road, are installing their system of uniform and accurate time-keeping throughout a number of buildings, of which the following are some of the more important :—Vickers, Ltd., new offices, Barrow-in-Furness ; Marconi's Wireless Telegraph Works, Chelmsford ; The British Thomson-Houston Meter Works, Coventry and Lamp Works, Willesden ; Diesel Engine Co.'s new offices ; four-faced public turret clocks at West Bromwich and Wednesbury ; Rangoon railway station of the Burmah State Railways ; Waterloo Station extension and the Nine Elms engine shed for the L. & S.W. Railway ; Amalgamated Press, Farringdon Street, E.C. ; *The Daily News and Leader*, Bouverie Street, E.C.

Bankruptcy Proceedings.—John William Garsden (trading as W. Garsden & Co.), electrical engineer, 24, Preston New Road, Blackburn.—The adjourned public examination of the abovenamed debtor was held at St. John's Lodge, Richmond Terrace, Blackburn, when the Official Receiver stated that the debtor had been made liable for a partnership debt, and he gave this as the cause of his present position. Mr. H. S. Haworth, for the trustee, said he had no further questions to ask, and on the application of Mr. Tom Backhouse, the case was closed.

R. E. Walker, 16, Widemarsh Street, Hereford, electrical engineer.—The order of July 16th last has been discharged, subject to a condition.

Catalogues and Lists.—The Electrical Co., Ltd., 122-4, Charing Cross Road, W.C.—Price list No. 12 of small motors and tools ; the former range from $\frac{1}{80}$ to $\frac{1}{3}$ B.H.P. in a variety of patterns, including a portable household motor for performing a number of functions.

The Foster Engineering Co., Ltd., Wimbledon, S.W.—Pamphlet describing a new line of "Standard" oil-filled transformers for 1 to 100 KW., 50-60 cycles, and up to 3,000 volts ; the specification and dimensions are given, and various special apparatus are also illustrated.

Messrs. Mavor & Coulson, Ltd., 47, King Street, Mile End, Glasgow.—Leaflet describing the "Dandy" ventilators for mine headings, &c.

The Schniewindt Electric Co., 40 and 41, Staniforth Street, Birmingham.—Leaflet relating to the Schniewindt-Asbestos woven-wire resistances, which are now, with other specialities, manufactured at the company's own works in Birmingham.

The General Electric Co., Ltd.—The company has made arrangements with the Holophane Co. for the sale of their various products, and has just issued "The only Complete Catalogue of Holophane Glassware." It will carry the largest stock of Holophane glassware in the United Kingdom. This catalogue contains the complete range of designs of Holophane and Holophane Benjamin products, beautifully illustrated on fine art paper, and gives a detailed description of scientific illumination. The new inverted type of Holophane bowls, which serve for indirect lighting, is shown, as well as the "Stiletto" reflectors in the usual extensive, intensive and concentrating types, and reflectors for residence use. Other features of the list are the "Uniflux" reflectors and reflector bowls, reflectors specially designed for use in factories, dockyards, &c.

Pamphlet No. L 1,591, of electric bells and accessories ; and C 1,561, of "Geekoduct" continuity devices, earthing devices, &c.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—For the convenience of contractors, this firm is now issuing an attractive showcard on which samples of all types of "Wotan" battery lamps can be mounted, and by means of which the various types of lamps can be displayed to the public.

In the centre on a vignetted background are illustrated all the different patterns, and a brass spring clip is fixed in a suitable position on each, so that a lamp of similar type is fixed directly above the illustration, and after a lamp has been removed, an illustration of it remains. The cards are supplied at the actual value of the lamps mounted thereon, less, of course, the usual trade discount. The sample showcard also depicts the various applications to which these battery lamps can be applied.

Messrs. Townshend's Art Metal Co., Ltd., Ernest Street, Holloway Head, Birmingham.—Catalogue of the "Calor" electric cooking and heating appliances, in which the heating element consists of non-oxidisable resistance spirals mounted on a refractory clay base which becomes red hot, and is readily renewable. The appliances include food warmers, hot plates, a variety of utensils, electric irons and "bright glowing electric fires."

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, E.C.—Catalogue No. 312 of "Efesca Wire" lamps, British-made, for which exceptional strength is claimed; they are made in sizes down to 10 c.p. for low voltage and 16 c.p. for high voltage and up to 1,000 c.p., in various shapes. Carbon lamps are also listed, and auto-transformers, &c.

Werths & Co., 41, Aldersgate Street, E.C.—Pamphlet describing the firm's specialities, viz., cast-steel draw plates and dies for rod and fine wire drawing; chilled cast-iron dies; steel and tools for wire manufacture; diamond dies and powder, and draw tats.

Mirrlees Condensing Plant.—A repeat order has been placed with the Mirrlees-Watson Co., Ltd., of Scotland Street, Glasgow, by Messrs. D. Colville & Sons, Mothewell, for a barometric jet condensing plant directly connected to rolling-mill engines, with a duty of 200,000 lb. steam per hour. The company are also supplying numerous sets of their Mirrlees-Leblanc multi-jet plant, amongst other recent orders being two sets each for John Foster and Sons, Queensbery; Lewis Merthyr Colliery, and East Hetton Colliery, while their Mirrlees-Leblanc rotary air pumps have been supplied to several home and foreign works. Their surface and jet condensers have also been in demand for electricity works and factories.

Trade Announcements.—The Schniewindt Electric Co. have recently opened a new works at 10 and 11, Staniforth Street, Birmingham, for the manufacture of their asbestos woven net resistances, and resistances to any specification; electric heating and cooking apparatus and elements, woven work in wire and asbestos, &c. These specialities were formally manufactured by Mr. Schniewindt, Neuenrade, Westphalia, but at the special request of numerous customers, these works have been started in Birmingham.

The business carried on for many years by the late Mr. James Tate, electrical and mechanical engineer, of 182, Harris Street, Leeds Road, Bradford, and which has since been continued by his executors, has been sold to Mr. William Henry Wilkinson, who, for a considerable time, was Mr. Tate's chief assistant.

Messrs. Quincey & Son, electrical engineers, announce that they are giving up their business at 298, Baker Street, Enfield, N. In consequence the stock is to be disposed of by auction on September 24th.

LIGHTING and POWER NOTES.

Aberdeen.—The T.C. has agreed to all round reductions in the price of electricity supply. For lighting, the flat rate is to be 3½d. per unit; heating and cooking, 1d. to ¾d. per unit; power, 2½d. to ½d. per unit according to quantity; and traction ·85d. per unit, with subsequent adjustment.

Acton.—Very considerable headway, says a correspondent, has been made by the Metropolitan E.S. Co. since the transfer of the Acton Council's electricity undertaking, some 18 months ago. Both in respect to lighting and power, the past year's trading has been very successful, the output increasing by about 100 per cent. and necessitating the erection in the southern portion of the district, of a sub-station adjoining Wilkinson's sword factory, which is now in course of construction.

Afghanistan.—News from Kabul is to the effect that the sanction given by the Amir to the scheme for generating electricity at Jabal Siraj north-east of the capital, is really to be effective this time. The idea is to provide electric power for the arsenals and workshops at Kabul, incidentally light will be available for the Amir's palaces and city generally, also the rifle, gun, and ammunition factories, not to mention the mint, have machinery which can be run by electricity, and a great saving should be effected when the Jabal Siraj installation is in full working order.

Balby-with-Hexthorpe.—The Doncaster Corporation, which obtained powers in 1898 to supply electricity within the borough, and recently secured extended powers in the Wheatley district, now desires to still further extend its area of supply, so that the district of Balby and Hexthorpe may be included. Application for support has been made to the District Council, and the latter has decided to deal with the matter in committee.

Barnsley.—The accounts of the Corporation for the past year, issued on Monday, show that the electricity department, the capital expenditure of which is now nearly £100,000, yielded a net profit of £2,383, with an average sale price of 2·054d. per unit.

Blackburn.—The borough electrical engineer (Mr. P. P. Wheelwright) has been instructed to prepare for submission to the Electricity Committee, a report on the [illegible] of new works for the electricity department.

Bradford.—The Electricity Committee has decided to change the system of electricity supply along certain roads in the Thornbury district from direct-current to alternating-current. The cost of the work is estimated to be about £1,480, and the cost of replacing mains at present in existence will be defrayed out of revenue.

Braintree.—The Witham Electric Light Co. has approached the U.D.C. with reference to the formation of a local syndicate to carry out an electric supply scheme for the town on lines similar to those at Witham. The Council has referred the whole matter to the Finance Committee.

Brighton.—The T.C. has reduced the price of current to consumers of 15,000 units per annum for lighting, from 4d. to 3d. per unit.

The T.C. has received from the L.G.B. sanction to a loan of £3,770 for the extension of the distributing and feeder mains and house services, and extension of the switchboard.

Burnley.—The Council has decided to apply for loans of £17,000 and £6,400 for the purpose of carrying out electricity extensions.

Cheltenham.—The T.C. has decided to at once proceed with the extension of the electrical mains to Prestbury and Leckhampton.

Continental Notes.—France.—A Sulzer-Diesel engine installation at St. Chamond central station consists of two two-stroke engines of 1,000 and 2,000 h.p. respectively. The oil is stored in cement tanks lined with glazed tiles, from which it is pumped into service tanks near the engines. Circulating water is stored on the top of the engine house, and is used for piston cooling as well as cylinder cooling.

La Compagnie Générale Electrique de la Champagne has secured the concession for the electric lighting of no less than 54 small towns and villages in the Departments of Marne, Aisne and Ardennes.

Germany.—An agreement has been arrived at between the municipal authorities of Brandenburg-am-Havel and the A.E.G., of Berlin, whereby the latter will take over the municipal central electric lighting station in the town of Brandenburg and operate the same during a period of 40 years.

Dudley.—The chairman of the Electricity Committee moved at the last Council meeting, that the electrical undertaking of the Corporation be sold at once upon terms agreed upon by the Committee. The *Birmingham Daily Post* says:—"Since publicity was given to the proposal nearly a fortnight ago, it has been generally supposed that the prospective purchasers were a company having a large electrical station at Ocker Hill, and possessing Parliamentary powers in all the districts immediately surrounding Dudley, but inquiries show that this surmise is incorrect. A *Post* representative was informed, on very good authority, that the offer to purchase which the Council are asked to accept emanated from the British Electric Traction Co., with whom negotiations have been conducted, and that two other companies are involved in the transaction—the Birmingham and Midland Tramway Co., and Shropshire Power Co. The offer embodies, our representative was informed, a guarantee to repay the whole of the outstanding loans on the power station, amounting to £68,000, with interest, plus £13,000, which includes the cost of the arbitration proceedings relative to the price of current to the tramway company, stated to be about £8,000, and also various sums expended on the station independent of money raised by loans. The security for the carrying out of the proposed agreement would be a mortgage on the power station and an arrangement implicating two of the companies named, the combined capital of which is about £2,000,000. The Corporation, however, would still remain liable for the repayment of the loans and interest in the event of these annual obligations not being met by the purchasers."

At a meeting of the Dudley Traders' Association and the Dudley Ratepayers' Protection Association, a resolution was passed urging the Council not to sell the concern until the matter has been fully placed before the public and was thoroughly understood by the ratepayers.

The T.C. on Tuesday decided to sell the electrical undertaking. The purchasers, who take over the concern as from last March, undertake to maintain the present rates for current for three years.

Dundee.—The T.C. has recently improved the street lighting of the city. In place of the old open-type arcs, 88 "Angold" magazine flame lamps have been installed. The change was so well organised that all the new lamps were switched on at the usual lighting-up time. The work of changing was commenced at twelve o'clock midnight Wednesday, August 28th, and the whole of the 88 new lamps were fixed and ready for switching on by mid-day on Thursday, the 29th.

Ealing.—Mr. J. D. Knight, borough electrical engineer, in a report to the T.C., says the time is now ripe for the appointment of an official publicity agent to the undertaking, whose sole duty would consist of canvassing the district continually from one end to the other. Some 12,000 pamphlets, showing the various purposes for which electricity may be used and the benefits accruing to the user, have been delivered to householders during recent months; and a canvass of shopkeepers for outside lighting by means of arc lamps has met with very favourable results.

Glasgow.—Through the extension of the boundaries of the city and the inclusion of the municipal areas of Govan and Partick, a number of departmental adjustments have had to be made. At a recent meeting of the City Council there was submitted a correspondence with the town clerk of Partick as to new electrical cables required by the Partick electricity department, to give a supply of electricity to the granary now in course of erection by the Clyde Trustees at Meadowside. It was agreed to remit to the Electricity Committee and the engineer of the electricity department to arrange with the Partick engineer for the providing of the necessary cables.

Ex-Bailie P. S. Stewart has given notice of the following motion for consideration at the next T.C. meeting :—"That it be remitted to a Joint-Committee of the Tramways and Electricity Committees to consider and report as to the advisability of putting under the control of one Committee, the generation of electricity for all purposes."

At a recent meeting the Health Committee of the Glasgow T.C. it was decided to install, at a cost of £70, an electric motor at Belvidere Hospital for the purpose of driving the laundry machinery. After further consideration, however, the scheme has been widened to include four motors at an additional cost of £120.

Officials of the electricity department have just completed a smart piece of work in what is claimed to be record time. On Thursday of last week a large engineering firm reported that through a breakdown of their steam plant the works had come to a practical standstill, and asked the department to assist them out of the difficulty as expeditiously as possible with the supply of 1,000 KW. Mr. Lackie and his assistants at once set to work, and two rotary converters were transferred to the works of the firm, along with the necessary switchgear, while the mains were also laid, the whole of the operations being concluded by Sunday evening. The works were able to resume full operations on Monday morning.

Greenock.—An appeal has been made by certain power users in Port-Glasgow to the B. of T. to use its influence in order to enable Greenock Corporation and the Port-Glasgow Town Council to come to an agreement on the question of the former authority entering the latter's territory to supply a number of the shipyards with electricity. The Board has communicated with the Port-Glasgow Council, which has replied that, while adhering to its previous decision not to give the 30 years' guarantee sought by Greenock, it is willing to attend any meeting arranged by the Board. The Greenock Corporation has also agreed to take part in the negotiations.

Horeham Road (Sussex).—An effort is being made to secure an electric supply for the parish by the formation of a company. The proposed scheme entails an outlay of £3,000, which includes the provision of cooking and heating stoves and about 30 public lamps.

Leek (Staffs.).—The U.D.C. has decided to obtain a loan of £1,400 to defray the cost of laying additional cables for supplying electricity.

London.—Islington.—On the evening of September 9th a junction box fused at the Council's electric lighting station, causing a fire, and the staff, in order to avert further damage, cut off the whole of the supply from the station, thus throwing the whole of electrically-lighted Islington into darkness. Naturally the effect was severely felt in the absence of street lighting in the main thoroughfares and in the many public buildings which depend on the supply ; the latter was, however, fully restored on the following day.

Lytham.—At a ratepayers' meeting at Lytham, on Monday evening, there was a discussion on the suggested order for the supply of electricity to the district. As matters at present stand both the Lytham and St. Annes Councils are intending to apply to the B. of T. for a provisional order for the supply of current in the town.

Middleton.—On the recommendation of the Electricity Committee, application is to be made to the L.G.B. for sanction to borrow £2,000 for a steam dynamo.

Motherwell.—The annual report of the burgh electrical engineer shows a net loss on last year's working of £1,689. The output was 3,553,113 units, a decrease of 365,948, but this is largely accounted for by the stoppage of the public works during the miners' strike. The capital expenditure involved in the installation was £113,739, and the total revenue for the year was £15,158. A committee has been appointed to consider and report upon the exact state of the undertaking.

Nelson.—The T.C. has decided to supply current for outside illuminations during the forthcoming shopping festival at 2d. per unit.

Rochdale.—An application having been received from the Milnrow D.C. for terms for a bulk supply of electricity, the Gas and Electricity Committee has decided to submit the same terms as those offered to the Whitworth D.C. A further supply is to be given to Whitworth for the motor at the latter's sewage works.

Scarborough.—The B. of G. has been recommended by a Committee to adopt a scheme which includes lighting the whole of the workhouse premises by electricity. The combined heating and lighting scheme is estimated to cost £5,150.

South Africa.—According to the *British South African Export Gazette*, a second extensive installation, including two 600-H.P. suction gas plants for generating electricity, and an electrical washing plant, is contemplated by the Colonial Mining Co. for its diamond mines in German S.W. Africa.

Southampton.—The B. of G. has passed a resolution sanctioning the expenditure of £850 on a scheme of electric lighting for the workhouse infirmary at Shirley Warren.

Stroud (Glos.).—Mr. V. A. Lawson, of Cirencester, has solicited the approval of the U.D.C. to an electric light scheme for the town, which it is proposed to carry out under a prov. order to be applied for. The Council has decided to seek further information of the scheme.

Todmorden.—The accounts in the electricity department for the past year shows a revenue of £2,392 ; expenses, £1,232 ; and gross profit of £1,160. Sinking fund charges, however, amounted to £1,220, leaving a deficit of £59, against a deficiency for the previous year of £33. The authorised borrowing power of £20.000 has been exercised, and the whole amount expended. The total outlay on capital account is £21,945.

Truro.—The Gas Co. has decided to apply to the B. of T. for a prov. order for E.L. The chairman of directors has announced that electricity cannot be profitably supplied to the city, but as there were a number of residents who had a preference for the electric light, the company was prepared to do its best to meet their desires.

Wakefield.—Application is to be made to the L.G.B. for sanction to the borrowing of £3,000 for mains, £500 for substations, and £500 for transformers. The contract for the lighting of the Market Hall has been given to the Gas Co. The failure of the electricity undertaking to obtain it was due to the fact that the Gas Co. had already a number of fittings in the hall : the quotation for illumination compared favourably. The electricity department has opened a permanent showroom in the centre of the city, in which last week a very successful heating and cooking demonstration was held. This showroom it is proposed to run on co-operative lines between the manufacturers, local contractors and the electricity department. The two former are invited to make whatever use they think fit of the premises as a showroom, and the electricity department provide the building, staff, current, advertising and all other such portions of the work. Whatever sales are made to customers will be made through the local contractors, and it is hoped that it will produce good results.

West Bromwich.—At a special meeting of the T.C. on Friday. last week, an important report was submitted by the Electricity Committee. The firm of Messrs. Braithwaite & Thirk have agreed to take at least 80,000 units of electricity per annum for five years, and to enable the Committee to give this supply and provide for further demands from other customers in the district, it recommended that an additional feeder cable be laid down at an estimated cost of £2,650, and also a new additional distributor cable, the total estimated expenditure in the district being £3,010. About £1,500, it was stated, had been spent on extensions of mains, and the Committee recommended that application be made to borrow the amount required, and also £2,000 to cover prospective expenditure, the total amount to be applied for being £6,500. It also recommended the acceptance of the tender of the Electrical Engineering and Equipment Co., Ltd., for the supply of the cable. This is a Continental firm, but it was pointed out by the Committee that the tender was so very much below that of any of the tenders from English firms that the Committee felt it had no alternative but to recommend its acceptance. Councillor Halford said there would, no doubt, be criticism in some quarters over the Council giving a contract to a foreign company, but he did not think the ratepayers at large would blame them when they understood that there was a difference of £500 between this firm's tender and that of the lowest British manufacturers. The tender, he repeated. was more than £500 lower than any English tender, and there would be a saving in the repayment of the loan making the total difference about £750. The Council adopted the Committee's report.

Whitwood (near Pontefract).—In connection with the electricity undertaking, the L.G.B. has formally sanctioned the borrowing of £2,480. for a period not exceeding 12 years, for works already executed ; £300, for 15 years, for mains and services ; and £120, for five years, for meters.

TRAMWAY and RAILWAY NOTES.

Audenshaw.—At the meeting of the D.C. on the 5th inst., it was reported that the Oldham, Ashton and Hyde Electric Tramways Co. had returned the rate-demand notes, contending that the demand should be corrected, as it was only liable to be rated at one-quarter, by reason of a recent decision that a tramway was a railway for rating purposes. A notice of appeal was also received from Manchester Corporation on the same lines with regard to its undertaking in the district. The clerk was instructed to write to the tramway company that its contention was not accepted, and that it should appeal against the rate in the ordinary way. The clerk was also asked to take steps to contest the appeals at the Quarter Sessions.

Barnoldswick.—The Council has been notified of the proposed construction on the overhead system of an electrically worked railway from Colne to Barnoldswick and Earby, a distance of about 5½ miles, at an estimated cost of over £60,000. The scheme is being promoted by Messrs. Matthew Watson, Landless and Pearce, architects and surveyors, of Liverpool and Burnley.

(*Continued on page 424.*)

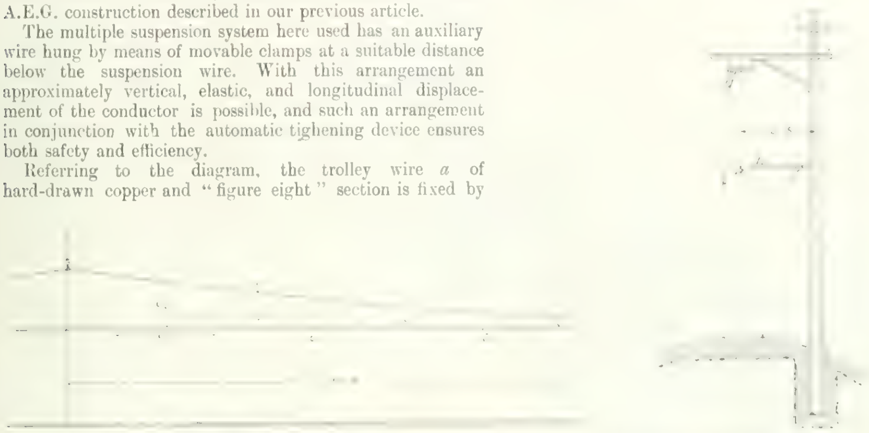
THE DESSAU-BITTERFELD RAILWAY.

SIEMENS-SCHUCKERT OVERHEAD WORK.

We gave, in our issue of May 24th last, a short description of the Dessau-Bitterfeld single-phase railway, the electrification of which was shared equally by the A.E.G. and Siemens-Schuckertwerke. Thus, the latter firm were responsible for the overhead equipment of the Raguhn-Dessau section of the line, which differs somewhat from the A.E.G. construction described in our previous article.

The multiple suspension system here used has an auxiliary wire hung by means of movable clamps at a suitable distance below the suspension wire. With this arrangement an approximately vertical, elastic, and longitudinal displacement of the conductor is possible, and such an arrangement in conjunction with the automatic tighening device ensures both safety and efficiency.

Referring to the diagram, the trolley wire *a* of hard-drawn copper and "figure eight" section is fixed by means of special clips *b* to a so-called auxiliary suspension wire *c* which runs approximately parallel to, and vertically above it. The clamps are arranged to grip the trolley wire tightly, and to hold the auxiliary wire only loosely. By this means a slight longitudinal displacement of the clamps along the auxiliary wire is possible. The clamps are also arranged to permit the trolley wire to move vertically, due to the pressure of the trolley or bow, giving certain contact between the bow and wire. The auxiliary suspension wire *c* is attached to the wire *d* at points whose distance apart is exactly double the distance between the points at which the trolley wire is supported. The line is suspended on vertical supporting wires *e*, which are fixed by special clamps *f*.



The Siemens-Schuckert Multiple Suspension System of Overhead Construction.

The suspension cable is carried on insulators *g*; and to prevent lateral movement of the live wire, it is held in position by a strut *h* at each pole. The struts are constructed of tubing, and are insulated from the pole by the insulator *i*. They are connected to the trolley wire by clamps *k*, specially constructed to allow the trolley wire to give both vertically and longitudinally.

All current-carrying parts are doubly insulated from the masts or brackets, a large factor of safety being allowed.

View on Railway Showing Siemens-Schuckert Overhead Construction.

The independent longitudinal movement of the trolley wire allows of its being tightened without distorting the supporting wires, and as sometimes happens in other systems, causing the suspension wire to break.

This feature is a great advantage for high travelling speeds where even tension of the live wire is required. The tension is obtained by means of automatic tension devices, which are placed at intervals of about 1,300 metres, and act by means of weights. Special attention is drawn to the fact that in case of breakage of the trolley wire, the actual supports—viz., auxiliary wire and suspension cable do not suffer since, as already mentioned, the trolley wire clamps can move along the auxiliary wire.

To compensate for the variation in length of the suspension and the auxiliary wires due to temperature changes, special tightening devices are not necessary, as the tension in the parts is arranged with a view to safety at the low temperatures in case of breakage. The variation of tension in these wires has no appreciable influence on the sag of the line or on the efficient collection of the current.

The supporting wire is suspended with a comparatively large sag, and temperature variation has practically no effect on it. Further, the change in length due to elasticity, which is considerable owing to the twisting of the cable, is compensated for. As a consequence, a suspension wire hung at a medium temperature shows extremely small alterations in height at high or low temperatures, and in the trolley wire only a very slight deflection is perceptible along the whole span.

Road Crossing and Gate, Dessau-Bitterfeld Railway.

The alteration in length of the auxiliary wire at various temperatures has no influence on the correct position of the live wire, as owing to the symmetrical arrangement of the trolley wire supports, the sag between two supporting wires is equal in all cases, and the points of trolley wire support rise or fall to an equal extent. These points have been found to be quite correct in the case of existing systems, and it has been found that good operation is assured at all temperatures.

To facilitate erection and obtain the proper tension, the suspension and auxiliary wires are provided with turnbuckles, with a left and right-handed thread, at intervals of 250 to 400 metres. The electrical connection of the trolley wire sections on each side of the automatic tightener is made either direct, or, if between two separate sections of the line, through a switch, which is fixed to the pole in any suitable position.

With the exception of the end-terminals for the wires and the turnbuckles, the connectors are of cast-brass, as these are less liable to rust. If iron is used for these parts, the paint with which they are covered before erection is apt to become damaged, and if not carefully repainted afterwards, the parts will rust. The clamps are provided with steel screws and brass nuts.

All other parts of the overhead system are supported by clamps in the same way as the trolley wire, so that all soldering work is avoided ; the trolley wire is, therefore, not heated, and consequently retains its maximum hardness and resistance.

The Siemens-Schuckertwerke were also responsible for some of the locomotives which, together with the overhead work, are illustrated in the accompanying figures.

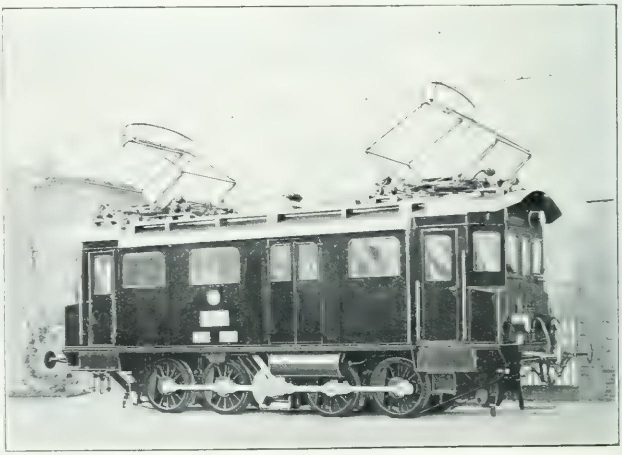
NORWICH ELECTRICITY WORKS AND THE FLOOD.

It is estimated that on August 26th nearly 400 million tons of rain fell in Norfolk alone—an average of 3-in. depth over the whole country. The rivers and dykes were quite unable to deal with this vast quantity of water, and the flat parts of the country were virtually shallow Broads.

The inundation was especially severe in the Norwich district. The only outlet for the water here is the River Yare, which meanders over a winding shallow bed, the fall in which from Norwich to the sea is only 20 ft. There is a 4-ft. tidal variation in the river which hinders the escape of flood water. On August 26th 6·5 in. of rain fell in this district in 24 hours ; 7·5 in. in 29 hours, and over 11 in. during the month of August. This unprecedented downpour caused a rise in the river level of about 12 ft. near the Norwich central station at the height of the flood.

For some distance above and below the station, the river is constricted by walls and buildings, so that a sudden inflow of water commenced directly the latter rose above openings in the side walls. That the flood in the station was so severe as to necessitate cessation of supply was due to a combination of unfortunate conditions, which could not be foreseen and which are very unlikely to recur. The buildings were erected nearly 20 years ago, and the engine room floor level was placed well above the previous record flood level (1878 ; 3 ft. lower than the floor-level). Since that date the river has been dredged considerably, and a number of mill dams above the station have been removed, so that only an extraordinary period of rain fall culminating in a prolonged heavy downpour could bring the river up to its recent flood level.

At the time of the disaster, the station was in that state of upset which inevitably accompanies such important extensions as are now in progress. Spare and dismantled parts covered much of the floor and were immersed during the height of the flood. The most serious of the unusual conditions in the station was the work proceeding on the new turbo-generator foundations. Some 10-13 ft. below the surface of the station site there is a 3-4 ft. layer of peaty soil, below this again is 2 ft or so of gravel and then chalk.



Siemens-Schuckert Electrical Goods Locomotive.

In excavating the station foundations, no serious percolation from the river (which is here only a few yards away), was experienced until the peaty stratum was penetrated, but thereafter great trouble was experienced. The new turbine foundations are only partially completed and infiltration through them was one of the most serious modes of ingress of the flood water.

The normal river level during the wet season is about 8 ft. below the engine-room floor, but by 3 a.m. on August 27th there was 3 ft. of water in the basement, and the water was then within 4 ft. of the engine-room floor.

Mr. Austin (the assistant engineer), who was in charge in the absence of the chief engineer, immediately proceeded to dam up such inlets as were accessible and capable of being closed. The Corporation pump store was flooded, hence the only pumps available were those lying spare in the station. Hand pumps were mounted over the various pits containing the engine and turbine auxiliaries, and by 11 a.m. a 6-in. centrifugal pump had been arranged to throw water out of the engine-room window. By this time the water in the basement was 5 ft. 6 in. deep and within 18 in. of the engine-room floor. The river continued to rise rapidly, much water flowed in by way of manhole covers and disused connecting ports in the condensing water culvert and many temporary clay plugs and dams gave way under the increasing water pressure. Another 6-in. pump was got to work during the afternoon, but at 9 p.m. the water (which was now 18 in. above the engine room floor level outside the works) reached the terminals of one of the dynamos, a "short" occurred, and the station had to be shut down. Up to this time, normal supply had been maintained, temporary cables being carried from the generators to the switchboard (the regular cable ducts being flooded early in the day), and a dam built across the mouth of the outgoing feeder tunnel.

Electric Goods Locomotive Drawing Train, Dessau-Bitterfeld Railway (page 419).

After the cessation of pumping, water speedily flowed into the power house, submerging the engine-driven sets to their shafts (see our views), but the turbine sets, being erected on raised foundations, were only submerged to their bed-plates. All the auxiliary machinery was under water. The conditions in one of the boiler houses are shown in one of our views. The fires of the water-tube boilers were not drawn till the flood was within 12 in. of the chain grates.

Examples of Siemens-Schuckert Overhead Construction, Dessau-Bitterfeld Railway (page 419).

The waters began to recede at 5 a.m. on August 28th, steadily falling during the next 24 hours to about 1 ft. below floor level.

The submerged auxiliary motors were raised as soon as possible, and arrangements were made for the field coils of all the wet machines and the armatures of the smaller motors to be baked as soon as they could be removed.

During Tuesday night, the whole of Wednesday and Wednesday night and the earlier part of Thursday, the supply was completely interrupted. The turbo-dynamos were dry but their auxiliaries were flooded, and temporary provision had to be made for a circulating water supply. One turbine was running to atmosphere by Thursday afternoon, the first duty performed being the charging of the battery. The latter had practically discharged prior to the shut-down, and could not be recharged till the flooded booster set had been dried. By Thursday evening a temporary circulating water supply had been arranged by belt-driving one centrifugal pump through an overhanging pulley mounted on its projecting spindle—the only bearing at this end being the gland—and another (in the basement) through a belt running on the commutator of the flooded pumping motor. Both expedients proved satisfactory; less brutal arrangements were made as soon as possible, and the gland and commutator were little the worse for their experience.

Messrs. Caley have a private generating plant, and also take a limited supply from the Corporation mains. They were able to supply 300-400 amperes to the latter for pumping, street lighting, &c., after shutting down their own load on Wednesday and Thursday evenings, and this was most valuable.

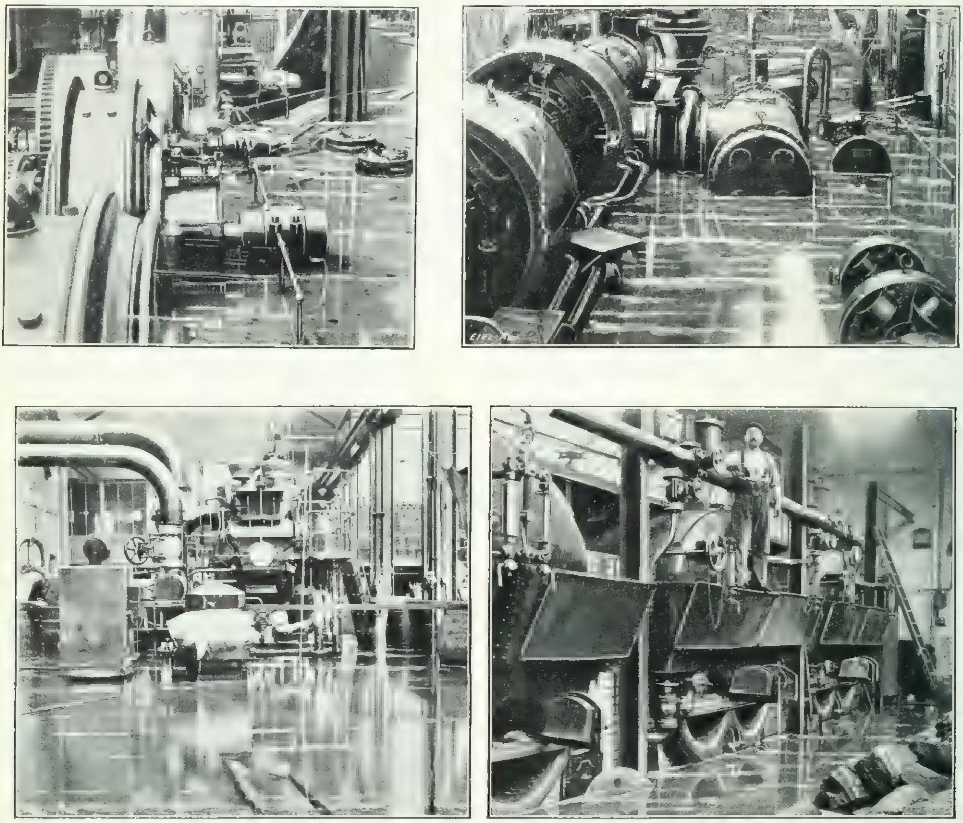
The station output was confined to a small pumping supply on Thursday morning, and to battery charging in the afternoon and evening. At 7 a.m. on Friday, the 1,000-kw. turbine was connected to such of the public supply mains as were not incapacitated by the flood. Thereafter the total output rose rapidly to the normal. The two turbo-units (1,000 and 750-kw. capacity respectively) were able to cope with the total demand until such time as the engine sets were dried out.

The original bare copper distributing mains have been gradually replaced by B.I. & H. and St. Helens cables, but many miles of the former are still in use (and give satisfaction apart from the low insulation resistance obtainable). Streets containing bare mains and junction boxes, on both systems, controlling supply to about one-third of the town were submerged, and a number of joints were broken by road subsidence. There was naturally some delay in restoring service to these areas, but within a week from the date of the disaster conditions were practically normal so far as the public was concerned. As soon as possible, further sections of the bare mains will be replaced.

The industrial inconvenience attributable to the cessation of supply was reduced by the fact that many works were flooded or short-handed, either owing to the inaccessibility of the works to the employés or owing to the latter absenting themselves to attend to their own troubles.

Drying the Machines.—During Tuesday night and Wednesday the engine room was flooded with a mixture of dirty water and oil which had flowed out of the engine crank cases. After cleaning and rough drying the machine windings affected, it was found that they still were too wet to be dried by the application of a heavy, low-pressure current, hence field coils and the smaller armatures were dispatched to drying ovens, and, on the occasion of our visit, the armature of the 750-kw. Crompton-Belliss set was in its bearings and being dried by steam radiators mounted in place of the field coils. The ends of the machine were covered with tarpaulins, and small fans maintained a brisk air circulation round the armature. The armature was expected to be fit for service in two or three days.

The remaining flooded units (two 440-kw., one of 500 kw.) were being dried by coke stoves placed inside a temporary wooden framework built right over the three sets and covered with strong paper. "Turk" stoves were being used to heat dry air to about 100° F., and fans were arranged to maintain a continuous air flow through the enclosure. It was hoped to dry the machines in a week or so by this means. The "Turk" system avoids the cost and labour of taking down the dynamos, while leaving the workmen free for other more urgent duties.



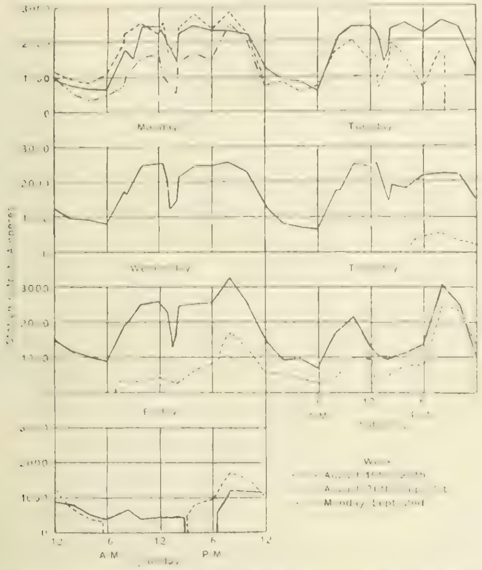
Typical Views in the Flooded Norwich Electricity Works.

Loss to the Station.—The cost of the disaster includes £500-£700 loss in revenue during the week of the flood, and a similar expenditure in cleaning and drying the works and machines, and in placing the distributing system in order again. Probably the total loss to the station will amount to about £1,500.

Certain gas enthusiasts in the neighbourhood have published statements concerning the failure of the electricity supply which are in very bad taste. Fortunately, we can afford to congratulate the gas company on having just sufficient gas in their gasholders to last from Tuesday afternoon (when the retort fires had to be drawn) till production could be recommenced, and on their enterprise in providing a temporary gas supply to some residents in streets where the electricity mains were disabled for several days.

Everything possible was done to minimise the magnitude of the disaster at the central station, and to restore supply after the waters had subsided. We have great pleasure in recording the chief engineer's gratitude to his staff for their assistance, and to consumers for the forbearance with which they accepted the position.

The disaster could not have been foreseen, the previous highest recorded flood (1614) being 18 in. lower than the present flood level. No such flood is likely to recur for decades—probably not for centuries—and, in any case, the station is not likely to be caught again with its concrete foundation raft cut away. As many minor precautions as possible will be taken against the injurious effect of a possible future flood, and the wall along the river front will be rebuilt higher.



Comparative Load Curves showing the Effect of the Flood.

Before leaving this subject, readers will doubtless be interested in the following brief description of the important extensions in progress at Norwich and in particulars of recent supply developments.

The generating equipment of the station (which commenced supply as a company-owned concern in October, 1893, with a number of small Laurence-Scott sets) now comprises two 420-kw. and one 500-kw. Willans-Siemens sets, a 750-kw. Crompton-Belliss set (these 4 units being the ones flooded); a 1,000-kw. Parsons turbine and a 600-kw. Willans-Siemens mixed-pressure turbo set. The Belliss set was installed after the Parsons unit, reversion to engine drive being attributable to the more or less experimental nature of turbine plant at that date, and to the great length of space required by the latter prior to the introduction of the disk and drum turbine.

A 2,000-kw. Howden turbine is to be completed this autumn, and the old reciprocating sets will be replaced by turbines as further extensions are required. In case of necessity, the power house can be extended towards the coal yard, thus providing sufficient accommodation for all the plant ever likely to be required.

The supply is on the 220/440-volt three-wire d.c. system, the turbines driving dynamos in tandem. Although a considerable factory load is supplied (nearly 4,000 h.p. being connected), there is no probability of high-tension three-phase generation being adopted for industrial purposes, since the consumers, including Messrs. Colman (350 kw.) and a number of boot factories, lie close to the supply station.

The original five single-drum water-tube boilers (each evaporating 5,000 lb. per hour) are now doing useful work at a neighbouring beet sugar factory, and are replaced at the central station by two double drum boilers, each of 25,000 lb. per hour evaporative capacity. Two B. and W. boilers of 8,000 lb. per hour capacity complete the equipment of the riverside boiler house. At the other side of the engine room is a second boiler house containing four Lancashire boilers each of 5,000 lb. per hour capacity and one marine type water-tube boiler evaporating 28,000-30,000 lb. per hour.

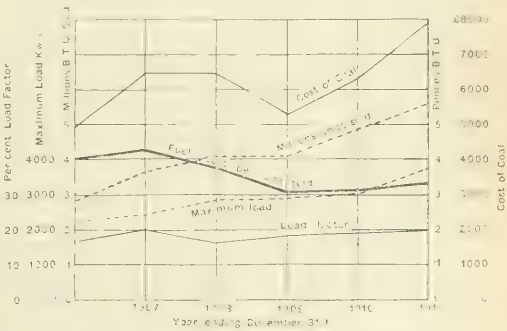
The riverside boiler house is being provided with overhead bunkers holding 500 tons, with gravity feed to the chain grate hoppers. A conveyor system is also being erected to connect with the riverside coal yard where 1,000 tons of fuel can be stored. The present winter coal consumption reaches 250 tons per week, so that the station will have about six weeks' fuel storage capacity. During the coal strike last spring, the stock-in-hand fell from 1,058 tons on March 8th, to 771 tons on April 8th, and 197 tons on May 6th, after which a large shipment was received by water; full supply was maintained throughout.

The present 18-in. condenser water intake from the river is to be replaced by a 36-in. sq. intake-culvert, work on which is now in progress. At the outer end of the intake, a Brackett screen is to be employed. This consists of an endless band of $\frac{1}{8}$ in. mesh phosphor-bronze netting running over top and bottom drums; all but the smallest *débris* is arrested, and that which clings to the netting is washed off by outward jets of water near the top drum, into a trough discharging down-stream. In addition to the usual trouble caused by inanimate *débris*, many eels have been drawn through the centrifugal pumps into the condensers, and a number have actually lived and grown in the coolers, &c. It is hoped that the new screen will largely prevent the ingress of organic spores (carried by slime washed out of barrels in a brewery above the station), which in the past have rapidly collected and grown in the condensers, necessitating weekly cleaning of the tubes.

A new battery of 224 Premier cells, having a discharge capacity of 980 amperes for three hours, 2,100 amperes for one hour, and 3,600 amperes momentarily, has recently been installed in a three-story accumulator house opening off the engine room. The walls of this building are of ribbed steel enclosed in 3-in. thickness of a plaster, through which the recent flood water easily percolated. At one time the water was half way up the cell boxes on the ground floor, but the cells were not damaged.

The new offices adjoining the works are nearing completion. At a cost of £3,000, a very handsome block has been erected, providing accommodation for the clerical staff, the wiring, meter, mains and the lighting staffs, and including showrooms, electric cooking demonstration rooms, and various work and repair shops. The whole of the old buildings will be used as stores.

The general progress of the undertaking is graphically illustrated below. During the quarter ending June 30th the average fuel consumption was 3·52 lb. per unit generated, or 3·95 lb. per unit delivered to the mains, while the boilers averaged 13·5 cwt. per 1,000 gallons of water evaporated.



Curves showing the Progress of the Norwich Electricity Department.

Two-thirds of the streets are now lighted electrically, and the remaining gas lamps will be converted as soon as possible. The expenditure involved is being met from the revenue, and it is expected that £1,000 per annum will be saved when the conversion is completed. Single lamps are employed on most of the standards (which have graceful swan necks and simple but efficient white-enamelled top reflectors and no lanterns). More than half the total number of lamps are 50-C.P. units; only 27 100-C.P. metal lamps are used, the remainder being of 75 C.P. each. In addition to 16 10-ampere open arcs along certain of the tram routes, there are nearly 1,200 metal lamps in use for public lighting.

By far the most interesting feature of the private supply is the remarkable popularity and efficacy of the assessment tariffs in vogue. Alternative to a flat rate of 4·5d. per unit, a consumer may pay 12 per cent. per annum on the rateable value of his house and is then supplied at 1d. per unit, flat rate. Two years ago about 47 per cent. of the total lighting sales were at 1d. per unit, and at present nearly 60 per cent. of the total are thus sold. This is a remarkable result when it is remembered that the total costs per unit sold are about 0·90d. (average revenue per unit sold = 2·1d.). The capital burden is high (£82·16 per KW.), and will be temporarily increased by the present extensions, but a handsome surplus has been secured during recent years. The introduction of the metallic-filament lamp was beneficial rather than unprofitable to the station.

Special tariffs have been designed for very small consumers. If the rateable value of a house is less than £10 per annum, free wiring and lamp renewals are offered at, say, 30s. per annum for six lamps, and current is supplied at 1d. per unit flat rate. The smallest consumers are supplied at 1s. per lamp per quarter (or even smaller fixed charges for wiring and lamp renewals), and 1d. per unit for current. Shop lighting is charged at 1d. per unit plus an annual charge, which varies from £10 to £7 per KW. of maximum demand, according to the size of the installation.

Our best thanks are due to Mr. F. M. Long, city electrical engineer, and Mr. Austin, assistant engineer, for their kind assistance in explaining the working of their station and the circumstances and effects of the flood—from the after-effects of which we wish them a speedy recovery.

TRAMWAY and RAILWAY NOTES.

(Continued from page 418.)

Belfast.—The extensions of the tramway system on the Oldpark Road, Ravenhill Road and Donegal Road are now well forward and only require linking up with the existing tramways with which they will connect. It is expected that all the extensions will be in running order by the end of the year.

Birkenhead.—It was reported at a meeting of the Corporation on September 4th, that the B. of T. had given sanction to the borrowing by the Council of £4,374 for the purchase of six new tramway cars for service on the New Ferry route between Woodside Ferry and Port Sunlight. The contract has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd., for supplying and delivering six double-bogie cars (with bodies built by Messrs. Hurst, Nelson & Co., Ltd.), each to seat 60 persons.

Bournemouth.—A poll of ratepayers is to taken on the question of running a Sunday afternoon and evening tramway service.

Burnley.—The Tramways Committee has received a letter from the B. of T. certifying Harle Syke Tramway fit for public traffic, and that a goods wagon attached to passenger cars could be used for a period of three months, at the end of which time a report was to be furnished on its working.

A deputation from the National Motor-Carriage Insurance Union attended with reference to the decision to run the goods wagon, and requested the Corporation to abandon the scheme on the following grounds:—(1) That the Corporation were thereby competing with ordinary carriers: (2) that it was dangerous to drivers of ordinary vehicles and to the public generally; and (3) that there were already sufficient vehicles using the roads. The Committee adhered to its decision, and fixed the charges for the conveyance of goods.

In view of the continued growth of the tramway traffic, the Tramways Committee proposes to purchase five new top-covered cars, at an estimated cost of £3,900.

Canada.—The Montreal City Council has received an application from the Comptoir Financier Franco-Canadian for permission to construct a system of underground electric railways. It is claimed that the capital will be furnished by Parisian bankers, and that Parliamentary powers are to be asked for in order to carry out the project. The present company is only a preliminary one, it being proposed to form a concern with $100,000,000 capital as soon as the necessary authority can be obtained. The trains will consist of five coaches, one of first-class and four of second class, each coach holding about 110 passengers. Plans are being drawn up by Parisian engineers. The Council has decided to await the full organisation of the company before taking action.

Preparations for the construction of the Mount Royal tunnel for the C.N.R. are being made, although the plans for electrification have not been prepared. Two 400-H.P. and four 200-H.P. electrical air-compressing plants for pumping and drilling, &c., are being supplied, and five contractors' electric locomotives have been purchased. The tunnel will be 3¼ miles long, and about 8 miles of route will be electrified.

Continental Notes.—AUSTRIA.—The Secretary of State for railways is negotiating for the electrification of the Arlberg line from Landeck to Bludenz. The estimate of cost for the electrification, exclusive of the power station, amounts to 11,000,000 kronen, while 15,000,000 kronen is set aside for the erection of the power station.—*Financial News.*

GERMANY.—A railway line much used by tourists in the Bavarian Alps—namely, that running from Salzburg, through Freilassing and Reichenhall to Berchtesgaden, is to be electrified. The work has been entrusted to the Siemens-Schuckertwerke, of Berlin. The poles are being erected, and the installation of the overhead lines will be begun in a few weeks. It is not intended to relay the metals.—*Elekt. u. Masch.*

Among the several new electric railway schemes projected recently are one from Frankfurt-on-the-Main, through Kronberg to Königstein, the Lokalbahn A.G. being the promoters; the Cologne to Bonn and the Cologne to Düsseldorf lines, for which and other works the T.C. of Cologne has just approved a loan of £3.950,000; a line from Lützelburg (Alsace-Lorraine) to Dagsburg and Wangenburg, promoted by the "La Houve" mining company, of Strassburg; a line from Neuss (Rhine Provinces) to Rheydt, with branches to Holzhain and München-Gladbach, the joint concern of the several towns named; a line from Offenbach (Hesse) to Isenburg, Sprendlingen and Egelsbach, the A.G. für Bahn-Bau und Betrieb being the concessionaires, and the municipal station at Offenbach furnishing the current; and a line from Wilstedt to Zeven and Tostedt, estimated to cost £165,000; also two electric tramway schemes—one from Darmstadt to Offenbach, promoted by the Hessischen Eisenbahn A.G. and the A.G. für Bahn-Bau und Betrieb, and another in the town of Insterburg, in East Prussia, for the construction of which the A.E.G. are in treaty with the municipal authorities.—*Elektro. Zeitschrift.*

Among the locomotives furnished for the Dessau-Bitterfeld electrification is a high-speed locomotive made by the Bergmann Electricity Works. This locomotive has a two-axle pony truck at the front, two driving axles with wheels of 63 in. diameter in the middle and a trailing axle at the rear. The transmission system is operated by a single-phase series motor, the speed control and reversal of which is obtained by shifting the commutator brushes. The motor is rated at 1,500 H.P. at 270 R.P.M., which corresponds to a locomotive speed of 49·6 M.P.H. During trial trips, however, a speed as high as 77·5 M.P.H. was attained. In practice, the locomotive has had no difficulty whatever in hauling passenger trains weighing more than 400 tons at the required speed, and freight trains weighing almost 1.000 tons have been hauled at 34·1 M.P.H. The normal drawbar pull is about 9,900 lb. with a maximum of 34.100 lb. when the locomotive is at a standstill. The total weight of the equipped locomotive is 72 tons. The motor weighs 15 tons and the transformer 7·6 tons.

Messrs. Brown, Boverie & Co., of Mannheim, are reported to have received an order from the Prussian State Railways for the delivery of 10 single-phase locomotives, each of 1,200 H.P., for the Lauban-Konigszelt railway.

FRANCE.—The French State Railway authorities, who have been engaged for some time past in making trials in connection with the introduction of electric traction on the nationalised Western Railway, have just placed an order for 100 motor coaches and 400 trailers with French and Belgian works. It is stated that the motor coaches are to be equipped with apparatus to permit of the automatic coupling of the coaches forming a train.

RUSSIA.—In amplication of the information given in our last issue regarding the railway to be built from Riga to the seaside resort of Majorenhoff, it is stated that the concession has been granted after the Riga Tramways Co. had been included in the consortium, and that the line will be on the single-rail system, electrically worked. A generating station is also to be built, a distributing network erected, and an iron bridge built over the Aa River. The whole installation must be in working by 1917. The constructional works will be in the hands of the Riga Tramways Co. —*Elekt. u. Masch.*

Dewsbury.—At a meeting of the Birstall and District Chamber of Commerce, on the 5th inst., a protest was made against the increase of tramway fares in the Yorkshire Woollen district, and at the Dewsbury T.C. the same evening it was stated that all the neighbouring authorities were supporting Dewsbury in its action against the local tramway company's methods. It was said that altogether the company had raised the fares 50 per cent., which was considered outrageous, while it was alleged the system was one of the best-paying the company had.

The B. of T. has extended the period for the commencement of the work in connection with the Shaw Cross tramways until August 18th, 1913, and the completion until August 18th, 1914.

Doncaster.—It has been decided to obtain, in time for the monthly meeting in October, tenders for the light railway extensions at Bentley which were authorised by the Doncaster Corporation Light Railways (Extension) Order, 1911.

Dundee.—After inspection on behalf of the B. of T., the railless traction system was opened for traffic last week. The route is along Clepington Road, at the east end of the town, and connects the terminus of the Maryfield section with the line at the Fairmuir, being a mile and a quarter in length. The cars, of which there are two, have been supplied by the R.E.T. Construction Co., London

Elland.—On the 6th inst. there was a conference between the D.C. and the Halifax Tramways Committee to discuss the proposed extension of the Halifax system to Elland. The members were not unanimous on the granting of a subsidy of £100 a year for four years, or upon the route. It was stated, however, that the Woodside route would probably be approved. This route will cost, with a double line all the way from Calder and Hebble to Elland, near Hull, over £20,000, while the route from West Vale with single track would cost only about £8,000. The Elland Council has ratified its promise made in February last to the Huddersfield Corporation to grant a subsidy of £500, to be extended over a term of five years and subject to the ratepayers' consent, if the Huddersfield tramways system was extended from Birchencliffe to Elland.

Glasgow.—The T.C.'s Committee on Tramways has decided, by a majority of five, to recommend the Corporation to approve of a proposal to remit to a special Sub-Committee to consider and report as to the desirability and practicability of the tramways department providing cottage dwellings to be rented by workmen in the service of the department.

London.—In connection with the collision which occurred at the Caledonian Road tube station of the Great Northern, Piccadilly and Brompton Railway last week, a B. of T. inquiry was opened on September 9th. The collision occurred through a non-stop train running into the rear of a train which was standing in the Caledonian Road Station, and the inquiry turned on the behaviour of the automatic signalling system. Evidence was given showing that the signal in question had once failed, but had then gone to danger (as it should have done in such a case). Further evidence as to the trip cock under the motor coach (which should automatically apply the brakes) disclosed nothing unusual, and the inquiry was eventually adjourned until the driver of the colliding train is sufficiently recovered to give evidence.

The Metropolitan Electric Tramways Co. is introducing some 300 Daimler 'buses, to supplement its tramway services on the roads of North London.

U.S.A.—According to the *Railway and Engineering Review*, the New York, N.H. and H. Railway, which has recently placed an order for 39 additional electric locomotives for combined goods and passenger service, will soon have a total of 106 heavy electric locomotives in service. The original locomotives had a maximum tractive effort of 19,200 lb., but in the more recent ones this has been increased to 40,000-45,000 lb. Some 16 switching locomotives, having a tractive effort of 39,500 lb. and weighing 80 tons each, have been introduced for use in the freight yards.

Wakefield.—The solicitors to the Yorkshire (West Riding) Electric Tramways Co. have written to the Council to the effect that the company were unable to raise capital for the construction of the lines not already constructed, as authorised by the Wakefield and District Light Railways Orders, 1901-2 (it will be remembered that the Yorkshire (West Riding) Electric Tramways Co., Ltd., took over the Wakefield undertaking some little time ago), and suggested that if the local authorities concerned in the extensions could arrange to construct the lines, the company would be prepared to work them. A Sub-Committee of the Corporation arranged to confer with the Stanley and Ardsley East and West Urban District Councils, and, after an interchange of views, the representatives undertook to take the instructions of their respective Councils, and communicate with the Corporation prior to a suggested interview with the directors of the company.

TELEGRAPH and TELEPHONE NOTES.

Admiralty.—The Admiralty has acquired seven acres of land at Stockton for the purpose of a wireless telegraph station.

Canadian Telegrams.—As the result of representations made to the Western Union Telegraph Co. by the Postmasters-General of Great Britain and Canada, the following reductions will be made at an early date in the rates for telegrams in plain language transmitted by that company and its associated companies between the United Kingdom on the one hand and Canada and the United States on the other hand:—

The present rate of 6d. per word for telegrams subject to a possible delay of 24 hours will be reduced to 4½d. per word, and the telegrams will be transmitted and delivered subject only to such delay as is necessary to give priority to ordinary traffic at 1s. per word. A new service of night letters will be brought into force at a charge of 3s. for 12 words and 2½d. for each additional word. These telegrams will be delivered, subject to the prior delivery of ordinary traffic, on the morning of the day following that on which they are handed in.

The present rate of 6s. for 30 words and 1s. for each additional group of five words for week-end cable letters handed in up to Saturday night for delivery on the following Tuesday will be reduced to 4s. 6d. for 24 words and 2½d. for each additional word, and the telegrams will be deliverable on the following Monday.

A reduced rate of 3½d. instead of 5d. for ordinary Press telegrams has already been brought into force, as well as an improvement in the conditions on which Press telegrams at the rate of 2½d. per word are transmitted and delivered. The latter telegrams have hitherto been subject to a delay of 19 hours reckoned by the clock time of the country of destination. They are now transmissible during the hours from midnight to 6 a.m. in the country of origin, and also during the hours from 6 to 9 p.m., Greenwich time, corresponding to 1 to 4 p.m. Montreal or New York time.

These rates apply to those places in the East of Canada and the United States to which the rate for ordinary telegrams is 1s. per word. The rates chargeable to other places both in Canada and the United States are being correspondingly reduced.

Germany.—The Gesellschaft für drahtlose Telegraphie has erected a wireless station on the roof of its offices in Berlin, with a range of 1,000 km.

Imperial Wireless.—The British wireless station will be erected near Carnarvon. The receiving station will be at Nebo, and the transmitting station some miles to the north.

Pacific Cable.—The accounts of the Pacific Cable Board were published last week; they show that the traffic receipts for the year ending March 31st, 1912, were £159,051 gross, £154,892 net, making, with £3,986 received for the charter of the *Iris*, and minor items, a total of £159,150. The excess of receipts over expenditure was £37,046, which goes towards meeting the annuity of £77,544 for interest and sinking fund on the capital outlay of £2,000,000. This surplus is £7,712 more than that of the previous year, and reduces the sum to be provided by the Imperial and Dominion Governments to £40,498. The net traffic receipts increased by £18,749. Expenditure increased by £12,761, of which £7,339 was due to the payment of a full year's rent for the land line, as against four months only in the previous year. A surplus of over £40,000 is expected for the current year. The renewal fund stood at £286,289 on March 31st; the cost of the new Australia-New Zealand cable will be met out of this account. The cable suffered no interruption during the year. The adoption of a contrivance for magnifying the signals on the long sections on either side of Fanning Island, due to Mr. E. S. Heurtley, aided accuracy of transmission and increased the speed by as much as 25 per cent.; a royalty of £1,000 a year, increasing to a maximum of £1,500, is paid for the use of the instrument.

The new cable will complete the triangle Norfolk Island-Australia-New Zealand, thus duplicating the two southern sections and providing a short route for inter-colonial traffic, and at the same time saving £6,000 per annum; the total cost of the addition is expected to be under £175,000. The principal contracts were placed with the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., and Messrs. Siemens Brothers & Co., Ltd., and it is hoped that the cables will be laid and in operation before the end of 1912. The Canadian land-line has continued to give satisfaction, and improvements in its working are in progress. Difficulties were experienced in maintaining communication by steamship with Fanning Island, owing to the exigencies of the mail service between Canada and New Zealand, which no longer allowed of the mail steamers visiting the island. Since August last year only occasional calls have been made, by special arrangement, and it is uncertain what will be done in the future. The result has been that the Board has been put to much expense and anxiety, and the staff on the island to much inconvenience, discomfort, and even risk of health. To mitigate the trying conditions of life on the island, refrigerating plant has been installed, and electric lighting will be substituted for the present system of illumination by oil lamps this year. New offices are being obtained in Sydney at a cost of £10,000. The deferred-rate system, which came into force in January last, has proved very satisfactory, the number of words carried in three months being 46,450, while the ordinary traffic also increased. The reduction of rates for deferred Press messages made in December last led to no increase in the total volume of Press traffic, about half of which was merely transferred to the deferred class. The total of international messages carried last year aggregated 2,131,376 words.

Norway.—Marconi's Wireless Telegraph Co., Ltd., has entered into a contract with the Norwegian Government for the erection of high-power stations in Norway and the vicinity of New York, for the purpose of conducting a commercial telegraph service between Northern Europe and America. The receipts of the joint stations will be pooled by the Norwegian Government and the Marconi Wireless Telegraph Co., of America, and divided equally between them. Marconi's Wireless Telegraph Co., Ltd., receives the sum of £70,000 for the Norwegian station, exclusive of site, foundations, and buildings, and 10 per cent. of the gross receipts. The contract is for a definite period of 25 years, at the end of which time the Norwegian Government has the right to renew it. The stations will be erected as quickly as possible and must be completed within 12 months of the foundations and buildings being ready.

A Roumanian Wireless Invention.—Two Roumanian military officers, Captain-lieutenants Dan Zaharia and Gustav Rötlander, have invented a novel wireless receiving apparatus, more especially adapted for flying machines, which weighs only 270 grammes. Tried on aeroplanes, the apparatus has given the best results.—*Elek und Masch.*

Suffragist Outrage.—On August 31st 14 important trunk telegraph wires were cut on the London Road near Potter's Bar, and a notice was affixed to a post stating that the damage which had been done was entirely owing to the attitude of the Government towards suffragists. Great inconvenience was caused to the telegraphic service in consequence of this malicious act.

U.S.A.—The Navy Department is seeking powers from Congress to establish a wireless telegraph system which will enable it to keep in touch with its ships in all parts of the world.

On August 16th President Taft approved the Bourne Bill regulating radio-communication. This Act requires every person, company or corporation within the jurisdiction of the United States operating any apparatus for commercial radio-communication among the several States, or with foreign nations, to obtain a licence from the Secretary of Commerce and Labour. All commercial wireless apparatus while in use shall be under the supervision of the Secretary of Commerce and Labour. The Act provides that the normal sending and receiving wave of each station shall have a definite length, either not exceeding 600 m. or exceeding 1,600 m. All ship stations, and all coast stations open to general public service, shall be prepared to use two sending wave-lengths, one of 300 m. and one of 600 m. Shipboard stations when within 15 nautical miles of a naval or military station shall not use a transformer input exceeding 1 kw., and when within 5 nautical miles the input shall not exceed ½ kw., except for distress signals. In general, wireless stations must not use more energy for transmission than is necessary. Penalties are provided for a violation of any of the regulations contained in the new Act, which was passed by the House of Representatives on August 9th, and was apparently enacted without any consideration of the Wireless Convention signed at London by the delegates of some 30 nations early in the month of July.—*Electrical World.*

Wireless for Troopships.—The Government of India has sanctioned the immediate installation of wireless telegraphy on the R.I.M. steamers *Dufferin*, *Hardinge* and *Northbrook*, and these vessels are now being fitted at the Government Dockyard, Bombay. The cost of installation is 16,000 rupees for each ship, and Mr. Parker, special officer in charge of wireless telegraphy, is supervising the work.

Wireless on Airships.—At the request of the Army Council, the Admiralty invited four naval wireless telegraph operators to volunteer for service in the military wing of the Royal Flying Corps, for the period of the Army manœuvres, to work the wireless telegraph equipment fitted to the airships taking part in the manœuvres.—*Daily Telegraph.*

Wireless on Board Ship.—A Bill to impose compulsorily the adoption of wireless telegraphy on certain classes of ships has been prepared by the Board of Trade in consultation with the Post Office and the Admiralty, but as the question is one on which international agreement is desirable, it is to be deferred until after the proposed international negotiations on Safety of Life at Sea.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—New South Wales.—September 25th. Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" August 23rd.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" to-day.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—September 17th.—One fuel economiser, for the Melbourne Corporation electricity works.

October 2nd.—Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" August 16th.

October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" to-day.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Trieste.—September 23rd. Twelve cranes of 1,500 kg. capacity are required for the Molo della Sanità. Half must be delivered complete ready for erection within 6, and half within 12 months. Particulars of the Technische Abteilung der k.k. Lägerhauser, Trieste.

Birmingham.—September 19th. Supply of 167,000 tons of coal to the generating stations of the Corporation electric supply department. Mr. R. A. Chattock, city electrical engineer and manager.

Bulgaria.—October 17th. The District Administration of Finances in Sofia is inviting tenders for the supply and erection of the mechanical and electrical plant required in connection with the power transmission installation to be laid down at the State collieries at Pernik.

Costa Rica.—December 9th. Tenders are invited for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Dundee.—September 23rd. Electric lighting at Carolina Shed, for the Harbour Trustees. Particulars from General Manager of the Dundee Harbour Trust.

Grimsby.—September 16th. Automatic balancer for the Corporation. See "Official Notices" September 6th.

Hungary.—The municipal authorities of Nagyteteny and Szekelyhid have just invited tenders for the establishment of central electric lighting stations in their respective towns.

Large Conduit Order.—One million feet of conduit, with accessories. See "Official Notices" to-day.

Leeds.—October 7th. The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. Mr. J. B. Hamilton, general manager.

London.—L.C.C.—September 24th. Electric spark gaps in brick cells for sub-stations. See "Official Notices" August 23rd.

Hammersmith.—September 25th. A.C. motors, for the Corporation. See "Official Notices" to-day.

Lossiemouth.—September 28th. Gas producer plant, engines and dynamos, battery, crane, overhead mains and public lamps, for the T.C. See "Official Notices" September 6th.

Manchester.—September 18th. Electric lighting of Crumpsall Workhouse, for the B. of G. See "Official Notices" September 6th.

Mexborough.—October 5th. Turbo-generator, condenser and switchgear, for the U.D.C. See "Official Notices" to-day.

Newcastle-on-Tyne.—September 18th. Electric light installation at the Cottage Homes, Ponteland, for the B. of G. Mr. G. Walker, clerk, 127, Pilgrim Street.

Newport (Mon.).—September 17th. Coal for the Corporation electricity department for a year. Mr. N. J. Young, general manager, Town Hall (returnable deposit of 10s. 6d.).

September 18th.—Extension of plant at the Corporation electricity works: Railway weighbridge, ash conveyor and bunker, water-tube boiler, flues, and forced and induced draught plant. See "Official Notices" September 6th.

Rosario.—October 15th and September 21st. According to the *Review of the River Plate*, the Municipality is calling for tenders, until October 15th, for a second system of electric tramways, including their construction and working. Full particulars from the Municipality. Tenders for the public electric lighting will be opened on September 21st.

Roumania.—The municipal authorities of Botoschani are reported to be about to invite tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

South Africa.—For the electric lighting of Cradock, Cape Colony, some £10,000 worth of machinery and apparatus will shortly be required.

Ventnor.—The U.D.C. has under consideration a scheme for the construction of a passenger lift from the Esplanade to the town, worked by electricity.

West Hartlepool.—September 14th. Steam, exhaust and other pipework, for the Corporation Electricity Department See "Official Notices" September 6th.

CLOSED.

Argentina.—In connection with the electrification of the suburban railway lines in and about the city of Buenos Ayres, a contract, which is probably the largest ever placed for an electric cable installation, and certainly the largest for extra-high-tension cables, has recently been placed by the Central Argentine Railway, Ltd., with W. T. Henley's Telegraph Works Co., Ltd., of Blomfield Street, London, E.C. The contract, which covers the supplying and laying of all the underground power cables that the undertaking requires, will take about 18 months to complete, and will necessitate the sending out of a number of engineers, foremen, jointers, &c., to carry out the work of laying and jointing. The principal item is one of 66,000 metres of ·1 sq. in. paper-insulated, lead-covered and armoured three-phase cable for a working pressure of 20,000 volts, which is to be laid directly in the ground. The laying of this cable will necessitate several hundred joints, which will be made in cast-iron sleeves filled with compound under vacuum. As may be imagined, very stringent tests are specified for the cables both before and after laying.

In addition there is a length of 66,000 metres of three-core pilot cable, and 28,000 metres of armoured telephone cable, which will also be laid direct in the ground. The contract also includes 20,000 metres of 1·0 sq. in. paper-insulated and vulcanised bitumen sheathed track cable, to be laid solid in troughing. The track cable referred to will be used for feeding the conductor rails and running rails, and for connecting across breaks in the rails at level crossings, junctions, &c. Track pillars to the number of 1,300 are to be supplied by the contractors, together with a large number of joint boxes and a considerable amount of telephone apparatus, &c.

The consulting engineers are Messrs. Livesey, Son & Henderson, 14, South Place, E.C., and Messrs. Merz & McLellan, of Westminster and Newcastle.

We may add that this important contract was secured in competition with British and Continental manufacturers.

Belgium.—Five concerns competed for the contract for the electrical equipment of a transformer sub-station at Dieghem in connection with the Société Nationale des Chemins de Fer Vicinaux's light electric railway between Brussels and Haecht. The lowest offer was that of the Société des Ateliers de Constructions Electriques, of Charleroi.

Bradford.—The tender of the British Westinghouse Co. for the supply of a 1,500-KW. rotary converter, for £3,978, has been accepted by the Corporation.

Bristol.—The City Council has accepted the tender of the British Insulated and Helsby Cables, Ltd., at £539, for an annual supply of electricity meters (watt-hour type, for alternating current).

Canada.—A Canadian contemporary states that Messrs. Siemens Bros. Dynamo Works recently obtained contracts for a 400-KW. direct-current generator for direct-coupling to a Belliss engine, for the city of Regina; also a 2,000-KW. three-phase generator for coupling to a Willans turbine, a 750-KW. direct-current generator for coupling to a Belliss engine, and a 425-H.P. three-phase motor, for the city of Edmonton.

Dundee.—The General Electric Co., Ltd., recently supplied the Corporation with 88 "Angold" magazine flame arc lamps for replacing the old open-type arcs hitherto used for street lighting in that town. It was necessary to have the installation completed for the opening meeting of the British Association, and no delay occurred anywhere: delivery was effected on time, all lamps were tested, and the entire change-over from old to new lamps was made without a hitch in one day.

Glasgow.—The Tramways Committee recommends the T.C. to accept the offer of the St. Helens Cable and Rubber Co., Ltd., for trolley feeder cable.

Keighley.—The Education Committee of the T.C. has accepted the tender of Messrs. Longbottom & Farrar for electrical fittings for the new Highfield School, at £39.

Leeds.—The Corporation has ordered two pairs of chain-grate stokers for B. & W. boilers from Messrs. Ed. Bennis & Co., Ltd. (repeat order).

London.—Amongst the contracts for power and lighting which are being carried out by Messrs. G. Weston & Sons, Ltd., are Messrs. Danneman's piano factory, Islington; Messrs. Pearks's factory, Stoke Newington; the Mitcham Margarine Co.'s works, Mitcham; and Messrs. Wheen & Sons' soap factory, Deptford.

Manchester.—Referring to our note last week, we are informed that Messrs. Wm. Geipel & Co. received the order for six of the seven sizes of time switches required by the Corporation.

Newcastle-on-Tyne.—A contract has been entered into with the British Westinghouse Co. for electrical plant and switchgear for the Corporation tramways power and sub-stations, at £6,817.

Stockport.—The T.C., on September 4th, accepted the following tenders:—

Lancashire Dynamo and Motor Co., Ltd., 170-K.V.A. alternator, £1,018; Ferranti, Ltd., high-tension switchboard, £72 10s.; Naylor Bros., Ltd., 100 lattice poles for tramways, £6 each.

Wallasey.—The Corporation has accepted the following tenders for supplies:—

Messrs. Sykes & Sugden, Ltd.—Boxes and switches and cut-outs.
Messrs. Alfred Hopps & Sons, Ltd.—Cylinder and lubricating oils.
British Insolated and Helsby Cables, Ltd.—Cable, boxes, &c.

FORTHCOMING EVENTS.

North Eastern Counties Electrical Exhibition. [illegible]

Hardware, Ironmongery and Oil Engineering Exhibition [illegible]

NOTES.

Inquiry.—A correspondent desires to find an English market for electric cookers and hot-plates, and will probably be able to place a large order for export.

Electrically-Illuminated Aeroplanes.—On September 26th an exhibition of night flying will be given at Hendon, when each aeroplane will carry a searchlight, with side and rear lights, and will be otherwise illuminated by electric lamps supplied from accumulators carried on the machine. Searchlights to guide the aviators and other ground illuminations are also to be features of the display.

Copper.—Statistics of this market, from Messrs. Merton's circular for August, do not show a particularly brisk demand, probably owing to the rise in price. The European visible supplies have, as a whole, increased during the month by 640 tons, the second time an increase has been shown since September, 1911. English stocks have increased 930 tons, and French 410 tons; the quantity afloat from Chile is 300 tons less, and from Australia 400 tons. Rotterdam stocks, at 570 tons, are 180 tons less, and Hamburg 702. If the Dutch and German stocks are included, therefore, the supplies are less for the end of August by 242 tons. The supplies from North America are rather below average at 25,660 tons, the average being 27,949 tons. Spain and Portugal are over double the average, with 3,740 tons; Chile shipments are also high, as well as Australian. The total deliveries, at 42 320 tons, are just above the average, but considerably below June and February. American stocks for the end of July show an increase of 2,653 tons over the return for June. The total visible supply for the end of July showed an increase of 5,089 tons over the preceding month.

The Manchester Rails Contract.—The following interesting letter appeared in the *Morning Post* of Saturday last:—

"There is a great deal more involved in the preference given to an American firm by the Manchester City Council in the contract for steel rails, described in your issue of the 5th instant, than the immediate loss of over £10,000 to British industry. The incident will be freely and very properly used as an advertisement not only by the individual firm directly interested in it, but by others engaged in similar industries, certainly in China and Japan, and no doubt also throughout the Latin States of South America, it may be even in our own Australian and Cape Colonies. Pamphlets will be drawn up in the Chinese and Japanese vernacular languages and freely circulated by active agents on the spot among all buyers, in which the transaction will be fully described and emphasis laid on the statements in the debate in the Council that the American product is fully equal in quality to that of the best Sheffield firms and is at the same time both substantially cheaper and more quickly delivered. Speedy delivery is of the essence of all contracts for public works, and if an American firm in Pennsylvania can deliver goods in Manchester more speedily than an English firm in Sheffield, how much greater will be the advantage of dealing with the former when the delivery has to be made either in the Far East or in South America! These points will be urged by agents who are, as a rule, not at all scrupulous in using unfair arguments, and will make the most of these which are perfectly honourable and are provided by ourselves. The ultimate results may be not a loss of £10,000, but of many tens, even hundreds, of thousands of pounds and a permanent injury to British industry.

I can remember very well the use that was made, both in Japan and China, of the contract for the Atbara bridge in Egypt, which was given by the India Office to an American firm in the late nineties of the last century, and it is my memory of that time which now induces me to submit to you that such actions on the part of British public bodies have more than the parochial results of one comparatively insignificant loss. The Atbara contract was then defended in the House of Commons in similar terms to those that have just been used in the Manchester City Council. Every word of the defence was fully translated into Japanese and Chinese and widely circulated, both in pamphlets and in advertisements and articles in the native Press, and no expense was spared by American agents in securing the widest publicity to the fact that the superior efficiency of American to British steel foundries was admitted in the most convincing way in England. I pointed this out, as fully and as strongly as was compatible with official limits, in my annual Trade Report for the year, but the report was edited in the Foreign Office, and all I wrote on this point was struck out before publication. That was fully 14 years ago, but I cannot recall ever having once seen in the interim the Imperial aspect of this rigid adherence to the cheapest markets mentioned in the English Press.—Yours, &c.,

"JOSEPH H. LONGFORD
"(*formerly H.M. Consul at Nagasaki*).

"Reform Club, *September 6th.*"

Fatality.—On Sept. 1st, according to the *Western Morning News*, Thomas John Rule, aged 21, of Hayle, was killed by a live wire near Nancledra, in the St. Ives district. Deceased and other employés were making an examination of the lines between Pendeen and Hayle. At Trenowan Downs deceased ascended one of the poles on the side where the current had not been stopped, and placed his hand on a 6,000-volt "live" wire, causing him to drop to the earth. A comrade hurried to the man's aid, but found him unconscious, and artificial respiration applied for half an hour proved ineffective.

Educational.—UNIVERSITY COLLEGE (UNIVERSITY OF LONDON).—The new session commences on the 30th inst.

The new session at the Battersea Polytechnic opens on September 24th. See our advertisement pages to-day.

UNIVERSITY COLLEGE, NOTTINGHAM.—A notice relating to the department of engineering appears in our advertisement pages to-day.

THE CORRESPONDENCE SCHOOL OF ENGINEERING MATHEMATICS has removed from Bilston to Harley Road, Blackpool.

The E.T.U. in Birmingham.—An attempt is being made to increase the strength of the Electrical Trades Union in Birmingham, where it numbers only 164 members, compared with 330 in Liverpool, 490 in Manchester and 780 in Glasgow.

Appointments Vacant.—STEPNEY.—Assistant installation inspector (30s.). MANCHESTER.—Shift engineer (£175 per annum). RATHMINES.—Shift engineer. SALFORD.—Meter tester (26s. to 30s.). See "Official Notices" to-day.

A Cracked Arm on a Tramcar Wheel.—In spite of every care on the part of the motorman it not infrequently happens that the car, owing to the speed at which it travels and the unexpected nature of obstacles encountered, sometimes runs over small impediments on the track: but it is very regrettable that this sort of thing happens inasmuch as the shock on the framework of the car, and especially on the wheels themselves, is very considerable. In most cases, the condition of the wheels can be ascertained after an incident of this sort by tapping them smartly with a piece of metal, such as a light hammer, and if there is a dull sound it is extremely probable that the wheel is cracked, while if they ring clearly, damage has been avoided.

In one instance of this nature where a car had run over a somewhat heavy obstacle in the shape of a piece of stone on the track, one wheel appeared from the sound to be cracked, as tested with a point bar. On closer examination, it was found to be cracked at about the centre of the arm. There is no doubt that this could have been run for a long period before anything serious would have happened, but in order to make the matter absolutely secure, it was decided that before the car resumed its journey, a piece of hard timber should be driven between the rim of the wheel and the boss, and this undoubtedly strengthened the wheel. With this provision the car was run for the rest of the day without any further trouble occurring.

When the car was taken home to the depôt it was debated whether the wheel should be withdrawn and a new one substituted, or whether some attempt should be made to repair it, and as only one arm appeared to be cracked, the latter alternative was decided upon. At first it was thought that the best way to tackle the job was to weld the crack electrically, but this would have meant a considerable amount of special preparation, so that eventually a very sound repair was effected by simply rusting the crack with sal ammoniac and iron filings, and although it may not sound as if this would be a strong job, the wheel, as a matter of practical fact, ran for a very considerable period without any further attention.

Copper in Rails.—According to the *Railway News* a new "bull" point for copper which might indicate a largely increased demand for the metal is discussed in the American papers. Recently the engineers of the New Haven Railroad looked into the history of about 6 miles of track that had far outlived the ordinary life and usefulness of the average steel rails, and is still in good condition. They found that this 6 miles of track was laid with rails imported from Glasgow, Scotland. Analysis of the rails showed that, in distinction to the ordinary type of steel rail, they contained about 1½ per cent. of copper. Many of the steel companies, it is said, now have orders on their books for the manufacture of rails containing copper, and an important new use for the metal is on the point of coming into existence.

Wrong Way Valves.—A correspondent points out that there are two ways of making a valve. The one is to make it with a left-hand thread on its spindle so that it closes when turned clockwise, the same as an ordinary household tap, the closing of which is done by that way of turning which employes the more powerful action of the hand. In the other valve the spindle is right-handed and the valve closes by turning the wheel counter clockwise. Now both these valves appear exactly alike, and both are often made without any indication on their wheels or elsewhere that there is any particular direction in which they ought to be turned for opening or closing. If valves of one kind get mixed on a job with valves of the other variety the results may be extremely dangerous. But for a safety valve on a water main such a mix-up would recently have caused very serious damage. Such valves should carry a plain "open" and "shut" indication. That there should be two varieties seems foolish. What reason can be shown for such lack of compliance with standard design? Some firms even make both kinds and yet provide no outward sign of the internal trap ever waiting for an opportunity to ensnare the unwary. This is one of the things that might well form subject matter for the Committee on Standards, for it is a far worse fault than mere difference of dimension.

Artificial Daylight.—According to the *Standard*, a Berlin firm has succeeded in imitating daylight with metal-filament lamps by passing the light through thin semi-transparent sheets of marble in place of glass.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—No fewer than 3 members of the staff of the Swansea Corporation Electricity Department have married quite recently, and the blushing husbands (MESSRS. D. R. GREY, H. O. DAVIES, and G. HOLDSWORTH) have each been presented by the rest of the staff with a handsome marble clock. The presentation was made by the borough electrical engineer, Mr. C. A. L. Prusmann, who hoped that the recipients would remain with him for many years to come, and wished them health, wealth, and happiness galore. Their response was both modest and grateful, its keynote being "Fellowship."

MR. WILLMORE, late of Tipton, has succeeded MR. W. D. JONES (who has gone to Australia) as manager of the Wellingborough E.L. Co.

At Tunbridge Wells, on September 4th, MR. J. W. BEAUCHAMP, late borough electrical engineer, who has been appointed to a similar position at West Ham, was presented with an illuminated address by the members of the Lighting Committee of the T.C. The Corporation officials and the staff of the electricity department also presented a framed photograph of the works staff, and a stand of silver egg cups and spoons for Mrs. Beauchamp, while the wiring contractors of the town handed Mr. Beauchamp a handsome silver inkstand and illuminated address.

MR. ALFRED WM. BARNETT, chief electrical engineer at the Ocker Hill generating station, Tipton, Staffs., was the recipient of a handsome marble clock and side pieces from the staff, on the occasion of his marriage with Miss A. M. Davies on August 3rd.

MR. J. W. CARTER has been appointed meter tester to the electric supply department of the Birmingham Corporation.

MR. A. A. HARRIS, of the Coventry Electricity Department, was the recipient of a table lamp and other presents from the staff on the occasion of his marriage to Miss S. L. Owen.

Tramway Officials.—The Bradford Tramways Committee has decided to recommend to the City Council the appointment of MR. WALTER K. FLEMING as parcels superintendent in the Tramways Department, in succession to Mr. Hobson. The salary is £200 per annum.

At a meeting of the South Shields T.C. on the 4th inst., MR. WILLIAM TUKE ROBSON, chief assistant engineer of the Hull Corporation Tramways, was appointed tramways manager at a salary of £300 per annum. There were 68 applicants for the position.

General.—MR. P. COLLINSON, of Messrs. Collinson Bros., electrical engineers, of Millergate, Bradford, was involved in a very serious motor accident, which occurred on Sunday whilst he was driving between Pateley Bridge and Harrogate. Mr. Collinson escaped any very serious injury, though he is at present confined to his bed; two of the occupants of the car have, however, succumbed to their injuries.

We learn that our friend and contributor, MR. JOHN D. MACKENZIE, Glasgow, was married there on the 5th inst. to Miss M. C. Miller, youngest daughter of the late Robert M. Miller, engineer, Glasgow.

MR. J. E. COWDEROY, who has recently acted as assistant electrical engineer to the Barking U.D.C., has received an appointment under the General Electrical Co., of London.

MR. E. J. BARKER, who has for nearly 15 years been assistant engineer to the Liverpool District Lighting Co., has resigned, and joined the firm of F. B. Hellor & Co., electrical engineers, of 57, Moorfields, Liverpool.

United Electric Car Co., Ltd.—The report of the directors for the year ending June 30th, 1912, states that after paying debenture interest amounting to £2,283, and charging £6,090 for depreciation, the profit for the year is £15,267, to which is added £2,482 brought from last year, making a total of £17,749. Deducting preference dividend for the six months ending December 31st, 1911, £3,000, there remained an available balance of £14,749. The directors recommend payment of the preference dividend less income-tax for the half-year ending June 30th, 1912, £3,000; a dividend of 5 per cent. less income-tax on the ordinary shares for the year ending June 30th, 1912, £7,500; and the carrying forward to next year of the balance of £4,249. In accordance with the articles of association, two directors retire viz., Mr. Richardson and Mr. Boddington, and being eligible offer themselves for re-election. Mr. Kerr, having inadvertently ceased to hold his necessary qualification shares as a director, temporarily disqualified himself. He has since acquired his full number of shares and has been re-elected by the board, and his re-election comes up for confirmation at the meeting.

CITY NOTES.

Yorkshire Electric Power Co.

The directors' report for the past half-year shows that the gross profit on the revenue account for the three corresponding half-yearly periods ending June 30th was 1912, £[illegible]; 1911, £[illegible]; 1910, £4,950. The net profit after payment of mortgage interest for the same periods was £3,349, £4,137 and £2,621 respectively. The balance available at June 30th last including £330 brought forward from 1911 was £3,679, and the directors recommend that this amount should be dealt with by paying a dividend (less income-tax) at the rate of 6 per cent. per annum on the cumulative preference shares, amounting to £2,323, and by carrying forward £1,356. The effect of the coal strike in March last was felt severely in the district supplied by the company, but owing to the provision made, supply was fully maintained throughout the strike to all users who rely on the company for their supply of power and light. The reduction in profits is due to the strike, to extra cost of fuel during the continuance of the strike and immediately thereafter when it was necessary to replenish the coal stock, and to the reduced consumption and unsatisfactory conditions of working produced by the disturbance of trade throughout the district. The directors regret to report a breakdown at Thornhill in July last, and gratefully acknowledge the consideration shown by the customers of the company during the short period of reduced supply required to couple up the additional plant which had already been installed at the works. The very considerable additions the company is making to the generating plant will, in the opinion of the directors, not only meet the increase of business, but also provide ample reserve power to secure a certain and continuous supply to customers in the future, even in the event of one or more units being temporarily disabled from any unforeseen cause. A special meeting of proprietors living in Leeds and district was held on July 23rd last, to explain the reasons for the formation of the Yorkshire Waste Heat Co., Ltd., and a report of this meeting will be circulated. It is believed that the generation of electrical energy with waste heat from coke ovens at Barugh will result in considerable economy and assist in the further development of the company's business. The whole of the preference capital (£100,000) authorised in September, 1910, has been applied for, and a quotation of these shares has been obtained on the Leeds Stock Exchange. The rapid development of the company's business and the increasing demands for electrical energy will necessitate a further issue of cumulative preference shares. At the close of the ordinary meeting on September 17th an extraordinary meeting will be held to consider the authorisation of an issue of 10,000 shares of £5 each. The directors regret to report the death of Mr. Hudson, who had been a director of the company since its commencement.

Halifax and Bermudas Cable Co., Ltd.—The twenty-third annual meeting of the above company was held on September 5th at 33, Old Broad Street. The proceedings were private, but our representative was furnished with a copy of the printed report, which states that the net result of the working for the year ended June 30th, 1912, is an available balance of £8,533, as compared with £8,168 for the previous year. An interim dividend of 2½ per cent., free of income-tax, has already been paid, and it is now proposed to make a further equal payment, free of income-tax, which will leave £6,033 to be carried forward. The balance to credit of revenue account, which was last year £27,345, has been debited with £1,250 applied to dividend, and credited with £6,033 surplus revenue of the past year, and it now stands at £32,128. It is proposed to elect to seats at the board Mr. T. Hewitt Skinner and Mr. William M. Kent. Mr. Geo. G. Ward and Mr. Frederick Ward retire on this occasion, and, being eligible, offer themselves for re-election.

British Electric Transformer Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares, for the half-year to June 30th.

Oxford Electric Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

County of Durham Electrical Power Distribution Co.—The directors announce an interim dividend of 2½ per cent. on the preference shares, payable on October 1st, less tax.

Buenos Ayres Port and City Tramways Co.—The directors report for the year ended December 31st, 1911, that the result of the year's working was a profit of £16,256, subject to provision for debenture interest. This required a sum of £23,367, to which had to be added £1,750, the amount of the sinking fund contributions for the year. The net result, therefore, was a debit balance of £8,861. The traffic receipts showed considerable increases, due mainly to the opening of the line from the boundary of the city at Barracas Bridge to the suburb of Alsina; and in the early part of the year there was a satisfactory diminution in the percentage of working expenses. In May, however, very severe floods occurred, materially affecting the working costs and decreasing the receipts; and from that time onwards the ratio of expenses has increased rather than diminished.—*Financial News*.

Dumbarton Burgh and County Tramways.

At the meeting of the company Mr. George Balfour, chairman, in moving the adoption of the annual report, said the result of the year's working was very satisfactory. The total receipts for the year amounted to £22,532, being an increase of traffic receipts of £2,160, which, together with an increase in receipts from advertising, made a total increase of £2,248. Working expenses are only increased by £214, the result being an increase of net revenue for the year of slightly over £2,000. The company's cars ran 534,832 miles during the year and carried 5,133,846 passengers. Regarding depreciation, the directors feel that they have adopted the soundest method of providing for depreciation, viz., by redemption of debenture stock. It was the unanimous opinion of the directors that it would be unwise to make a distribution on the ordinary shares this year, and that it was in the interest of both classes of shareholders that the surplus should be carried forward. The carry forward amounted to £4,568, and this might be regarded as a dividend equalisation fund, and, bearing this in mind, the directors were of opinion that a continuance of approximately the present earnings would justify them in making a distribution on the ordinary shares next year.

The report having been adopted, Mr. Balfour intimated that, in view of his election as chairman of the company, he proposed to waive the benefit of his agreement as managing director. He accordingly moved that the remuneration of the directors (which was voluntarily reduced to £350 by the directors two years ago) should, until otherwise determined, be at the rate of £600 per annum, to be divided among the members of the board as they should themselves resolve. This was unanimously agreed to.

Direct West India Cable Co., Ltd.—The directors state that the net result of the year's working is an available balance of £7,764, as compared with £6,323 for the previous year. An interim dividend of 3 per cent., free of income-tax, has already been paid, and it is now proposed to make a further equal payment, free of income-tax, which will leave £5,964 to be carried forward. The balance to credit of revenue account, which was last year £37,149, has been debited with £900 applied to dividend, and credited with £5,964 surplus revenue of the past year, and it now stands at £42,213. During the year debentures have been paid off to the amount of £7,000, leaving £22,000 outstanding.

Manila Electric Railroad and Lighting Corporation.—The Municipal and General Securities Co., Ltd. (European agents), announce that a dividend of 1½ per cent. ($1.50 per share) for the quarter ending September 30th has been declared on the common capital stock of the above corporation, payable in New York on October 1st to stockholders on record at September 18th, 1912.

STOCKS AND SHARES.

Tuesday Evening.

After their hurry and flurry of the preceding fortnight, Stock Exchange markets have gone rather more quietly, with the usual result that prices are down on balance, and, if such a thing may be mentioned, there is so much the less to write about here. Perhaps the firmest market this past week has been that for Electric Supply shares, while the Latin-Canadian group has been disposed to go back a little, and the Underground Railway stocks are irregular.

Steady crumbling in the price of Consols is of no use to investment markets, but this time it has had a useful effect in checking new issues, of which recently there have been comparatively few, in spite of the unusual activity of markets for this season of the year. The improvements which we noted last month amongst Home Railway Prior Charge stocks are maintained fairly well, although here and there appears some sign of weakening, for buyers are not quite so eager as they were before the Bank Rate went up at the end of last month.

The strength of Electric Supply shares is the more noticeable in that other investment sections are quiet. Various hints have been given here for some time past as to the probability of Electric Lighting shares advancing; and, of course, the record of the past three months bears out the wisdom of those who bought shares for themselves. August was a dry month in the market—in contradistinction to what it was out-of-doors. But this week the rise has been resumed, and gains have been scored by Brompton Ordinary and Preference, Charing Cross Ordinary, Metropolitans, St. James', and Westminsters. Moreover, it is not an easy matter to secure the leading shares except at prices very near the top of those officially quoted; and although there is a fair amount of floating supply, it does not take much inquiry to make the sellers put up their prices. The only fall in the list is one of 15s. in City of London Ordinary, which are back to 16¾ middle, the speculative account in these being still quite heavy enough for the shares to be affected when general conditions round the Stock Exchange are disposed to dulness. In our modest opinion, Electric Lighting shares should certainly not be sold, for the prospects are that the rise will go yet further.

The Underground Railway group remains the centre of considerable animation and interest. There was a little hesitation shown on the part of holders last week on the news of the collision on the Piccadilly Tube, but, in the event, this did not bring out much stock. Central London Ordinary and Deferred have slipped back a point. City and South London Ordinary is lower to the same extent. Districts fell ¼, although Underground Electric Railway shares are strong, the Ordinary hardening ¼ and the "A" shares, in which a good deal of business is reviving, improved to 15s. When there is anything doing in these, the market is a lively one: there is a close price, and they are popular gambles with a wide circle of operators. Metropolitan Consolidated, after being flat, hardened up, and shows a rise of 1¼, after its jump of nearly five points last week. Great Northern and City Preferred rose ⅛ to 2⅛, and there has been a lot doing in the stocks of the East London Railway, upon further attention having been called to the prospects of the line under electrification. From 9½ the price rose to 10⅜, reacting later on to 9⅞. The three junior Debenture stocks are all substantially better.

London Tramway shares are merely quiet, and command little attention. Foreign Tractions descriptions are also somewhat inactive. Mexico Trams fell a point, receding to the position they occupied a fortnight ago. The news from Mexico is still a little disquieting, and owing to the difficulty of getting reliable information, the market in Mexican Railway stocks has been weak. Other Mexican things, however, keep their prices fairly well. Mexican Light and Power Common are easier in tone. Vera Cruz Bonds, however, rose 1, and Mexico Trams Sixes put on ½, holders of the Fives evidently exchanging into these, for the price of the former is ½ lower. Rio Trams at 152 show a small loss, and La Plata Trams at 10s. middle are ⅛ down. A private letter from Vancouver speaks of the amazing prosperity of the British Columbia Electric Railway, the writer complaining, indeed, of the way in which the company's cars are literally packed, in spite of the number which it has running. The Deferred stock has risen 2. Para Electric Railways Ordinary shares continue their improvement, and have again jumped $\frac{3}{16}$, while the 6 per cent. Preference shares are ⅛ higher at 5¼.

In the Canadian group, Electric Developments of Ontario Bonds are a point down, while Canadian General Electric Preference came into some notice in consequence of the good yield accorded by the investment, and the price moved up to 123½. Montreal Light and Power has failed to recover any of the 10 points which the price lost last week, and Sao Paulo Trams are steady at their previous quotation. Brazilian Traction shares eased off a little to 97.

Fresh excitement has broken out in the National Telephone market, and the price of the Deferred stock, after being dull at 150, moved up swiftly to 157½. The grounds for this sudden rush were, of course, declared to be the probability of the stock being paid off at a much higher figure; but, as we said before, to deal in the stock is an amusement only for those with good nerves and a sound financial constitution. Marconis, too, have been revived in popular favour, and the prices of all the shares connected with the group have again been advanced. The parent shares at $5\frac{9}{16}$ are now fully £1 over the figure to which they dipped only a fortnight since. There has been an increased demand for the American Marconis and Canadian Marconis, the latter more particularly from the speculative investor, who will not touch Marconis proper because of the relatively high price at which they stand, but who likes to have an interest in this comparatively new industry with such possibilities. West India and Panama Telegraphs are moving erratically, and on balance show a slight fall. The Eastern group is steady, with ⅛ rise in "China" shares, and ½ in Eastern Telegraph stock. The Anglo-American division retains its rises, and in the manufacturing shares there is no special alteration.

India-rubbers are a strong market, and at 11½ are 10s. up on the week. The rise has failed to bring out any of the shares which were bought by shrewd people when the company passed its last dividend, and there are more buyers than sellers at the moment. British Westinghouse 4 per cent. Debenture stock and British Aluminium 5 per cent. Debenture stock are better to the extent of 2 and 1 respectively. In the share list, Castner-Kellners hardened to $3\frac{13}{16}$ upon the expectation of an improved dividend; while Babcocks eased off in consequence of a general weakening in their particular market. Rubber shares have been depressed by a record amount of the raw stuff being brought forward at the auctions in Mincing Lane this week; but those who profess to study the market appear to consider that there may be a recovery when the sales are over. For the time being, the rubber market is slackening its hold upon public fancy, and until rubber itself makes a move towards a higher level, it is possible that shares will be disposed to sag.

Stock Exchange Notices.—Applications have been made to the Stock Exchange Committee to appoint a special settling day in and to grant a quotation to:—

Callender's Share and Investment Trust, Ltd.—£115,000 5 per cent. debenture stock.

And to allow the following securities to be quoted in the Official List:—

Melbourne Electric Supply Co., Ltd.—Further issue of £125,830 consolidated ordinary stock.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Certificates of deposit for shares of $100 fully paid.

Sao Paulo Tramway, Light and Power Co., Ltd.—Certificates of deposit for shares of $100 each fully paid.

Globe Telegraph and Trust Co.—The directors announce an interim dividend of 2s. per share on the ordinary shares for the past quarter.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, September 11th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	„ Nitric	„	22/-	..
a	„ Oxalic	per lb.	2¾d.	..
a	„ Sulphuric	per cwt.	5/6	..
a	Ammoniac Sal	„	42/-	..
a	Ammonia, Muriate (large crystal)	per ton	£29 10	..
a	Bleaching powder	„	£5 10	..
a	Bisulphide of Carbon	„	£18	..
a	Borax	„	£16 10	..
a	Copper Sulphate	„	£24 15	..
a	Lead, Nitrate	„	£26 10	..
a	„ White Sugar	„	£25 10	..
a	„ Peroxide	„	£32	..
e	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (88/90 %)	per ton	£22 10	..
a	„ Chlorate	per lb.	3½d.	..
a	„ Perchlorate	„	4½d.	..
a	Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7¼d.	..
a	Shellac	per cwt.	70/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	„	£6 10	..
a	„ Recovered	„	£5 10	..
a	„ Lump	„	£5 5	..
a	Soda, Caustic (white 70/72 %)	„	£10 5	..
a	„ Chlorate	per lb.	3⅝d.	..
a	„ Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks	per lb	3d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£80	..
b	„ Wire, in ton lots	„	£102	..
b	„ Sheet, in ton lots	„	£120	..
p	Babbitt's metal ingots	„	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	1d. inc.
c	„ Tube (brazed)	„	11¾d.	¼d. inc.
c	„ „ (solid drawn)	„	1[illegible]d.	¼d. inc.
c	„ Wire, basis	„	9⅝d.	⅛d. inc.
c	Copper Tubes (brazed)	„	10¾d.	¼d. inc.
c	„ „ (solid drawn)	„	11¾d.	¼d. inc.
g	„ Bars (best selected)	per ton	£95	..
g	„ Sheet	„	£95	..
g	„ Rod	„	£95	..
d	„ (Electrolytic) Bars	„	£82 10s.	10s. inc.
d	„ „ Sheets	„	£100 10s.	10s. inc.
d	„ „ Rods	„	£89	10s. inc.
d	„ „ H.C. Wire	per lb.	10½d.	⅛d. inc.
f	Ebonite Rod	„	5/3	..
f	„ Sheet	„	4/9	..
n	German Silver Wire	„	1/7	..
h	Gutta-percha, fine	„	..	..
h	India-rubber, Para fine	„	4/10	3¼d. dec.
j	Iron Pig (Cleveland warrants)	per ton	66/10½	8 1½ inc.
l	„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g	Lead, English Pig	„	£23 10	£2 inc.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£8 5	10s. inc.
e	Mica (in original cases) small	per lb.	6d. to 3s.	..
e	„ „ „ medium	„	3/6 to 6/-	..
e	„ „ „ large	„	7/6 to 11/-	..
p	Phosphor Bronze, plain castings	„	11d.	..
p	„ „ rolled bars & rods	„	1/0½	..
p	„ „ rolled strip & sheet	„	1/1	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	11d.	..
	Steel, Magnet, in bars	per ton	£55	..
g	Tin, Block (English)	„	£225	£10 inc.
n	„ Wire, Nos. 1 to 16	per lb.	2/6	2d. inc.
p	White Anti-friction Metals	per ton	£45 to £150	
k	Zinc, Sh't (Vieille Montagne bnd.)	„	£30 12 6	7/6 inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

South Metropolitan Electric Light and Power Co., Ltd.—The directors have declared the usual dividends on the 7 per cent. first preference shares and 6 per cent. second preference shares for the half-year to June 30th. The debenture stock register and register of transfers will be closed from September 17th to 30th, 1912 (both days inclusive), for the preparation of warrants for interest for the half-year to October 1st.

Continental.—La Société "Oriona" is the name of a new company which has just been formed in Brussels with a capital of £40,000 to manufacture metal-filament electric lamps.

The Suddeutsche Telefon-Apparate, Kabel und Drahtwerke Gesellschaft is the name of a new company which has just been formed in Nuremberg with a capital of £50,000 to acquire and carry on the Nuremberg branch of the business of Messrs. Felten und Guilleaume Carlswerk, of Mulheim.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividend for 1910.	Dividend for 1911	Closing Quotations Sept. 10th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911			£ s. d.
Bournemouth & Poole, Ord.	10	5¼	5¼	[illegible]	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	[illegible]		4 12 4
Do. Second 6 % Pref.	10	6	6	10¾ — 1[illegible]	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	[illegible]	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	[illegible]	+ ⅛	5 9 7
Do. 7 % Cum. Pref.	5	7	7	7¼ — [illegible]	+ ⅛	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4¼ — [illegible]	+ ¼	4 15 3
Do. 4½ % Cum. Pref.	5	4½	4½	[illegible]		4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4½ — [illegible]	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	16 — 17¼		4 11 5
Do. 6 % Cum. Pref.	10	6	6	12 — 1[illegible]	..	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	5	6	11[illegible] — 11[illegible]	..	5 1 1
Do. 6 % Pref.	10	6	6	11[illegible] — 1[illegible]	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	[illegible]	..	4 8 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 8
Edmundson's, Ord.	5	Nil	Nil	[illegible]	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	[illegible]	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	[illegible]	..	5 14 8
Do. 5 % Cum. Pref.	5	5	5	[illegible]	..	4 15 8
Do. 4½ % First Deb.	100	4½	4½	92 — 9[illegible]	..	4 14 9
Hove	5	9	9	7 — 8		5 12 6

NAME.	Stock or Share	Dividend for 1910	Dividend for 1911	Closing Quotations Sept. 10th.	Rise + or Fall	Present Yield p.c.
	*	1910	1911			£ s. d.
Kensington & Knightsbridge, Ord	5	[illegible]	[illegible]	7[illegible] — 7½	..	5 10 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1[illegible] — 1½	..	4 [illegible] 8
Do. 6 % Pref.	5	6	6	[illegible] — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	[illegible] — 4	+ ⅛	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4[illegible] — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅞ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	5¾ — 6¼	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	[illegible] — 9½	+ ¼	5 5 3
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	[illegible]	..	4 1 5
Smithfield Markets, Ord.	5	Nil	2	1½ — 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½	.	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	£3	5	..	½ — ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	.	5 1 8
Westminster, Ord.	5	10	10	8¾ — 9¼	+ ¼	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5½	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¾ — [illegible] xd	..	5 4 4
Calcutta, Ord.	5	8½	8½	7¾ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	[illegible] xd	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	94 — 97	..	5 2 7
Canadian Gen. El. Com.	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	121 —125	+1	5 12 0
Cordoba Lt., Power and T., Ord.	1	3	3†	[illegible]	..	3 4 0
Do. 5 % Deb.	100	5	..	95 — 98	+1	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 — 98 xd	—1	[illegible] 2 [illegible]
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	1	6	6	½ — ⅝	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1¾ — 2¼	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 91	..	5 10 0
Mexican Lt. & Power, Common	$100	4	4	[illegible] — 99	..	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½ — 98½	..	5 1 6

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87 — 89	– ½	5 12 4
Montreal, Lt., H. and Power	$100	7	8	232 —237	..	3 7 6
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	..
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	151 —156	..	8 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107½—109½	..	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	+1	5 5 3
Victoria Falls Power, Pref.	1	Nil	11¾d.	[illegible] — 1[illegible]	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105 xd	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	95½ — 97½	..	5 2 7
American Telep. & Teleg., Cap.	$100	8	8†	147½—149½	..	5 7 0
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph	Stock	8¾	8	67½ — 69½	..	5 7 11
Do. 6 % Pref.	Do.	6	6	113¼—114¼	..	5 5 0
Do. Def.	Do.	80/-	80/-	26[illegible] — 2[illegible]	..	5 12 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104 xd	..	4 16 2
Chili Telephone	5	7	..	7½ — 7¾	..	4 10 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	84½ — 85½	..	4 13 7
Cuba Telegraph	10	6	6†	9½ — 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7 — 7½	..	6 9 0
Direct United States Cable	10	4½	5	7½ — 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	129½—132½	+ ½	5 5 8
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	..	3 18 10
Eastern Extension	10	7	7	13⅛ — 13⅜	+ ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	98½—100½	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97½—100½	..	3 19 7
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12¾ — 13¼	..	4 10 7
Great Northern Telegraph	10	18	18	28¼ — 29¼	..	6 3 1
Indo-European Telegraph	25	13	13	57 — 59	..	5 3 5
Mackay Companies Common	$100	5	5	90 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	20	5¼ — 5½	+ 7/16	3 11 2
Do. 7 % Cum. Partic. Pref.	1	16	17	4¾ — 5	+ ¼	3 8 0

Monte Video Telephone, Ord.	1	6	6	1 1/32 — 1 3/32	..	5 6 8
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
National Telephone Def.	Stock	6	6	156½—158½	+4	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100½—101½	..	4 8 8
Oriental Telep. and Elec.	1	8	8	1[illegible] — 1[illegible]	..	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1[illegible]	..	4 15 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18 5
Reuter's	8	5	5†	10⅛ — 10⅝	..	3 15 9
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	8	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	+ ⅛	4 8 11
West Coast of America	2½	2½	2½	1 11/32 — 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	½	3⅜ — 3⅝	— 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17 7
Western Telegraph, Ltd.	10	7	7	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Sept. 10th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	9/16 — 5/8	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	..	..
Do. 5 % Perp. Deb. ..	100	5	5	98 —101	..	4 19 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8	76 — 78	—1	3 16 11
Do. Pref.	100	4	4	82 — 84	..	4 15 3
Do. Def...	100	2	2	76 — 78	—1	2 11 3
Do. 4 % Deb.	100	4	4	100 —102	+1	3 18 5
City & South London, Ord. ..	100	1½	1⅝	37½ — 38½	—1	3 11 5
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	103 —105	..	4 15 3
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½ — 11½	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	2 — 2¼	+ ⅛	Nil
Hastings Trams, 6 % Pref. ..	1	Nil	6	½ — ¾	..	8 0 0
Do. 4½ % Deb...	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4½ — 5½	..	..
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3
Metropolitan Railway Consol. ..	100	1⅝	1⅞	60¾ — 61¼	+1½	2 13 0
Do. Surplus Lands	100	2¾	2⅞	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref...	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	41½ — 42	— ¼	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref... ..	100	3¾	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	5½	6	1 — 1⅛	..	5 6 8
Do. Def...	1	Nil	..	3/16 — ¼	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
Do. 4½ % Deb...	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % Deb.	100	5	5	100 —103	+1	4 17 1
Potteries, Ord.	1	2	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb...	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4¼ — 4⅜	+ ⅛	Nil
Do. "A"	1/-	..	..	11/16 — ¾	+ 1/16	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	89 — 91	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ½	..	Nil
Do. 6 % Pref.	5	Nil	3	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb...	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Sept. 10th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5	5⅛	5¼ — 5¾	..	5 2 4
Do. 2nd Pref.	5	5	5⅜	4 15/16 — 5 1/16	..	5 6 0
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb...	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb. ..	100	5	5	103 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12	..	5 0 0
Do. 4½ % Deb...	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brisbane Trams Invt., Ord. ..	5	8	8	7 — 7½	..	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb...	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	8	143 —148	+2	5 8 1
Do. Pref. Ord...	100	6	6	119 —124	..	4 16 9
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 1
Do. 4½ % 1st Mort. Deb. ..	100	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	103 —105	+1	4 5 9
Calcutta Trams, Ord.	5	6	7	6⅛ — 6⅜	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb...	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	Nil	2½†	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5½ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	5	3	35 — 43	..	6 19 6
La Plata Elec. Trms, Ord. ..	1	..	..	⅜ — ⅝	— ⅛	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	5½	6	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	..	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7	127 —130	—1	5 7 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	99 —101	— ½	4 19 0
Do. 6 % Bonds	100	6	6	103 —105	+ ½	5 14 3
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7½ — 7¾	+ 3/16	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5½	+ ⅛	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½ —102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1 1/32 — 1 3/32 xd	..	1 18 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	4½	5†	151 —153	—1	3 5 4
Do. 1st Mort. 5 % Bonds ..	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	100½ —101½	+ ½	4 18 6
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	261 —266	..	3 15 2
Do. 5 % 1st Deb.	$500	5	5	104½ —106½	..	4 14 0
Singapore Trams, 5 % Deb. ..	100	5	5	84 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	7	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Sept. 10th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	Nil	6	⅝ — ¾	..	8 0 0
Do. 6 % Pref.	1	9	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	26	28	3 1/16 — 3 5/16	— 1/16	4 4 7
Do. Pref.	1	6	6	1 1/16 — 1 3/16	..	3 16 10
British Aluminium, Ord. ..	1	..	..	13/16 — 15/16	..	..
Do. 6 % Cum. Pref... ..	1	..	..	⅝ — ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	+1	5 13 8
B.I. & Helsby Cables	5	10	10	7¾ — 8¼	..	6 1 3
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	+ ½	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96 xd	..	4 13 9
British Westinghouse, Pref. ..	3	Nil	..	9/16 — 11/16	..	Nil
Do. Deb...	100	4	4	60 — 63	+2	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb...	100	4½	4½	50 — 55 xd	..	8 3 8
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	10†	10¼ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅜	..	4 17 7
Do. Deb...	100	4½	4½	99—101	..	4 9 1
Castner-Kellner	1	17½	20	8¾ — 9⅛	+ 1/16	5 3 3
Do. Deb...	100	4½	4½	102 —105	..	4 5 9
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	5	¾ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	97 — 100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16 — 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅝ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	74 — 77	—1	6 9 10
Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	15	10†	12 — 12¾	..	5 17 8
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	10	..	11 — 12	+ ½	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction.. ..	12	20	10†	33½ — 35½	..	6 8 2
Do. Deb...	100	4	4	97 — 99	..	4 0 10
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

*** Unless otherwise stated, all shares are fully paid. † Interim dividend.**

Bank rate of Discount 4 per cent., August 29th, 1912.

THE CARE OF COOLING TOWERS.

[COMMUNICATED.]

A good many central stations are situated in positions where there is no abundant supply of cheap water available, and in order to make it possible for the engines to run condensing, the expedient has been resorted to, in a good many cases, of using cooling towers in connection with the condensing water, the latter being circulated through the condensers and towers repeatedly. In this way undoubted economies are obtained, the amount of water required being limited to the feed for the boilers (this can be minimised if the condensed water can be cleansed of oil and returned to the hot well) and the circulating water for the condenser cooling system. The amount of this latter varies considerably, depending on local conditions and also on the state of humidity of the atmosphere. During dry and hot weather a lot of the circulating water passes away in steam, escaping from the cooling tower, and this has to be made up.

Without a certain amount of care, however, cooling towers may become a nuisance; and without entering at all into the question of design of such cooling towers, it may be permissible to give one or two brief notes concerning the essentially practical points which have to be remembered if a cooling tower, or cooling tower-system, is to be maintained in its proper condition. Some of these towers are built of wood, others of structural steel and mild steel plate. The writer is not prepared to offer any opinion as to which is the best type, as he considers that this is influenced by the conditions under which the tower is to work. For example, a wooden cooling tower is cheap to construct and erect where the necessary raw material in the shape of suitable wood is obtainable, and where labour is fairly cheap. It will, however, be found that the wood is preferably impregnated with some rot-resisting solution, as the failure of one of the principal members of the structure owing to rot may cause the collapse of the whole arrangement. Moreover, the wooden tower is, perhaps, more useful in situations where it is continuously kept in action. If its service is to be intermittent it will be found that the alternating periods of wetness and dryness have a tendency to produce warping, and cracks will soon form in the outer casing diminishing the efficiency, and the woodwork within the structure will probably get distorted. Moreover, as has been shown by more than one sad experience, the wooden tower, when in a dry condition, is liable to catch fire, and this fire may quite easily extend to the other apparatus of the equipment. On the other hand, it must be remembered that a mild steel construction is extremely liable to rust, especially as, in the case of a cooling tower, it is exposed to hot, wet vapour and fine streams of running water. More especially at the seams and rivet holes there is danger of bad rusting setting in, and particularly where the tower is subjected to intermittent work, because there are not only alternating periods of wetness and dryness, but also corresponding periods of heat and cold, causing expansion and contraction among the members of the structure, and slight displacements at the seams. For this reason a mild steel tower should be frequently laid off for a thorough painting inside and out, and about the best preservative which the writer knows for this purpose is good tar. In getting at the inside of the tower it is not sufficient simply to paint over those portions which can be easily seen. Bit by bit the woodwork inside the tower must be removed to make way for the painter, and every square inch of the inside surface must be properly covered when it is in a dry state. It is a tedious and bothersome business, but without it no steel tower is safe.

Another thing which should be very carefully watched in connection with the working of a steel tower is to see that the distribution of the water at the top of the tower is uniform. The makers of different types of towers have each their own device for spreading the water over the top horizontal surface of the tower, so that the water descends through the tower in the form of fine streams or films. On its way down it is frequently caught by baffles and redistributed, so as to keep it well spread over the entire section of the tower. As originally set up, the distributing system may answer perfectly, but many causes operate against continued satisfactory working, unless the tower is watched. For instance, in the course of time, the woodwork inside the tower may take a slightly different bedding, due to the swelling or warping of some of the members, and this may slightly throw the distributing arrangements at the top of the tower out of the horizontal. In those forms of towers whose distribution depends on V notches in the top troughs, the slightest want of truth will cause an undue bulk of water to flow down in one part of the tower as compared with the other. These must be checked by observation, and it should be said that very careful watching is necessary to make sure of the even distribution of the water.

It is not a very pleasant job to stand in the top enclosure of a cooling tower when it is in full action, and, by the light of a portable lamp, try to see through the clouds of water vapour the general distribution of the falling streams. Nevertheless, it has to be done if the cooling tower is to work properly. Then, again, there is the question of floating impurities in the water. After passing through the tower, the water usually falls into an open tank below the tower, from which it is again drawn through the condenser system by the circulating pump of the engine. If this tank is at all exposed, a lot of impure matter gets into it, this matter being of charmingly interesting variety, and some of it gets drawn through the circulating system and pumped up to the top of the tower. As the water loses its velocity in the top distributing system, there is a fine chance for some matter in suspension to settle at the top of the tower, and ultimately choke up one or more of the distributing ducts. This defect is aggravated if, as frequently occurs, the condensed water of the engine is discharged in the condensing system. This is often done because a lot of oil passes through and the station engineer does not think it safe to return the water to the hotwell. The presence of this oil, which is in the form of a soapy scum, makes the distribution at the top of the tower rather difficult unless care is taken to see that the troughs or other distributing devices are carefully and systematically cleaned out at short intervals.

Another point which has to be watched is the appearance of the streams of water falling from the bottom of the tower. The baffles in the tower, which are in nearly every case of wood are arranged by the makers, so that they preserve a uniform distribution of the water, but in course of time portions of these baffles may get displaced owing to the action of the water, or they have been improperly fixed, or the spaces between them may get clogged up with impurities. These causes produce an uneven distribution of the water as it falls to the bottom of the tower, and since the cooling action depends on every portion of the water meeting a maximum amount of upward air, it is obvious that any trouble in the interior of the tower must be watched for and corrected. Fortunately, such troubles do not often occur, as they are among the most difficult to put right. If, for example, one of the baffles half way up the tower in the centre gets displaced, there is a very strong temptation to leave it on account of the difficulty of getting at it.

Some cooling towers depend for their action on natural draught, that is to say, the heat inside the tower produces an upward draught of cold air, which, entering in the space between the tank and the tower itself, passes up the interior of the tower and is discharged at the top usually through an extension piece in the shape of a chimney. Other towers depend on forced draught. In this case, the tower is completely enclosed and the air is driven through it by means of a fan usually electrically driven. The rate of cooling and hence the temperature of the water as it passes into the tank can be regulated by means of the air passed up the tower by the fan, and in this respect the electric motor lends itself very favourably to regulation of speed whereby the tower can, if necessary, be made to cope with overloads for a greater or lesser period. Even so simple a thing as an electric fan, however, requires periodic attention, and cases have been known where the continuous running of a fan has been presumed upon, with the result that the fan has unexpectedly broken down, due either to moisture getting at the motor or to inattention and consequent wear on the bearings. Needless to say, this sort of thing ought not to happen, and would not happen if operating engineers did not forget that their duties of inspection sometimes extended beyond the four walls of the buildings.

The treatment of the tanks themselves is a matter of some importance, particularly where there is an open space between the tower and the tank into which dust may blow, and refuse may be thrown. In course of time an accumulation of foreign matter ranging from mud to disused cats accumulates in these tanks. The collecting pipe for the circulation pumps is usually protected by means of a grid or strum which is calculated to stop any such matter from getting into the circulating system, but the choice lies between making the mesh of the strum large enough to allow the water to pass freely even when a sediment is accumulated, and thus incurring the danger of foreign matter getting through, or making the holes so fine that they may become choked up. In one case a somewhat serious interference with the supply was only narrowly averted. The engines were running on peak load when one of them suddenly lost its vacuum and dropped load, which was thrown on to the other generators, heavily overloading them. Fortunately there was a small spare set which was quickly run up and put into commission to carry the station over the peak, the faulty large engine in the meantime running on atmosphere. Subsequent examination showed the condenser to be very hot, and it was found that the carpenters in erecting the cooling tower had unfortunately let a considerable amount of shavings get into the tanks underneath, and these had not been properly cleaned out before the tank was filled, and this particular system started. When the shavings became sodden with water, as the wood was rather heavy, they sank and accumulated around the strum, with the result that the water could not be drawn from the tank to the condenser, a rush of water only tending to bind the shavings more tightly on to the strum.

In another instance the trouble was even more serious. Some difficulty had apparently been experienced in getting water through to the condenser, and instead of searching out the root cause, the circulating pump—which was an electrically driven one of the centrifugal type—was simply speeded up until the suction on the tank was, perhaps, twice its proper value. The result was that the strum suddenly collapsed, and a mass of *débris* consisting of mud, small billets of wood and other obstacles rushed through the pump into the condenser. Some of these billets got wedged in the tube and did an immense amount of damage, and it required a considerable amount of trouble to get them out again. The effect of such an inrush on a reciprocating pump could easily be imagined. If the pump had rubber valves, the rubber would be torn away and the metal guards would be bent into useless shapes, while even with metal valves the damage would very likely be very considerable. Therefore it is obvious that careful attention should be paid to the periodic cleaning out of these tanks. Where it is impossible to put the cooling tower system altogether out of commission, as is the case in a good many large stations, the load should be taken if possible on other cooling towers. Each tower should have a separate tank with an equalising pipe passing between and valves whereby each tank can be isolated. Similarly, it is advantageous not to draw direct from the tank, but to place on the outlet a subsidiary tank of moderate capacity from which the supply of each circulating system is drawn. This subsidiary tank should be capable of being shut off from the main tank by means of a valve, and all the subsidiary tanks should be joined together by means of an equalising pipe with valves, the return arm, forming a ring main, being utilised for the suction of the circulating systems.

When the water is delivered to the top of the cooling towers, it should be delivered first of all to a similar ring main system from which each tower can be fed as required. In this way it is possible to do two or three things. It the first place, each tower with its tank can be shut off from the rest without interfering with the circulating system normally connected to it; next the subsidiary tanks act as a species of buffer between the tanks themselves and the circulating system; the load on the engines can be distributed as desired among the various cooling towers; the tanks can be run dry or kept at various levels as desired; and when a test on any particular engine is required, one tower can be separated off to deal with the circulating system of that engine without interfering in any way with the running of the main station. With such an arrangement the cleaning out of the towers can be accomplished with the greatest ease, the tanks being pumped dry and the load taken up by the other towers. Where there is no duplicate tower and tanks, of course, the only thing to do is to cut off the make-up water, if this is supplied, until the level of the water in the tank has been reduced as much as is safely possible and then to put the tower out of commission, running the remaining water in the tank away to waste and cleaning out the tank. This is, as will be seen, a rather wasteful process. In some installations the evil day is deferred as long as possible by using some form of strum having self-cleaning arrangements operating by reversal of flow, change of position, or some other device, but the only satisfactory method in the long run is to go straight to the root of the trouble and keep the tanks clean.

Most of the above remarks when set down in writing appear to be self-evident, as it really only requires a little care and common sense to look after a cooling tower equipment. The fact remains, however, that troubles have occurred which might have been prevented, and this is, therefore, the apology for offering a reminder that even a cooling tower sometimes requires a little attention on the part of those who have the responsibility for the proper maintenance of the plant.

WEAR OF TRAMCAR WHEELS.

The question of the wear of wheels on electrical street railway rolling stock is a very important one, inasmuch as the amount of wear very largely determines an important proportion of the maintenance expenses of a tramway undertaking, and therefore a note concerning a difficulty which was discovered on one undertaking may not be without interest. It was noted in this case that the wear in the wheels of some single truck cars was very unequal, and at first it was thought that the wheels, as supplied to the undertaking, were of very unequal quality and durability. Investigation, however, showed that the fault did not lie with the wheels themselves, but with the trucks on which they were mounted. It was discovered that the cross braces of the truck frames were not sufficiently rigid, and that the trucks themselves were out of alignment.

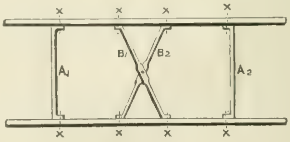


Fig. 1.

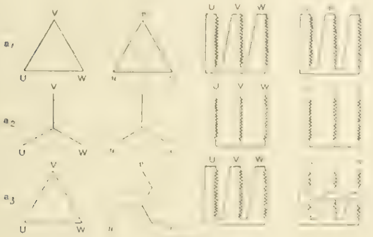
Fig. 1 shows diagrammatically the bracing of the trucks, in which A^1 A^2 are the cross braces, B^1 B^2 being the diagonal braces. In the construction ordinary black iron bolts had been used on the braces, and trouble had been experienced owing to these bolts slacking and working in the holes. It was appreciated that it was at this point where lack of rigidity occurred, and therefore the truck frames were lined up afresh, and the braces were then fitted with turned taper bolts, which were made a tight driving fit in tapered holes in the frames, the taper being secured by rehammering out the original bolt holes. In this way a beautiful fit was obtained in the holes, which were formerly rather slack, and no further trouble was experienced from unequal wearing of the wheels.

This incident goes to show the extreme care which is necessary in the construction of tramway trucks in order to secure perfect rigidity and solidity, and any detail, however apparently slight and unimportant, which is overlooked, will give severe results in undue wear and deterioration.

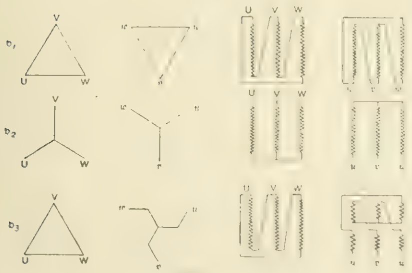
GERMAN RULES FOR TESTING AND RATING ELECTRICAL MACHINERY AND TRANSFORMERS.

THE "Maschinennormalien" Committee of the V.D.E. has lately issued a revised set of rules for the rating and testing of electrical machinery and transformers, and the more important quantitative recommendations are reproduced in abstract in the following paragraphs. The new rules are very clear and reasonable, but, in view of space limitations, we omit a considerable amount of general matter, which, however necessary in an official set of rules, is familiar to every qualified engineer.

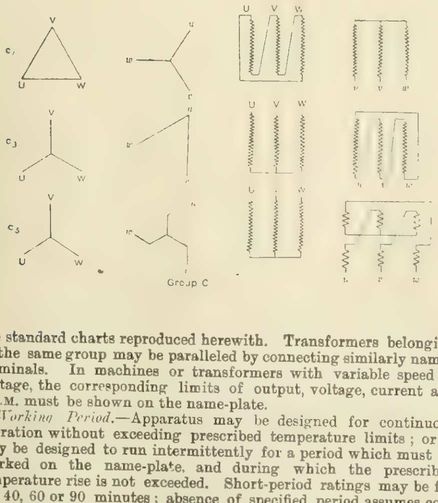
Name-Plates.—Must be stamped with the following particulars, or as many thereof as are applicable to any particular case: Purpose of apparatus; manufacturer's serial number; normal voltage, current and power factor; normal output and working period (*vide infra*); R.P.M.; frequency; starting voltage; excitation voltage. In the case of transformers, the voltage ratio and short-circuit voltage must be quoted and the connecting system must be indicated by the reference letter of the appropriate set of diagrams shown on the standard charts reproduced herewith. Transformers belonging to the same group may be paralleled by connecting similarly named terminals. In machines or transformers with variable speed or voltage, the corresponding limits of output, voltage, current and R.P.M. must be shown on the name-plate.



Group A



Group B



Group C

Working Period.—Apparatus may be designed for continuous operation without exceeding prescribed temperature limits; or it may be designed to run intermittently for a period which must be marked on the name-plate, and during which the prescribed temperature rise is not exceeded. Short-period ratings may be for 10, 40, 60 or 90 minutes; absence of specified period assumes continuous running.

Commutation.—In machines with stationary brush-gear, commutation must be practically sparkless between quarter and full load (without interpoles), or between light and 25 per cent. overload (with interpoles).

Temperature Rise.—The general conditions and methods advanced for the determination of temperature rise show no novel features. In determining the atmospheric temperature, a number of thermometer readings should be taken during the last quarter of the test, at about half the height of the machine or transformer, and about 1 m. distant from the latter. Where artificial cooling is provided, the temperature of the ingoing air is to be taken. The temperature rise of stationary windings had best be determined by the increase in their ohmic resistance; in other cases, thermometric measurements should be made (as far as possible at the warmest points), and, in designing apparatus, reasonable provision should be made for the introduction of thermometers to various parts.

Assuming an atmospheric temperature of 35° C. (or lower), permissible temperature rises are as follows:—

	[illegible]	[illegible]
Cotton insulation	50° C.	70° C.
Cotton in oil; slot insulation, including paper	60° C.	80° C.
Enamel, mica, asbestos and compounds thereof	80° C.	100° C.
Commutators	55° C.	80° C.
Slip-rings	60° C.	80° C.
Bearings	50° C.	50° C.

The figures for traction motors are not to be exceeded during one hour's full-load run on the test bed. In stationary D.C. field coils the above allowances may be increased about 10° C. The temperature rise of iron surrounding insulated windings is limited by the insulation. In complex cases the lowest rise determined by any of the above considerations is to be observed.

Overload.—Provided the above temperature regulations are observed, suitable overload capacities are 25 per cent. for half an hour (at normal P.F.), and 40 per cent. for 3 minutes (at normal voltage in the case of motors). Constant-speed machines should be able to run at 15 per cent. above normal R.P.M. without injury for 5 minutes on light load. At normal speed and power factor generators should maintain full terminal voltage up to 15 per cent. overload.

Insulation.—Machines or transformers must withstand the following test pressures, applied as below:—

Normal voltage, 40 – 5,000 volts; test pressure = 2·5 × normal; minimum, 1,000 volts.

Normal voltage, 5,000 – 7,500 volts; test pressure = normal + 7,500; minimum, 12,500 volts.

Normal voltage over 7,500 volts; test pressure = 2·0 × normal; minimum, 15,000 volts.

These rules do not apply to testing transformers for very high pressures. Apparatus for use below 40 volts should be tested at 100 volts. If D.C. is used for testing, all the above pressures must be increased by 40 per cent.

Breakdown tests must be carried out when the apparatus is at its maximum temperature; pressure must be applied gradually and maintained at full value for at least 1 minute. All apparatus should withstand 30 per cent. increase in the working voltage for at least 5 minutes.

Testing pressure is to be applied between the windings and the frame, and between the windings themselves. If windings are for different pressures, the latter test must be at the pressure determined by the higher working voltage. The test pressure between connected windings and frame is to be that determined by the highest working voltage in any part of the circuit.

Separately excited field coils should be tested at 3 × excitation pressure (minimum 1,000 volts); and wound rotors should be tested at 2·5 × the maximum rotor voltage (minimum 100 volts). Cage rotors need not be subjected to breakdown test.

Voltage Regulation.—The voltage regulation of a separately excited generator is the percentage voltage variation which occurs when the load is removed at a moment when the machine is supplying full load at normal voltage. The R.P.M. and excitation are supposed to remain constant; if the speed rises, a correction factor must be applied. In the case of self-excited and compound generators, the same definition applies under the proviso that the position of the field regulator also remains constant during the load variation. Unless otherwise specified, the regulation of an A.C. generator on inductive load is to be taken at 0·8 power factor. In the case of transformers, the ohmic voltage drop should be determined and also the short-circuit voltage at normal current (both referred to secondary).

Appendix.—The following are recommended as desirable values for general adoption:—

Frequency:—50 cycles per second.

A.C. Machines and D.C. Motors.—No. of poles 2, 4, 6, 8, 10, 12, 16, 20, 24, 28, 32, 36, 40, 48, 56, 64, 72, 80; R.P.M. = 6,000 ÷ No. of poles.

Voltage.—D.C. motors 110, 220, 440, 500, 750 volts; A.C. motors and transformer primaries 120, 220, 380, 500, 1,000, 2,000, 3,000 5,000, 6,000 volts.

The direct linear distances between bare live parts and earth, or between those of different polarities or phase, should be not less than the following values:—

Voltage.	*Min. distance.*
750	30 mm.
3,000	75 mm.
6,000	100 mm.
12,000 . . .	125 mm.
24,000	180 mm.
35,000	240 mm.

REVIEWS.

The Electrical Nature of Matter and Radio-activity. By PROF. H. C. JONES. London: Constable & Co., Ltd. Second edition. Price 8s. net.

The contents of this book have already been published as a series of articles in the *Electrical Review*, New York. We are told in the preface that the two correlated subjects under consideration are of such general interest that it seemed desirable that the discussion of them should be made accessible in compact form. The aim of the writer has, therefore, been to present the more important facts and conclusions as far as possible in non-mathematical language. This has been done with the belief that there are a large number of those who have a truly scientific interest in these most recent and important developments in physics and physical chemistry, but to whom a more technical and rigidly mathematical treatment might not appeal. While the work is written in a semi-popular style, the attempt has been made to treat the subject with scientific accuracy. The facts presented have nearly always been taken directly from the original sources.

The author has been extremely successful in his labours. For the man whose mathematical attainments are limited, and whose knowledge of physics and chemistry is but general, the book is the very best that has ever been presented. The whole development of this fascinating subject is treated clearly and consecutively, yet so simply, that one might well wonder how the author could reduce such a recondite matter to such simple terms. Yet this is not a book that treats the subject in an elementary manner. On the contrary, the details are very fully given, and nothing has been omitted of any importance. It is quite a treat to obtain such a readable and interesting account as is here presented.

Chapter I treats of the electrical conductivity of gases, and of the ratio e/m. It shows in simple yet sufficient language how this ratio is obtained for different gases, and how it varies for the different ions of electrolytes.

Chapter II is concerned with the determination of the mass of the negative ion in gases, and reviews the work of Prof. Sir J. J. Thomson in this respect. It shows that the nature of the positive ion is different for every gas, being simply the atom minus that constituent common to all atoms, the corpuscle.

Chapter III is on the nature of the corpuscle and the electrical theory of matter. The experiments of Kaufmann are reviewed. It is shown that the corpuscle is nothing but a disembodied electrical charge, and that the atom of one elementary substance differs from the atom of another only in the number and arrangement of the corpuscles (*i.e.*, the electrons) contained in it.

Chapter IV discusses the nature of the atom in terms of the electron theory. The connection between the latter and the periodic system is shown. Sir J. J. Thomson's partial solution as to the arrangement of the corpuscles that will produce stable systems, in the case of a number of the less complex atoms, is gone into very clearly and without mathematical entanglement, and the beautiful development with regard to univalent, bivalent, trivalent, positive and negative elements, &c., is clearly explained.

Chapter V is on X-rays. It is shown that the X-ray is not a succession of waves in the ether, like light, but is a series of pulses sent out at irregular intervals. The difference between the X-ray and the Becquerel ray is pointed out.

Chapter VI gives an account of the discovery of radium, its spectrum and atomic weight.

Chapter VII discusses other radio-active substances in pitch-blende, such as polonium and actinium, and gives a summary of the types of rays, α, β, γ and δ, emitted by radio-active elements.

Chapter VIII gives a very full treatment of the alpha rays. An account of the spinthariscope is given, with particulars of the theories entertained with regard to it. The chapter discusses the critical velocity of the alpha particles, production of delta particles by the alpha particles, the connection between alpha particles and helium atoms, the action of alpha particles on a photographic and on a fluorescent plate, and the stopping power of matter for the alpha particles.

Chapter IX treats of the beta and gamma rays. It indicates the nature of the charge carried by the beta particle, the determination of e/m for the particle, and shows that it is essentially identical with the cathode particle, only differing in velocity. An estimation of the total number of particles shot off by radium is made.

Chapter X is on various properties of the radiation: the self-luminosity of radium compounds, phosphorescence produced by radium salts, increase in the conductivity of dielectrics by radium, chemical effects produced by radio-active substances, physiological action of the radiations from radium, &c.

Chapter XI discusses the production of heat by radium salts. It shows how the measurement of the heat liberated has been accomplished, and treats of the source of the heat, its effect on solar heat, and the question of the existence of radium in the sun.

Chapter XII gives an account of the emanation from radio-active substances, and this difficult and confusing subject is treated very well indeed. The amount and nature of the emanation are discussed, as well as its diffusion, determination of its molecular weight, and so on.

Chapter XIII gives an account of the experiments made to show that helium is produced from the emanation.

Chapter XIV is on induced radio-activity, and Chapter XV on the production of radio-active matter.

Chapter XVI gives a summary of the theoretical considerations in connection with radio-activity, and shows the importance of a theory of generalisation.

Chapter XVII indicates the wide distribution of radio-active matter, and discusses the origin of radium.

It will thus be seen that the subject is exhaustively dealt with. The book appears to us to be much the best yet published for a non-specialist, and it should certainly be found in the library of every engineer who desires to keep in touch with modern developments in the line treated.

The Electric Circuit. By V. KARAPETOFF. London: Hill Publishing Co. Price 8s. 6d. net.

The first edition of this book was issued as a pamphlet of 85 pages; the second edition, which we have before us, is a volume containing 230 pages, and claims to give to advanced students of electrical engineering "the theoretical elements necessary for calculation of the performance of dynamo-electric machinery and of transmission lines."

In view of the italicised statement that the book is *not* intended for a beginner, it is rather surprising that the first three chapters are devoted to the discussion of such elementary topics as temperature coefficients and resistances in series and parallel, and even Kirchoff's laws are not exactly satisfying fare for advanced students. Even when we reach the Promised Land of alternating currents in Chapter IV, it is with slow and painful steps that we proceed to conquer the land. Surely the "advanced" student does not need to be spoon-fed with addition and subtraction of vectors before he is prepared to grasp the idea of the power factor.

The chapter on Inductance and Reactance wears a more satisfying appearance, and we are just beginning to find something worthy of the advanced student's attention when we have thrust upon us two whole chapters on the use of complex quantities. This would surely seem to cast a grave aspersion on the mathematical attainments of young American engineers, for whom the book is undoubtedly written, and we would humbly suggest that a working knowledge of De Moivre's theorem and its associated mathematics should precede and not be included in an advanced study of electrical engineering theory.

The author returns from his mathematical digression and deals with polyphase systems in a very straightforward chapter, and then proceeds to the transformer, calculating its regulation by an approximate and also by a more rigid method.

The induction motor is then treated very thoroughly, as a transformer with a short-circuited secondary free to rotate, to the entire exclusion of the synchronous motor, which, athough simpler in theory, is not so simple as to warrant its complete neglect even in an advanced text-book.

The rest of the book is devoted to the dielectric circuit, the treatment being strictly analogous to that of the electric circuit. The paragraph on the energy in the electrostatic field is especially good, the analogies being well drawn.

Following a discussion of the inductances and capacities of transmission lines, there is an interesting section on current and voltage resonance, and frequent reference is made to the works of Steinmetz on the subject of electric transients, waves, and impulses.

An appendix and bibliography complete the book. The perusal of such a book as this causes one to doubt very seriously the possibility of successfully treating the theoretical matters connected with electrical engineering in a volume apart from the descriptive and practical side of the work. The inconsistencies that we have noted, and the marked discrepancy existing between the acknowledged aim, and the accomplishment of this book must, perhaps, be attributed rather to its method than its author. In any case we shall doubt the *possibility* of the text-book on the theory of electrical engineering until we see a more successful attempt than this.—P. K.

MR. DOOLEY VISITS A TELEPHONE FACTORY.

"Ye know what a tillyphone is, Hinnessy—the little dingus ye lie to yer woife through when ye want to stay downtown av an avenin'? Yez call it a 'phone,' but 'tillyphone' is the roight name fer ut. It comes from the Grayk wurrd 'tilly,' manin' 'to tell,' an 'phoney,' meanin' somethin' bogus; so whin ye tell them little fibs to yer woife, ye're usin' it accordin' to Hoyle. If I was a married man, Hinnessy (which, thank the Lorrd, I am not), I wud starrt a movement to raise a monymint to the man that invinted the tillyphone. Wid a tillyphone an' six moiles av capper wire, a man kin lay down the law to his woife in a dignified way, widoubt havin' to go to the ixpense av buying a new rollin' pin afthberwards.

"I was out to Hawthorne last wake, visitin' the Westerrn Aylictric Comp'ny's place, where they make thim things. Man, man, but it's a foine place! Whin ye go in at the gate, ye are shtopped be a felly ye take fer a polaceman, until ye see thot he ain't Oirish. He wants to know who ye are an' what yer business is. I tol' him I wanted to see the place.

"'Have yez a pass'? siz he.

"'Past is it?' siz I. 'Shure, do ye have to exhibit yer family skiliton to get through these worruks?'

"No, no,' siz he, 'Oi don't care about yer past. Oi siz 'pass'—a permission to go through the plant.'

"'No, I ain't,' I siz. 'But, maybe ye could git me wan; I'm perfissor av applied electricity (which I am, Hinnessy, fer don't I turn on me own electhric loights'?)

"So I got me pass an' a guide to show me through the worruks. Wan av the things thot struck me furrst was the big clocks shtanding around iverywhere, so's the help will know whin to stop worruk. They looked loik an orthinary toimepace, except thot they had a big circle around thim, wid numbers on it, an' a handle thot ye tuk an shtabbed at the numbers wid; if yez hit the bull's-eye, ye rung a bell. An' they shure have some marksmin over there, Hinnessy. Wan after another walked up to thim clocks, an' divil a wan missed the bull's-eye.

"Siz I to me guide, 'Phwat do they all crowd in so fast for?'

"'Why,' sid he, 'the 8.30 whistle has blew, an' they want to poonch in before the clocks register 8.31. Fer if they're a minnit late, they're fifteen minnites late.'

"'Wud ye moind doin' that on paper fer me?' I asked. 'Me arithmetic ain't as spry as it was some years back.'

"'Shure,' he siz. 'I don't know how it's figgered. Thot ain't my job, but I know thim's the rooles.'

"No it luks to me, Hinnessy, loike they was infringin' on me frind Billy Bryan's copyroight. Thrue, he figgered sixteen to wan instid of fifteen to wan, but the principle's the same, an' afther all, what difference does a figger make, as the ossified man said whin he married the fat lady.

"'An' pwhat kapes track av the night force?' I asked.

"'Why, thim same clocks,' siz he.

"'Thin,' siz I, 'why the devil have they got 'em labeled "Dey Time Registers?"'

"'Ye kin search me,' he siz.

"It's a moighty big force they got over there, Hinnessy—hundreds an' hundreds of gurruls, an' ivery wan chewin'.

"'Phwat are they all atin'? I asked the felly.

"'They ain't atin',' he answered. 'They're only chewin'. Ye see, we don't allow thim to chew the rag durin' wurrkin' hours, so they takes to gum. It takes six gum factories, workin' noight an' day, to supply the T. A. buildin' alone.'

"'It's nice woide aisles ye have here,' I remarked, 'but ain't they afther bein' woider thin necessary? Ye waste space.'

"'Yis,' siz he, 'they're pretty wide now, but they was laid out whin hair was in style. Why, a few months back a man had to go through these aisles sideways an' push his shadow through ahead av 'im, to get past the coiffoors widout takin' home enough av thim on his coat to git him in throuble wid his woife. But the comp'ny cudn't git along widout the girruls. Ye know the fair sex completely outclasses us min whin it comes to conversayshun, so the comp'ny hires thim to learn the baby 'phones to talk. Why a man thryin' to butt into the conversation av our gurrul experts wudn't shtand as much chanct of gettin' a hearin' as an echo at a deaf mutes' convintion.'

"An' there's the Worruks lab'ratory, Hinnessy. Thot's a quare place. The've got all kinds av shtrange infernal machines, aylictrical an' chimical, to help thim in their business, which is to call an all-wise but sometimes onrooly Providence up on the cyarpet an' make it explain itsilf whin some conthraption or ither rafuses to come up to 'spec.' 'Spec.' is short for 'specifications,' which is a sort of a Bible iverywan has to live up to, over there. It's diffrunt from the old wan, though. It cuts out the Prophets intoirely. Still, it makes up fer thot by bein' extry shtrong on Commandments. But, as I was sayin', av all the quare conthraptions yez iver seen, they've got the quarest. Oi don't want to brag, but ye knows yersilf, Hinnessy, I've been in some of the foinest bar-rooms in this conthry, but niver annywheres have I seen a colliction av glassware to aqual theirn. Why, if a man took a drink of wake tay out av wan av thim twisty bottles they have, it wud take him six wakes to git his legs straightened out agin.

"But, shpakin' av twistin', Hinnessy, did ye iver see an insultin' machine puttin' insults on wires? Well, ye don't want to. It luks loike sivinteen attacks of delirium tremens thryin' to bust up a Maypole dance. If I had to luk at wan of thim machines all day, I'd sign the pledge.

"But don't ye be gettin' the notion in yer head thot machines is all there is over there. They've got a libr'y an' a band an' orchesthry, not to mintion the Men's Club, which kapes the mimbers supplied wid lectures, voddyville an' nickel shows free of charrge.

"An' they've got ball grounds an' tinnis coorts an' sick-likes fer thim as wants to amuse thimselves at noon, an' a rist'rant fer the old-fashioned wans thot wants to ate. An' take it from me, Hinnessy, as the b'ys says now-a-days, it's *some* rist'rant. There's a siction upstairs, where ye ate on pay-day at not less than twinty cints a throw; an' the rist av the wake ye kin ate downstairs on the Open Board, where the ante runs from a penny up to whativer you've got. Things shure are fixed up foine. Ye kin git a piece av pie wid decorayshuns on it for tin cints, an' they aven kape burrds for the eddyfication av the guests. An' mind ye, it ain't none av yer quick-lunch joints. It's genteel. I waited half an hour before I got a bite to ate at all. I made wan bad break, Hinnessy, an't it's ashamed av it I am. I ordered a steak, an' afther a bit the young lady sits down a plate befure me. I looked at it, an' thin I siz to her, 'Beggin' yer pardon, Miss, but it's a dirthy plate ye've brought me.'

"'Dirthy?' siz she. 'It looks clane to me. Where's the dirrt, plaze?'

"I pointed out the spot to her.

"'Why, bless yer soul,' she siz, 'thot ain't dirt. Thot's the steak!'

"An' may ye stroike me dead, Hinnessy, if it wasn't."

"'An' was the steak good?' asked Mr. Hennessy.

"'Sh-sh-sh,' said Mr. Dooley. 'I promised on the worrud of a gintlemin not to divulge any company secrets.'"—*Western Electric News*.

An American Fish Story.—The sale of large quantities of fish by dealers and peddlers in Lafayette, Ind., recently attracted the attention of the fish and game warden of Tippecanoe County, who after investigation, assured himself that no seines or nets were in use in his district. Setting out to ascertain the source of the unusual supply of fish, he discovered two men near an interurban railway bridge, one of whom from time to time indulged in the extraordinary practice of striking his fishing pole against the trolley wire, after which the other would gather in a boatload of the dead and stunned fish which floated to the surface. Investigation showed that an insulated wire ran down the fish pole and dipped into the water under the bridge. The 500-volt contact with the trolley served to electrocute all fish near the wire, killing them outright, it is declared, instead of stunning them as in the case of dynamiting.—*Electrical World.*

The Reduction of Iron Ore.—A recent issue of the *Iron and Coal Trades Review* described some experiments at Herräng, Sweden, in the reduction of iron ore to iron sponge by means of a direct process, which it is pointed out is applicable chiefly to Swedish and Norwegian ores. The ore is first subjected to a magnetic treatment, then mixed with coal, and fed into an inclined rotary furnace through which flame from a producer gas furnace passes, the burnt gas being returned to a regenerator for heating the air supplied for combustion. The product analysed between 97 and 98 per cent. of iron. The important feature of the process appears to be the "estimated" low cost, viz., 53s. per ton as against 62s. for electric smelting, and 66s. by the blast furnace method. The capital expenditure is, however, considerably higher than for electric smelting. The figures refer to Scandinavian conditions.

TRADE STATISTICS OF CHILE.

The following figures, showing the imports of electrical and similar goods into Chile in the year 1911, are taken from the official trade statistics recently issued; details for 1910 are not available (peso = 1s. 6d.) :—

—	Gas and electricity meters.	Lamps.	Copper wire.	Copper, brass or bronze lamps.	Telephones.	Telegraph apparatus.	Materials for telegraph and telephones.	Boilers.	Mining machinery.	Cranes.	Electrical machinery and apparatus.	Machinery and apparatus for electric lighting.	Industrial machinery.	Motors.	Insulators.
Gt. Britain	14,000	47,000	160,000	98,000	17,000	12,000	39,000	83,000	776,000	470,000	149,000	162,000	3,103,000	2,157,000	18,000
Germany ...	86,000	21,000	1,651,000	203,000	106,000	—	44,000	91,000	2,004 000	196,000	449,000	740,000	1,598,000	512,000	84,000
France ...	—	—		23,000	—	—	—	—	—	—	18,000	31,000	70,000	—	—
Belgium ...	—	—	—	—	—	—	7,000	—	241,000	—	4,000	42,000	98,000	53,000	—
Austria ...	—	2,000		—	—	—	—		—	—	—	—	—	—	—
U.S.A. ...	9,000	—	192,000	24,000	8,000	—	14,000	1,000	756,000	22,000	101,000	125,000	489,000	333,000	9,000
Other countries	5,000	—	96,000	5,000	—	1,000	—	—	206,000	27,000	1,500	1,000	82,000	11,000	1,000
Total, pesos	114,000	70,000	2,099,000	353,000	131,000	13,000	104,000	175,000	3,983,000	715,000	722,500	1,101,000	5,410,000	3,066,000	112,000

THE USE OF NAKED ALUMINIUM WIRE IN ELECTROMAGNETS.

In the course of an article in the *Electrical World*, Mr. H. F. Stratton gives some useful information on this subject. On the basis of the Matthiessen standard, he says, the conductivity of 99 per cent. aluminium is 61 per cent. of that of annealed copper, which possesses the characteristics of copper used in magnet wire. A bare aluminium conductor will therefore be 64 per cent. larger in cross-sectional area than a bare copper conductor of equal conductivity.

Fig. 1 gives a graphic comparison between round copper wire and both round and square aluminium wire of sizes having conductivity equal to the conductivity of the various sizes of copper wire. In general, and approximately, the conductivity of any one size of copper wire is equivalent to the conductivity of round aluminium wire of the next two sizes larger, and to the conductivity of square aluminium wire of the next one size larger, in terms of the B. & S. wire gauge.

Since the aluminium oxide should not be exposed to a potential stress larger than 0·5 volt, this oxide film is, in general, serviceable only between turns and not between layers, and it is necessary to wind on a sheet of some insulating material, such as asbestos paper, between layers. The writer has found, in his experience with aluminium coils, extending from a coil containing perhaps ¼ lb. of aluminium up to a coil containing about 400 lb. of aluminium, that the thickness of the insulating material between layers can be successfully taken as about 10 per cent. of the diameter of the wire.

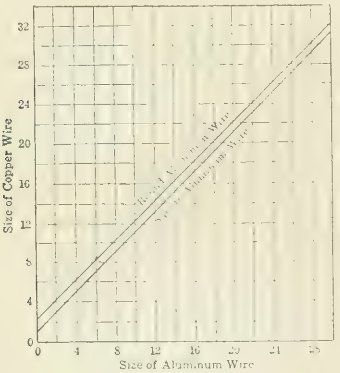


Fig. 1.—Relation of Aluminium and Copper Wires of same Conductivity.

Taking this additional space into consideration, first, comparing single cotton-covered copper wire with round aluminium wire, the space utilisation of the aluminium wire, on a basis of equal conductivity, is unity at No. 29 size of copper wire, less than unity in larger sizes, and greater than unity in smaller sizes; and, secondly, comparing the single cotton-covered copper wire with square aluminium wire, the space utilisation of the aluminium wire, on the basis of equal conductivity, is unity at No. 25 size, less than unity in larger sizes, and greater than unity in smaller sizes.

On the basis of equal conductivity and equal length of conductor it is evident that in most sizes bare aluminium wire will occupy more space than single cotton-covered copper wire, and where the problem is one of replacing a copper coil by an aluminium coil in a fixed coil space in standard apparatus there is evidently small opportunity of accomplishing the desired result if the characteristics of the copper coil must be duplicated by those of the aluminium coil. In many cases it would be pertinent to inquire, however, if a higher ultimate temperature should not be permitted in aluminium coils than in coils constituted of single cotton-covered copper wire. There are undoubtedly many examples of commercial apparatus where the permissible coil temperature is dictated solely by the consideration that this temperature should be kept safely below the charring temperature of the cotton insulation. It has generally been assumed that coils wound with single cotton-covered wire should not reach a higher ultimate temperature than 100° C., and in many cases specifications for lower temperatures are proper and are warranted by considerations of precautions or reductions of the I^2R losses.

On the other hand, the writer is familiar with the history of a large aluminium coil, which, in a lifting magnet, has been subjected almost constantly day and night to a temperature of about 300° C., and which, after quite a long period of operation, as yet shows absolutely no measurable change in resistance. It goes without saying that a coil composed of cotton-covered wire and subjected to these same oparating conditions would by this time have failed completely. It should be noted that the aluminium coil in question, in addition to being subjected to extremely high temperature, also withstood mechanical abuse, the severity of which is probably second to none experienced in electrical apparatus.

Where the increase in resistance due to rise in temperature has determined the final temperature of copper coils, a slightly higher temperature may be permitted with the same results in the case of aluminium coils, since the temperature resistance coefficient of aluminium is about 6 per cent. less than that of soft copper.

When, however, the question of coil weight is considered, the advantage of aluminium over copper is so conspicuous as not to be open to argument. An aluminium coil will weigh about 49 per cent. as much as a copper coil composed of single cotton-covered copper wire and of equal conductivity and length of conductor.

When the very important question of cost is considered, the use of aluminium seems to show some startling advantages. The accompanying table was prepared showing the saving in the cost of conductor secured by using bare aluminium wire in place of single cotton-covered copper wire, and assuming in each case that a size of aluminium wire was employed having a conductivity equal to that of copper wire. This table considers round and square aluminium wire of several typical sizes; it was based on quotations existing in May, 1912, and is, of course, inconsistent in its relative figures pertaining to different sizes of wire, since it takes into account the arbitrary fixing of prices of both aluminium and copper. It should not be assumed that the total cost of aluminium coils should be less than the total costs of copper coils in the ratio indicated by this table, since the winding and other processes of manufacture of aluminium coils will be found to be more expensive than similar operations in the case of copper coils. This table does, however, indicate the possibilities of large monetary savings to the electrical industry, when it is remembered that insulated copper wire to the value of many millions of dollars is used annually in building the various kinds of electrical machinery.

Size of copper wire, B. and S. gauge.	Percentage saved, round aluminium wire.	Percentage saved, square aluminium wire.
0	32	20
5	33	20
10	36	25
15	40	20
20	27	2
25	36	17
30	26	−8

Aluminium wire can be purchased under the supposition that it is enveloped in a skin of aluminium oxide. The writer, however, has not been able to wind coils of such wire which do not exhibit a serious degree of short-circuit, either because the oxide did not sufficiently enclose the wire when it was received from the wire manufacturers, or because the oxide was partly scraped off during the process of winding. In Europe some manufacturers claim to have formed the oxide successfully on the surface of the wire after the coil has been wound, by thoroughly wetting the entire coil structure with water and then heating the coil. In such a case, the oxide is supposed to be formed by the presence of the hot moisture. The writer, in attempting to carry out this process, succeeded in forming a considerable degree of the oxide, but not enough to prevent a partial short-circuit, and not nearly enough to produce a coil of absolutely stable and uniform resistance. Very successful results have been obtained by passing the wire through a solution of sodium hydroxide as the wire is wound on the coil, and then drying out the solution by passing current through the coil winding. The current, of course, should be regulated by a rheostat, as initially quite a degree of short-circuit will exist, but as the temperature of the coil increases with the progress of the chemical action, and as the moisture is driven off, the resistance of the coil will increase until it reaches a point where no short-circuit exists in the entire coil structure.

Irrespective of the precise chemical composition of the substance which results from the action of sodium hydroxide and metallic aluminium, the fact remains that this substance, in practice, has proved to be stable, and a sufficiently good insulator.

In winding large coils which contain such a length of conductor that joints must be made, it will be found that the aluminium wire can be easily and successfully welded together. The procedure is first to cut off the two ends of the wire squarely, and hold each of them in the flame of a blow-torch until they become molten. The film of aluminium oxide which will surround the coil, being very highly refractory, does not melt, and serves to inclose and retain the molten metal. After the two ends have reached this condition they should be suddenly pushed together, and it will be found that a weld will be secured which will exhibit nearly, if not entirely, 100 per cent. strength and electrical conductivity.

VERTICAL SYNCHRONOUS BOOSTER ROTARIES.

The American Westinghouse Co. has recently completed two vertical-shaft synchronous-booster type commutating-pole rotary converters, each of 3,000-KW. capacity, for the New York Edison Co.'s Clinton and Crosby Street sub-stations.

The converters deliver a normal direct-current voltage of 270 and are for 25-cycle six-phase operation. The direct-current voltage variation obtained by virtue of the booster feature is 15 per cent. buck and 15 per cent. boost from the normal voltage, giving a total direct-current voltage variation of 30 per cent. These machines were made of the vertical type to conform in general construction to the other converters in the sub-stations, all of which are vertical machines.

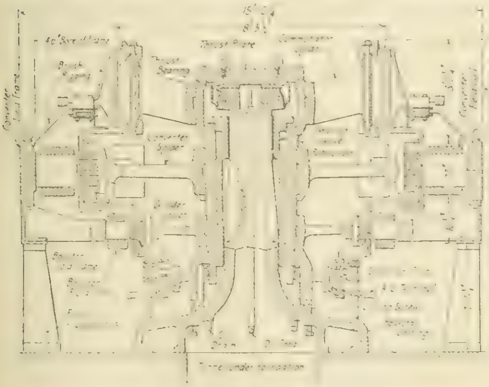


Fig. 1.—Sectional View of Machine.

Fig. 1 shows the detail construction of the machines. The converter armature and frame are mounted above the booster armature and frame. The commutator is at the top of the machine and the collector rings are at the bottom. The armature is of the usual construction mounted on the same shaft with the smaller booster armature, which is connected in series with the converter armature, so that when the booster-field excitation is varied the alternating-current voltage impressed on the converter armature will be decreased or increased accordingly.

The main or converter poles are shunt wound. The commutating poles which lie between the main poles have been so wound that variations in armature reaction introduced by the booster are taken care of. The copper grids embedded in the main pole faces do not extend from pole to pole as in ordinary machines, but are cut off flush with the sides of each main pole. This construction is used on all commutating-pole converters, and forms the most effective starting and damping winding. The booster poles are shunt wound, and the booster field is arranged for hand regulation. Provision is made for effectively cooling the commutator by the insertion of copper heat-radiating vanes in the upper end of each commutator bar. Ample space is provided between the commutator necks, which extend from the commutator bars to the armature coils, and through these spaces the cooling air is forced by the rotation of the machines.

A commutating-pole converter which is to be started from the alternating-current end must be provided with a brush-lifting device, but inasmuch as these machines are to be started from the direct-current end, a brush-lifting arrangement is not necessary.

A roller thrust bearing is arranged at the top of the pedestal to take the weight of the revolving element. The bearing rests on a plate which has a spherical seat carried on the pedestal so that alignment is assured. The roller bearing can be taken out by removing the top plate of the machine. To assume the weight of the rotating part at times when it is necessary to remove the top plate, six 1¾-in. bolts are provided in the lower portion of the pedestal flange. When it is necessary to take off the top plate, these bolts are screwed up until they raise the rotating element a trifle and assume its weight.

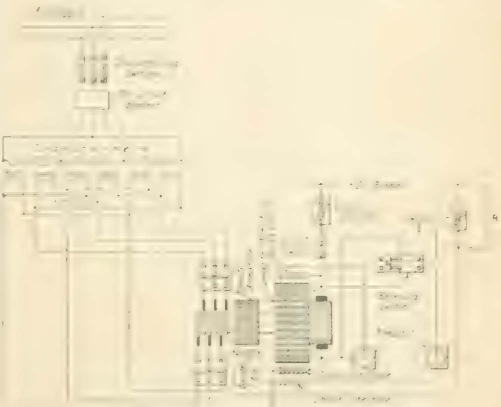


Fig. 2.—Typical Connections of Machine.

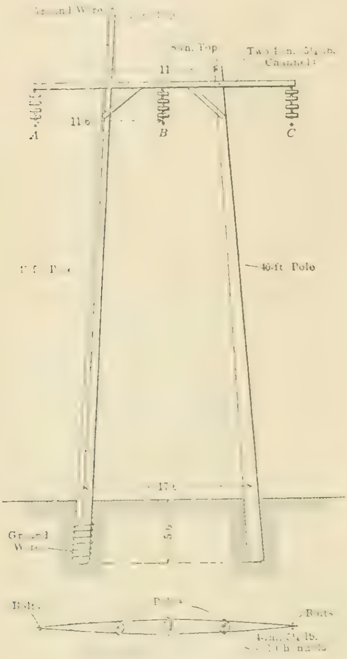
Lubrication is effected with a gravity oiling system. The oil is drawn from the reservoirs and forced up through the oil pipe in the centre of the pedestal. At the top of the pedestal, the oil discharges through a nozzle into a cylindrical chamber within the roller bearing. The pressure on the oil forces it from this chamber out between the bearing rollers into an annular pan surrounding the roller bearing; the height of the outlet nozzle and the oil pan rim are such that the bearing rollers always travel in a bath of oil. When the oil overflows, it passes into an annular chamber just above the upper pedestal bearing and through oil grooves in the pedestal. While it is passing through these grooves, the rotating babbitt bearing surfaces take up oil. From the upper pedestal bearing the oil flows down through the chamber around the shaft to oil grooves for the lower bearing similar to those above described. Fig. 2 shows typical wiring connections for a machine of this class. The switch S is so attached to the circuit-breaker that it closes when the latter is closed, and the resistance R is then short-circuited. Upon opening the circuit-breaker, the resistance is put into the booster field circuit and the shunt interpole windings by the opening of switch S. It is necessary to introduce this resistance in the shunt interpole circuit to prevent the neutral position from shifting when the circuit-breaker trips under load.

A description of these machines appeared in a recent issue of *Power* (U.S.A.), from which journal our illustrations are taken.

WOODEN TOWER FOR 100,000-VOLT TRANSMISSION LINE.

The wooden transmission tower construction shown in the sketch on p. 440 has been adopted by the Central Colorado Power Co. for a new 70-mile line at 100,000 volts. Each tower comprises one 45-ft. and one 40-ft. pole, which are set into the ground to a depth of 5 ft. 6 in. At the ground line the poles are separated by a distance of 17 ft. 6 in., and converge to a distance of 11 ft. at a level 35-ft. above the ground. The cross-arm is formed of a pair of 4-in. 5¼-lb. steel channels bolted together at their ends and enclosing the poles as a bow-spring. Although pinned to the poles by through bolts, the spring pressure of these deflected channels is sufficient to grip the cross-arm securely in position. A 10-in. spacing block is inserted at the mid-point of the bow, and the channels are braced to the poles with 4-ft. knee-pieces. These towers are being spaced at 500-ft. intervals throughout the 70-mile line which is under construction.

The arrangement of suspension insulators used places all three-phase wires in the same plane. While such disposition is susceptible of slight theoretical disadvantages, the arrangement has the great practical advantage of permitting any wire to be reached and worked upon without danger of contact with the others. As the sketch shows, the ground wire is carried at a distance of nearly 8 ft. from the nearest conductor. At each pole a ground tap is run down under staples and wrapped in a spiral about the pole butt to provide a permanent earth connection. The Central Colorado Co. has used a construction similar to this in some of its 13,000-volt lines, where the bow-spring cross-arms are formed of two 6-in. × 6-in. hardwood members. With this construction spans as long as 1,100 ft. have been used.—*Electrical World.*



Wooden Tower for 100,000-Volt Line.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

RUSSIA.—British firms exporting goods to Russia are often in doubt and difficulty as to the proper steps to be taken in appealing against the fines and overcharges which are frequently imposed by the Russian Customs authorities, mostly on account of clerical or other errors in bills of lading, invoices and Customs documents. In a memorandum recently issued for the guidance of British firms, the Foreign Office points out that although these fines and overcharges are imposed upon the agents, consignees, or receivers of the goods in Russia, the responsibility falls eventually upon the British merchants or shippers, who should therefore carefully observe the procedure prescribed by the Russian Customs regulations, as well as the rules established for soliciting any possible assistance from His Britannic Majesty's diplomatic and Consular representatives.

When the agents, consignees, or receivers of goods in Russia have unsuccessfully protested at the local Custom house, they have a right during two months to petition direct to the Customs Department at St. Petersburg. To enable them to do this the merchants or shippers in England should furnish them without delay with all necessary information and legalise any documentary evidence by having it sworn to before a competent British authority, whose signature must then be attested by a Russian Consul.

Apart from this, the British merchants or shippers also are at liberty to present a similar petition in English or Russian within the same two months to the same Customs Department, and this petition may be forwarded either direct or through the British Consulate at St. Petersburg, subject, however, to observance of the rules given in the last two paragraphs of this circular.

Should this petition to the Customs Department be rejected, a further two months' period is allowed from the date of the rejection within which to address a petition to the Russian Minister of Finance. The second petition, like the first, may be sent in either direct or through the British Consulate.

At the same time, at this stage of the proceedings the aid may be invoked of His Britannic Majesty's Ambassador, in which case all information and copies and translations of all petitions and documents in the matter must be sent in to the British Embassy at St. Petersburg, with a request for official support; but in no case should the complaint be brought to the notice of the Russian Government in the first instance through the channel of His Majesty's Embassy.

If all these steps fail to obtain satisfaction for the petitioners, the latter may make a final appeal within another two months' period to the governing Senate in St. Petersburg; but as this appeal is a purely judicial matter, the British Embassy and British Consulate cannot be asked to interfere.

No attention is paid to petitions or appeals which reach their destination after the expiration of the two months' limit in each case as above described.

Every application or petition addressed to the Russian authorities must be accompanied by a 75-copeck Russian revenue stamp for each double sheet of foolscap upon which the petition is written, and one 75-copeck revenue stamp for the reply. These stamps may be purchased and affixed to the petition by his Majesty's Consul at the request of the parties concerned. And in each such case the sum of 8s. 3d., if the petition consist of not more than one sheet of foolscap, should be remitted to his Majesty's Consul at St. Petersburg in English penny postage stamps, for defraying the cost of the Russian stamps, and for a Consular fee of 5s., chargeable for sending in a covering dispatch with the petition.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,480. "Electric arc lighting systems." M. J. Railing and O. Brooks. August 26th.

19,481. "Method of and means for indicating the continuity and workability of telephonic systems." W. J. Rickets. August 26th.

19,483. "Electrical generation and transmission of power, for industrial and ships' auxiliary machine-driving, propulsion of ships, road and rail locomotives, tramcars, omnibuses, trains, and other self-contained vehicles, and the like." W. P. Durtnall. August 26th.

19,522. "Magnetic toy and game." H. Brockas. August 26th.

19,533. "Electric fuses." G. W. Christians. (Convention date, December 27th, 1911, United States.) August 26th. (Complete.)

19,534. "Electrical junction boxes." T. E. Murray. (Convention date, September 11th, 1911, United States.) August 26th. (Complete.)

19,535. "Connection apparatus for electric circuit conductors." T. E. Murray. (Convention date, February 9th, 1912, United States.) August 26th. (Complete.)

19,537. "Systems of electric distribution." Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston. (Convention date, August 26th, 1911, France.) August 26th. (Complete.)

19,538. "Holders for telephone receivers." G. B. Stern. August 26th. (Complete.)

19,543. "Electric cooking and heating apparatus." G. Wilkinson. August 27th.

19,569. "Polyphase electro-motors for marine propulsion." B. Ljungstrom. August 27th.

19,585. "Electric signalling systems." Sir A. T. Dawson and G. T. Buckham. August 27th.

19,587. "Water-tight electric bells." E. A. Graham. August 27th. (Complete.)

19,607. "Furnaces of the channel type." E. C. R. Marks. (Electric Smelting and Aluminium Co., United States.) August 27th. (Complete.)

19,621. "Shade supports for electric or incandescent lights." J. N. Mollett and E. E. Edwards. August 28th.

19,642. "Fuse devices for electric circuits." J. H. Tucker. August 28th.

19,647. "Electric fittings." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 28th.

19,661. "Electrical massage apparatus." G. W. Mascord. August 28th.

19,708. "Electric thermometer." R. Alt. August 29th.

19,740. "Contact fingers or brushes for electric controllers and like purposes." W. G. H. Cox. August 29th.

19,754. "Electrically heated cookers." A. J. Kercher. August 29th. (Complete.)

19,763. "Apparatus for producing electric oscillations adapted for wireless communication and other purposes." W. Dubilier. (Addition to 11,091, 1912.) August 29th.

19,771. "Electrically heated cookers." A. J. Kercher. August 29th. (Complete.)

19,787. "Rotary engine with electrical power transmission gear." A. Beldiman. (Convention date, September 26th, 1911, Germany.) August 29th. (Complete.)

19,807. "Electric flexible conducting-cords." M. S. Conner and J. Healey. August 30th.

19,825. "Electrically-propelled road vehicles." E. Cross. August 30th.

19,834. "Telephone meters." G. L. Bates. August 30th.

19,868. "Musical instruments with electrically-operated vibratory sounders." M. L. Severy and G. B. Sinclair. August 30th. (Complete.)

19,869. "Musical instruments with electrically-operated vibratory sounders." M. L. Severy and G. B. Sinclair. August 30th. (Complete.)

19,870. "Pulsation timing devices for use in electrically-operated vibratory musical instruments" M. L. Severy and G. B. Sinclair. August 30th. (Complete.)

19,890. "Electric locomotives, motor-boats, and the like." Maschinenfabrik Oerlikon. (Convention date, September 23rd, 1911, Switzerland.) August 31st. (Complete.)

19,900. "Resonating-relays." H. von Kramer and G. Kapp. (Addition to 5,950/12.) August 31st.

19,913. "Magneto-ignition apparatus." Hartmann & Braun Akt. Ges. (Convention date, August 31st, 1911, Germany.) August 31st. (Complete.)

THE

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ELECTRICITY IN TEXTILE MILLS.

WE reproduce elsewhere in this issue an account of the proceedings at the Congress of the Textile Institute last week, so far as they relate to the use of electricity for motive power, and to the choice of a prime mover. The discussion arose out of the dissolution of the special joint committee which was appointed last year to investigate the respective merits of mechanical and electric driving; the composition of the Committee was apparently regarded as unsatisfactory, though we do not see any reason why its conclusions would not have been impartial and reliable, and the Textile Institute undertook the investigation on its own account. Thus the organised discussion at the Congress was the first step towards an authoritative settlement of the controversy which has arisen on this topic, and we trust that the inquiry will be energetically pursued to a final verdict, which will be all the more weighty when delivered by such a tribunal. It was unfortunate that, owing to the length of the four papers, the verbal discussion was curtailed, but further opportunities will no doubt be found for a more adequate debate.

In the meantime, we have a strong impression that the question is rapidly solving itself, as such matters have a way of doing when there is a pecuniary advantage to be gained by prompt action. While the rival experts are contending in the arena, the practical hard-headed mill-owners are getting on with the work. They are much too 'cute to dally with so important a question, and they appraise the balance of advantage not in terms of pounds of coal or watts expended, but in £ s. d. Hence it is that, as Mr. Crowley stated, within 18 months the number of looms driven by individual motors has risen from under 300 to more than 7,000, and the employment of electric power in textile mills generally has made great strides, so that the manufacture of the apparatus and the supply of energy for this purpose have already become important branches of the electrical industry. That they are destined to attain to vastly increased proportions may be regarded as certain.

It is noteworthy that the advocates of steam and gas engines as prime movers not only accept electrical transmission as entirely agreeable to them, but even, more or less directly, urge its adoption, and the speaker for the Diesel engine was at least neutral. But these interests, of course, would not be greatly affected by the use of electricity, for their plant must be employed either in the private engine room or in the central power station. The makers of mechanical transmission appliances, who have yet to be heard, will adopt a less friendly attitude.

The efforts of the engineers and manufacturers who have so energetically carried on the campaign during recent years, and who, we hope and believe, are now about to reap the reward of their exertions, are deserving of the highest praise. It is interesting to observe that their opponents have been on the defensive all the time, fighting a losing battle.

The facts brought out by Mr. Crowley regarding the material advantages derived in practice from the adoption of the electric drive are extremely interesting, and highly gratifying, the increase of output being greater than has usually been supposed. It will be observed that the greatest benefit is realised when the fullest advantage is taken of the system—that is, by adopting the individual motor drive, which exhibits quite as great a superiority over the group drive as the latter does over mechanical transmission.

The results remind us of the history of the steam engine, as affected by the development of electricity supply. There is no doubt that a very large proportion of the great improvement which took place in the efficiency and economy of steam plant towards the end of the last century was directly due to its application to the generation of electrical energy, and to the facilities afforded by electricity for exact measurement; in a similar way, the electric motor has drawn attention to the deficiencies of even the most approved and highly developed systems of mechanical transmission employed in textile mills, and has led to the minute examination of their behaviour, revealing unsuspected possibilities of improvement.

The British Association.

The papers which we reproduce in abstract to-day will be found of exceptional interest, as they relate to two new developments which, though at present in embryo, will in all probability be ultimately of immense importance to the electrical industry. In his paper on the Gas Turbine, Dr. Dugald Clerk concisely sums up the present condition of that much-discussed machine, which affords some of the most interesting, and, at the same time, most difficult, problems for the mechanical engineer and his *confrères*—the metallurgist and the chemist—to tackle. Were a satisfactory solution attained, its effect on the social and industrial applications of electricity would undoubtedly be profound and far-reaching. We fear, however, that a vast amount of work remains to be accomplished before that desirable end is attained.

Mr. Mavor's paper on "Electricity in Marine Propulsion" similarly marks an epoch in the evolution of a new system. With admirable perseverance and tireless industry he has kept on pegging away at the problem of the adaptation of electricity as the link between the high-speed engine and the slowly rotating propeller, and has had the satisfaction at last of embodying his views in the equipment of a new vessel of considerable tonnage. We congratulate him on his present and prospective success, and look forward to the wide adoption of electricity on ships of all classes.

The extraordinary flexibility of electrical systems, which seem capable of fulfilling almost innumerable functions, is well exemplified by the several instances cited by the author.

Train Dispatching by Telegraph.

A monument has been erected at Harriman, New York, U.S.A., to commemorate the sending of the first "train order" by telegraph, which led to the universal adoption of the system on American railways. To Charles Minot, general superintendent of the Erie Railroad, the credit is due for taking the first step, in 1851. The story is told in an admirable pamphlet mentioned in our "Book Notices" to-day. In those days the single-line railways were operated on a system, according to which trains going in opposite directions were timed to meet and pass one another at specified stations; if one was late, the other had to wait at the passing place until the late one arrived. Minot was travelling on such a line, when his train was held up at "Turner's" station in this way; it occurred to him to telegraph to the next station, 14 miles away, and inquire whether the other train had reached there, and finding that it had not done so, he telegraphed an order for it to be held there, while he proceeded to drive his train (the engine driver having refused to carry out so revolutionary a proposition) to that station. Fortunately, the result proved satisfactory, and the new system was launched upon the world. It may seem obvious to us nowadays—the most natural thing in the world; but the telegraph in those days occupied a very different and more humble position, and no doubt the feat was one well worthy of the memorial which has been erected on the site of the old Turner station.

Copper.

Messrs. Merton's mid-monthly return (September 14th) shows a slight decline in price, and lower demand. Stocks (England and France and afloat from Chile and Australia) are 270 tons less on the fortnight, traceable mainly to the smaller quantity afloat from Australia than at the close of last month. As would be expected, English stocks have increased 338 tons, and French stocks are 442 tons heavier. Rotterdam shows a reduction of 70 tons, and Hamburg of 524 tons, probably due to brisk German trade.

In detailed supplies we find North America sending over a smaller quantity than half a month's average supply, while Spain and Portugal are represented by only 30 tons (average supply per month 1,700 tons). Shipments from Chile and Australia, on the other hand, exceed the average. Total deliveries, at 15,685 tons, are distinctly low. The market appears to be waiting for some expected improvement in outlook.

American stocks (the figures of the American Producers' Association) at the end of August were 1,597 tons less than at the end of September—not a heavy reduction. Last year, however, the figure was only 1,919 tons on a price of £56 per ton, and the stocks rose during September. The total visible supply, including Holland and Germany, stands (end of August) at 71,181 tons, a reduction of 1,839 tons on that for the end of July. For the same date last year it was 144,935 tons, or more than double. The total deliveries (European) for September, 1911, were 33,043 tons, the lowest for the year. The labour outlook at that period was, however, very gloomy.

Two Continental Exhibitions.

Two Exhibitions are to be held on the Continent during 1913, to which the attention of British manufacturers and traders should be directed. The Barcelona International Exhibition will be opened by the King of Spain on January 1st, and during its four months' run British exporters should have an excellent opportunity of gaining intimate knowledge of industrial and commercial possibilities in Spain and of establishing relations with desirable buyers. The period chosen for the Exhibition is unusual to us in this country, where most of our events of the kind run between May and October, but we understand that from January to April is essentially the season of the year when Barcelona, the commercial and industrial capital of Spain, is visited by many buyers representing the leading South American firms. Our Continental competitors for Spanish and South American trade are stated to be fully alive to the importance of the occasion, and it is to be hoped that British electrical and engineering firms will not adopt a weak policy, for our export trade to Spain has certainly required increased attention. The other Exhibition to which we are asked to allude is the International Belgian Exhibition which opens at Ghent in April next. Here the wisdom of manufacturers of particular classes showing combined or co-operative exhibits, avoiding overlapping and purposeless rivalry, is being urged. The special features of this Exhibition will be machinery, machine tools, textile trades and applied arts. The addresses in London from which particulars of these two exhibitions can be obtained are given in our "Business Notices."

THE QUARTZ MERCURY VAPOUR LAMP FOR ALTERNATING CURRENTS.*

In recent years the mercury vapour quartz lamp has advanced in favour considerably, partly because of its high efficiency, and partly because the colour of its light is almost white compared with that of the older mercury-vapour lamps. Both these improvements are the direct result of the higher temperature permissible in quartz glass, this higher temperature being produced by increasing the voltage drop per cm. of tube from about 1 volt (as was usual in the old Cooper-Hewitt glass lamp) to about 12 volts.

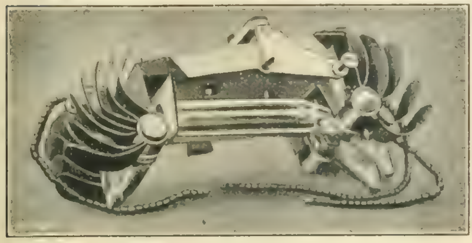

Fig. 1.

Hitherto mercury-vapour lamps have been chiefly confined to direct-current circuits, because of the well-known difficulty of maintaining an arc in any metal vapour unless the negative electrode is permanently maintained above a certain minimum temperature. This difficulty can, however, be got over with alternating currents if the double anode arrangement used by Cooper-Hewitt in his mercury-vapour rectifiers is adopted.

An alternate-current quartz lamp arranged on this principle has been recently developed at the laboratory of Messrs. Heraeus, of Hanau, and is shown in fig. 1. The diagram of connections is shown in fig. 2. The quartz burner is provided with two separate anode chambers in a fork at one end and with a cathode chamber at the other end. The anodes are connected to the two ends of the secondary of the supply transformer whilst the carthode is connected to the centre point of the secondary. When the lamp is alight, a more or less pulsating direct current flows between the cathode and the centre of the transformer winding, whilst the two anodes take it in turns to supply current to the lamp—each only being active for half a wave at a time, viz., so long as it happens to be the positive pole of the transformer. Owing to the absence of cathode excitation, there is little danger of current passing from one anode to the other, even though the voltage between them is twice the working voltage of the lamp.

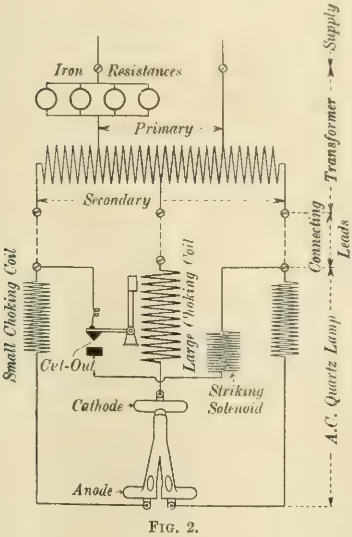

Fig. 2.

The striking of the arc is effected by tipping the lamp until a narrow thread of mercury bridges across from cathode to anode for a moment. At the same time, the liability to short-circuit the two anodes is avoided by providing a narrow dividing wall, about ¼ in. high, along the bottom of the lamp from the anodes practically to the cathode. The electromagnetic tipping device is provided with a repeating arrangement so that, in case the arc does not strike because the mercury thread is either broken at an instant when the current is zero, or at an instant when the anode at which the break occurs happens to be negative, the tipping process shall be repeated once or twice until the lamp lights up. The tipping solenoid is eventually disconnected, when the lamp is alight, by means of a cut-out. A damping device is added in the form of a simple clockwork mechanism which allows a quick forward motion, but a slow return, through the action of a small air vane.

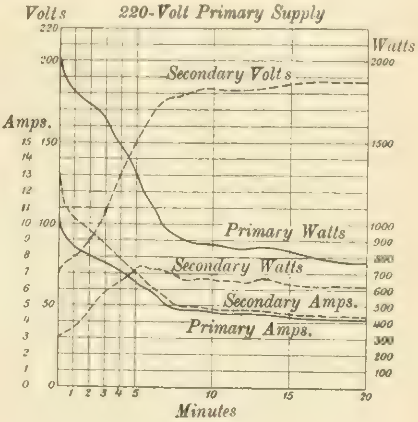

Fig. 3.

For each lamp rating in watts only a single size of burner is made whatever the supply voltage—the necessary adjustment being made in the transformer instead of in the lamp. Thus the 770-watt lamp is arranged to take 180 volts across the burner. The transformers are then wound for 2 × 180 volts on the secondary and any desired primary voltage. For the ordinary 110 and 220-volt supplies auto-transformers are used, and tappings are provided to suit slight variations from these voltages.

A small series resistance in the form of thin iron wire enclosed in four glass bulbs is provided, in order to prevent an excessive rush of current when striking the arc.

Choking coils to steady the direct current through the lamp are also provided at the cathode, and at each anode as shown in fig. 2. The tipping solenoid and its cut-out are connected right across the whole secondary voltage. The transformer, starting resistance and choking coils are usually put in a separate case independent of the lamp.

When the arc is first struck a heavy current passes (about 10 primary amps. and 13 secondary amps. with a 220-volt supply), bringing the iron resistances up to a dull red glow, whilst about 150 volts are lost across them. The secondary transformer voltage falls to about 70 volts. These conditions gradually change as shown in fig. 3 until, after about 10 minutes, the steady state is reached, with only 12 to 15 volts lost in the resistance.

The efficiency of this alternating lamp is hardly lower than that of the direct-current lamp, one Hefner c.p. being

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[*] Herr F. Girard, *E.T.Z.*, July 4th, 1912.

obtained for about ·25 watt. This is because the reduced starting resistance loss in the A.C. lamp approximately compensates for the additional losses involved by the use of the double anode.

As regards sensitiveness to voltage variations, the A.C. and D.C. lamps are about alike, both allowing variations of 10 or more volts without trouble. In consequence of the necessity for the transformer, large choking coils and more complicated burner, the cost of the A.C. lamp is, however, considerably greater than that of the D.C. lamp at present.

THE USE OF MICA IN THE INSULATION OF ELECTRICAL APPARATUS.

By A. P. M. FLEMING, M.I.E.E., and R. JOHNSON, A.M.I.E.E.

The valuable insulating properties of mica are generally well known. There appears to be, however, a lack of knowledge among engineers as to the limitations to the use of this material, and it is frequently called upon to fulfil quite impossible functions in specifications for the insulation of electrical machinery.

This article has been prepared with a view to correcting some of the erroneous impressions prevalent in connection with the practical use of mica, and at the same time to afford some general information for the guidance of those engineeers to whom the subject is of importance, but whose opportunities for carrying out personal investigations are very limited.

The subject will be dealt with in four parts :—(1) Raw mica; (2) Mica products; (3) Commutator mica; (4) Other applications of mica.

1. *Raw Mica.*—Mica is found as a constituent of granite, gneiss and mica schist. The larger crystallisations occur in granite veins intersecting these rocks. There are a great number of micas. That most commonly used for electrical purposes is known to mineralogists as Muscovite. Chemically it is a double silicate of aluminium and potassium, with varying proportions of impurities. An analysis of one sample gave :—

Silica	46·3	Fluorine	0·7
Alumina	36·8	Water	1·8
Potash	9·2		
Iron sesquioxide ...	4·5		99·3

There are many valuable deposits of Muscovite in the United States and in Canada. In New England plates 2 to 3 ft. across have been obtained. Large quantities of mica are now obtained from India. A specially soft kind, commercially known as amber mica, is obtained from Canada. Much of this amber mica consists of the mineral phlogopite, and one analysis gave :—

Silica	43·00	Iron sesquioxide ...	1·71
Alumina	12·37	Fluorine	5·67
Potash	10·32	Water	0·38
Magnesia	27·70		
Soda	0·30		102·35

The colour is mainly a yellowish brown, with a copper-like reflection. This amber mica is quite distinct from the other qualities, not only on account of its colour, but its crystalline structure is different, and also such physical characteristics as cleavage, hardness, flexibility, insulating properties and resistance. It is of particular value on account of its softness, and this characteristic will be specially dealt with later in connection with mica for commutator work.

In general, the hardness of mica lies between two and three in the standard scale—that is to say, two to three times the hardness of talc, while the specific gravity ranges from about 2·7 to 3·1.

The qualities of mica most extensively used are the harder and cheaper varieties known commercially as white, ruby and soft green, mined mainly in India. A very hard form, also of a greenish tint, mined in the United States, is seldom used for electrical work.

In addition to these qualities, there are varieties of each, mottled or stained with flecks of green, ruby, brown and black colour.

As regards insulating properties, amber mica has about half the dielectric strength of the other varieties used. When tested in sheets of ·002 in. or ·003 in. thickness, the voltage required to puncture amber mica is about 2,000 volts per mil. With the white, ruby and soft green varieties, the voltage per mil to produce breakdown is about the same for each, and runs from 3,000 to 4,000 volts. Compared with other insulating materials, even the lowest of these values is so high that, as a general plan, it may be said that any kind of mica may be used for any insulating purpose to which its other characteristics render it adaptable.

The principal features to be considered in selecting mica for any particular insulating purpose are cleavage, flexibility, softness and cost. As regards the latter, amber mica is by far the most expensive. It is also more difficult to cleave into thin laminæ; there is considerable waste in cleavage and a marked tendency for the laminæ to split, so as to form "heels"—*i.e.*, there is considerable difference in the thickness of opposite edges of the same sheet.

The harder varieties are cheaper, and cleave more readily; in fact, in general the harder the mica the cheaper the cost of cleavage and the less the waste. These varieties can be split economically as thin as ·0005 in., or about half the thickness of the usual amber splittings.

As regards hardness, the micas can be classified as follows, starting with the softest :—Amber; green (the variety known as soft Madras green); ruby, white, India; green, U.S.A. In addition to this classification, various trade terms are sometimes introduced by suppliers to mark special consignments.

It should be noted that while the amber mica is consistently softer than the other varieties, the difference in hardness between it and the softest of the green micas is not great. Further, samples of white mica, quite as soft as Madras green, can sometimes be obtained and *vice-versâ*. But while experts are able to judge this by merely handling the material, the above classification is, in general, a fairly good guide to a purchaser.

Regarding the mottled mica noted above, this is frequently avoided by purchasers under the mistaken idea that the insulating properties must necessarily be poor. In the vast majority of cases, however, this is by no means the case, and very rarely is there found to be any appreciable difference in insulating value between the clear and mottled portions of the same sheet. The discolouration in some cases has been caused by the action of radio-active substances, in others it is due to the presence of microscopic quantities of organic material enclosed between laminæ, and in others, again, to slight traces of inorganic deposit.

Mica is obtained from the mines in rough flakes encrusted in schist, the latter being trimmed away with the fingers or by knife or machine on the spot. The sheets are graded into sizes varying from a few square inches to 100 sq. in. and upwards in area, and in thicknesses varying from about $\frac{1}{16}$ in. to $\frac{1}{4}$ in. They are further graded and shipped as "knife" or "thumb" trimmed, as the case may be, the former best lending itself to further cleavage.

The cost of raw mica of any variety varies enormously with size, *e.g.*, soft green mica of approximately 3 sq. in. of superficial area can be bought as cheaply as 5d. per lb., whereas pieces of 30 sq. in. will cost as much as 6s. per lb.

It will be readily seen that the most economical size of raw mica to purchase depends on the use to which it is to be put. When the laminæ are to be built into sheets, as is usually the case, it becomes a compromise between the cost of splitting and building and the initial cost of the raw mica. The cost of raw amber mica runs approximately from three to four times that of soft green.

For the bulk of work where the harder varieties of mica are used, two sizes have become practically universal, and are known as No. 5 and No. 6 respectively. These sizes are of irregular shape, and are of such an area that from No. 5 mica a circle having a diameter of about 2 in., and from No. 6 a circle of about 1½ in., may be cut.

Large sizes are used for special purposes, as will be noted later. Amber mica is ordinarily sold in sizes varying from 6 to 10 sq. in.

Many users purchase their mica already split into laminæ of a thickness suitable for building into sheets, others prefer to split it themselves. Sometimes this is done by machine, but more usually by knife in the hands of girl workers.

It is not generally appreciated that mica is capable of absorbing considerable quantities of water, oil, &c.; in fact, nearly all raw mica contains considerable moisture absorbed between its laminæ. Similarly it will readily absorb oil by capillary action along the surfaces of the laminæ.

The effect of moisture between the laminæ is to apparently increase the flexibility—a characteristic that is liable to be mistaken for softness—the resilience is destroyed, and the mica assumes a talc-like nature. As regards softness, while a comparison of different qualities of mica can be obtained by testing with a hardened "scraper," an expert can form a good idea by the mere feel of the material.

Mica is unaffected by heat until a temperature of several hundred degrees centigrade is reached. The harder varieties then undergo a remarkable change. The laminæ separate, giving a very flexible and soft character to the mica, which tends to disintegrate into very small scales or flakes. Some attempts have been made to utilise this softening effect produced by "annealing" mica, as will be noted later. Amber mica is much less affected than the other varieties, possibly because it contains less water in its composition.

Mica is generally employed built up into large sheets from small splittings in the manner described later. Block mica and splittings without any adhesive cement have only a restricted application on account of the limited area of the sheets. For small insulating washers, and to some extent for commutator work, mica in its pure form is used, and this will be considered at greater length in dealing with commutator insulation.

2. *Mica Products.*—For most purposes where mica is employed as an insulator, it is first necessary to build it up into one of the following forms:—

Stiff flat plates of various thicknesses.

Flexible sheets.

Sheets made up of a combination of mica with paper or cloth.

In each of these forms the process of manufacture is similar, in that small mica splittings are cemented together in layers by means of a suitable insulating varnish.

The mica splittings vary from ·0005 in. to ·0025 in. in thickness, and are usually of the No. 5 or No. 6 size.

When specially uniform sheets are required, mica of rectangular shape is employed, otherwise quite irregular pieces are used on account of cheapness. The splittings are overlapped when irregular-shaped pieces are used. Each layer as it is built up is sprayed or brushed with varnish, and the layers are so arranged that the joints are broken.

For stiff flat plates the sheets are usually built up with a varnish made by dissolving shellac, or one of the many similar gums, in wood alcohol or methylated spirits. When a sufficient number of layers have been thus prepared, the sheets are heavily compressed in a steam-heated press to expel the solvent and excess varnish. When cold, they are usually milled to a uniform thickness. Except for commutator work, where amber mica is sometimes employed, the cheaper green or white mica is used for these sheets. The trade term "Micanite" is generally applied to mica built up in this form.

Flexible sheets are built up in a similar manner, except that a non-drying varnish is employed for cementing the laminæ together, and the hot pressing is omitted. Greater care has therefore to be exercised in the building, so as to obtain uniformity in the thickness of the sheet. For this work also, the splittings should be the thinnest possible.

Insulating sheets composed of mica and paper or cloth are prepared by cementing one or more layers on to the paper or cloth with either shellac or a flexible sticking varnish, according to the use to which the product is to be applied.

Great care must be exercised in the choice of flexible varnish to be used, as there are a number of preparations on the market that are chemically active and liable to attack any copper with which they may come into contact. For mica sheets backed in this manner with paper or cloth, the thinnest soft green splittings are best employed, so as to give the most flexible product. Scrap and powdered mica are used to some extent in the preparation of many of the fireproof insulating compositions sold in the form of bushings, strain insulators, arc shields, &c.

3. *Commutator Mica.*—For the insulating of commutator segments from one another, mica is almost invariably used, and also, with few exceptions, for the insulating bushings between the segments and supporting frame.

Considering first the insulating of the segments, the mica sheets employed are usually from ·020 in. to ·035 in. thick. Unless the mica is milled out between the copper segments on the wearing face in the manner referred to later, it is necessary to use a quality of mica that will be as soft as, or softer than the copper itself, otherwise there will be uneven wearing of the commutator, ultimately resulting in high mica and destructive sparking under the brushes. The safest plan is, of course, to use amber mica, but this entails high cost, and the softer green micas are now very largely employed with, on the whole, satisfactory results. In the case of large machines, it becomes possible to make up the insulating sheets with the wearing surfaces only of amber mica, and the remainder of green or white mica, the increase in expense over sheets made up entirely with hard mica not then being very great.

Considerable difference of opinion exists as to the relative merits of "pure" mica and built up mica for the insulating of commutator segments. Many engineers maintain that in cases where oil has crept on to the commutator, pitting of the insulation between bars has rapidly resulted when the insulation has consisted of built-up mica, whereas pure mica has withstood such deterioration fairly well. It is the writers' experience, however, that in this respect there is very little to choose between built-up mica—when well made—and pure mica. Deterioration is bound to occur in either case when oil is present on the surface of the commutator, and the prevention of this class of trouble can only be effected by keeping oil off the commutator by means of properly designed bearings and oil throwers.

Another objection put forward to the use of built-up mica is that the small pieces composing it are liable to work loose and creep up from between the bars. While this may happen with poorly manufactured material, experience does not show it to be the case where the insulation has been properly prepared.

In the case of large machines the question resolves itself, as it then becomes impossible to obtain pure mica in sheets sufficiently large for the purpose, and there is no alternative to the use of built-up sheets.

As a commercial proposition where the segments are longer than about 12 in., a pure mica insulation is impossible. When the segments are small, say, not longer than about 4 in., economy favours the use of pure mica, the strips being sawn or punched out of the raw block. When this is done the increase in cost due to the large mica is more than compensated for by the saving in the building, pressing and milling.

The one great advantage that well built-up mica possesses over the pure sheet, is that it ensures uniformity of wear, the splittings being thoroughly well mixed.

With pure mica it is impossible to ensure that all the segments will be of equal softness, and even in the same sheet hard spots will often occur.

The principal feature in the manufacture of the hard sheets of built-up mica for commutator segments is the pressing. The pressure employed should be as great as possible, and the temperature sufficiently high to expel all traces of solvent. The amount of shellac or other insulating cement left in the finished segment should not exceed 10 per cent. by weight; 5 per cent. is sometimes attained.

Where pure mica segments are used, improved wearing is obtained by dividing the sheets, after these are cut to size, into as many thin laminæ as possible, and reassembling to the thicknesses required before placing into position between the copper bars.

"High mica" will occasionally occur in practice whatever kind and quality is used, and it is now common practice to mill down the mica about $\frac{1}{16}$ in. below the wearing surface of the copper of the finished commutator. This may appear to involve some risk of trouble due to the lodgment of dirt in the channels thus made. In actual practice, however, trouble of this kind is scarcely ever experienced, and the only drawbacks to the practice are some slight tendency to cause "chattering" of the brushes and the necessity of re-milling the ducts from time to time.

For very high-speed commutators rectangular strips of considerable size have frequently to be employed in the building-up of the mica sheet, the strips being arranged so that their ends are held in place under the shrink rings or bands around the commutator. If this is not done the cement and the friction of the surfaces may not be sufficient to prevent the mica being forced out from between the bars.

(*To be concluded.*)

THE BRITISH ASSOCIATION.—III.

On Monday, September 9th, in Section B (Chemistry), the Committee on Electro-Analysis submitted an interim report, stating that the work was still in progress. In Section G, a discussion on the Gas Turbine was opened by Dr. Dugald Clerk, whose paper is reproduced in abstract below. An experimental investigation of the Transmission of Heat was described by Dr. C. N. Lander and Prof. Petavel, to which we shall refer later, the data relating to the insulating of steam pipes being of interest. Dr. J. G. Gray and Mr. G. Burnside treated of some new gyroscopic apparatus.

On Tuesday Mr. H. A. Mavor presented to Section G an interesting paper on "Marine Propulsion by Electrical Transmission," which he summarised with a degree of wit and humour that rendered the hearing exceptionally enjoyable. Below we abstract his paper at considerable length, together with the discussion.

The next paper was by Mr. Axel Welin "On Lifeboats on Ocean-going Ships." He provides electric motors for hoisting the boats inboard again after a drill (they weigh from three tons upwards, and have to be lifted in some cases 70 ft. above the water). They are lowered on the brake. The paper was effectively presented, and a very fine set of models was shown in the ante-room.

In Section G on Wednesday, September 11th, before commencing the regular business of the meeting, the President (Dr. Barr) announced that subscriptions for the proposed memorial to Lord Kelvin in Westminster Abbey had been coming in from all quarters of the globe, and it was now possible to make definite arrangements for a stained glass window, through which the light would fall upon the grave of Lord Kelvin. The Dean and Chapter of the Abbey had already agreed to this proposal.

The President moved that the hearty congratulations of the Section be extended to Sir Wm. White, K.C.B., F.R.S., on his election as President of the British Association for next year's meeting at Birmingham. He felt that the Section was also to be congratulated on being represented in the highest office by such an eminent and devoted member, and next year's meeting should prove to be a memorable one to engineers.

Prof. Coker then read his paper on "The Determina- of the Stresses in Springs and other Bodies by Optical and Electrical Methods." The optical method was to exhibit, by means of models made of xylonite or other sufficiently transparent material, the distribution of stresses in plate and volute springs, and the paper was illustrated by lantern slides which showed the stresses in a wonderfully satisfactory manner.

The second method was to exhibit the stresses in various parts of an actual steel I-beam by a very delicate determination of the changes of temperature in the various parts of the beam. In the electrical (temperature) method he could measure exactly to $\frac{1}{200}$ of a degree. A very thin layer of varnish or paper was used as insulation between the thermocouple and the scraped steel surface of the beam being tested.

The next paper was by Mr. Bernard P. Haigh, of the Glasgow University, on experiments carried out there. The paper was entitled "Alternating Load Tests," but the loads were really repeated tension stresses, the wires not being subject to compression.

The tests were not prolonged fatigue tests, though these may be undertaken with the same apparatus, but were directed to ascertaining the effect of loads of uniform magnitude being repeated with high frequency over quite a short period.

The apparatus for applying the stress to wires of small diameter, which was shown at work upon the lecture table, was an electromagnet supplied with alternating current.

It was found that stresses upon mild steel wire amounting to 10 per cent. less than the real elastic limit could be repeated 2,000,000 times without elongation of the specimen, but if the full elastic limit were repeatedly applied, extension at once took place. Hard steel wire such as is used in steel wire ropes was found to show the least susceptibility to repetition of the safe load, being nearly as strong under repeated loads as under one normal load.

This method appears to offer immense possibilities for fatigue and vibration tests upon all sorts of materials. A device on similar lines invented by Prof. Kapp was described in our issues of January 12th and June 21st, 1912.

Prof. Ernest Wilson next read a paper on "Exposure Tests of Light Aluminium Alloys," showing the loss of electrical conductivity in wires exposed for long periods on the roof of King's College. The results were by no means encouraging for the use of aluminium for electrical conductors. An abstract of the paper appears on a later page.

The next paper, by Mr. R. S. Whipple, of the Cambridge Scientific Instrument Co., on the Féry bomb calorimeter, is of great interest to all buyers of coal, especially central station engineers. This very accurate and handy instrument was shown on the lecture table, the readings being thrown by a mirror on to a large scale for the demonstration. It was shown that by its use the fuel value of any coal could be ascertained in five minutes.

The next paper was by Dr. T. F. Wall on "The Hysteresis Loss in Iron due to a Combined Pulsating and Rotating Magnetic Field," and was ably summarised in the absence of the author by Prof. G. W. O. Howe.

A report on "The Importance of Previous Magnetic History to Engineers," was passed over in the absence of the author, only the title being read, and this only just left time, in a busy morning, for a beautiful demonstration by Mr. C. E. Larard with the kinematograph at the Palace Electric Theatre. Mr. Larard showed on the kinematograph and described torsional and extension tests in a Wicksteed testing machine. He also showed autographic test diagrams extending over long periods. By extending the time of the test to 10 hours, the yield point almost disappears, a diagram being obtained which is almost a regular curve.

The test exhibited on steel test pieces of 3 in. diameter extended for upwards of half an hour, and by means of the kinematograph 15,000 photographs were taken. The behaviour of a square bar being twisted to destruction was very striking, and in all cases the enlarged views of the test piece itself under the test were of quite extraordinary interest and beauty. Unfortunately, the hour was late and the audience small.

An extended use of the kinematograph for scientific demonstrations would not only assist the man in the street to understand many difficult problems, but would also undoubtedly disclose to the man of science many important features of the experiment which otherwise he might miss.

At the conclusion of the meetings of Section G, Mr. Chas. Hawksley moved a vote of thanks to Dr. Archibald Barr for so ably presiding over the meetings, and congratulated him on their marked success. The vote was carried with loud applause.

The whole of a very full programme of papers of a very valuable character had been worked through with the minimum of "drive" and hurry, and the only drawback to Dr. Barr's presidency was that he did not allow himself time to contribute at any great length to the discussion.

Note on the Gas Turbine.

By Dugald Clerk, D.Sc., F.R.S., M.Inst.C.E.

(*Section G. Abstract.*)

Many attempts have been made to produce a commercial gas turbine. So far, no attempt has succeeded; the practical difficulties have proved to be too serious. Much useful knowledge, however, has been obtained by able and adventurous experimenters. The late M. René Armengaud, together with M. Lemale, built in 1906 two experimental gas turbines of the constant-pressure type, one of which developed 30 B.H.P and the other 300 B.H.P. A gas turbine of the explosion type, without compression was built by M. Karovodine, in 1907. It gave 1·6 B.H.P. at 10,000 R.P.M. Recently the explosion type has been studied by Mr. Hans Holzwarth, who has built a gas turbine of a rated power of 1,000 H.P., the wheel of which rotates at 3,000 R.P.M.

In a paper written by M. Réné Armengaud, and published in *Cassier's Magazine* in January, 1907, the inventor gives an interesting account of his experimental work on the constant-pressure turbine. A small experimental machine, it appears, was made by altering a De Laval steam turbine of 25 H.P., so as to operate it with compressed air instead of steam. The air was supplied at the desired pressure from a high-speed compressor, whose efficiency had been carefully determined. The compressed air was passed into a combustion chamber with measured quantities of gasoline vapour, and the mixture was ignited as it entered the chamber by an incandescent platinum wire. The combustion was then maintained continuously at a constant pressure. The combustion chamber was lined with refractory material, ultimately carborundum, and a temperature of about 1,800° C. was maintained at the flame, but the mean temperature of the discharging gaseous contents of the chamber was reduced to 400° C. by the admixture of steam under pressure. This steam was generated in a coil embedded in a portion of the combustion chamber. The working fluid thus consisted of a mixture of products of combustion and steam at the low temperature of 400° C. The constant pressure maintained in the combustion chamber was about 10 atmospheres, and the hot gases were allowed to expand through a conical Laval jet in which the expansion produced a high velocity, and reduced the temperature of the fluid. At this reduced temperature and high velocity the gases impinged upon the Laval wheel, and rotated the wheel in the same way as steam would have done. The experiments showed that under these conditions the total power obtained from the turbine separate from the compressor was double that necessary to drive the compressor.

In the large 300-H.P. turbine the first part of the combustion chamber was lined with carborundum, backed by sand, but the second part was surrounded by a coil through which water was circulated. The water kept the temperature of the combustion chamber within safe limits, and after absorbing heat, it passed also around the jet nozzle, and was discharged into the passage leading to the jet, and there converted into steam by the hot gases. A mixture of products of combustion and steam thus impinged upon the turbine wheel. The expanding jet was arranged to convert the whole of the energy into motion before the fluid struck the wheel; the temperature was thus reduced to a minimum before the gases touched the blades. Notwithstanding this, the wheel itself had passages through which cooling water flowed, and each blade was supplied with a hollow into which water found its way. In the large turbine the compressor was mounted on the turbine spindle; it was of the Rateau type, and consisted of an inverted turbine of four stages, which delivered the compressed air finally to the combustion chamber at a pressure of 112 lb. per sq. in. absolute. The efficiency of this turbine compressor was found to be about 65 per cent. The total efficiency of the combined turbine and compressor was low, as the fuel consumption amounted to nearly 3·9 lb. of petrol per B.H.P.-hour. An ordinary petrol engine with a moderate compression can readily give its power at the rate of 0·5 lb. of petrol per B.H.P.-hour. The combined turbine and compressor was stated to have run at 4,000 R.P.M., and to have developed 300 H.P. over and above the negative work absorbed by the compressor. Notwithstanding the high fuel consumption, it was a notable achievement to obtain 300 H.P. from an internal-combustion turbine under any circumstances, and had it not been for the untimely death of M. Armengaud this turbine might have been greatly advanced.

The explosion gas turbine invented by M. Karovodine was exceedingly ingenious. It contained four explosion chambers having four jets actuating a single turbine wheel, which wheel was of the Laval type, about 6 in. diameter, having a speed of 10,000 R.P.M. The explosion chambers were vertical, and had a water jacket surrounding the lower end. The upper portion contained the igniting plug on one side, and the discharge pipe connecting with the expanding jet on the other. In the lower water-jacketed part there was provided a circular cover, held in place by a screwed cap. This circular plate was perforated with many holes, and it carried a light steel plate valve of the flap or hinging type, which pulled down by a spring contained within the admission passage. This spring could be adjusted, and the lift of the valve was regulated by means of a set screw passing diagonally through the water jacket. Air was admitted at one side by a pipe leading into the valve inlet chamber, and a corresponding passage or pipe admitted petrol and air or gas to mix with the air before reaching the thin plate valve. Adjusting contrivances were supplied in both air and fuel ducts. To start the apparatus, an air blast was forced through the valve, carrying with it sufficient petrol vapour to make the mixture explosive. The electrical igniter was started, and the spark kept passing continuously. Whenever the inflammable mixture reached the upper part of the combustion chamber ignition took place, and the pressure rose in the ordinary way, due to gaseous explosion. The gases were then discharged through the pipe and nozzle on to the Laval wheel. The cooling of the flame after explosion and the momentum of the moving gas column reduced the pressure within the explosion chamber to about 2 lb. per sq. in. below atmosphere. Air and petrol vapour then flowed in to fill up the chamber, and as soon as the mixture reached the igniter, explosion again occurred. In this way a series of explosions was automatically obtained, and a series of gaseous discharges was made upon the turbine wheel. Diagrams taken from the explosion chamber showed a fall in pressure during suction of 2 lb. per sq. in.; ignition occurred while the pressure was low, and the pressure rapidly rose to about 1⅓ atmospheres absolute. The pressure propelling the gas column and jet was thus only 5 lb. per sq. in. above atmosphere. The pressure rapidly fell, and the whole process was repeated again. According to the diagrams taken, a complete oscillation required about 0·026 second, so that about 40 explosions per second were obtained.

Mr. Suplee, in his interesting work upon the gas turbine, describes experiments made by M. Baudezat on a turbine of this type. The volume of one chamber was 230 cb. cm. Each nozzle was 3 m. long and 16 mm. diameter. The wheel itself was 150 mm. in diameter, or 5·9 in. It made 10,000 R.P.M., corresponding to a perimeter velocity of 78½ metres, or 258 ft. per second.

This experiment gave 1·6 B.H.P., and Mr. Suplee takes the wheel and journal friction as 0·5 H.P., so that the equivalent power was 2·1 I.H.P. The fuel consumption was nearly 6·5 lb. per B.H.P.-hour. The little explosion turbine thus consumed more than double the petrol required per horse-power by the large constant-pressure turbine.

The large Holzwarth gas turbine also operates on the explosion principle, but the construction and action is very different from that of M. Karovodine. The turbine in general arrangement outwardly resembles the Curtis steam turbine, in that the turbine wheel rotates in a horizontal plane, the spindle or shaft is vertical and a dynamo is mounted on this spindle above the turbine. In the Holzwarth turbine ten combustion chambers are provided, each of a pear or bag shape. They are arranged in a circle around the wheel, and are cast so as to form the base of the machine. The wheel is of the Curtis type, with two rows of moving and one row of stationary blades. Mr. Holzwarth does not give the dimensions of his turbine wheel, but from the drawings and some of the velocities given by him it appears to be about 1 m. in external diameter. The lower part of each combustion chamber carries gas and air inlet valves, and the upper part carries a nozzle arranged to cause the gases to impinge upon the first row of moving blades. This nozzle is connected to and disconnected from the combustion chamber by means of an ingeniously operated valve. The explosion chambers are charged with a mixture of gas and air, which appears to attain a pressure of about two atmospheres within the chamber before explosion. The air and gas are supplied under sufficient pressure from turbine compressors, actuated by steam raised from the waste heat of the explosion and the gases of combustion, so that whatever work is done in compression is obtained by this regenerative action, and does not put any negative work upon the turbine itself. The combustion chambers are fired in series, by means of high-tension jump spark ignition. The action is as follows: Air is caused to flow through the combustion chamber to sweep out the products of the previous explosion, and also to assist in cooling the wheel by impinging upon it. The nozzle valve is closed, then gas is forced in to produce the explosive mixture. Gas and air valves are both closed, and the electric spark is passed. The pressure of the explosion opens the nozzle valve, and the gases acquire velocity within the nozzle, the temperature falls, and the high-velocity lower temperature gases impinge upon the wheel. As the pressure falls, the nozzle valve gradually closes, but remains open until the scavenging and cooling current has been passed through. When closed, the charging proceeds and explosions occur as already described.

Many practical difficulties were found, but ultimately the turbine was operated by producer gas made from coke. It was found that when all 10 chambers were in operation the maximum pressure on explosion which could be obtained with the best mixture was only about 45 lb. above atmosphere. Using five combustion chambers, the best explosion pressure varied between 80 lb. and 90 lb. per sq. in. above atmosphere; while with four chambers, the highest result obtained was 105 lb. per sq. in. So far as I understand Mr. Holzwarth's experiments, the highest power actually obtained was about 160 B.H.P. (according to latest news, now 450 H.P.). In this experiment 10 chambers were used, giving 16 H.P. each. With five chambers, a total of 145 H.P. was obtained, at 29 H.P. per chamber; and with four chambers, the total was 121·6 B.H.P. at 34 H.P. per chamber. With 10 chambers in operation the power fell to about one-half per chamber, as compared with four chambers. From these experiments Mr. Holzwarth came to the conclusion that the successive explosions interfered with each other, and prevented proper charging and action. Obviously with the arrangements used in the experiments, 10 chambers were inadmissible.

Notwithstanding the unsatisfactory results of those experiments, Mr. Holzwarth is to be congratulated upon his courage and perseverance in attempting to solve a very difficult problem on so large a scale.

The existing internal-combustion engines are quite satisfactory for small and moderate power units; but the weight increases so rapidly with increase of cylinder diameter that large units, such as 20,000 H.P. per shaft, easily attained by the steam turbine, have proved quite impossible for the reciprocating gas engine. In order to apply internal combustion for the purpose of such large units, it appears to me to be necessary to dispense with the cylinder, piston and crank. I fear that this cannot be done on the lines of either constant-pressure or explosion turbines here shortly discussed. The results obtained only appear to show that progress can hardly be expected on the lines of flame impinging on turbine blades, either in impulse or reaction turbines. Several engineers have suggested the use of explosion to give water velocity, which velocity actuates a water turbine in some form. Mr. Humphrey figures such a combined gas and water turbine; and although in the form suggested by him the conditions required too cumbrous a machine, yet it does seem to me that the more hopeful line is to use explosion and expansion to give water velocity, and so avoid all heat difficulties in the turbine part of the apparatus. It is true that such an arrangement still necessitates a reciprocating mass of water, but it will probably be found that great gain in weight can be obtained by the suppression of the piston, connecting rod, engine frame and crank. This line seems to me to be a much more hopeful one than any scheme involving the direct contact of flame with turbine blades.

After reading his paper, Dr. Dugald Clerk said that Mr. Holzwarth had, unfortunately, been unable to attend. He had, however, telegraphed to him that morning giving the latest test on the big gas turbine which had been designed for 1,000 h.p. The highest brake horse-power actually realised to date was 450, and the best all-over efficiency 23 per cent., but it was not stated if this was indicated or on the brake. Mr. Holzwarth referred to his latest published tests as being dated June 13th this year. Dr. Clerk showed sketches of the Armengaud gas turbine referred to in the paper, and mentioned that a part of the explosion chamber had been lined with carborundum. It was really a mixed turbine, highly superheated steam being mixed with the gas resulting from the explosions, and the mixture being projected against the turbine blades. Dr. Clerk's own opinion was that the problem was most likely to be solved by using some other working fluid such as, for instance, water, with the gas.

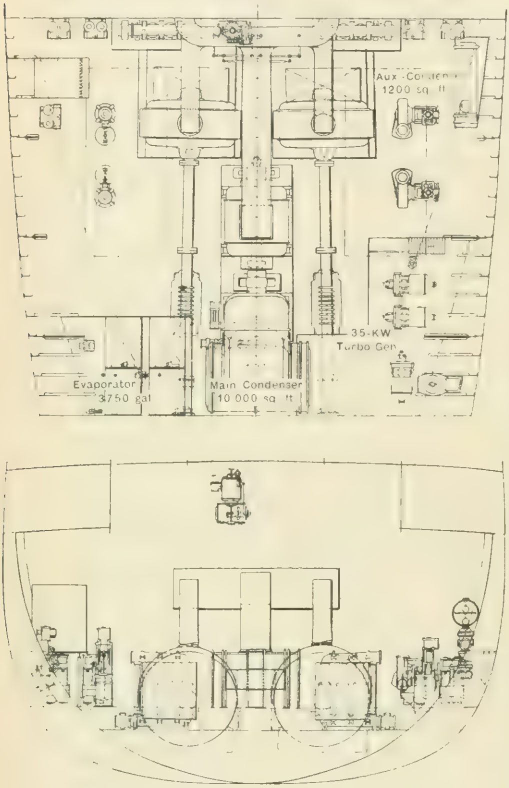


Fig. 1.—Arrangement of Machinery in U.S. Collier "Jupiter."

Sir Wm. White said that no one would like to go back to the reciprocating principle for big marine work, the control and management of turbine engines at sea was so much easier. One had only to compare the main (turbine) engine room of the *Mauritania* with the auxiliary (reciprocating) engine room to realise the vast advantage of the turbine, especially in a heavy sea. With regard to Diesel engines, he had lately travelled 100 miles in the sister ship to the *Selandia*, and could not help admiring the cleverness of the Danish engineers in overcoming mechanical difficulties. He agreed with Dr. Clerk that the vanes of the turbine must not be subjected to high temperatures.

Prof. Silvanus P. Thompson said a temperature of 1,800° was impossible for metal blades. The jet should be reduced below red-heat, say to 400° F. With regard to the carborundum lining to the combustion chamber, he would have thought it would break up under the repeated blows of the explosions and be blown amongst the vanes. He understood that Mr. Ferranti was working at the problem, but as yet he knew nothing of the results.

Sir Alfred Ewing, F.R.S., endorsed what had been said as to the enormous advantages of turbine driving on board ship. He thought a solution of the problem would be reached most speedily by finding a new material for the turbine blades.

Dr. Robert Mond referred to the splendid perseverance of Mr. Holzwarth. The difficulties to be overcome were immense. Mr. Herbert Humphrey had tried an explosive gas engine with two cylinders side by side and a small cylinder between. He had made an attempt with a separate explosion cylinder. That engine required another engine to turn it round. In his opinion, the separate explosion cylinder was no good. He had tried a rotatory type of engine, but the difficulty was to get it steam tight. When it was tightened up it was too stiff to work. He believed it was only a question of time till they had the steam turbine generally at work. The engines should be built to suit the ship instead of the ship to suit the engines.

Mr. F. Samuelson thought it would be better to turn our attention to improving the overall efficiency of the steam turbine. With steam turbines, an overall efficiency of 18 per cent. to 20 per cent. could be secured, and with Diesel engines, 30 per cent. Some considerable advance would be made if we could have pressures of 400 lb., and superheat temperature of 750° F. If the overall thermal efficiency could be brought up to 22 per cent., it would mean 20 per cent. saving in coal. In his opinion the high price of oil fuel would prevent the Diesel engine from displacing the steam turbine, which he regarded as likely to live for many years yet.

Dr. Dugald Clerk, in reply, said that in the Holzwarth combustion chamber, there was no very definite explosion. It was practically maintained at constant pressure. Parsons and Curtis, and other turbine inventors, had not been blind to the advantages of much higher pressures and temperatures; but it had been found that the cast-iron casing loses its "nature," and eventually fails at temperatures over 600° F. It was necessary to realise the temperature of the steam before it reached the turbine. If a new metal could be discovered which would stand the temperatures as suggested by Sir Alfred Ewing (Sir A. Ewing interjected that he did not say "metal," but "substance") the problem might be solved. After all, the gas engine proper would be difficult to displace. Gas engines were now being made up to 1,500 h.p. in single units. The present coal supply of the world was eleven hundred million tons a year, and the oil supply only 45 million tons, or not much more than 4 per cent. of the coal supply, and it must not be overlooked that of that quantity of oil a large proportion was used for lighting and for the making of lubricants and for other purposes, only a small proportion being used for oil engines. At present it would require far more than all the oil available to run the navies of the world alone. A vote of thanks to Dr. Dugald Clerk was moved by Dr. Barr, who remarked on the splendid progress already made, in spite of very serious difficulties.

Marine Propulsion by Electric Transmission.

By Henry A. Mavor.

(*Section G. Abstract.*)

At the Portsmouth meeting of the British Association in September, 1911, the present writer submitted a communication on "Electric Drives for Screw Propellers." Since that date some further developments have occurred. The first of the three propositions of which details were given has been superseded by an ordinary reciprocating engine equipment. The second proposition, an oil-electric tank barge for Canadian service, is now under construction (the details of the machinery equipment form part of this communication). The third proposition is still on paper only, but the United States Government has ordered an equipment closely resembling that described. This equipment has been constructed by the General Electric Co., of America. Descriptions of this plant have already been published by Mr. W. L. R. Emmet, the designer and are here summarised.

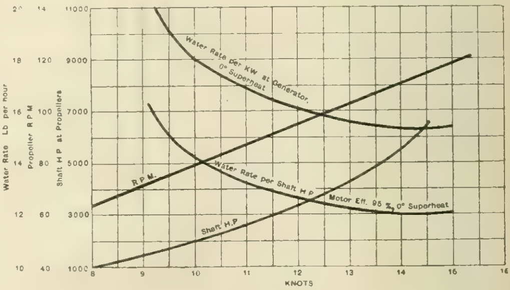
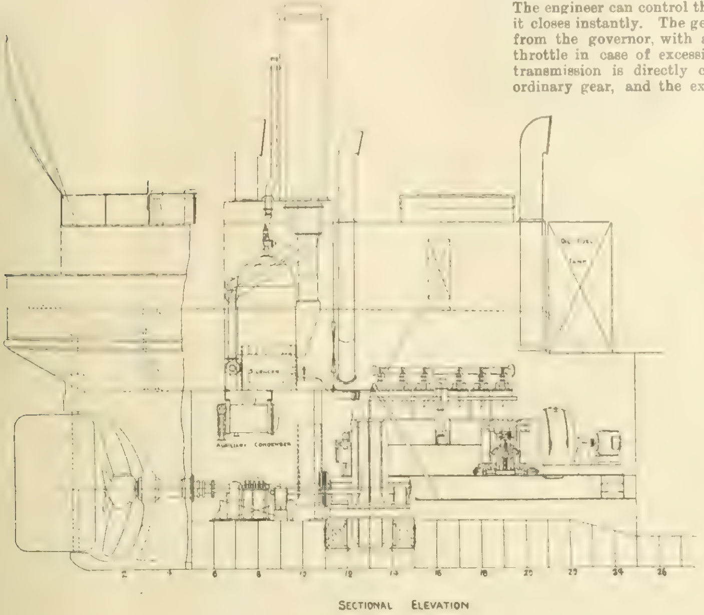


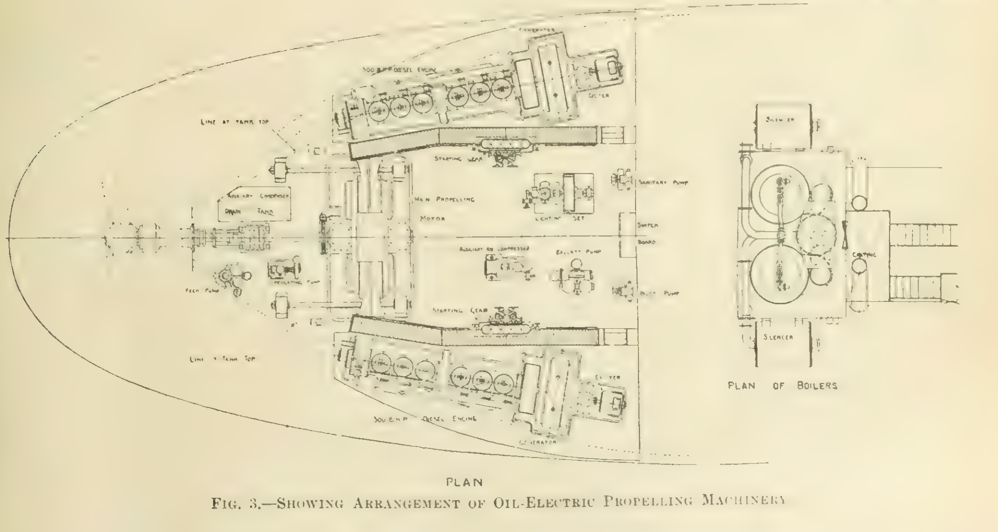
Fig. 2.—Performance Curves, U.S.A. Collier "Jupiter."

The *Jupiter* is one of three colliers being built for the United States Government. They are to be called *Cyclops*, *Neptune* and *Jupiter*. The *Cyclops* is equipped with reciprocating engines, the *Neptune* with a steam turbine connected to the propellers by gearing, and the *Jupiter* with a steam turbine connected to the propellers by electric transmission. These ships have a displacement of about 20,000 tons and carry something like 12,000 tons cargo. The speed is 14 knots. The *Cyclops* has already been tried on a 48-hour trial at an average speed of 14·6 knots, with a coal consumption, for the main engines only, of 1·485 lb. per I.H.P.-hour, the total average I.H.P. of both engines for the run being 6,705, and the average rate of propeller revolution 92 per minute.

The trials of the *Neptune* are not yet complete. It is reported that the gearing works in an entirely satisfactory manner, but that the efficiency of the turbine and propellers has not yet proved so good as expected.



SECTIONAL ELEVATION



PLAN

PLAN OF BOILERS

Fig. 3.—Showing Arrangement of Oil-Electric Propelling Machinery

The collier *Jupiter* is being built at the Mare Island Navy Yard. The electric propelling machinery is now complete and has been tested in the shops. The generating unit consists of a six-stage Curtis turbine connected to a bipolar alternator; the speed of the generator at 14 knots is about 2,000 R.P.M., and the voltage about 2,200. This generating unit delivers electricity to two motors, one coupled directly to each propeller shaft. These motors have 36 poles; therefore the ratio of synchronous speed reduction is 18·3 to 1, the propeller at 14 knots being designed to operate at 110 R.P.M. (The *Neptune* speed ratio is from 1,250 to 135, or 9·25 to 1.) The connection between the parts of the electric equipment is provided by a switchboard arrangement with oil switches for connecting the motors for either direction of rotation, and with apparatus to show and record the electric power delivered to the motors. There are also two special resistance devices for use in circuit with the revolving part of the motors during the processes of reversing. The generating unit and motors are self-lubricating and self-ventilating. Sheet-metal ducts are to be connected to the air outlets, and the heated air will be led to the suction of the stokehole blowers. The speed of the motors in this vessel will be changed by variations in the speed of the generating unit, the ratio of speed reduction remaining fixed. These changes are accomplished by means of a governor of novel construction, so arranged that it is capable of automatically holding the speed at any point from about 5 to 14 knots. The setting of this governor is controlled from the switch platform, and the operating engineer, without changing his position, can run the vessel at any speed ahead or astern, and can stop and start, and read on his instruments the speed and rate of power delivered to each propeller. The engineer can control the main throttle valve or trip it so that it closes instantly. The generating unit is also equipped, separate from the governor, with an automatic device to trip the main throttle in case of excessive speed of the turbine. The electric transmission is directly comparable in function to that of an ordinary gear, and the experimental comparison which is being here made will be of value in estimating the relative effectiveness as well as efficiency of the two new methods. The methods used on this ship constitute the simplest known form of electric power transmission, in many respects novel in the detailed arrangements, but, broadly speaking, the plant is designed and built on exactly the lines on which the General Electric Co. have carried out work on a very extensive scale and for a great variety of purposes on shore under conditions far more complicated and difficult, and with immunity from trouble. In the many years of production of alternating apparatus of this type there has hardly been a case recorded of insulation failure, and it is claimed that in this respect the record of the electrical part of the equipment is superior to the record of any other type of apparatus which has hitherto been used for ship propulsion. An illustration showing the arrangement of the plant in the ship accompanies this paper (see fig. 1, page 448).

The writer saw this plant officially tested at Schenectady in the summer of this year. For the purpose of the test, the apparatus was erected in the General Electric Co.'s power station at Schenectady. The turbine was connected to a condenser, and one motor installed in the position relative to the switchboard and controlling mechanism which it will occupy on board the ship. The other motor was arranged as a generator, and directly coupled to the first motor, so as to afford a load for it. With this generating motor as load, the conditions of service can be approximated, although they are more difficult than the driving of a propeller, because the load falls off only slightly with diminutions of speed and constant exciting current. With the apparatus so installed, the processes of starting, stopping, speed variation and reversal can be accomplished very much as they would be on board ship, and the time and difficulty involved can be correctly judged. The motor can be operated at its full load or any desired proportion of its load, and at any desired speed. Variation is accomplished by a mechanical action of the governing mechanism of the turbine equivalent to that which would be used on board ship. These arrangements afford means of experimenting with the operating conditions up to about half load, the work being applied to one motor only, and the second machine being used as a generator, the current from which is carried to an artificial resistance for absorbing the energy. This device is necessary because the absorption of 7,000 H.P. on the propeller shaft is beyond the resources of existing mechanical power-wasting devices. On the other hand, it is easy to provide means of ascertaining the working conditions as applied to the generating unit, because it is easy to absorb the power of the electric generating unit in artificial water resistances. The water rates of the generating unit have thus been tested in all loads and conditions, and the record of these tests is shown by the accompanying curves (see fig. 2. p. 448). In these tests the effects of speed, voltage, vacuum and superheat are all thoroughly investigated in a series of tests run under the conditions of load characteristic of the ship's operation. Experience gained on these tests has suggested modifications by which it is anticipated that the rate can be reduced from 12 lb. to 11¼ lb. of steam per shaft H.P.-hour.

The following operations were carried out in the shop trials: (1) Start turbine by opening trottle, the speed being shown by an indicator on the switchboard. (2) Bring turbine to moderate speed by movement of dial controller; adjust the motor resistance and start the motor by closing "ahead" switch. (3) Reverse the motor repeatedly by simply throwing over the switches with the speed and load corresponding to about 8 knots. (4) Increase the speed and adjust the load to correspond to the maximum which can, with the normal speed and voltage of the generator, be run with resistance in, this being the maximum speed which would ordinarily be used in "backing and filling." (5) Cut resistance out of circuit by slowing down the generator, opening the field, throwing a resistance lever and again closing the field switch. (6) Increase the speed to 14 knots and adjust the load to correspond. (7) Reduce the load to about half that which corresponds to the maximum load on the ship after reversal; then reverse the motor by interrupting the field, throwing the resistance lever, change from "ahead" to "reverse" position of the switch and again close the field. (8) Stop the motor and start with resistance. (9) Reverse with resistance.

These operations cover all the conditions likely to be met with in service, and all of them were repeated and varied, showing complete facility of handling the equipment. The reversal particularly was easily and smoothly accomplished. The writer took no specific records of the time required to produce the reversal. This would require special apparatus, because it was so short that it could not be conveniently observed by means of a stop-watch and visual observation.

In the writer's preliminary studies on this question he considered it necessary to deal with the question specially from the point of view of propeller efficiency. Further experience has shown that in most of the cases with which he has been called upon to deal, the propeller conditions are determined by the conditions under which the ship has to work in respect of draft, &c., so that there are not many cases where the saving in propeller efficiency is a fundamental determining factor in the choice of electric equipment.

Returning to the Canadian vessel, the arrangements shown in the drawings accompanying the writer's paper to the Association at Portsmouth last year have been somewhat modified in carrying them into actual form. It has been found more convenient to arrange the generating plant in two units, as shown in the drawings herewith (see figs. 3 and 4). The general principle of the apparatus is as described in last year's paper. This is one of the cases where the limitations imposed by the conditions of service are such that the best results are obtained by adopting the propeller size and rate of revolution which have been determined by experience in working with steam. The present arrangement results in an increase of about 250 tons in the carrying capacity as compared with the steam equipment; first, due to the absence of the boilers and consequent reduction in space and weight of machinery; secondly, due to the important difference in the heat value of the fuel and the efficiency with which it is used, so that the bunker capacity can be materially reduced.

The vessel as now designed has dimensions—

Length overall...	... 256 ft.
Length between perpendiculars	... 250 ft.
Extreme breadth	... 42 ft. 6 in.
Depth moulded...	... 19 ft.
Speed	... 9 knots.

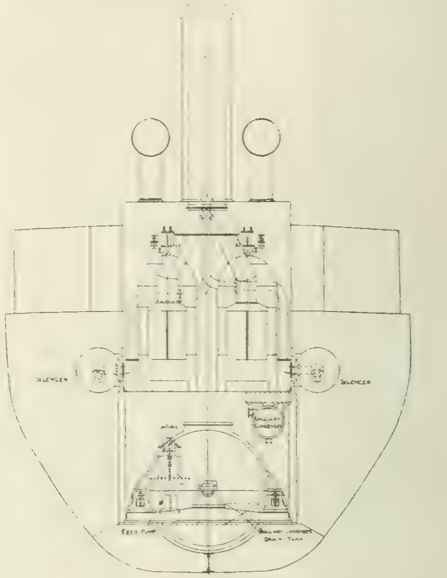
The vessel is designed for and is estimated to carry about 2,400 tons dead-weight of cargo, fuel, fresh water and stores on 14 ft. mean draft in fresh water. She is classified for service on the Canadian canals, Great Lakes, St. Lawrence river and gulf, with occasional trips to Sydney, Cape Breton.

It will be noted that two steam boilers are provided for the working of the deck equipment, steering gear and electric light, and for the supply of heat for the living quarters. It may at first sight seem out of place to return to steam equipment for these services, but the conditions of the service in question are such as to call for an auxiliary equipment at small capital cost. The season is short, and the amount of work called for from the auxiliary equipment is small, and therefore, although an electric equipment would be much more economical in working, there is not time or opportunity for the more economical plant to justify the increased capital expenditure, which is very considerable. The necessity for providing steam for heat has also a strong bearing upon the question at issue. If the steam boiler has to be used it involves but little additional expense to provide steam for the steering gear, electric light and whistle. The boilers are oil fired, and the fuel and working pressure are in perfect control. The same fuel is used in the boilers as in the internal-combustion engines.

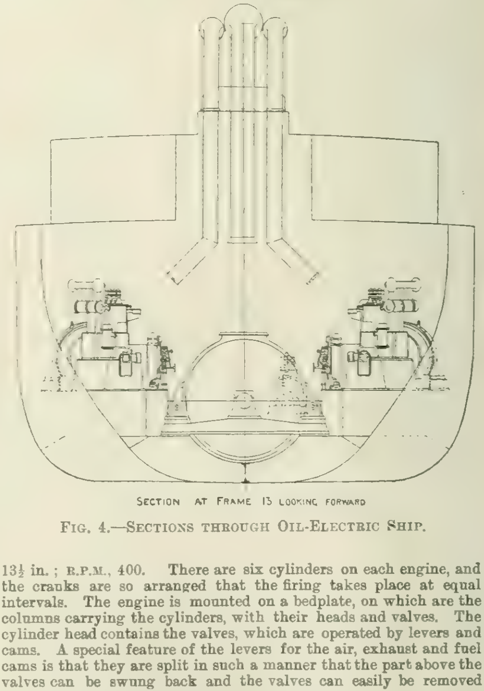
The main machinery equipment is in two units, each consisting of an engine, dynamo and a winding on the propeller motor. The engine is of the high-speed type which has been developed by Messrs. Mirrlees, Bickerton & Day. Large numbers of these engines have been made, and their capabilities thoroughly demonstrated, so that there is little that is experimental in the use of this plant for the purpose intended.

The engine works on the Diesel four-cycle principle, and has the following main dimensions:—Cylinders, 12 in. diameter; stroke, 13½ in.; R.P.M., 400. There are six cylinders on each engine, and the cranks are so arranged that the firing takes place at equal intervals. The engine is mounted on a bedplate, on which are the columns carrying the cylinders, with their heads and valves. The cylinder head contains the valves, which are operated by levers and cams. A special feature of the levers for the air, exhaust and fuel cams is that they are split in such a manner that the part above the valves can be swung back and the valves can easily be removed without disturbing any other gear.

The working parts of the engine are entirely enclosed, and a system of forced lubrication is used, supplied by a valveless pump driven by an eccentric on the crankshaft, placed at the compressor end. The second motion shaft is driven by means of a worm wheel mounted on the crankshaft directly midway between the centre



Section at Frame 13 looking Aft



Section at Frame 13 looking Forward

Fig. 4.—Sections through Oil-Electric Ship.

cylinders through a vertical shaft, which also carries the governor at its upper end. On the second motion shaft, which is placed at the front of the engine and carries the cams for operating the valves, are mounted the eccentrics which drive the fuel pumps, there being a separate pump for each cylinder. This arrangement enables the power to be very equally divided between the cylinders. The compressor is driven directly from the main crankshaft, and is mounted in the bedplate, which is extended to carry it.

The starting of the engine is effected in the usual Diesel manner by means of compressed air stored in receivers placed in a handy position near the engine. The compressed air for this purpose is supplied by the compressor on the engine, which also supplies that required for blowing the fuel oil into the cylinders. The engine is provided with a patented device for preventing the accumulation of fuel oil in the fuel valves, which are inoperative during starting. A small fly-wheel is fitted of sufficient weight to ensure steady running and to facilitate barring round when required. It is bolted to a flanged coupling forged solid with the crankshaft

Cooling water is circulated through the cylinder and compressor jacket by a pump of the rotary type, which draws direct from the sea. This pump is driven by mitre-gearing from the compressor end of the crankshaft. The exhaust pipes also are water cooled. The air for the main cylinders is drawn through the bedplate, thus effectually silencing the suction.

In the normal operation of the ship the engines run under governor control at 400 R.P.M., but the speed of revolution can be adjusted by manipulating the governor so that the engine may maintain constant revolutions per minute at a rate considerably below 400 should this be required.

The electric equipment consists of two three-phase generators, each giving about 235 K.V.A. at 500 volts alternating. The generators have six and eight poles respectively, giving frequencies of 20 and 26·6 per second. Connected to the shaft of each generator is an exciter which, in normal working, gives about 30 amperes at 100 volts, but is capable of a considerable overload. A single three-phase motor is coupled direct to the propeller shaft. This motor develops 500 shaft H.P. The rotor is of the simple squirrel-cage type without any electrical or mechanical connections other than its rigid attachment to the propeller shaft. The stationary part of the motor has two separate windings, for 30 and 40 poles respectively. The windings are mutually non-inductive, so that, except for slight possible leakage of magnetism, they exercise no influence whatever on one another, and operate independently on the magnetic circuit of the motor. When each of these two windings is connected respectively to the appropriate generator the synchronous speed due to each is 80 R.P.M., or actually about 78 R.P.M. when at full speed. By changing the connections the direction of rotation is reversed, and by connecting the 40-pole winding of the motor to the 6-pole generator the synchronous speed drops to 60 R.P.M., or actually to 58 R.P.M., giving about three-quarters of the full speed of the ship under this condition. One generator may be stopped and the other left running at full revolutions under governor control, and, therefore, at approximately its full economy, because the power required to drive the ship at three-quarter speed is about half of that required to drive it at full speed. If either of the generators is left attached to its own winding, the other generator being shut down either by intent or by accident, the ship is propelled by either engine at a little over half speed, the speed of the ship falling with the speed of rotation of the engine until an automatic adjustment of power and speed is reached. This occurs at about half speed.

The control gear is so simple as hardly to require any specific description. In the first instance it is not proposed to operate the control from the bridge, but arrangements are made by which this can easily be done if required. There are five positions on the switch corresponding to the ordinary positions on the engine-room "telegraph." They are "full speed ahead," "half speed ahead," "stop," "half speed astern," and "full speed astern." Each position of the controller is definitely fixed by means of cams and roller, so that stopping at intermediate positions is prevented. For half speed, No. 1 generator is coupled to No. 2 winding of the motor, and No. 2 generator is running light or stopped. For full speed each generator is connected to its own winding on the motor respectively. The controlling gear provides for the interruption of the excitation of the generators while the switch is being moved from one step to another. This mode of operation renders the electric circuits "dead" while the switching-over operation is being accomplished and thus injurious sparking is avoided.

It will be seen that in this case the control gear is somewhat different from that described for the *Jupiter*. In the *Jupiter* the motors are provided with wound rotors in which resistances can be inserted for control of the rotor currents. In the present case there is no such control. The rotor current is allowed to rise to the value determined by the properties of the motor and the mechanical resistance imposed upon it by the shaft. The control of this current is limited to what is obtainable by control of the exciting field of the generator.

A long series of trials was carried out on the experimental vessel *Electric Arc*, which was described by the writer in his communication last year, and on the data there obtained it has been found possible to design the equipment for this vessel so that it is equal in simplicity to the smaller experimental equipment. This vessel has been purchased by the Montreal Transportation Co. for service on the Canadian lakes. It is to be named *Tynemount*, and is being built by Messrs. Swan, Hunter & Wigham Richardson, to the order of the Electric Marine Propulsion Co. The writer desires to acknowledge the valuable co-operation of Mr. John Reid, of Glasgow and Montreal, in the design of this vessel and equipment.

Many other propositions are under consideration, but the policy of proceeding by successive steps towards the more important applications renders the rate of progress slow. The steps now made are from 50 to 500 and 5,000 H.P., so that not many more are required to demonstrate completely what are the capabilities of electric marine propulsion. It is to be hoped that this country may have the glory of making the next step. At present the credit of the largest equipment is with America.

Sir Wm. White, M.Inst.C.E., said he had no doubt that in certain cases electric transmission for ship propulsion would be advantageous. But the development would be gradual, and would be confined to certain classes of vessel. He admired the patience, moderation and skill which Mr. Mavor had for some years devoted to this subject. He himself had used a small electric launch built as a working model to ascertain the solution of some of the problems that had to be faced in the design of the *Mauretania*, and had found the electric drive very favourable to obtaining the required data. He had lately been in the States, where he learned all about the trials with the three naval ships referred to. The *Neptune* (with geared turbines) was now having her propellers altered in order to get a higher efficiency.

Prof. G. W. Howe (London) pointed out that, with the arrangement of Diesel engines described by Mr. Mavor, the efficiency would be much more reduced by the breakdown of one of the two sets of engines than if the other were to stop.

Prof. Marchant (Liverpool) remarked on the saving of weight that might be effected by the use of very high-speed engines with electric transmission.

Mr. Mavor, in reply, said he could not admit that there were any disadvantages about electrical transmission. The system cost about 10 per cent. more than direct driving systems in initial outlay, and that was the great obstacle to its general adoption for certain sizes of vessels. As compared with a reciprocating engine set, the saving in weight was important. With the steam engines or turbines themselves the best chance to save weight lay in the direction of high superheat. With very large vessels designed for high speeds he did not think electrical transmission would beat the direct-driving turbine in economy or in any other way. On the other hand, for moderate displacements and speeds the economies to be effected fully justified the adoption of electrical transmission; and, where gear was to be used, it was the most efficient gear, and it was no more expensive than mechanical gear.

Dr. Archibald Barr, M.Inst.C.E. (the President of the Section), in moving a vote of thanks to Mr. Mavor, said he was delighted to hear of the progress being made.

Exposure Tests of Light Aluminium Alloys.

By Ernest Wilson.

(Section G. Abstract.)

The physical properties of certain light aluminium alloys have formed the subject of several communications, and as stated therein each alloy has been suspended on the roof of King's College, London, in order to investigate the influence of exposure upon electrical conductivity. All the specimens are in the form of wire 0·126 in. (3·2 mm.) in diameter, and all the resistances are reduced to 15° C.

It has been pointed out that alloying commercial aluminium with copper alone has proved unsatisfactory, as a 2·6 per cent. copper alloy had completely deteriorated in 10 years and increased its electrical resistance 25 per cent.

An increase in the percentage of the iron always found in commercial aluminium, or the addition of nickel or manganese to an alloy containing about 0·09 per cent. of copper, has beneficial results both from the standpoint of tensile strength and the power to resist deterioration. For example, specimens containing, respectively, 1·16 per cent. iron, 2·25 nickel, and 1·78 manganese have only increased their electrical resistance about 9 per cent. in 11 years.

"Duralumin" is a copper-manganese alloy of aluminium with the addition of about 0·5 per cent. magnesium. A specimen about 80 ft. long has been exposed one year, and has increased its electrical resistance 5·15 per cent. It would be interesting to know if this is due to the comparatively large percentage of copper (3·5 to 5·5) which this alloy is stated to contain, or if the percentage of manganese (0·5 to 0·8) is too low. This alloy has attracted attention in that a breaking load as high as 90,000 lb. can be obtained, if desired, according to treatment; but as an electrical conductor it does not compare well, since the specific resistance is about twice as great as that of commercial aluminium.

A specimen of high-conductivity copper about 80 ft. long has been exposed for one year, and has increased its electrical resistance 1·2 per cent.

Mr. Arnold Lupton referred to Messrs. Vickers's alloy "Duralumin," and asked whether there was much salt in the atmosphere at King's College, as salt was known to be very destructive to aluminium and its alloys.

Prof. Petavel remarked that "Duralumin" had very fine properties, but was unfortunately very delicate as regarded heat, and most susceptible to sea atmosphere, and exact homogeneity of the material was difficult to obtain. It was, strength for strength, five times lighter than steel.

Prof. Ernest Wilson, in reply, said there was practically no salt in the atmosphere at King's College, but a good deal of sulphur. Aluminium had been found very risky for yacht building, as if the protective covering were scratched off, the material was very rapidly attacked by the salt water. In jointing aluminium, copper must never be used, because of the galvanic action which would be set up.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Mining Electric Lamps.

We thank you for your very kind notice of the "Stach" electric mining lamp in the issue of the 6th inst., but we venture to object mildly to one or two statements contained in your articles.

In a leaderette on page 362 you say:—"From the descriptions of the two lamps in this issue, it will easily be seen why the 'Ceag' is the better." With regard to this statement, we would inform you that we do not consider that the "Ceag" is better in respect of anything except price, and this, of course, counted in its favour in the competition.

At the end of your second article, on page 368, you state that the weight of the "Stach" lamp is about 6 lb., and the weight of the "Ceag" lamp is stated on page 366 to be a little over 4 lb. As a matter of actual fact (the writer having personally weighed one of each), the weight of the "Stach" lamp is 5 lb. $7\frac{1}{2}$ oz., and the weight of the "Ceag" lamp is 5 lb. $1\frac{1}{2}$ oz.

As to the rest of your comments, we have no remarks to make, but these two points are facts, and we think it right to draw the attention of your readers to them.

The Electrical Co., Ltd.
A. J. CRIDGE (Meter Department).

London, W.C., *September* 10*th*, 1912.

Earthing in Mines.

Mr. Walker's plea in last week's ELECTRICAL REVIEW for the abolition of earthing in mines is not likely to commend itself to many mining or electrical engineers. The title of his letter, "Insulation *v.* Earth," is itself sufficient to show the fallacy of his position. There is nothing antagonistic between insulation and earthing; they are respectively our first and second lines of defence against shock and fire, while earthing is an essential part of the "efficient means" which Rule 7 (*d*) of the Home Office new code requires "to be provided for immediately indicating any defect in the insulation of a system."

A system with inferior insulation may be perfectly safe if the earthing is sound. A failure of the insulation will operate the breakers or blow the fuses, but the earthing can, and should, be made to prevent any possibility of shock. On the other hand, it is never safe to trust to insulation alone; at the best, it is liable to be damaged by some external cause, *e.g.*, a fall of roof. There is a long list of fatal accidents resulting from tubs or other moving gear cutting through cable insulation, all of which would have been prevented if the cables had been provided with earthed armour. If there is no earthing system, any metal work in the mine may become "live," and remain so unsuspected, ready to give a fatal shock to the first man who touches it.

To say that insulation can be made a certainty, and that earthing at best is more or less of an accident, is surely a misstatement of the case. All insulators are of a delicate nature, either brittle or friable; most are affected by heat and damp. All insulation in a mine is covered, out of sight, and cannot be inspected. However well made the windings of a motor may be, the insulation is liable at some time to succumb to the combined effects of vibration, rough handling, heat, damp, dust and oil, and fail without warning. On the other hand, the materials used for earthing are metallic, and can be chosen to resist chemical or mechanical damage. All earthing conductors can, and should, be made mechanically strong, and be kept uncovered and in full view. Their general condition can then be ascertained at any time with no other apparatus but a lamp and a good pair of eyes. Regular measurements of the conductivity should also be made, which will detect any loose joints or reduced cross-section. What is there of haphazard in such a system? After making a joint in armoured cables there is no difficulty in securing continuity of the sheathing. An armour clamp at each end of the "clumsy mass," with a piece of bare copper wire connecting the two, will do all that is required.

There is no practical difficulty in having every scrap of live metal—cable conductor, switch, terminal, motor winding, connector or meter—completely enclosed with its insulation in a strong metal sheathing of some sort, nor in making and maintaining complete continuity between all the sheathings, nor in making them with a conductivity at all parts equal to that of the largest conductor they enclose (or half this for cables), so that they will carry current enough to blow the fuse and make a fault dead directly it develops. There is no real practical difficulty in connecting all these sheathings through the shaft cable armour to an efficient earth plate at the surface, and also, if thought desirable, to other earth plates in the mine itself. If the earthing is done on this plan, and the mid-voltage point of the electrical system is also connected to the earth plates mentioned above (not to a separate one), there will be no need of local earthing at the face; and, in spite of possible variations in the resistances of different strata, or even given an insulating stratum, it is hard to see how a failure of the insulation could result in anything more serious than a blown fuse.

A. L. Rawlings.

London, S.W., *September* 10*th*, 1912.

Switchboard Fires.

I have been interested in the "Communicated" article on the above subject, published in your journal of September 6th. It is evident that the writer of the article has a wide knowledge and experience of his subject, but it surprises me that he does not refer to the totally ironclad and foolproof type of switchboard evolved during the last few years, which evidently has not come before his notice. The advent of the totally-enclosed ironclad foolproof switchboard has undoubtedly solved the problem of switchboard fires.

My company claim to be the absolute pioneers of the foolproof ironclad low and medium pressure switchboard, with thanks to the initiative of Mr. Frank Broadbent, probably the first consulting engineer to actively interest himself and assist in the development of this new phase of switchboard enterprise.

For the benefit of the writer of the article, and for other of your readers who may be interested, I should like to mention that the latest developments of "Ironsafe" switchboards are able to fill, without extravagant first cost, the following comprehensive and drastic specification:—

1. The whole switchgear is self-contained, and can be built up from standard units entirely of metal, mica only being used for insulation. No combustible material of any sort is utilised; slate, marble and porcelain are entirely eliminated.

2. The bus-bars and connections are totally encased in a separate steel chamber, and are accessible only from the front. No gangways or expanded metal sides are needed. The saving of space is considerable. Every fuse can be replaced without close proximity to any live parts, the interlocking nature of each separate unit rendering it impossible to replace a fuse unless the switch controlling the circuit has first been operated. No switch is allowed to carry current through its hinges, and the blades of every switch are removed when the current is cut off, to such a distance from the live terminals that they can be renewed without the possibility of contact.

3. When required, access can only be obtained to the bus-bar chamber after current has first been removed, the cover of the chamber being interlocked with the switch controlling the main current.

4. Where it is desirable to employ oil-break apparatus, the whole of the foregoing conditions can be employed, the apparatus designed for the purpose being foolproof, and so constructed that when the current is first cut off, the fuses can be safely examined, and the oil switches examined without the slightest inconvenience.

5. "Ironsafe" switchboards required for use in collieries can now be supplied of the "explosion-proof" type, and conforming to the requirements of the new Mining Regulations for use in places where dangerous gases may be present.

In conclusion, I would like particularly to emphasise the fact that for ordinary commercial purposes for use in factories, central stations, dockyards, and the like, the first cost of this apparatus is a trifle higher than the old-fashioned open-type switchboard, but it is indisputably the cheaper method in the long run. To quote the words of one of our foremost engineers, the "appearance of the 'Ironsafe' switchboard, as compared with the ornate and decadent slate or marble effigy is to the trained eye as a modern 'Dreadnought' to its early predecessor."

Hubert Berry.
BERRY, SKINNER & Co.

London, E.C., *September 17th*, 1912.

BREAKDOWNS AND LEGAL LIABILITY.

[FROM OUR LEGAL CONTRIBUTOR.]

THE accident which caused Islington to be plunged in darkness last week calls attention once more to the question of legal responsibility for occurrences of this character. Who, if anyone, is liable? On referring to the Acts which deal with the supply of electricity for lighting purposes, it will be found that the possibility of accident has been specially provided for. The Electric Lighting Clauses Act, 1899, provides that whenever the undertakers make default in supplying energy in accordance with the terms of the Board of Trade regulations, they shall be liable to such penalties as are prescribed in the regulations in that behalf. These penalties may be recovered summarily. The effect of the clause which provides for them is to impose a duty on every electric lighting company to keep up a constant supply. But they are not to be held liable in every case of stoppage. Thus there is a proviso to the effect that the penalties to be inflicted on the undertakers must in no case exceed in the aggregate the sum of £50 in respect of any defaults not being wilful defaults on the part of the undertakers for any one day, and provided also that in no case shall any penalty be inflicted in respect of any default if the Court are of opinion that the default was caused by inevitable accident or *force majeure*, or was of so slight or unimportant a character as not materially to affect the value of the supply.

There are few cases on the subject of inevitable accident, but it may be presumed that a stoppage due to the negligence of one of the servants of the lighting authority would not come under this head. In the case of Sun Insurance Co. *v.* Dublin Corporation (December 9th, 1899), a cable which had been laid down proved to be defective, and the supply of electricity accordingly broke down. This failure was held to have been caused by inevitable accident. This case, however, does not completely establish the proposition that a burning out is an inevitable accident. It is presumed that the Court would make inquiry into the cause of the burn-out. Thus, if a company with a view to saving the expense of a new cable were to deliberately overload an old one, an accident arising from this cause could scarcely be looked upon as inevitable. Again, suppose that a large addition was made to a number of consumers so that the machinery at the generating station might occasionally be taxed to its utmost capacity, a breakdown arising from such a cause could hardly be regarded as inevitable.

Force majeure is a legal phase, which relates to the happening of something for which the company could not reasonably be held liable, *e.g.*, a flood, earthquake, or a subsidence sufficiently violent to break the cable.

As to a breakdown due to an increase in the number of consumers, there is only one case, and this throws a somewhat doubtful light on the subject. The case in question, Marylebone Vestry *v.* Metropolitan Electric Supply Co., was heard in January, 1900. The company were summoned for making default in the supply of energy to the workhouse and vestry offices on certain days. They admitted the default, but pleaded in extenuation that their inability was due to inevitable accident caused by a great demand for electricity which had exceeded all expectations. The case was adjourned for three months, and was not heard of again.

In Shaddock *v.* London Electric Supply Corporation, (May 8th, 1900), the keeper of a licensed house at Deptford summoned the London Electric Supply Corporation for failure to supply his premises. The default was admitted, but the defence was *force majeure*, it being contended that, the supply of electricity having become deficient owing to unavoidable causes, it became essential that some portion of the district of the company should be cut off, and that Deptford was selected as causing the least public inconvenience. The full penalty of 40s. was inflicted in each of the seven cases, with 20 guineas costs in the first case and 2s. costs in each of the others.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Credenda Continuity Fittings.

THE CREDENDA CONDUITS Co., of Chester Street, Aston, Birmingham, have now introduced a continuity grip nipple, by means of which ordinary plain tubing and fittings can be made electrically continuous at a small cost. This nipple is slightly tapered, milled on the outside, and split: it can be slipped over the tube end (from which the enamel must be removed) and driven into the fitting by means of a spanner (fig. 1), removing the interior enamel of the fitting itself in the process.

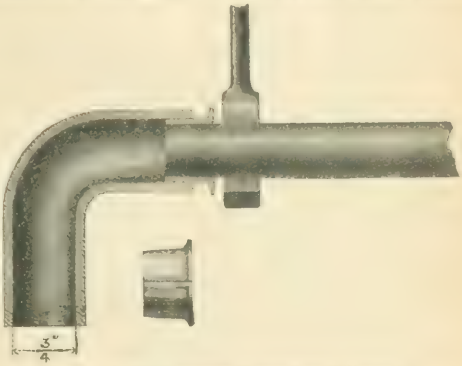


FIG. 1.—THE CREDENDA CONTINUITY NIPPLE.

These nipples have a neat appearance when erected, and are stocked in ½ in. to 1 in. sizes.

Automatic Machine for Polishing Diamond Dies.

Our illustration, fig. 2, shows a new Poppe automatic machine for re-grinding diamond dies in which the draw-holes have become irregular or non-circular. The machine, which weighs about 130 lb. and measures 26 in. × 38 in., is under the sole agency in this country of MESSRS. WERTHS & Co., 41, Aldersgate Street, E.C.

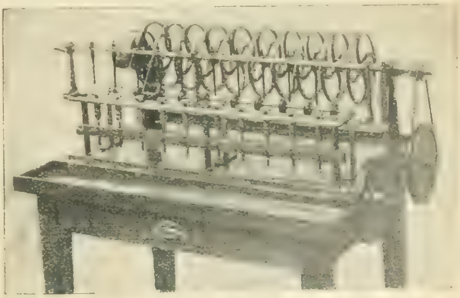


FIG. 2. POPPE AUTOMATIC GRINDER FOR DIAMOND DIES.

One of its advantages over existing machines is that by the Poppe method one man can attend to 20 or 30 spindles polishing large and small calibres simultaneously, as against two or thre

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pindles in the ordinary way ; the polishing is completed in the machine, no hand-finishing being required, and the consumption of diamond powder is small.

The fundamental feature of the Poppe method consists in the manner in which the grinding tool a pointed steel pin is manipulated about the axis of the rotating draw stone. The pin merely slips into the hole so far that its point rests freely on the walls of the drawing hole and grinds off the irregularities, moving under the action of its own weight. As the point scrapes over the interior of the hole, the polishing material is always conveyed to the place of grinding, which economises in the expensive diamond dust used.

It is further claimed that one man can easily attend to two or three Poppe machines polishing 20 to 30 stones simultaneously.

PROCEEDINGS OF INSTITUTIONS.

Power in Textile Mills.

At the Congress of the Textile Institute, on Friday last, an important discussion took place on this subject. The following introductory statement was made :—

Some time ago, at the suggestion of the Local Committee of the Institution of Electrical Engineers, a Joint Committee consisting of members of that body and of the Textile Institute was formed to investigate and report on the best methods of driving textile factories. Shortly after its formation it was for many reasons considered desirable that such a Committee, which had to report on what might be termed rival systems, should be elected independently of the great engineering institutions, and a decision was arrived at to confine the membership of the Committee to members of the Textile Institute itself. The work of this new Committee when fully formed will be to report periodically to the Council on the various methods of mill driving and on any improvements or developments that may be introduced either in this country or elsewhere, and it will be on this account a permanent Committee of the Institute.

The authors, when they consented to read these papers, did so on the understanding that they were to form merely a general introduction to the exhaustive and detailed treatment which this subject is subsequently to receive at the hands of this special Committee. It is obviously not possible in a single paper to treat in detail of the various matters connected with the drives advocated, though these are, of course, of distinct interest to the textile manufacturer, nor indeed were it possible would it be desirable to do so, since these details are afterwards to be made the subject of systematic investigation.

Prior to the writing of the papers the authors held several meetings, chiefly with a view to the adoption of a standard basis of estimating, so that any figures given in one paper might be readily comparable with corresponding figures in any other. They believe that the majority would prefer simple practical statements, and have agreed, so far as is possible, to adhere to these.

In endeavouring to arrive at a basis for expression of results, an important difficulty is at once obvious—namely, the adoption of a common power unit. The majority of manufacturers, using as they do reciprocating steam engines, think and speak in indicated horse-power. The indicator is applicable to the gas engine and the oil engine, as well as to the steam engine, and records with reasonable accuracy the work done on the piston. Unfortunately for comparative purposes, the net or useful power commonly called brake or shaft horse-power is not proportional to the indicated horse-power for any two engines. Again, with the indicator it is not practicable to ascertain the horse-power of a steam turbine. Still again, electrical power plays an important part in factory driving, and is destined to play a much larger part in the future. While electricity is purchased by the B. of T. unit, and electrical engineers think and talk in kilowatts, here, however, the difficulty is not so great, as the kilowatt and the brake or shaft horse-power bear a constant ratio to one another—viz., 1,000 to 746, and so are readily convertible. The authors have decided to adopt the brake horse-power as their standard. In good steam-engine practice the brake horse-power is to the indicated horse-power as 9 : 10, in good gas-engine practice as 8·5 : 10, and in Diesel oil-engine practice as 8 : 10. These ratios are arbitrarily adopted for the papers, but purchasers of prime movers or motors of any type can always obtain guarantees of mechanical efficiency from the makers, and, should these not correspond with the ratios given above, the conversion and adjustment is a simple one.

The following bases for running costs and charges have likewise been adopted for each paper :—

Running hours per annum : For the spinning mill or weaving shed, 2,750.

Interest and depreciation on engines, turbines, and electrical machinery, 10 per cent.

Interest and depreciation on boilers, gas plant, tank work, and the like, 10 per cent.

Interest and depreciation on buildings and foundations, 8 per cent.

Labour : Skilled engineers £120 per annum ; mechanics and electricians, £100 per annum ; labourers, firemen, &c., £65 per annum.

Fuel : Steam or bituminous producer coal, 11s. per ton ; anthracite, 32s. per ton ; coke, 13s. per ton ; Diesel oil, 50s. per ton.

It is the authors' sincere wish that the papers will do something towards assisting textile manufacturers in deciding upon the most suitable procedure in each instance when new works are to be built or old ones extended or altered.

Mr. George B. Storie (Manchester) presented the case for the steam engine ; he said that no country in the world produced finer engines than those found in the textile factories of Great Britain, but he questioned whether this high state of excellency was to be maintained. During the last three years competition of an unhealthy nature had been taking place, and firms of the highest standing, unable to withstand the financial strain, had been compelled to close their doors. He hoped the end of this ruinous practice of underselling was in sight.

The chief factors to be considered in selecting a prime mover for driving a textile mill were reliability, uniformity of speed and economy—especially reliability. He would endeavour to show that with steam engines or turbines these three requirements could be fulfilled, irrespective of the manner in which the power was conveyed to the machines in the factory.

The author then explained the supersession of the Corliss engine, formerly the standard type for mill driving, by the drop-valve type with superheated steam ; one of the latter engines, belonging to the Durham Street Weaving Co., Belfast, with steam superheated to 700° F., was using only 8·7 lb. of steam per I.H.P.-hour. A drop-valve engine at York Road Mills, Belfast, working with saturated steam, consumed 11·9 lb. steam per I.H.P.-hour.

The steam turbine, he said, was likely to play a great part in the driving of textile mills in the future. As regarded reliability, about which there was some doubt when the earlier machines were installed, there was now no question, and the turbine ranked in service with the reciprocating engine. Evidence as to the confidence placed in its behaviour could be obtained at almost any large power station in this country, where comparatively few turbines could be seen doing the work once performed by a large number of reciprocating engines now standing idle.

In respect of uniformity of speed the turbine offered very great advantages, as, owing to its absolutely uniform turning movement, combined with great storage of kinetic energy in the revolving parts, the speed regulation could be accomplished in a more efficient manner than was possible with reciprocating engines.

The cost of oil was extremely low, about 1 per cent. of the cost of the fuel used, while for a reciprocating engine it would be about 8 per cent. In many cases the absence of oil in the exhaust steam resulted in a much greater saving than the cost of oil itself. Amongst other advantages were : Small number of moving parts, few repairs, small space required, and low first cost. The turbine must be recognised as the simplest heat engine of the present time.

Tests of a 1,000-KW. turbo-generator carried out in October last year showed, with steam at 162 lb. superheated to 667° F., and with an absolute pressure of 1·43 lb. in the exhaust pipe, a consumption of 11·55 lb. of steam per KW.-hour, and 8 lb. per B.H.P.-hour—the lowest steam consumpton recorded. Moreover, the turbine was capable of utilising the exhaust steam from existing engines and greatly enhancing the output, at small cost, with increased economy ; a 750-I.H.P. engine thus combined with a 400-KW. turbo-generator gave a total output of 1,250 I.H.P., while the steam consumption was reduced from 15 or more to 11·4 lb. per I.H.P.-hour.

In works where the dyeing and finishing of textile materials was carried on and where comparatively large quantities of low-pressure steam were required for boiling and drying, turbine driving offered special advantages. In generating steam in dyeworks, a common practice was to install batteries of high and low-pressure boilers, the former supplying steam for power and the latter for manufacturing purposes. In some works high-pressure boilers only had been installed, and the steam reduced to the necessary low pressure by means of reducing valves. If in this arrangement the reducing valve was replaced by a back-pressure turbine in which the steam required for boiling and drying was allowed to expand to the desired low pressure, great economy could be effected, and, in addition to the plant being highly efficient, power for driving the works was available at a cost considerably less than it could be obtained at from any other source.

The buildings and foundations cost much less in the case of turbine plant than in that of the reciprocating engine, and the costs for labour, repairs, oil and stores were exceedingly low. It was not uncommon practice to judge the economy of an installation by the fuel or steam consumption. This, however, was not alone sufficient to allow of a true estimate being formed of its overall economy. It was imperative when a new plant was in contemplation that the steam user should take steps to ascertain how many other items had to be added to the cost of the fuel, in order to know how much the production of his power would cost, before he decided upon the prime mover that was to drive his mill.

The author appended to his paper tables showing the relative capital and running costs of various drives, and a list of the principal turbine plants installed and on order for driving British textile mills. According to the former, a 750-KW. turbo-electric plant complete cost £8,584, and the running cost (1,080 I.H.P.) was £2 4s. 4d. per I.H.P. per annum, inclusive, corresponding to 0·3d. per KW.-hour. A reciprocating engine electric plant of equal output would cost £10,684, and the running cost came to £2 10s. 8d. per I.H.P. per annum, equivalent to 0·34d. per unit. A reciprocating engine arranged for rope driving under similar conditions cost £9,434, and the running cost was £2 7s. 10½d. per I.H.P. per annum.

PRINCIPAL TURBINE PLANTS INSTALLED AND ON ORDER FOR DRIVING TEXTILE MILLS IN BRITAIN.

User.	Makers' name.	Type.	Load in K.W.	Steam press. Lbs. per sq. in.	Revolutions.	Current.	Voltage.
—	A.E.G. of Berlin	Horizontal Curtis	2,000	180	1,500	Alternating	500
—	"	"	1,000	180	3,000	"	"
—	"	"	1,000	170	3,000	"	"
—	"	"	1,000	170	3,000	"	"
Kearsley Spinning Co.	"	"	750	200	3,000	"	[illegible]
"	"	"	"	"	"	"	"
—	"	Impulse Curtis	1,000	160	"	"	3,000
—	"	"	"	"	"	"	"
—	"	"	2,000	180	1,500	—	525
Ark Mill, Ltd., Stockport	Fraser & Chalmers & Siemens	Rateau	600	160	3,000	"	500
"	"	"	"	"	"	"	"
Ashton, Harrison and Co.	Willans & Robinson & Siemens	Willans Parsons	1,000	200	1,500	"	"
Brown & Stewart, Dalmarnock	"	Exhaust Parsons	375	16 abs.	2,700	Direct	250
Hollins, Peasley	"	Willans-Parsons	375	150	3,000	Alternating	500
Clough, Keighley	"		"	160	[illegible]	"	550
Thor Cotton Spinning Co.	"	"	500	160	3,000	"	"
"	"	"	"	"	"		"
James Scott and Sons, Dundee	Howden & Co. and Siemens	Impulse [illegible]	1,000 1,250	180	"	"	[illegible]
Mellor & Sons, Ashton-u-Lyne	Greenwood and Batley	Multiple Wheel De Laval	1,000	200	1,500	"	"
Falcon Mill, Ltd.	Musgrave & Sons, and Siemens	Curtis	[illegible]	160	[illegible]	"	"
"	"	"	"	"	"	"	"
Braidwater Spinning Co.	B.T.H. Co.	Horizontal Curtis	750	[illegible]	"	"	"
Tootal, Broadhurst, Lee Co.	"	Curtis	1,500	157		"	550
Tootal, Broadhurst, Lee Co.	"	Curtis	1,500*	157	3,000	Alternating	[illegible]
English Sewing Cotton Co., Belper.	"	"	1,000	180	"	"	"
Thos Rhodes, Hollingworth.	"	"	750	170	"	"	440
English Sewing Cotton Co., Matlock.	"	"	750	180	"	"	550
Ashworth, Hadwen and Co.	Willans & Robinson & Dick, Kerr	Willans-Parsons	750	185	1,500	"	440
Sladen Wood Mill Co.	Brush Electric Eng. Co.	Brush-Parsons	500	200	3,000	"	500
—	"	"	[illegible]	160	3,000	"	"
—	"	Brush disk and drum	1,550	200	"	"	"
—	"		1,200	180	"	"	"
Sladen Wood Mill Co.			750	200	"	"	"
Milnrow Spinning Co., Ltd.	"	"	"	[illegible]	"	"	400
—		Exhaust Brush-Parsons	400	16 abs.	"	"	500
The Leather Cloth Co.	Willans & Robinson and General Electric Co.	Reducing disk and drum	500	16 abs.	3,000	"	480
English Sewing Cotton Co., Skipton	Brit. West. Co.	Westinghouse Parsons	1,000	170	"	"	550
Oldham Twist Spinning Co., Oldham	"	Westinghouse Rateau	[illegible]	160	"	"	440
Lister & Co., Bradford	"	Mixed pressure Rateau	700	120 and 16 abs.	2,500	Direct	200
William Smeeton, Ltd., Halifax	"	Westinghouse-Rateau	400	[illegible]	3,600	Alternating	440
R. H. Barker and Co., Wakefield	"	"	"	160	"	"	"
J. Haigh & Sons, Huddersfield	"	"	300	95	3,000	"	"

The steam temperature in most cases was 500-575° F., and the frequency 50 cycles per second, except in two cases.

MR. T. R. WOLLASTON, of Manchester, dealt with the subject of gas power. Considering *seriatim* the objections brought against gas engines, he claimed that they were now as easy to start as any steam engine, if not easier; there was no difficulty in maintaining a steady quality of gas if suction plant was not used; the overall cost of the plant was no greater than that of steam plant; the liability of gas plant to breakdown was steadily decreasing; the regularity of turning was amply sufficient; the space occupied might be greater, in the case of large powers, but the parts of the plant could be coupled together in many ways, so as to utilise waste space, and the distance between gas plant and engine was of no consequence; the reliability of gas plant, as witnessed by Mr. Hodgkinson, of the Hollins Mill, Marple, was unsurpassed by the great majority of steam installations, his engine having run on Mond gas for 21 months with only one running stop, lasting a few minutes. The author, while acknowledging that the suction gas plant had been largely instrumental in popularising gas power, expressed the view that it was responsible for at least one-half of the unsatisfactory installations of gas power plant in textile mills, owing to the lack of proper provision for correct regulation of the quality of the gas. He regarded electricity not as a competitor with gas, but as a means of transmission, and believed it to have a great future in the textile industries: everything he said in favour of gas power for mechanical driving in textile mills applied with added import to the generation of electrical energy at the mill or at the central station.

The fuel cost per B.H.P.-hour for the gas engine, as compared with that for a high-class steam engine, was in the ratio of about 5 : 9. Taking the gas engine fuel at 1¼ lb. of coal, and that of the Diesel engine at ½ lb. of oil per B.H.P.-hour, costing respectively 11s. and 50s. per ton, the fuel costs were as 14 : 25. Steam was always required in textile mills; about 2 lb. of steam per hour per H.P. driven could be obtained from boilers coupled to the exhaust of the gas engines, or probably about half the total required, and much of the balance could be got by burning the tar under the boiler. One ton of tar was produced by 25 tons of coal, and was equivalent to 1 ton of coal. The stand-by losses of gas engines were about one quarter those of the average boiler house, and careless stoking did not affect gas plant as it did steam plant.

One of the most important advantages of gas power for textile mills was the facility with which gas could be led any distance for heating purposes; of the total steam generated in bleaching, dyeing and print works, only one-third was used for power, the rest being employed for heating and boiling, with the result that enormous losses occurred through condensation in the pipes, which would be entirely obviated if gas were used.

Lastly, the by-products recovered from the gas plant were of great value, and the price of sulphate of ammonia, at present about £14 per ton, tended to rise. The probable adoption of gas recovery plant at central stations would decrease the cost of energy, and, when a firm had several mills close together, the system could be employed in a private plant. About 90 lb. of sulphate of ammonia could be obtained from a ton of coal, worth about 11s.—as much as the coal itself.

In appendices the author showed that the results of the Mond gas plant at Hollins Mill were as follows, after adjustment to the basis laid down in the introductory statement:—

Running cost ...	£1,080
Interest and depreciation on £7,250	725
Interest on buildings, £160	128
	£1,933
Sale of tar and sulphate of ammonia... ...	470
Net cost	£1,463

At 670 B.H.P. the cost per B.H.P.-hour was 0·17d. and per KW.-hour 0·298d. The capital cost of a gas power installation of 250 B.H.P. would be £3,050. The net inclusive running cost would be £708, equivalent to 0·248d. per B.H.P.-hour.

For a large textile works with several departments, requiring 3,500 B.H.P., Mond gas recovery plant, gas engines and dynamos, &c., cost, complete, £49,000; the running costs would be £11,381, less sale of by-products £3,937, net cost £7,444. The cost per B.H.P.-hour would be 0·149d., and per unit 0·222d.

MR. FRANK CARTER, of Stockport, read a paper on the suitability of the Diesel engine for textile mill driving. Taking a weaving shed requiring 320 B.H.P., with oil at 50s. per ton, the capital cost (with rope drive) would be £3,565. The running cost, inclusive of capital charges, would be £913 per annum, equal to 0·33d. per B.H.P.-hour. For a spinning mill using 1,000 H.P., with rope drive, the capital cost would be £10,290; the running costs would be £2,699 per annum, equal to 0·26d. per B.H.P.-hour. The author, however, referred to the interest taken in electrical driving, and gave the figures for the same mills on this system. The plant for the weaving shed would cost £3,804, and the running cost would be £904, equivalent to 0·49d. per unit. The cost of the spinning mill installation would be £11,570, and the running cost would be £2,745 per annum, equivalent to 0·39d. per unit. After referring to the necessity of including in comparative statements the expenditure on all auxiliaries, cleaning and repairs, &c., the author pointed out that the Diesel engine was a self-contained plant, and that the fuel could be stored in a very small space and handled with ease, while there was no ash or clinker to be got rid of—often a difficult matter. Neither was there trouble from smoke or fumes. As regarded steady turning and reliability, the Diesel engine was equal to the most modern steam engine, and the supply of oil was abundant; recent fluctuations in price were due to the lack of sufficient oil-carrying vessels, but 66 of these were being built, and as soon as they were in service the price would become normal. The engine was economical, the fuel safe and cheap, preignition impossible, vaporisers and ignition devices were absent, the engine could be started easily, and was self-contained, compact and silent. A large number of Diesel engines had been installed in textile factories, especially in India, and the author gave a list of a score of installations with which he was personally acquainted. Figures obtained in electricity supply stations were also quoted showing that the total works cost with Diesel engines was about half that of steam and gas plant, for powers up to 1,000 H.P.

The subject of electrical power in textile mills was handled by MR. J. F. CROWLEY (Manchester), and we give his paper in abstract:—

A little over eight years ago "the actual horse-power of motors installed for driving textile factories in Great Britain was limited to a few hundreds, practically all in one mill." Four years later it had been increased to 28,000 H.P., and to-day the textile load of three power supply companies would practically total this figure, which is less than the advertised sales of textile motors of several of the larger electrical manufacturing companies.

Prior to January, 1911, considerably less than 300 motors in all had been supplied for the individual driving of looms in the United Kingdom. To-day over 7,000 of these have been supplied, or are on order, for loom driving, about one-half of these being supplied by a single company. The case for electrical driving must be a strong one to justify such general adoption. This case does not rest mainly on a saving in transmission losses. It rests broadly on—

(*a*) Steadiness of drive, resulting in higher maintained speeds, increased production, and improved quality of material.

(*b*) Specific advantages on the adoption of individual drive resulting in still greater production and improvement in quality.

The other advantages, such as flexibility, lighter and cheaper buildings, better utilisation of building space, concentration of generating plant, improved illumination, reduced risk of accident, &c., have been frequently referred to, and need not be touched on here.

It is very difficult to convince the average manufacturer that with the ordinary mechanical transmission, whether rope, gearing, line shaft or belting, or a combination of these, serious fluctuations in speed occur, and that when they occur they affect production and quality to any marked extent.

Delicate instruments have, however, been constructed for recording speed variations, and interesting and important work in this connection has been carried out in Yorkshire mills by Mr. W. B. Woodhouse.

The mule is the worst offender in the textile mill so far as speed fluctuations are concerned, as the following tachograph readings, taken by Mr. Woodhouse, will show :—

Mule counter shaft.	*Max. speed range.*
Mechanical drive	25 % of mean speed.
Individual electrical motor drive D.C.	17 % „ „
Individual electrical motor drive A.C.	6 % „ „

The power curve of a mule is a peculiar one, the load showing peaks which may be many times the average, falling away during a portion of the cycle to a value much below the average. Ordinarily the mule load in a mechanically-operated mill affects the running of every machine in any way connected with the shafting from which the mules are operated, and this is actually a principle in the laying out of spinning mills. The momentum of the engine and of all shafting, &c., connecting the mules to the engine is depended upon to steady the drive of the mules themselves, and since, of course, no energy can be given to or taken from a revolving mass without altering its speed, we have here a fruitful source of trouble. On electrical drive, mules may either be group or individually driven. Important principles to be borne in mind are that, as far as possible, constant speed should be maintained during the "draw" or the actual spinning portion of the mule cycle, and that a given variation in speed where mules are grouped for mechanical drive or electrical drive is liable to be far more serious than a variation of similar range with individually driven mules. With individual drive, the speed fluctuations would naturally result from the variation in load of the mule itself, and would therefore follow the cycle of operations of the mule.

It is generally agreed that the motors should have a good efficiency over a particularly wide range of load and a high overload capacity. The best results have been obtained on worsted mules, since the problem is here somewhat simpler and the motors required of smaller size.

In general, it may be said that group electrical driving is better than mechanical driving, particularly from the point of view of the mill as a whole, and that individually driven mules give an increased production of about 5 per cent. over group or mechanically driven machines, even when the very simple expedient of merely belting an ordinary three-phase motor of suitable size and of good regulation direct to the mule countershaft is adopted. A considerable saving in power is one of the special features of the individual drive.

For the driving of ring-spinning frames electricity has peculiar advantages, and motors of the single-phase commutator and the three-phase commutator type have been developed for this purpose. Owing to well-known peculiarities, with a ring frame driven at constant speed the yarn is subjected to varying tension, and as the speed at which the frame can be run is determined by the maximum tension the yarn will stand, the speed must be such as to prevent this tension being exceeded at any moment, and consequently with a constant-speed drive considerable loss in production occurs. The only satisfactory solution, so far, has been the electrical one, which gives not only a low speed during the forming of the base of the cop, but also an automatic variation of the speed during the cyclic movement of the ring rail.

The question of ring spinning *v.* mule spinning in the worsted trade is one of considerable importance, and there is little doubt that the case for the ring frame is very largely aided by the advantages which individual electrical driving with automatic speed control can give. Tests were carried out in a German worsted mill on a spinning frame of 400 spindles, rings 1·9 in. diameter, spindle space 2¾ in. Tests carried out on 16 frames driven from an electrically-operated line shaft, with therefore a much steadier turning movement than would be provided by the ordinary mechanical drive, showed that the average number of broken ends per frame during a period of 10 minutes was 5·5, and that the average time taken to complete a cop was 2 hours 47 minutes. On conversion to individual drive and the adjustment of the automatic regulator, so that the average number of broken ends did not exceed the figure given above, it was found that the average time taken to complete a cop was 2 hours 17 minutes, and that in no case did the time exceed 2 hours 22 minutes. This clearly showed that by the use of individual drive with an automatic regulator a saving in time of 30 minutes per doffing, or 18 per cent., was obtained. It may be added that with group electrical drive the spindle speed was 5,500 R.P.M., while with individual drive after the first eight minutes of the run the maximum average speed was 6,900 R.P.M. Similar tests in a Lancashire cotton mill resulted in an increased production of about 15 per cent. This result also was obtained against group electrical driving, and both results show that in the case of ring spinning frames greater increases in production may be obtained by the adoption of individual drive with automatic regulation than in the case of loom driving. When this fact is fully realised, a similar development to that which obtains in the application of individual driving to weaving sheds may confidently be expected in spinning mills.

The following tests were carried out on a ring doubling frame now on the mains of the Lancashire Electric Power Co., before and after conversion to individual driving :—

	Max. speed range.
Mechanical drive	6 % of mean speed.
Individual electrical motor drive ...	0·5 % „ „

This shows clearly the advantages of the individual drive, and it may be said generally that constant-speed motors are usually employed for the electrical driving of these machines.

The speeds at which mechanically-driven looms can be run can be increased by group electrical driving, and to a still greater extent by individual electrical driving; the load factor can be improved to a certain extent by group driving, owing to the steadier speeds causing fewer breakages, and to a remarkable extent by individual driving, owing to the prompter starts obtainable.

The following test results, which are self-explanatory, are instructive, and illustrate the first part of the case for electrical driving, so far as weaving sheds are concerned :—

	Max. speed range.
1. Engine	5·5% of mean speed.
Loom line shaft (near belt drive) ...	9 % „ „
„ „ (middle)	12 % „ „
„ „ (end)	16·5% „ „
2. Loom line shaft (group electrical drive)	6 % „ „
3. Loom (individual electrical drive) ...	2 % „ „

Perhaps the principal lesson to be gathered from these figures is the steady manner in which the speed fluctuations grow worse as the distance from the engine increases, and this is confirmed by other tests. In a Yorkshire mill it was shown that for a 3 per cent. variation in engine speed, 20 per cent. variation occurred on the line shafting. In a high-class Lancashire mill, for a variation in speed of 5 per cent. on the engine shaft, the line shaft speed varied 16 per cent.

The question of load factor is also of great importance. The following results relate to a test carried out in a spinning mill on jute looms, to convince the manufacturer of the results it was possible to obtain before individual driving had attained the position it holds to-day. The looms were changed from the ordinary mechanical drive to individual motor-gear drive, and it was found that the average speeds could be raised 9 per cent. without any increase in breakages, the material being improved in quality, and the production increased by from 15 to 20 per cent. The excess of the increase in production over the increase in speed was due to the improved load factor. The test was carried out by an independent authority on behalf of the manufacturer.

To obtain the increased production claimed for individual electrical driving the power taken by the loom has naturally to be increased, and this increase usually takes place as the square of the speed. The proportion the power costs in any textile factory bear to the total running costs is, however, very small, being stated in the case of woollen mills to be from 2 to 5 per cent. of the total costs, and consequently the power increase referred to will have little effect on the actual cost of the product. For Lancashire mills I was able to show, assuming figures based on the Board of Trade returns to hold true for an individual case, that a 10 per cent. increase in production actually resulted in a 30 per cent. increase in profits after full allowance had been made for the increase in power costs referred to.

The question of temperature rise as affected by the use of electrical motors has been brought into prominence in Lancashire recently.

The total loss in a ½-H.P. loom motor on full load is only 15 per cent., and with the slight electrical losses in the cabling, and the loss in the belt or gear, the total is lower than in any mechanically-driven shed. It must be borne in mind that with electrical transmission, as distinct from mechanical transmission, some 20 to 30 per cent. of the total transmission loss takes place in the engine-room itself.

The transmission losses in the case of the average mechanical drive in a weaving shed are undoubtedly greater than in a high-class modern individual equipment, and therefore the temperature rise due to these losses must obviously be greater also.

Motors for the individual driving of mules are almost invariably three-phase, the unsuitability of the direct-current motor being well shown by the speed fluctuation of a mule driven by such a motor. Motors for driving ring-spinning and doubling machines may be either three-phase, single-phase or direct-current, but the two former are the more suitable; of the variable-speed type for ring spinning, and the constant-speed type for ring doubling. For looms, three-phase or occasionally two-phase motors are used. The manufacturer will then install three-phase generators of standard voltage and standard frequency. For the driving of printing machinery direct-current motors, owing to their adaptability to large variations in speed, are specially suitable. Three-phase and single-phase commutator motors and motors of the pole-changing type are also used for this purpose. A voltage of 500 volts and a frequency of 50 periods are now common in the textile districts, but several large power supply companies standardise on 400 volts, as this leaves single-phase current at 230 volts available for lighting. For a weaving shed a voltage of 200 is suitable, since the building of small motors for a higher voltage means a somewhat lowered efficiency and increased manufacturing cost. The following figures are given as a rough guide to capital expenditure

		Turbo-Alternators (3,000 r.p.m., 50 Cycles).			Reciprocating Sets.			
Kw.	Volts.	Alternator efficiency. Per cent.	Alternator without bearings.	Turbine and bed plate, &c.	Speed, R.P.M.	Alternator efficiency. Per cent.	Alternator and exciter.	Condensing plant and engine.
250	220 3,000	85	£700	£904	375	92	£440	1,820
500	440 6,600	90	850	1,322	300	92	800	2,200
1,000	„	92·5	1,050	2,200	220	93	1,500	5,000
1,500	„	93	1,350	2,800	230	94	1,650	7,850
2,000	„	93·5	1,650	3,200	–	—		

Turbo-alternators are finding increasing favour for textile driving, and their use is every day extending.

When supply is taken from a public supply company, transformers replace the generators, and are almost invariably supplied by the power companies and under the direction of their engineers.

Breakdowns very seldom occur on transformers, and the question of stand-by is usually met by the power supply company concerned standardising their transformers and keeping spares ready to hand for insertion if required.

The subject of switchgear is rather a technical one, and it is usually best to leave the main details in the hands of a good consulting engineer or a reliable manufacturing company.

In order that power consumption figures may readily be taken, special provision should be made for the insertion of instruments in the various circuits controlled without interfering with the running of particular machines. In a large individual drive equipment for a weaving shed recently designed, this has been reduced to such refinement that, without stopping a single loom, power readings on each motor can at any time be taken, and similar figures obtained on each main feeder line supplying a row of looms.

Very special consideration is required in the designing of the motors for textile work, and considerable experience in this class of work has been necessary for the evolution of the best prevailing types. The following summarised requirements may be given :-

1. Satisfactory protection from dust and "fly."
2. Liberal rating, as the load is usually continuous, the working conditions stringent, and factory temperatures high.
3. High efficiency for large load variations.
4. High starting torque, that for loom motors usually being two and a half times and for spinning machines twice normal torque.
5. Small variation in speed from no load to full load.
6. Good regulation or small variation in speed for a given variation in voltage.
7. Dimensions of such a nature as to meet the prevailing factory conditions.
8. Bearings designed to be absolutely "fly" proof.

It has been a rather remarkable feature of electrical work during recent years that practically every new development has originated and has been carried out in the electrical factory, and in consequence of this it is generally found that the larger electrical manufacturer possesses the best available knowledge of the type of material to put forward for each individual case, and that it is to a large extent advisable, where a reliable consulting engineer has not been called in, and when matters of cost have been finally settled, to leave all plant details in the hands of a manufacturing concern with experience in the class of work required, demanding from them guarantees as to performance and tests to show that the guarantees given are adhered to.

In deciding whether to take power from an outside supply company a number of factors have to be taken into consideration, and it is always desirable when in the area of such a company to obtain electrical rates from them for comparison with the estimated cost of private generation before deciding on the course to adopt. In the most competitive areas, where the demand is high and better opportunities exist for the power company, 0·5d. per unit is regarded to-day as a good competitive figure for a fair load on the usual cotton mill load factor of 25 per cent. to 29 per cent. For particularly good loads from the station engineer's standpoint, figures of 0·45d. and 0·4d. per unit are quoted, and in one area some manufacturers actually obtain current at 0·3d. per unit. But this figure must be regarded as rather special, and the remarks made about 0·5d. per unit taken exactly as given. The price at which it pays to take current from outside depends altogether on the individual case, and current at 0·6d. and 0·75d. and even higher may very well pay the manufacturer in particular cases.

The system of supply on restricted demand is in force with some supply companies, and manufacturers with existing plant may find it an advantage to drive, say, preparing rooms with current at a low rate on this basis, the understanding being that the supply is cut off at a definite hour during a certain period of the year.

A strong point in favour of power supply companies is that as their load increases their running costs must be reduced, a fact that is borne out by the steady reduction they have been able to effect in their rates, and that in time advantages from the point of view of economical working should enable them to produce current at rates considerably below those possible with the best private plants on mill load.

If the course suggested of comparing the power companies' rate with the cost of private generation is carried out, it will be practical before making the comparison to add to the latter costs a fair percentage to cover advantages such as reduced capital expenditure, freedom from worry about engineering details, ease of running any part of the mill by itself, &c.

The discussion on the papers, which took place after the whole series had been presented, gave evidence of the enormous amount of interest taken in the subject by those engaged in the various branches of the textile industries. In the extent of its appeal, the series of papers stands out as the most important which has yet been submitted to the members of the Institute, and as time goes on the interest aroused in the subject will, without doubt, be considerably increased by the issue of the reports of the Special Committee of the Institute, which has the whole matter of the driving of textile mills under consideration.

A somewhat curious fact was that so far as the electric drive was concerned no one paid any attention to the material saving in mill construction and the advantage of increased light, and so forth. These aspects of the case have been pressed forward on other occasions before manufacturers and mill managers, and it is quite possible, of course, that there is general recognition of the advantages of the electric drive in regard to these phases of the subject. The various other methods of driving advocated—steam, gas and oil—were strongly criticised upon many of their suggested advantages, and when the discussion was of necessity brought to a close owing to inability to devote further time to the matter, it was probably true, as one delegate put it, that those present knew just about as much at the end as they did before the papers were read. It was unfortunate in every way that such an intricate, complex and debatable question should be brought forward at the closing session of the Congress.

The criticisms of the various methods had by no means been exhausted when the closure was applied, and, the authors not having time to reply, it was decided that further questions might be forwarded to the Institute within the next 14 days, and replies would then be made to the whole of the questions raised. The discussion will certainly stimulate the permanent Mill Driving Committee of the Textile Institute to go deeply into the matter in order that fuller information may be placed at the disposal of the members of the Institute.

Lord Rotherham, the president of the Institute, said that the papers were of a very important character, and he thought everyone would recognise the importance of hearing all sides of the question upon such an intricate matter, in order to be in a position to arrive at an accurate opinion as to which was the best, the most efficient and the most economical drive for textile factories nowadays. It was obviously most important that manufacturers should keep themselves posted as to new methods and new inventions, and in that way keep themselves abreast of the most intelligent and enterprising of their competitors whether at home or abroad.

Mr. A. N. Wrye (Guernsey) said that from the sizes of the installations mentioned in the various papers, it was evident that they were designed more for the requirements of large mills in Lancashire and Yorkshire than for the much smaller requirements of mills in the Border district, where costs were relatively higher per unit. In nearly all cases it was admitted that electrical transmission had great advantages, and it was reasonable to suppose that, whatever the prime mover might be, electrical transmission would be even more largely used than it was at the present day. For various reasons it was probably economical and advisable, in some cases, to use isolated plant, but the price of electricity was falling, and as time went on, the position of the private plant would become more and more difficult. In the Hawick district it was frequently necessary to run the spinning plant all night, and with a large prime mover running at something under half load, the very good efficiency usually shown by the private plant would fall away completely.

Mr. Ram Singh said that, as a cotton manufacturer, he thought the steam drive was cheaper than the electric drive. Giving a shed 1,000 looms, the capital expenditure on individual electric driving would be £10 per loom. For looms driven by the best transmission, as he called it, it would be £3 to £3 10s., but he would take it at £4. Mr. Crowley had said there was a 10 per cent. increased production (in instances quoted) by the individual electric drive. For that 10 per cent. increase of production they had to pay £6,000 more—the difference between the cost of the systems. That was to say that the production would be equal to that of 1,100 looms. Taking the cost of the looms at £40 for driving by transmission, that figure including building, engine, boilers, chimney and everything, they could get 150 more looms with the £6,000 already mentioned, or an increased production of 15 per cent. It might be said that with the individual electric drive they reduced the pillars inside the sheds. In that case they would require stronger beams, and he had no hesitation in declaring that there would be no difference in the cost of mill construction.

Mr. Leon Gaster (London) strongly urged manufacturers to consult experts whenever they were in doubt on such difficult problems as those connected with the driving of textile mills.

Mr. H. Joseph (Hawick) said that the very low prices given by the speakers for fuel consumption and for cost of electricity were lower than could be got in his locality. There had been many remarks about speed regulation with electric driving, and whilst he would not go into the relative merits of the three-phase or continuous-current motor, he might say that their system in Hawick so far had been the group drive. Some excellent curves had been taken on steam drives and gas drives—there were none of the latter left in the town now—and the electric drive which succeeded both of them, and the contrast between their speed regulation was exceedingly remarkable. Certainly it had been found that one of the great advantages of electric driving had been steadiness of speed.

Mr. Oscar S. Hall (Bury), a large loom maker, said he did not think anybody was consulted more than he was as to the relative merits of systems of driving textile machinery. When he was asked if the best method of driving looms and textile machinery generally was by electric motors, his invariable reply was that it depended upon the circumstances of the case. The subject was far greater than many people thought it was. Electric motors were much more efficient the more complicated the weaving became. What he meant by that was that complicated Jacquard looms or other heavy and intricate machines were often kept standing for a while, and in cases like that there was no shafting running round, there was no wear and tear, and there were no losses, if they were run by the system referred to. Many other classes of looms and various types of textile machines were not kept continuously running because the manufacturers were not able to keep them fully occupied, and in all such cases driving by electricity had many advantages over other methods of driving.

BUSINESS NOTES.

Electric Lamp Patents Litigation.—From an announcement appearing in our advertisement pages to-day, it will be observed that the appeal of the "Z" Electric Lamp Manufacturing Co., Ltd., from the judgment of Mr. Justice Warrington upholding the validity of the master patent No. 23,899/04 of the Osram Lamps Works, Ltd., having been withdrawn, it is intended to enforce rights against all infringers. The "Z" Co. and the Foster Engineering Co., Ltd., have both been granted licences to manufacture and sell lamps under the above patent.

Lea Recorders.—Amongst the orders for their apparatus recently received by the "Lea" Recorder Co. are the following for electricity works:—Sunderland, Walthamstow (repeat order), Nuneaton, Kirkcaldy, Aberdeen (repeat order), and Croydon, as well as the Hobart Gas Co., Tasmania, the Ceara Tramways Co., and Ensenada Electricity Works, Cape Town Electricity Works, and Edmonton Electricity Works, Canada.

Miners' Safety Lamps.—We are informed that in the recent competition the winning lamp, and three of those to which £50 awards were given, were all fitted with Osram lamps. Many of these winning miners' lamps to which Osrams were fitted had been in actual service. The particular type of Osram lamp used in them is a 1·5-c.p., 2-volt lamp, and costs only ½d. per shift of approximately 12 hours.

Bankruptcy Proceedings.—Henry Hallifield Oxley (otherwise known as Oliver Huxley), 22, Uxbridge Road, Hanwell, Middlesex, consulting engineer.—The adjourned meeting of creditors in this case was held on Monday at the offices of the Official Receiver, 14, Bedford Row, W.C. The debtor's statement of affairs showed unsecured liabilities £1,424, and assets £117, or a deficiency of £1,307. It will be remembered that the debtor attributed his failure to want of employment, and losses owing to the attempted flotation of a company. His deficiency account showed that he had lost £1,400 by bad debts, and he had also incurred liabilities of £545 on behalf of a company. The previous meeting had been adjourned at the debtor's urgent request to enable him to complete negotiations with his friends which would enable him to bring in a scheme of arrangement for a composition. At the meeting on Monday the debtor did not attend. The Official Receiver reported that no proposal for a composition or scheme had been lodged, and that there was no explanation why this had not been done in the face of the statement made at the previous meeting. There was not a quorum of creditors present, so that no resolutions could be passed, and the matter remained in the hands of the Official Receiver, the chairman intimating that he would apply to the Court for an order of adjudication in bankruptcy.

Albert Edward Martin (Midland Electrical Supply Co.), electrical engineer, 39, Great Charles Street, Birmingham.—Receiving order made on September 9th on a creditor's petition. First meeting, September 25th; public examination, October 9th; both at Birmingham.

Westinghouse London Showroom.—In the accompanying picture we show a view of the new supplies showroom of the British Westinghouse Electric and Manufacturing Co., Ltd., at 179, Wardour Street, London, W.C. This, together with offices and stores on the same premises, has been established for the convenience of contractors and the trade. Clients can be taken there for the selection of their requirements, and moderate-sized trade orders can be executed from stock, larger ones being handled from the headquarters at Trafford Park, Manchester. We paid a visit to the premises early in the week and found a varied supply of Westinghouse electric supplies on view, including the following:—Westinghouse Auriga lamps from 8 to 1,000 c.p., Cooper-Hewitt mercury vapour lamps, single carbon flame arc lamps such as the company is to supply under the 12 months' contract for the Hammersmith Borough Council, and the Magazine flame lamp for 105 of which an order has been received from the S.E. and C. Railway, for their Ashford Works; a full line of tumbler switches, ironclad switchgear, distribution boards, wood blocks; also radiators (luminous, convector and Bastian types), and electric heating and cooking apparatus. A special feature is made of electric fans. These are supplied in many varieties. A large powerful ceiling fan is in position in the showroom, and this is a line which is chiefly supplied for export to India and other like countries. Fitted into the window there are box-blade fans suitable for picture theatre and general purposes. A Holophane demonstration cabinet will serve a very useful end, and a number of excellent examples of fittings in this style are on view. One cannot exhaust in these notes all the lines of table standards and other fittings, silk shades and other lighting accessories that are displayed in a comparatively small space, but we have said sufficient to indicate the nature of the exhibit. It is intended very shortly to hold a stock of the Auriga drawn wire lamp. It is anticipated that a considerable over-the-counter trade will be done in many of the items enumerated. The main London Westinghouse establishment will, of course, remain at Norfolk Street, the Wardour Street premises being intended as a London office and store for the sale of Westinghouse electric supplies, many of which are already being manufactured at Trafford Park.

Westinghouse Supplies Showroom.

Book Notices.—"How to Take Out Patents." By A. E. Edwards. London: Arthur Edwards & Co., Ltd. Price 2s. net.

"Electricity." By Gisbert Kapp (Home University Library of Modern Knowledge). London: Williams & Norgate. Price 1s. net.

"Ignition of Gas by Miniature Electric Lamps with Tungsten Filaments." By H. H. Clark. "Magazines and Thaw Houses for Explosives." By C. Hall and S. P. Howell. "The Effect of Stemming on the Efficiency of Explosives." By W. O. Snelling and C. Hall. "The Transmission of Heat into Steam Boilers." By H. Kreisinger and W. T. Ray. 1912. Washington: Government Printing Office.

"*Journal* of the Franklin Institute." Vol. CLXXIV, No. 3. September, 1912. Philadelphia, Pa.: The Institute. Price 50 cents.

"Electricity for Everybody." By R. Borlase Matthews. 1912. London: Electrical Press, Ltd. Second Edition. Price 5s. net.

"Atti della Associazione Elettrotecnica Italiana." August, 1912. Milan: Stucchi, Ceretti & Co.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXIX, Nos. 6 and 7. June and July, 1912. Brussels: E. Bruylant. Price 1 fr. 75.

"*Journal* of the American Society of Mechanical Engineers." September, 1912. New York: The Society. Price 35 cents.

"The Motor Manual." Fifteenth Edition. London: Temple Press, Ltd. Price 1s. 6d. net.

"History of the Monument to Commemorate the Sending of the First Train Order by Telegraph." New York: *Telegraph and Telephone Age.*

"Canada for the Investor and the Industrious Millions of Great Britain." By T. W. Sheffield. Bristol: J. W. Arrowsmith, Ltd. 1s. net.

"Wireless Telegraphy and How to Make the Apparatus." 1912. London: Cassell & Co., Ltd. Price 1s. net.

Catalogues and Lists.—Albion Metal Manufacturing Co., 68, Victoria Street, London, S.W. Leaflet relating to their metal name-plates and advertisement souvenirs.

The Electrical Co., Ltd., 122-4, Charing Cross Road, London, W.C.—40-page list, giving illustrated descriptive matter, also tabulated information, prices, &c., of their direct-current motors and dynamos (110, 220, 440 and 500 volt machines), also motor-generators. Prices of spares and starters, instructions for starting and running machines, diagrams of connections, and full dimensional particulars are also published.

The London Electrical Trading Co., Ltd., Palmerston House, Old Broad Street, London, E.C., have prepared a specially-designed envelope for the purpose of advertising the Bastian "Pygmy" heater, and they will be glad to hear from contractors desiring to have a supply over-printed with their name and address.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—New 16-page booklet, entitled "The Attraction of Custom." It is intended to appeal to the actual user of light, and therefore is available for distribution by contractors. It compares flame arc lamps with high-pressure gas, and particularly brings out the merits of the "Excello," a number of excellent prints being included to illustrate the use of these in lighting the exteriors of a number of important London buildings. Copies can be obtained on application.

The Linolite Co., 25, Victoria Street, Westminster, S.W.—Price list of Woodhouse patent steel casing and accessories, of which they are the sole manufacturers.

South Africa.—According to the *British and South African Export Gazette*, additional plant is required for the Queen's Mine (Willoughby's Consolidated), and will include either a further 10 stamps or a complete 20-stamp battery, probably also, a new sands treatment plant and a complete electrical power plant.

Trade Announcements.—The Westinghouse Cooper Hewitt Co., Ltd., of 151/2, Great Saffron Hill, London, E.C., inform us that they have appointed Mr. F. J. Lyons-Davis, of 27, Ruthin Gardens, Cardiff, as their agent in the South Wales district. Mr. Lyons-Davis will deal with this company's well-known specialities, namely, silica and Cooper-Hewitt lamps and mercury vapour converters.

On Monday next the Titan Lift Co., Ltd., are moving to new premises at 9/11, Eagle Street, Holborn, W.C. This is on account of the large increase in their business during the last two years. The new premises are provided with a "Titan" electric lift.

The General Electric Co., Ltd., are just now offering to the trade a quantity of electrical goods—stock rendered obsolete by the issuance of their complete catalogue—at greatly reduced prices. These are on view in a separate department at 67, Queen Victoria Street, E.C.

The British L.M. Ericsson Manufacturing Co., of London and Beeston, have appointed Messrs. Watson & Whyte, of 19, Waterloo Street, Glasgow, to be agents in Scotland for the sale of their telephone apparatus.

According to an Indian exchange, the Eastern Electric and Trading Co. announces that its head office is now removed from Sukkur to Karachi.

The Naylor (Patent) Battery Co., Ltd., of 1a, Lammermoor Road, Balham, London, S.W., inform us that they have taken over, for the purposes of extension, the business carried on by the Regenerating Battery Co., of 3a, Blenheim Street, Chelsea, London, S.W. All correspondence should in future be addressed to the new company as above.

Mr. Joseph West Howarth has, owing to the retirement of Mr. Harry Howarth, taken over the business of Messrs. Joseph Howarth & Co., lighting engineers, of 365, Rochdale Road, Manchester.

The Linolite Co. have taken over from the Woodhouse Steel Casing Co., Ltd., the sole rights to manufacture and sell steel casing, and fittings for the same, under their patents of 1906, 1909 and 1911, and are making arrangements to supply large or small quantities.

The South London Conduit Fittings Co., of 56a, Harleyford Road, Kennington, S.E., inform us that they are now manufacturing fittings for electrical conduits, and would be glad to receive inquiries.

For Sale.—The York City Electricity Department has for sale three electric capstans. The Halifax Tramways and Electricity Committee has for disposal a 750-kw. direct-coupled Belliss engine and E.C.C. dynamo, with surface condenser. See our advertisement pages to-day.

Two Continental Exhibitions.—With reference to the Barcelona and Ghent Exhibitions mentioned in our leaderette pages, inquiries respecting the former should be addressed to Anglo-International Permanent Exhibitions, Ltd., 76, Finsbury Pavement, London, E.C., the Commissioners-Delegate for the United Kingdom; those relating to the Ghent Exhibition should be sent to the office of the British Representative, 1, Southampton Row, London, W.C.

Canada.—Messrs. Ashmore, Benson, Pease & Co., Ltd., of Stockton-on-Tees, have been given an order by the Montreal Light, Heat and Power Co. to supply and erect at their Outremont station a four-lift gasholder of 3,000,000 cb. ft. capacity and a steel tank to contain the same. It is expected that the work will be begun immediately. The Canadian British Engineering Co., Ltd., are the Canadian representatives of Messrs. Ashmore, Benson, Pease and Co.

The "Magic" Suction Cleaner.—The stand of Messrs. Magic Appliances, Ltd., at the Hardware Exhibition at Olympia, faced the main entrance, and the cleaner was demonstrated in an interesting fashion throughout the day, by a stalwart white-clad negro, who cleaned rugs and furniture with great ease. Our readers are already fully familiar with the principle and construction of this electrically-operated cleaner.

LIGHTING and POWER NOTES.

Argentina.—It is reported from Tucuman that the Hydro-Electric Co. will commence its service on September 15th, giving current in 30 squares.

The Municipality of San Vicente (Buenos Ayres) has applied for permission to call for tenders for a public and private electric light station.—*Review of the River Plate.*

Australia.—The Port Melbourne [illegible] Council has appointed Mr. Ashman as consulting engineer in connection with the proposed electric supply system, for which tenders are to be called shortly.

The North Sydney Council has advertised for applications for the concession to establish an electricity supply and for refuse destruction, also for competent electrical engineers to advise on and supervise the work of construction, &c.

Balderton.—An inquiry was held on September 12th by Mr. T. C. Ekin into the application of the Parish Council for a loan of £650 for street lighting by electricity, for which current will be supplied at 1d. per unit by Messrs. Simpson & Co. The only opposition was from one or two ratepayers who preferred gas lighting.

Basingstoke.—After considering a letter from the L. and S.W. Railway Co., in which the latter inquired whether the T.C. had any idea of establishing electricity works, as otherwise it would have to make alterations in its present plant, the Lighting Committee reported that it was not able to recommend the Council to apply for a prov. order. Having, however, given full consideration to an offer made by Messrs. Edwards & Armstrong to establish an electrical undertaking in the borough for the purpose of the public supply of electricity, it recommended the Council to render that firm all necessary facilities in connection with the matter.

Batley.—In reference to the controversy as to whether the local electricity works should be extended at a cost of about £20,000, or electric current obtained from the Yorkshire Power Co., it has been decided by the Electricity Committee to call in an independent adviser in regard to the matter.

Brazil.—The town of Santa Barbara, San Paulo, is having an electric lighting system installed under the supervision of a well-known German electrical engineer.

Burton-on-Trent.—The T.C. has decided to extend the low-tension overhead lines to supply the premises of the English Grain Co. An extension is also to be made to the Outwoods districts.

Clacton-on-Sea.—Mr. H. R. Hooper, on September 10th, held an inquiry into the application of the U.D.C. for a loan of £2,650 for mains, &c. The Inspector altered the particulars to £700 for services and £1,900 for mains. There was no opposition.

Continental Notes.—France.—Since 1911, according to an official report, electrical installations in the Department of the Aisne have undergone a remarkable multiplication. This is owing principally to the introduction of the high-pressure mains of the Compagnie Electrique du Nord. Some 34 subsidiary companies have been formed, drawing their supplies from this company, to work one or more communes, the length of the lines aggregating 124 km. Over 23 distribution systems are now either projected, under construction, or ready for working.

La Société Lorraine d'Electricité, of Nancy, has secured the concession for the supply of electrical energy for lighting and power purposes in a number of villages in the Departments of Vosges and Meurthe-et-Moselle.

Spain.—The municipal authorities of Palafragell (province of Gerona) have just invited tenders for the concession for the supply of electric energy for lighting and power purposes in the town during a period of 20 years.

Italy.—We are informed, says *La Revue Pratique de l'Electricité*, that a group of capitalists associated with concessionaires of sundry lignite mines in Italy have decided to establish, near Figline, a large sulphate of ammonia factory, utilising the excess of gas for a power station for the production and distribution of electric current.

Germany.—According to the *Deutsche Forstzeitung*, it is intended to set up a new power station on the great peat moor of Burtanger, and a second in the Stade neighbourhood near Bremervörde. By means of these two stations a large part of the Province of Hanover will be provided with electric power, which will serve for the furthering of the minor industries to the widest extent. Of two other peat power stations, that on the Wiesmoor has been in existence two years and the Schweegemoor station since October last year. The latter supplies electric current to six circuits and to the City of Osnabrück, besides producing gas and ammonia by the Mond process. It is, furthermore, intended next to cultivate, by means of electric ploughs, &c. a large part of the moor surface. The Wiesmoor station, whose erection was begun two years ago by the Domain Fiskus, has served a useful purpose. It now supplies with electric current not only East Friesland but a part of the Grand Duchy of Oldenburg. Steam turbines are employed for the generation of the current; the boilers are heated with peat sods. Hereabouts, all the peat dredgers, sand dredgers, ploughs, harrows and rollers are worked by electric power. Many hundreds of hectares are also cultivated by implements driven by current drawn from this station, and have given good results, especially the hay crops. The establishment of new stations is of great importance to the potash industry, as they tend to enlarge the area of consumption, and the agricultural utilisation of the moor surface is only possible by means of the regular application of potash manures. For this purpose, 100 kg. per hectare must be applied each year.

RUSSIA.—Imperial sanction has been given to the contracts concluded with Mr. Charles Stewart, an Englishman, for the lease of Crown lands in the neighbourhood of Lake Gokcha in the Caucasus, for the purpose of establishing a hydro-electric station.

[illegible].

Dundalk.—At the bi-monthly meeting of the Council last week, Mr. P. A. Spalding, the electrical engineer, reported that the contracts for the underground and overhead street mains had been completed.

Dover.—A number of residents have petitioned the T.C. protesting against the system of extinguishing the street lamps after midnight and 1 a.m., by which apparently some 35 per cent. of the recent cost of street lighting is being saved. The *Dover Express*, in commenting on the matter, says that it is desired that every lamp shall be lighted, even if a reduced light is given.

Eccles.—An inquiry was held by Mr. T. C. Ekin, of the L.G.B., on September 11th, relative to the T.C.'s application for sanction to borrow £5,220 for purposes of the electricity undertaking. Mr. Angus, borough electrical engineer, said the growth of the undertaking was chiefly in connection with the extension of power services, and the amounts to be borrowed included £2,000 for new mains, £750 for new services, £750 for transformers, £625 for a new boiler house to accommodate three boilers (one of which was now to be put in), and other smaller expenditures connected with the extension. A reduction in the net profit shown last year was owing to £655 being expended out of revenue for a switchboard, and £75 for a pumping set. After further evidence, the Inspector agreed to amend the application respecting the boiler house to £800, to cover the advance in price of materials and workmanship since the estimate was obtained.

Eccleshall.—After consideration of a scheme submitted by Mr. Balbiani, consulting electrical engineer, of Birmingham, for supplying the district with electric light, the P.C. has decided to inform that gentleman that the parishioners and the Council are favourably disposed towards the proposals, but they prefer that he should apply to the B. of T. for an order rather than give permission themselves.

Edinburgh.—At a meeting of the Corporation Electric Lighting Committee, a motion by Councillor Stevenson to consider as to the disposal of the ascertained surplus of £2,179 on the year's accounts of the electric lighting undertaking to May 15th, 1912, was considered. Councillor Hamilton moved that they recommend the Town Council to place the £2,179 to a suspense account for the purpose of city improvements. This was seconded. Bailie Stewart moved as an amendment that the sum should be placed towards the relief of rates. It was also moved that the amount be applied to the reduction of debt on the undertaking. Ultimately it was decided to submit the matter to the T.C. for decision.

Epsom.—The R.D.C. has consented to the Leatherhead and District Electricity Co. laying mains at Stoke D'Abernon, where several premises are to be supplied.

Galashiels.—The Law and Finance Committee has considered a letter from the Urban Electric Supply Co., Hawick, as to the introduction of electricity into the burgh, and decided to favourably consider the terms of any arrangement which might be submitted by the company, or by the local company which it suggested should be promoted for the carrying out of a suitable undertaking. It having been pointed out that the town was very favourably situated for such a scheme, and that there was valuable power going to waste, which was worth anything from £150 to £200 a year, the Committee's recommendation was adopted.

Glasgow.—Great interest is being taken in the forthcoming Smoke Abatement Exhibition organised by the Corporation. All the most modern electrical apparatus for cooking, heating and lighting will be seen in operation. The School Board is co-operating with the Committee in arranging a series of competitions for girls in cooking and baking by electrical appliances. Other interesting features will be an electrical luncheon and tea-room where the visitors will be able to see their meals cooked by electrical apparatus.

Hartshead (Yorks.).—This village, not to be out-done by the neighbouring townships in the Spen Valley district of Yorkshire, has now got an electricity supply for the illumination of its streets. The current is supplied by the Yorkshire Electric Power Co., at a rental of £2 per lamp, including maintenance, and no care or attention needed on the part of the Hartshead Council.

Hindley (Lancs.).—The Council has had under consideration a communication from the B. of T. in reference to the proposed revocation of the Electric Lighting Order. It was decided to make a strong appeal to the Board for an interview to discuss the desirability of allowing the order to remain in force, the expenses to be paid by the Council. The B.O.T. has since consented to meet a deputation from the U.D.C.

Isle of Man.—An electrical plant has been installed at Noble's New Hospital, the installation consisting of a Walker-Horrocks automatic plant to supply 370 16-C.P. lamps. The generating plant includes a 10-H.P. Austin engine and Vickers dynamo, with a Chloride "Plantoid" 54-cell battery. An electric lift is also installed; Messrs. Baxter & Impey were responsible for the electric lighting work.

Japan.—The Yokohama Electric Co., in order to meet the rapidly increasing demand for a supply of current, has entered into a contract with the Mine Hydraulic Electric Co., for the supply of 5,000 KW., commencing on January 1st next.

Keadby.—Sir Wm. Arrol & Co. have secured the contract for the bridge to be erected accross the River Trent at Keadby; electrical machinery will be fitted for working the bridge, which will be the largest and heaviest of its kind in Great Britain.

Kendal.—For the year ended March 31st last there was a gross profit on the electricity undertaking of £283.

Killarney.—The Guardians are considering a scheme for the electric lighting of the union, which at present is illuminated by gas at cost of £110 per annum. It is calculated that the installation will cost about £424, £324 being for transformers and cables, and about £100 for fittings. The annual cost of lighting is calculated at £50 per annum.

Kingstown.—At the meeting of the Urban Council, a letter was read from Mr. C. J. Reddy suggesting that the Council should consider the amalgamation of the townships of Dalkey, Kingstown and Blackrock with the object of establishing in the combined townships a public and private electric lighting scheme. Mr. Potterton, in proposing that the letter should be sent to the Lighting and Roads Committee for consideration, said that some years ago a lighting system had been projected, a prov. order secured and about £1,500 liabilities incurred. The scheme involved about £50,000. Mr. Evans, in seconding the motion, referred to the operations of a private company concerned in electric lighting, and said that the matter had advanced a certain extent, and they hoped to put a proposition before the Council in a short time.

Loftus-in-Cleveland.—The U.D.C. has decided to discuss with the manager of the Electric Power Co. the question of public lighting by electricity.

London.—ST. PANCRAS.—Having regard to the satisfactory position in which the electricity reserve fund stands, the Finance Committee has decided to recommend the Council that an amount equal to a 1½d. rate from the profits of the electricity undertaking for the past year, should be used for the relief of the rates. Electricity mains are to be extended in various parts of the district at an estimated cost of £654.

BETHNAL GREEN.—The Electricity Committee states that in July last its report dealing with a proposal for supplying electricity in the borough, was referred back for further consideration to ascertain on what terms the Stepney B.C. would be prepared to undertake the administration of the proposed supply. A scheme for the administration of the supply has been discussed, and the Committee understands that the Stepney B.C. would be willing to undertake the administration of the proposed undertaking without seeking to obtain a profit in respect of such work. It, therefore, believes that there is every probability that an agreement could be entered into with Stepney on satisfactory terms for the purpose of working the proposed undertaking. Mr. Snell had, in the Committee's opinion, made sufficient provision in his estimates for the cost of administrative work, and it was as a result of the adoption of his suggestion that preliminary negotiations were entered into with Stepney to see whether the Council would be willing to work the undertaking, it being the opinion of the consulting electrical engineer that this would be the best course to take. The Committee, therefore, again submitted its recommendation, that Mr. Snell's report should be adopted and that a supply should be taken from the Stepney B.C., for approval.

BATTERSEA.—A loan of £7,808 is to be taken up from the L.C.C. in connection with the electricity undertaking. This amount is divided as follows:—Mains, £4,600; house services, £1,200; boiler plant, £1,608; meters, £400. The electrical engineer and chairman of the Electricity Committee have been appointed as the Council's representatives at the conference of metropolitan authorities owning electricity undertakings.

Newcastle Emlyn.—It is announced that the U.D.C. has now accepted the terms of the electricity company for public lighting, after a brief re-trial of oil lamps pending the settlement of points in dispute with the company.

Newmarket.—The U.D.C. has asked the electricity company to erect three 300-C.P. lamps in High Street for the inspection of the Council. Similar lamps are to be provided by the gas company.

Newton-in-Makerfield.—Writing to the local D.C. in response to a request for assistance in securing the renewal of its E.L. Order, the Hon. Arthur Stanley, M.P., said he was bound to admit that one of the principal stumbling blocks in the way of the expansion of electrical matters had been the action of local authorities such as Newton-in-Makerfield. In this case the Council held the Order for six years, but did nothing with in—in other words, the Council would not supply electricity itself nor allow anyone else to do it.

North Wales.—The North Wales Power and Traction Co., Ltd., has applied to the B. of T. for consent to erect overhead lines for the transmission of current from Pen-yr-Orsedd Slate Quarry to Alexander Quarry, Llandwrog

Paisley.—The General Electrical Co. has obtained permission to fit up within the burgh, by way of experiment and free of cost, a circuit of 12 lamps. These are described as a new type of flame lamp, giving a 400 C.P. greater light than those at present in use. The cost for similar lamps for permanent use would, it is stated, be £10 per lamp.

Pontardawe.—The District Council has agreed to negotiate with Messrs. Gilbertson with a view to the latter supplying electricity to the town. The price is to be 5d. per unit.

Rochdale.—It was reported to a meeting of the Electricity Committee last week that the extension of the electricity works was practically at a standstill owing to the non-delivery of ironwork. This material, it is said, is now difficult to obtain.

Rotherham.—A fire recently occurred at the Corporation electricity works, in connection with an air filter. The fire reached the roof of the building through an exhaust trunk, and was extinguished by the fire brigade.

St. Mellons.—A prov. order for E.L. is being applied for by the South Wales Electrical Power Distribution Co. for the rural district. The company has quoted terms to the R.D.C. for public lighting at Bedwas and Machen Upper, and consideration is deferred until the order is secured.

Shipley.—Electrical extensions and alterations, involving an expenditure of £5,000, are to be undertaken by the District Council. These include the laying of new cables and the provision of new machinery at the works

Sligo.—The B. of G. is proposing to install an electric lighting plant at the workhouse in view of a rise in the price of gas from £130 to £150 per annum for about 93 burners. Tenders have been received from Messrs. Allen & Grosse, of Belfast, £560; Messrs. Edmundson's Electricity Corporation, Ltd., £670, and the Phœnix Works, Liverpool.

In a long letter from Messrs. Edmundson to the Board, the firm recommended one of their automatic E.L. sets with storage battery, The tenderers were prepared to send a man each quarter to clean the plant, &c., at a cost of £12 10s. per annum. The cost of supplying and erecting a 120-light plant would be £390. For a larger plant, to provide for cooking and heating, the additional charge would be about £280. An economy could be effected by using overhead cable between the buildings. The whole matter of electric lighting has been referred to Mr. P. J. Kilgallen, engineer to the Board, who is also preparing a plan for lighting the town of Sligo, and the Board is seeking further information to discuss at the meeting on September 21st. There is a local prejudice against giving the contract to a Belfast firm.

Southport.—With a view to securing an expert report concerning the state of the electricity and tramways undertaking, the Corporation, on the recommendation of the Electricity and Tramways Committee, recently appointed Mr. S. J. Watson, borough electrical engineer, of Bury, to report upon the electricity department, with special regard to the cost of generating. The matter was referred to at a meeting of the Council on Wednesday last, when Councillor O'Regan called attention to a recommendation instructing their engineer to report on the electrical expert's report and circulate both together. An amendment was moved by Councillor Shaw, and carried, that a copy of the report by Mr. Watson be supplied to every member of the Council separate from any other report, at least a week before the next Council meeting.

Councillor O'Regan also raised the question of deputations, and moved that they refer back the resolution empowering the chairman, vice-chairman and electrical engineer to attend the conference of the Municipal Tramways Association at West Ham. The policy of sending deputations was defended by Ald. Griffiths, and the amendment was defeated, the minutes then being adopted.

Swinton and Pendlebury.—Terms have been agreed between the Lancashire Electric Power Co. and the Council for the supply of electricity in bulk to the Council for a period of five years, with the option of extension to 10 years. Under this agreement the company is permitted to supply direct customers who, by reason of the amount of the demand or the distance of the premises from the Council's mains, cannot be satisfactorily supplied by the local authority. There is a clause requiring the company to obtain the consent of the Council before commencing to supply local power consumers direct other than the Acme Spinning Co., Messrs. Sackville & Swallow, Ltd., and Messrs. J. Berry, Ltd. It had been thought that the steam generated at the new refuse destructor might have been utilised for an electric generating plant, but the engineer consulted by the Council holds out little hope of it being able to generate at a price approaching that at which it is now supplied by the Lancs. Electric Power Co

Truro.—With reference to the E.L. question, mentioned in our last issue, the T.C. has decided that the Committee dealing with the matter shall be empowered to expend up to £20 in seeking expert advice.

Walsall.—Sanction has been received from the L.G.B. to the borrowing of £9,000 for the purposes of the Council's undertaking. The engineer has been instructed to proceed with the laying of ducts for the mains for the Darwall Street sub-station and the tramway feeders in the Litchfield Street, and to obtain prices for the necessary cables. Owing to the increased cost to the electricity department of coal and other charges, the Electricity Committee has appointed a sub-committee to inquire generally, and report on the working of the undertaking; and particularly (1) as to the best means of ensuring the more profitable utilisation of new plant and machinery and new mains; and (2) as to the effect under present conditions, of the increased cost of fuel and any capital and other charges, and the way in which such increases should be met.

Watford.—At the last meeting of the Guardians it was decided to install electric light throughout the workhouse buildings, and to ask Mr. Purse, electrical engineer to the Watford undertaking, to prepare a specification for carrying out the scheme.

The assessment of the electricity undertaking of the U.D.C. has been increased to £2,050 rateable. The question of an appeal is being considered by a Committee.

Wednesbury.—Mr. H. R. Hooper, L.G.B. Inspector, held an inquiry on Friday, last week. into an application by the T.C. for sanction to borrow £3,700 for the purchase of an engine and dynamo.

Windsor.—The T.C. has by a large majority rejected a motion "that before any further contract is entered into with the Electric Light Co. by the Council, an agreement shall be executed to the effect that any profit from Council contracts shall not be included in the purchase amount should the Council at any time determine to purchase the undertaking." A member pointed out that if the resolution was passed, the Electric Light Co. could not tender for street lighting, &c., and the Council would be entirely in the hands of the Gas Co.

Worsley.—There is a prospect of Worsley shortly being in possession of a supply of electricity for lighting or power, as satisfactory arrangements have been come to between the Lancashire Power Co. and the Earl of Ellesmere. The company holds the Worsley Electric Lighting Order obtained by the Council, and has supplied Walkden for the past two years. It is now proposed to extend the cables to Worsley underground, and to establish a sub station at Worsley. Mr. Taite (general manager) intends to put the work in hand immediately in order that consumers shall receive the supply with as little delay as possible. The Swinton and Pendlebury District Council has decided against extending the distributing mains to the Worsley boundary on the ground that the probable consumption would not justify the heavy cost of laying a cable from the sub-station, and it is possible that the Swinton Council will come to some arrangement with the Power Co. for the latter to supply the numerous large residences in the Broad Oak Park district from the cable which will supply Worsley.

Yarmouth.—As it is expedient to extend plant, machinery and mains, the Electricity Committee has decided to apply to the L.G.B. for sanction to borrow £4,000 for machinery, £1,000 for switchboard, £2,000 for services, and £750 for public lighting mains.

TRAMWAY and RAILWAY NOTES.

Aberdare.—The U.D.C. recently discussed, at length, a recommendation of Mr. Sellon, its engineer adviser, to purchase foreign-made Sandberg rails in preference to British. Mr. Sellon is reported as having said that no British firm would produce rails to his specification, but German firms would do so readily. He had no doubt that the foreign rails were superior. Several "patriots" spoke up for British rails, but eventually Mr. Sellon's recommendation was adopted.

Argentina.—A new electric railway is to be built from Punta Gorda *viâ* San Fernando Anchovena and Vicente Lopez to Belgrano. The line, which will be 85 km. long, will be built from one end and completed section by section, and the necessary materials will be brought along the line as it is constructed.

The company building the electric tramway from the Buenos Aires city boundary to the Tigre has informed the Government of the Province of Buenos Aires that 10½ km. are finished, or say half the line, but, due to unforeseen circumstances, work has been stopped. An extension of 18 months, in which to finish the work, has been applied for. The *Review of the River Plate* understands that want of capital is the cause of the suspension of work.

Australia.—Though the report of Mr. Hay to the N.S.W. Government on the question of relieving the street tramway congestion in Sydney has not been made public, it is stated that he proposes building shallow tramways with street stations at intervals. The tramways will also connect under the harbour with Balmain.

The Chief Commissioner of Railways (N.S.W.) has stated that the electrification of the Newcastle tramways will be carried out shortly, and that a power house to be erected will also supply energy to the railway workshops and yards.

Ayr.—Mr. W. Grant, the Corporation Tramway manager, reports that the number of passengers carried during the year was 3,739,237, an increase of 68,491 over the previous year. The cars ran 385,796 miles, a decrease of 638 miles. The revenue was £15,752, as against £15,492.

Blackpool.—The annual returns in connection with the Corporation Tramways show that the £5,000 made last year represents 20 per cent of the gross profit. The chief feature was the increase of £2,782 in the "circular tour" receipts, and annual contracts amounting to £2,679. There had been an addition to the rolling stock of 17 cars, and since the introduction of car-meters there had been a saving of at least 10 per cent. in the current consumed. Last year the sum was £8,262 for 942,829 miles; in 1909 it was £10,066 for 945,229 miles. The manager states that the experimental steel-tired wheels have proved much preferable to the chilled cast-iron tires. There are now 72 cars, of which 21 are top-deckers.

Bradford.—A long discussion in the City Council took place on the proposed central tramway depôt at Longlands, and ultimately it was decided not to adopt the scheme, by 30 votes to 27.

Canada.—According to the *Times*, an electric railway is to be built to Hudson's Bay, a hydro-electric plant on the Nelson River supplying the necessary electrical energy.

Continental Notes.—Austria.—The first aerial cable railway in Austria—that from Lana to the top of the Vigiljoch—was opened on August 31st. Its total length is 1,153 metres, and it rises to a height of 1,153 metres. It is built on the Ceretti and Tanfani system, four separate steel lines being employed, the standards having a height of 31 metres. The carriages each carry 16 persons, and weigh 3,500 kg. The railway is worked by direct current at 550 volts, obtained from a mountain power-house. The winding motors are of 50 H.P. capacity. The line has taken three years to build, and constitutes the first of the aerial railway units of the local railway system of Austria. Its cost works out at one-fifth that of the rack railway, and one-half that of the fixed cable railway. Its advantages are that it is unaffected by snowfalls, it rises high above forest and plain, and forms no disfigurement of the landscape.—*Elektr. und Masch.*

France.—A general movement in electric tramway and railway work is shown by the references to new projects in the French papers. Proposals are on foot for short lines in the neighbourhood of Sedan and Dieppe; in the Department de l'Ovne a loan of 3 million francs has been sanctioned for five lines; tramway extensions are proposed in Pontoise, and extensions and surveys for several lines are sanctioned in the Department of the Yonne.

Spain.—The *Gaceta de Madrid* publishes the application of a company to the Direction-General of Public Works for a concession for the construction and working of a line of electric tramway at Gigon.—*Revue Pratique de l'Electricité.*

Denmark.—The Vestjälland Sugar Factory, which has just been founded with a capital of 5,000,000 kronen, half in shares and half in debentures, proposes to spend a sum of 975,000 kronen in the building of an electric railway, for beetroot transport, and the construction of a power house to supply light and power to drive the railway and small machinery.—*Elektr. und Maschinenbau.*

Dundee.—The new railless trolley car system shows every sign of being a big success. The returns for the first five days show that 6,856 passengers travelled on it: 3,635 of that number were ½d. fares, and 3,221 1d., the revenue being £21. The convener of the Tramway Committee characterises the success as nothing short of phenomenal.

Halifax.—The Corporation Tramways Committee has been authorised by the T.C. to take steps for the promotion of a Bill in the next session of Parliament to enable the Corporation to consolidate and extend its tramway system. It is proposed to extend the system from Triangle to Ripponden in one direction and to Stainland and Elland in another direction. Conferences were recently held with representatives from the outside bodies so as to ensure the necessary financial assistance.

Leith.—The total traffic receipts to May 15th last on the Corporation tramways amounted to £33,850, as against £30,570 in the previous year. The working expenses totalled £18,230. The capital charges amounted to £14,455, and there was a net credit balance of £2,093, as compared with a debit balance of £1,903 in the preceding year. This year the traffic receipts were the highest recorded. The percentage of working expenses to total receipts was 52·54, as against 56·59 in the previous year.

London.—A Commission representing the Berlin railways has recently paid a visit of inspection to the London underground railways, particularly the Metropolitan and District lines. The Commission's conclusions will serve as a basis for discussion on the Berlin railways electrification.

The recent accident on the Piccadilly tube line has drawn attention to the automatic signalling system there installed. The *Railway Review*, in commenting on the accident, attacks the signalling arrangements and suggests that there have been numerous cases of failure which have not received publicity. The chief complaint seems to hinge round the description of the system as "perfect." While, strictly speaking, the *Railway Review's* contention as to imperfection cannot be disputed, yet, in view of the results obtained, the imperfections of the automatic system will cheerfully bear comparison with those of the manually operated signal. Moreover, an instance of failure, quoted as occurring at Turnham Green, turns out to be due to a signal worked from a box, and not automatic in the ordinary sense of the word.

Lincolnshire.—The Light Railway Commissioners have granted an Order, which has been modified and confirmed by the B. of T., authorising the construction of a light railway, about 15 miles long, from Kirkstead to Little Steeping.

Philippine Islands.—Seven electric motor-vans are about to be acquired by the postal authorities in the Philippine Islands for the rapid collection and delivery of letters in Manilla.

South Africa.—In a report on future extensions of the Johannesburg tramway system, Prof. Dobson, manager of the tramways, goes into the comparative merits of tramway, railless, and petrol omnibus systems for outlying suburbs, coming to the conclusion that the plain omnibus would be the least costly and best on tolerably good roads. His estimate, for serving an 8-mile route, of £18,800, includes £12,000, or half the cost (£3,000 per mile) of making 40-ft. macadamised roads, and compares with £34,800 for the railless traction system (also including road making). Prof. Dobson lays much stress on the flexibility of the motor-'bus, suggesting that if necessary it can be tried on other routes and in other districts. He does not, however, point out that this involves fresh road making for the 'buses, or, in the alternative, extravagantly high working costs.

Southampton.—Tenders are invited for the supply of tramway rails required in connection with the proposed reconstruction of the permanent way between Clock Tower and Bargate. The tramway manager has again urged the Council to install meters on the cars, and emphasises the fact that with this installation of meters, bonus schemes for careful driving must be brought up, and, on the other hand, the penalising of drivers who are continuously wasting energy, should be provided for. He further points out that since the six various types of meters were installed on the cars some years ago, which proved to be far from satisfactory, owing to their delicacy, a stronger and heavier type of meter has been brought out specially for this work, and has proved reliable.

U.S.A.—The Philadelphia Electric Co. has signed a contract with the Rapid Transit Co., to supply the latter's railway load of 26,200 KW.; the Transit Co.'s stations will in consequence be shut down or converted into sub-stations, and leased to the supply company. This is the third contract of the kind made this year, says the *Electric Railway Journal*, the others being the Cleveland Railway and the Third Avenue (N.Y.) Railway. Only four years ago the first American contract of this kind was settled between the Chicago Traction Companies and the Commonwealth Edison Co., of Chicago.

According to recent advices, a contract has just been closed for the electrification of the Butte, Anaconda and Pacific Railway, with a 2,400-volt D.C. system. Power will be supplied by the Great Falls Power Co. over a three-phase, 60-cycle, 50,000-volt transmission line to two sub-stations, one at Butte and the other at Anaconda, 26 miles apart. At the sub-stations the voltage is to be stepped down to 2,300 volts, at which pressure the current will be supplied to synchronous motor-generator sets, each consisting of two 1,200-volt compound-wound commutating-pole D.C. generators, and one 2,300-volt, three-phase, synchronous motor. The generators will be arranged to operate in series to supply 2,400 volts to the trolley wire.—*Power.*

Wardle.—A deputation of the D.C. has been appointed to wait upon the Rochdale Corporation Tramways Committee, to ascertain on what terms it will extend the electric tramway along Wardle Road.

York.—The B. of T. has sanctioned the extension of the tramway system to Queen Victoria Street. This will serve the populous South Bank area, and will incidentally furnish an alternative route to the racecourse, the new terminus being a few hundred yards from the back of the grand stand.

TELEGRAPH and TELEPHONE NOTES.

France.—Telephone facilities are being actively installed throughout France, the Consuls-Général of the several departments voting sums of money for the purpose almost daily. In the Department of the Aisne, 550,000 fr. have been recently so voted; Vosges, 485,000 fr.; Deux-Sèvres, 101,500 fr.; Aube, 100,000 fr.; Puy-de-Dôme, 80,000 fr.; Eure, 44,610 fr.; and Yonne, 46,530 fr.—*La Lumière Electrique.*

German Colonial Cables.—It is stated that the German South American Telegraph Co., which laid in 1909 and 1910 a cable from Emden *viâ* Teneriffe to Monrovia, Liberia, on the West Coast of Africa, and which extended the cable from Monrovia to Pernambuco in 1911, proposes to continue the cable from Monrovia to Togoland, then to the Cameroons and subsequently to South-West Africa. By this means the three Colonies would obtain a direct connection with Germany, whereas at present they are dependent upon British cable communications. The landing place is to be at Lome in Togoland, and at Duala in the Cameroons. According to the company's contracts with the Government the cable to the Cameroons has to be completed by February 1st, 1913, at the latest, whilst that to German South-West Africa will presumably be carried out by April 1st, 1919. The expenditure on the Cameroons cable is estimated at £317,000.

Telephone Inquiry.—At the Congress held at Newcastle-on-Tyne last week, a resolution was passed almost unanimously demanding that a systematic inquiry into the working of the telephone service should be instituted as soon as the arbitration proceedings between the Post Office and the National Telephone Co. were completed. The Deputy-Mayor of Newcastle stated that of 100 local calls that he had made, no fewer than 62 were interrupted, and 19 were cut off before completion of the conversation. On no occasion did he get through within one minute. It was estimated that the service was 20 per cent. slower since the Post Office took over the system. Other delegates corroborated the complaints of bad service.

Walsall.—The town clerk and tramways manager have come to an arrangement with the Postmaster-General for insulating a number of the Government's wires which cross the Corporation trolley line.

CONTRACTS OPEN and CLOSED.

OPEN.

Ashton-under-Lyne.—September 24th. Installation of intercommunication telephones between the departments at the Union Offices, for the Board of Guardians. Mr. G. H. Partington, Clerk.

Australia.—New South Wales.—September 25th. Trunk line switchboard, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 2nd.—N.S.W. Government Railways. Six 1,000-kw. sub-station units to specification No. 357. Specification (10s.) from Electrical Engineer's Office, 61, Hunter Street, Sydney.

October 16th.—N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, as above.

South Australia.—October 1st. Telephone switchboards at Unley, Adelaide, for the Postmaster-General's department. See "Official Notices" August 23rd.

October 1st.—Telephone switchboards at Norwood, for the P.M.G.'s department. See "Official Notices" August 23rd.

October 22nd.—Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" September 13th.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" September 13th.

Victoria.—October 2nd. Two vertical sets of electrically-driven rotary pumps, for the Melbourne City Council. See "Official Notices" August 16th.

October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" September 13th.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—November 30th. Plans are required for the erection and operation of an electrically-worked municipal central clock installation. Particulars, Magistratabteilung V, Vienna.

Trieste.—September 23rd. Twelve cranes of 1,500 kg. capacity are required for the Molo della Sanità. Half must be delivered complete ready for erection within 6, and half within 12 months. Particulars from the Technische Abteilung der k.k. Lägerhauser, Trieste.

Bulgaria.—October 17th. The District Administration of Finances in Sofia is inviting tenders for the supply and erection of the mechanical and electrical plant required in connection with the power transmission installation to be laid down at the State collieries at Pernik.

Costa Rica.—December 9th. Tenders are invited for the building and working of an electric tramway between Alajuela and Grecia, a distance of 18,100 m. Particulars from the Secretaria de Fomento, San José.

Dundee.—September 23rd. Electric lighting at Carolina Shed, for the Harbour Trustees. Particulars from General Manager of the Dundee Harbour Trust.

Gravesend.—September 21st. Small coal (2,500 tons) for the Corporation electricity works. The Electrical Engineer.

Halifax.—September 24th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, clerk, 4, Carlton Street.

Isle of Thanet.—General stores for a year, for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" to-day.

Large Conduit Order.—One million feet of conduit, with accessories. See "Official Notices" September 13th.

Leeds.—October 7th. The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. Mr. J. B. Hamilton, general manager.

Liverpool.—September 24th. Electrical supplies for a year, for the West Derby B.G. Mr. H. P. Cleaver, Clerk, Brougham Terrace.

London.—L.C.C.—September 24th. Electric spark gaps in brick cells for sub-stations. See "Official Notices" August 23rd.

Hammersmith.—September 25th. A.C. motors, for the Corporation. See "Official Notices" September 13th.

Hackney.—Tenders are to be invited for the supply of 100,000 pairs each of white open-type arc lamp carbons and yellow flame arc lamp carbons.

Fulham.—September 25th. 5,000 tons of nutty slack coal, for the B.C. See "Official Notices" to-day.

Southwark.—October 2nd. [illegible] and [illegible] for the B.C. See "Official Notices" to-day.

Lossiemouth.—September 28th. Gas producer plant, engines and dynamos, battery, crane, overhead mains and public lamps, for the T.C. See "Official Notices" September 6th.

Manchester.—October 1st. Permanent way points, tongues, and hardened steel centres, for the Tramways Committee. Specifications and forms of tender (£1 1s. returnable) from Mr. J. M. McElroy, general manager.

Mexborough.—October 5th. Turbo-generator, condenser and switchgear, for the U.D.C. See "Official Notices" September 13th.

Nuneaton.—September 30th. Cast-iron and steel pipework, valves and accessories, for the Corporation. See "Official Notices" to-day.

Sweden.—October 15th. Tenders are invited for machinery required at the Porjus Power Works: (1) Electric lift for passenger and goods, with a carrying capacity of 1,000 kilogs.; (2) two electrically-driven oil pumps, each with a pumping capacity of 100 litres of oil per minute, or 200 litres as an alternative at a drawing height of 22 metres; and (3) three electrically-driven water pumps, each with a pumping capacity of 1,500 litres of water per minute at a total drawing height of 20 metres. Particulars from "Förestandaren, Kungl. Vattenfallstyrelsens Elektrotekniska Byra," Stockholm. Specifications, &c. (in Swedish), together with drawings, may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Taunton.—The T.C. invites tenders for 2,500 tons of steam coal for the electricity works. Particulars from the electrical engineer, Mr. A. J. Howard.

Watford.—September 30th. The U.D.C. is inviting tenders for one electrically-driven pumping plant. Specifications and forms of tender (£2 returnable) from Mr. D. Waterhouse, Engineer and Surveyor, Watford.

CLOSED.

Aberdare.—The U.D.C. has accepted the tender of the Lancashire Dynamo Co., Ltd., for electric light plant, at £4,439, and that of Messrs. Wm. Griffiths & Co., Ltd., for the construction of the new electric tramways, at £45,870. On the advice of Mr. Sellon the Sandberg rails are to be made by the Phœnix Co., of Belgium.

Ashton-under-Lyne.—The Electricity Committee has accepted the following tenders:—

Goodbrand & Co.—One fuel economiser.
Nichols Bros.—Two boiler feed pumps.
British Westinghouse Electric Co.—Converting machinery.
Dempster & Co.—Coal-handling plant.

Bexley.—The U.D.C. has accepted the tender of the British Insulated and Helsby Cables, for cable, at £95, for the extension of the mains to Halfway Street.

Bolton.—The B. of G. has accepted the tender of the Austin Motor Co., Ltd., at £445, for a motor ambulance.

The Watch Committee of the T.C. has accepted the tender of Mr. B. Bleasdale, of Bolton, for electrical fittings.

British Columbia.—The contract for the construction of the big dam at Jordan river, B.C., for the British Columbia Electric Railway Co., has been awarded to the Puget Sound Bridge and Dredging Co., of Seattle. The dam will be 800 ft. long and 115 ft. deep, and will be modelled after the Ambursden type of reinforced concrete structure.

Australia.—According to the *Australian Mining Standard* the Prahran-Malvern (V.) Tramway Trust has accepted the following tenders in connection with tramway extensions to Kew, Hawthorn, Malvern, Caulfield and St. Kilda :—

Special trackwork (points and crossings).—Messrs. Edgar Allen & Co., £8,875.
Overhead construction and erection, feeders, cables, &c.—British Insulated and Helsby Cables, Ltd., £10,797.

The same contemporary says that tenders have been accepted by the Postmaster-General in connection with telegraphic and telephone branches of the department, amounting to £70,000, and including the following :—

Hoffmann Brick and Potteries, Ltd., Melbourne.—24,771 glazed earthenware conduits, six ducts, at 3s. 8½d. each, £4,076, and 51,621 conduits, four ducts, at 2s. 3½d. each, £5,914.
Callender's Cable and Construction Co., Ltd., through Noyes Bros.—10½ miles of cable, £3,569; 11 miles paper-insulated lead covered cable, £2,629.
James Miller & Co.—45,000 lb. of twine, £1,942.
India-Rubber, Gutta-Percha and Telegraph Works Co., Melbourne.—Brushes, speiders, zincs and cells, £789.
A. J. Sage & Co.—6,460 cells, £669.
British Insulated and Helsby Cables, Ltd.—Copper tapes and bronze and copper wire, £31,202.
W. T. Henley's Telegraph Works Co., Ltd.—30 miles paper-insulated lead-covered cables, £7,170.

Brighton.—The B.G. has accepted the tender of Mr. H. J. Galliers, of Brighton, for electrical fittings, at £42.

Croydon.—The Infirmary Committee of the Guardians has provisionally accepted the tender of Messrs. Waygood, at £647, for the installation of two electric lifts at the infirmary.

France.—The Compagnie des Chemins de Fer de l'Etat have just placed orders for 80 motor-cars for service on the Paris suburban lines, with the Ateliers du Nord de la France, and for 20 with the Compagnie de Chemins de Fer d'Ivry. The price per motor is 133,000 fr. The orders for electric equipment (cables, controllers, lighting and heating apparatus, &c.) were shared between the Thomson-Houston Co. and the Ateliers de Constructions Electriques du Nord et de l'Est.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named :—

Admiralty, Contract Department.

Breakers and contactors.—Whipp & Bourne.

India Office, Store Department.

Apparatus.—Marconi's Wireless Telegraph Co.
Cable.—Siemens Bros. & Co.
Dynamo, &c.—J. Stone & Co.
Telephones, &c.—Peel-Conner Telephone Works, Ltd.

Crown Agents for the Colonies.

Train lighting cells.—Chloride Electrical Storage Co., Ltd.
Electric dock crane.—Babcock & Wilcox, Ltd.; Stothert & Pitt, Ltd.
Telegraph poles.—Bullers, Ltd.
Telephone switchboard.—Western Electric Co., Ltd.

H.M. Office of Works.

Electric lamps.—A.E.G. Electric Co.; Radium Electric Co.; Pope's Electric Lamp Co., Ltd.

General Post Office.

Protective apparatus.—The British L. M. Ericsson Manufacturing Co., Ltd.
Telegraphic apparatus.—The Gell Telegraphic Appliances Syndicate, Ltd.
Telephonic apparatus.—London Electric Wire Co. and Smiths, Ltd.; Automatic Telephone Manufacturing Co., Ltd.; The British L. M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.; British Insulated and Helsby Cables, Ltd.
Telegraphic cable.—Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Telephonic do.—Western Electric Co., Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co. and Smiths, Ltd.; British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Earthenware ducts.—Albion Clay Co., Ltd.
Insulators.—J. Bourne & Son.
Telegraphic ironwork.—T. W. Leach, Ltd.; Bullers, Ltd.; F. W. Cotterill, Ltd.
Wheatstone telegraph paper.—Waterlow & Sons, Ltd.
Zinc rods.—Eyre Smelting Co., Ltd.
Telegraphic wire.—Shropshire Iron Co., Ltd.; Dorman, Long & Co., Ltd.; R. Johnson & Nephew, Ltd.
Four electric lifts, S.W. District Office, London.—Medway's Safety Lift Co.
Lattice masts, Wireless Telegraph Station, St. Just, Cornwall.—R. W. Blackwell & Co., Ltd.
Telephone exchange equipment, London (Brixton, S.W., Gerrard Exchange, W., and Walthamstow, E.), Liverpool (Bootle) and Glasgow (Hillhead).—Western Electric Co., Ltd.
Do., Barrow-in-Furness.—Peel-Conner Telephone Works, Ltd.
Do., Post Office, Salisbury.—Peel-Conner Telephone Works, Ltd.

Halifax.—The Guardians have accepted the tender of the General Electric Co., Ltd., for the supply of a portable X-ray switchboard to work coils at the Halifax Hospital; also for a tube stand, with attachments.

Houghton-le-Spring.—The R.D.C. has accepted the tender of Messrs. S. Stobart & Co., of Newcastle-on-Tyne, for the installation of the electric light at the hospital, at £32.

India.—Messrs. Crompton & Co., Ltd., have entered into a contract with the Nagpur Electric Light and Power Co., Ltd., for a complete plant to generate and supply electricity in Nagpur. The contract includes generating plant, about 13 miles of cable for the street lighting, and 600 street lighting brackets.

Llandrindod Wells.—A contract for four "Bennis" high-duty smokeless and gritless coking stokers and self-cleaning compressed-air furnaces, for Lancashire boilers, has been placed with Messrs. Ed. Bennis & Co., Ltd., by the Llandrindod Wells Electric Power and Lighting Co.

London.—Shoreditch.—The B.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for reinsulating with paper and lead a quantity of old rubber-insulated cable, at £189 per mile for ·15 cable, and £278 per mile for ·25 cable.

Bermondsey.—The B.C. has accepted the tender of Messrs. Davidson & Co., Ltd., at £20, for the supply of an electric fan.

Luton.—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for a 500-KW. converter and transformer, at £1,246.

Malvern.—The U.D.C. has accepted the tenders of the South Wales and Cannock Chase Coal Co., Ltd., and Mr. W. A. Thompson, of Malvern, for coal for the electricity works.

Newport (Mon.).—The Electricity and Tramways Committee of the T.C. has accepted the tender of Messrs. Edgar Allen and Co., Ltd., for special track work for the tramways, at £665.

Paisley.—The Electricity Committee has accepted tenders for coal as follows :—Messrs. James Wood & Co., 2,500 tons Viewpark coal, at 12s. 7d. per ton; 2,000 tons Bothwell Castle coal, at 12s. 9d. per ton; and 2,500 tons Greenfield coal, at 13s. 0½d. per ton.

Rochdale.—The Corporation has accepted the tender of Messrs. W. T. Glover & Co. for the supply of cable to the electricity department for the next 12 months.

Rosario.—The municipality has received the following tenders for the supply of arc lamp carbons :—

Cia. India-rubber	$16,450	Buxton, Casini & Co.	$19,480
Siemens, Schuckert	18,135	Cia. Industrial de Electricidad	17,380

Review of the River Plate.

Rotherham.—The Corporation has accepted the tender of the Reason Manufacturing Co., Ltd., for the next year's supply of electrolytic meters.

Southampton.—The T.C. has accepted the tender of Mr. J. Douglas, at £879, for carrying out alterations and additions to Portswood tramcar depôt. The following tenders have been accepted for supplies of coal to the electricity department :—

Bradbury, Son & Co., Ltd.—1,500 tons Newbury, 12s. 9d. per ton, and 2,000 tons Tamworth, 16s. 10d. per ton.
J. R. Wood & Co., Ltd.—2,250 tons North Country, 14s. 1d. per ton.
Phœnix Wharf and Coal Co., Ltd.—2,250 tons North Country, 14s. 1d. per ton.
Myers, Rose & Co., Ltd.—2,800 tons Gedling, 16s. 9d. per ton.

Wallasey.—The Sun Evaporator Co., Ltd., are supplying superheaters and evaporators to the electricity works, and the Davenport Engineering Co. a water-cooling tower.

The offer of Messrs. Hanchett, Burnett & Co. has been accepted for new transformer windings.

Walsall.—The tender of Halley's Industrial Motors, Ltd., has been accepted by the T.C. for the supply of a 34-H.P. motor tower wagon.

Warrington.—The B. of G. has accepted the tender of Mr. Harry Rogers for electrical requisites.

FORTHCOMING EVENTS.

North Eastern Counties Electrical Exhibition.—Open daily to Saturday, September 28th inclusive. At the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne.

Municipal Tramways Association Conference and Exhibition.—At West Ham. Wednesday, September 25th, to Friday, September 27th. For programme see our issue of August 23rd, page 305.

Roumanian Oil-Well Fire and Electricity.—In connection with the fire which occurred last month in the Moreni oilfield, the Government Inspector reports that it was due to a spark from an electric motor, and advises that electricity should be forbidden as a motive power in oilfields, on the ground that electric motors as commercially supplied are so imperfect that they must produce sparks, either directly or through accessories, and that these sparks have often caused fires. The Inspector's recommendation is already arousing great opposition from those aware of the many advantages of electrical installations on oilfields, and it is not likely to be adopted without grave consideration. The success hitherto attained by electric motors has been based partly on the absence of fire and sparks inseparable from a boiler installation, and for lighting a derrick and buildings electricity has a positive advantage in being less dangerous as regards fire than any other source of artificial light. Moreover, the recommendation, if carefully read, does not condemn electric motors, but only imperfect ones supplied commercially. The remedy would appear to be a higher class of goods.

NOTES.

Miners' Safety Lamp Tests.—Particulars have been issued by the Home Office regarding tests which miners' safety lamps should pass in order to be admitted to the list of "approved" lamps in accordance with Sec. 33 of the Coal Mines Act, 1911. The Committee appointed to deal with the matter does not propose that each individual lamp used in a coal mine shall be tested, but that no lamp shall be adopted that does not conform in all particulars with an official specification which is the outcome of the official test. In the case of an electric lamp, it is to be dropped, complete with its glass, from a height of 6 ft. upon a wooden floor five times in succession. A different glass is to be employed each time, and not more than one broken glass is to be permitted in the five tests. If two glasses break the lamp is to undergo five more tests, and if the glass breaks in two of these it will be held to fail. The test will be carried out with the battery removed and a dummy of the same weight substituted. The lamp should give not less than 1½ C.P. after 10 hours' use, and, as regards the danger of causing explosion, it will be tested by having the light switched on and off while it is in an explosive mixture. Another requirement is that no liquid shall escape from the battery when the lamp is turned upside down. The Committee thinks it desirable that the light should be well distributed outside the lamp, and that a movable reflector should be provided to concentrate or shield the light at will.

The Home Office station at Eskmeals, Cumberland, is now open for the reception and testing of lamps. Under Sec. 33 of the Act, after January 1st next no safety lamp must be used by any person employed in a mine, unless it is of a type for the time being approved by the Secretary of State. Instructions as to the submission of lamps to the official test are given in a memorandum, which can be obtained on application to the Home Office.—*Times.*

Glover's Almanac.—In the sheet for September 8th an extract from the *Journal* of the I.E.E. on the subject of meter errors is attributed to Mr. C. Ashmore Baker, of Westminster, who writes pointing out that the words used are, as a matter of fact, those of Mr. Charles Alfred Baker, of the London County Council, to whom the credit should be given.

Educational Notes.—University College, London.—In connection with the opening of the Session, the Provost, the Dean and the Vice-Dean in the Faculty of Engineering will attend from 10 a.m. to 1 p.m. on Monday, September 30th, and Tuesday, October 1st, for the purpose of giving advice and information to students entering the College.

Prof. J. A. Fleming will give a public introductory lecture on "The Sources of Energy Available to Man," on Wednesday, October 9th, at 5 p.m. Dr. Dugald Clerk, F.R.S., will preside at this lecture.

L.C.C. School of Building.—The session opens on September 23rd.

Battersea Polytechnic.—The new session commenced on Tuesday last. Full day and evening courses are provided in science and engineering, and students attending the Polytechnic may be registered as internal students of the University of London. In the Electrical Engineering Department a new course in Electric Lighting and Illumination will be held, and new equipment is being provided in connection with the subject of Electric Traction.

Borough Polytechnic Institute, London, S.E.—The Polytechnic reopens on September 23rd for courses in electrotechnics, electric wiremen's work, electrical design and workshop drawing. See our advertisement pages to-day.

Municipal Technical Institute, West Ham, E.—Notice is given in our advertisement pages to-day regarding day and evening courses in electrical energy.

The Technical College, Finsbury.—The evening courses in electrical engineering begin on September 20th. The lectures of the advanced course on Monday evenings will be given by Prof. Silvanus P. Thompson during the autumn term on dynamo and motor design and on alternating-current work; after Christmas a special course of lectures on alternating-current motors will be given by Mr. J. K. Catterson-Smith. On Wednesday evenings, commencing October 2nd, Prof. Thompson and Mr. Howgrave-Graham will lecture on magnetism, electric measurements, illumination, &c. In the Mechanical Department, in January, Mr. Wimperis will deliver a special course of lectures on "The Application of Power to Load Transport."

Electric Lighting Plant Valuation.—Mr. Edwin Bolton, Carbrook, Larbert, presiding over the Valuation Appeal Court for the western division of Stirlingshire last week, heard an appeal by Sir Walter Menzies, M.P., Culcreuch, Fintry, against the valuation of £20 placed on a workshop and sawmill and £15 on an electric lighting plant. According to a report in the *Glasgow Daily Herald* Sir Walter was not represented at the Court, but he sent a letter, in the course of which he said that after some discussion at the Parish Council meeting he had agreed to the valuation of the workshop and sawmill being placed at £16. With reference to the electric lighting plant, this was installed in 1895, and had always been considered as part and parcel of the old mill building. Mr. Barr, the assessor, explained that Sir Walter now used the plant for supplying light not only to his own house but also to a neighbouring residence, and this, of course, made him liable to valuation. Mr. R. A. Hill, writer, Stirling, thought Sir Walter ought to have been represented at the Court if he wished to oppose the finding of the assessor. The Court ultimately decided to dismiss the appeal.

In Memory of Etienne Lenoir.—The little town of Mussey-la-Ville (Luxembourg) was *en fête* recently, the occasion being the inauguration of a commemorative plaque on the house in which the late M. Etienne Lenoir, one of the pioneers of the gas engine, was born in 1822.

Institution and Lecture Notes.—Illuminating Engineering Society, U.S.A.—The sixth annual Convention of this Society was opened on Tuesday, 16th inst., at Niagara Falls, Ont., and was to close yesterday. Many papers on gas and electrical illumination were down for reading.

Appointments Vacant.—Electrical engineer, for the Liverpool City Council (£1,000); shift engineer, for the City of London Asylum, Dartford (34s.); instructor for electric wiremen's classes, for the Wimbledon Technical Institute. See our advertisement pages to-day.

Annual Outings.—The employés of Messrs. Elliott Bros., electrical engineers, held a most enjoyable outing on September 7th. A special steamer left Greenwich Pier at 2.30 for Kew, where tea was partaken of, the return trip being made at 8 o'clock. During the afternoon, the swimming club held their ¼-mile championship race from the "Queen's Head," Mortlake, to Barnes Bridge, for the challenge shield and medals for the first three competitors finishing the course. Over 300 employés took part in the outing, which was organised and carried through by the Amusements Committee, acting in conjunction with the Swimming Club.

On Thursday, September 12th, the staff and workpeople of Messrs. J. H. Heathman & Co. had their annual river trip. Over 100 of the staff and friends assembled at Richmond, and proceeded by launch to Hampton Court, where a stop was made to visit the gardens; afterwards they went on to Laleham. During the trip an excellent luncheon and tea were provided, while music beguiled the fleeting hours. Fortunately, excellent weather prevailed, making the trip most enjoyable. From a short speech made by Mr. Heathman, as Richmond was reached on the return journey, we gather that the recent fire caused very little disturbance at the factory, thanks, as he said, to the way in which his efforts had been seconded by the staff and workpeople.

The annual outing of the employés of Messrs. [illegible] & Co., of Clapham Junction, S.W., took place on Saturday, August 31st, to Southend.

Copper.—The relationship of supply to demand in the copper market is discussed by the writer of an article in the *Financier* of September 5th. He quotes the National Conduit and Cable Co. (U.S.A.) to the effect that, although that market has not been so active recently, there is every reason to anticipate a continuance of high prices. The very cheap lots to be had in July have mostly disappeared. The Copper Producers' Association shows a marked increase in refinery production. This increase is given as 6,700 tons (July over June). At this rate, the production of marketable copper for the year 1912 would be in the neighbourhood of 735,000 tons, an increase of 95,500 tons on 1911. The London market is, on the whole, strong. A good share of recent activity came from bull covering. Germany, as usual, appears to be absorbing copper on a heavy scale, and English manufacturers are also said to be booking good orders.

Fatality.—A correspondent reports that an apprentice at the Sheffield works of the Provincial Motor Cab Co. was killed on Tuesday. He took hold of a displaced electric conduit pipe which contained a live wire, and he was unable to release his hands. Hearing his shrieks, the workpeople rushed to his assistance, but they had to sever the pipe before the lad's hands could be loosened. The flesh was burnt to the bone. He was in a state of collapse, and was hurried to the hospital, but he died before medical aid could be given.

The Extraction of Nitrogen.—The commercial success of undertakings engaged in the extraction of nitrogen from the atmosphere is claimed to have hitherto been dependent upon the possession of large water-powers able to yield cheap power, and for this reason Norway is the centre of the industry. On the other hand, water-power in Sweden is said to be costly, and there is only one works—the Stockholm Superfosfat Fabriks A.B.—which is based upon the use of water-power. In this connection it is reported from Gothenburg that Messrs. Bjorne and Torsell, Swedish engineers, some time ago devised a different process for the extraction of nitrogen from the atmosphere, whereby the use of water-power is declared to be made of subsidiary importance. A company was formed in Gothenburg a year ago, under the title of the Kvafveindustri, for the purpose of working the method, and the results obtained by the experimental works have proved satisfactory. It is now intended to erect a large factory for the working of the process on a considerable scale.

Legal Query.—The following paragraph, received after part of this issue had gone to press, should be added at the end of our "Legal Query" column, page 480 (reply to "Lex").—There does not appear to be any statute or decision which bears upon the latter part of the question—namely, Is a local authority obliged to publish the amounts of tenders made, or to disclose them to any ratepayer who may apply for the information? The statute merely provides that tenders shall be advertised for; but it does not go on to state that the results of the advertisement shall be made public, or that a ratepayer may demand the information. Nor can it be said to be the general duty of a local authority to disclose information of this kind, because it is common practice in statutes relating to local government to provide that certain information shall be at the disposal of ratepayers on payment of specified fees.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—From an Irish paper we gather that MR. R. B. GRANGER, borough electrical engineer of Limerick, has resigned his position. A successor is to be appointed within two months; the candidates at the time of Mr. Granger's appointment are to be asked to send in applications, the qualifying examination to apply. Intending applicants may, with advantage, read the *Limerick Chronicle*, of September 7th. Mr. Granger has only recently taken up the Limerick appointment, in fact the Paisley Electricity Committee has just sent him a letter appreciative of his services, and is discussing the appointment of his successor at Paisley.

The Islington Electric Lighting Committee have resolved to recommend to the B.C. that an honorarium of five guineas shall be presented to each of the under-mentioned officials as a recognition of their promptitude in extinguishing the fire on the switchboard at the electricity works on Monday, 9th inst., and for the expeditious manner in which they succeeded in restoring the normal supply in the borough :—MR. M. J. ALLWARD, station superintendent; MR. T. A. G. MARGARY, mains superintendent; MR. CHAS. F. WADE, engineer-in-charge; MR. ST. CLAIR COMPTON, assistant engineer-in-charge; and MR. J. B. PALMER, representative of the British Westinghouse Co., who is in charge of the constructional work on the new switchboard which was very seriously damaged by the fire.

MR. H. W. LAWRENCE has left the Newcastle-on-Tyne Electric Supply Co. to take up the position of station superintendent under the Sudan Civil Service, and will be stationed at Khartoum.

The Battersea B.C. has appointed MR. FREDERICK TYRRELL as commercial assistant to the electricity undertaking.

The note which appeared in our last issue referring to "Mr. Alfred Wm. Barnett, chief electrical engineer at the Ocker Hill generating station," should have read "MR WM. A. BARNETT, shift engineer at the Ocker Hill station," the latter gentleman being the recipient of various presents on the occasion of his marriage to the lady mentioned. The error on the part of our correspondent, for which we offer our apologies, is to some extent explained by the similarity of the names and occupations of the gentlemen referred to.

On the occasion of his marriage, MR. L. DE ROME, of the Keighley Corporation electricity staff, has been presented by his colleagues with a barometer and three flower vases.

MR. C. H. THOMAS, who is leaving the Stoke-on-Trent electricity works to take up a position with the Llanelly Electric Power Co., under Mr. P. J. S. Tiddeman, the former chief at Stoke, has been presented by his colleagues with a dinner service and pair of vases.

The Worcester T.C. has increased the salary of MR. RONALD SMITH, chief assistant at the electricity works, from £156 per annum to £167, with a further annual increase of £11 for three years. Small increases have also been given to MR. E. PAGE, station superintendent, and MR. H. SMITH, shift engineer.

The staff of the Exeter City Electricity Department have presented a barometer to MR. R. C. TOTHILL, late official canvasser for the department, on his resignation.

The Harrogate T.C. has been recommended by the Lighting Committee to increase the salary of the borough electrical engineer by £50 a year.

MR. GEO. D. MALCOLM, assistant mains superintendent at the Borough Electricity Works, Tynemouth, has been appointed distribution engineer to the Stockton-on-Tees Electricity Department.

MR. H. W. WOLTON has resigned his position on the commercial staff of the City of Birmingham electric supply department to take up an appointment with the A.E.G. Electric and Manufacturing Co., Ltd., as their power representative for the Midlands.

MR. E. SIMISTER, who had been offered an appointment at Salford, has decided to remain with the Bury electricity department as canvassing engineer.

Tramway Officials.—MR. CHAS. BURGESS, tramway manager at Wigan, who had been appointed general manager of the tramways at West Hartlepool, has been presented by the Corporation tramway staff and employés at Wigan, with an oak smoker's cabinet.

General.—MR. C. HAMILTON WICKES, H.M. Trade Commissioner for the Dominions of Canada and Newfoundland, has recently visited the works of the General Electric Co., Ltd., at Witton, near Birmingham, upon a tour of inspection, prior to his departure from this country to take up his new duties.

MR. H. J. LOUGHLIN, late of the British Westinghouse and the Chloride Electric Storage Companies, sails for Iquique, Chile, on the 25th inst., under a three years' contract, to take up a position on the staff of J. K. Robinson.

MR. PERCY A. SANDERS, A.M.I.M.E., has been elected a director of the firm of Davey, Paxman & Co., Ltd. Mr. Sanders originally served his apprenticeship with the firm, and was for several years with the General Electric Co., at Schenectady, U.S.A., subsequently holding an important position with the British Westinghouse Electric and Manufacturing Co., Ltd., at Manchester.

The following War Office appointment is announced in the *London Gazette* for September 13th :—"MAJOR ALGERNON H. DUMARESQ, Royal Engineers, to be Inspector of Electric Lights at the War Office, vice Lieut.-Col. E. C. Seaman, Royal Engineers."

At Middlesbrough Parish Church on September 11th, the marriage took place of MR. JAS. ROBERT BEARD, of Newcastle-on-Tyne, and Miss Gertrude Robinson, second daughter of Councillor W. H. Robinson, of Middlesbrough.

The marriage took place at St. David's Church, Beaufort, on September 9th, of MR. DAVID ARTHUR PRITCHARD, electrical engineer, of Westgrove, Pennsylvania, U.S.A., and Miss Marie Llewelyn, eldest daughter of the vicar of the parish, the Rev. D. J. Llewelyn.

A Montreal paper states that, on 5th inst., MR. W. D. MATTHEWS, a director of the Canadian General Electric Co., was elected vice-president, to fill the place of the late Mr. H. P. Dwight. The vacancy on the board caused by the death of Mr. Dwight has been filled by the appointment of Mr. F. Gordon Osler.

NEW COMPANIES REGISTERED.

Rural Districts Electric Undertakings, Ltd. (124,045).—Registered August 30th, by Herbert Smith, Goss, King & Gregory, 62, London Wall, E.C. Capital, £50,000 in £1 shares. Objects: To carry on business as electricians, mechanical engineers and suppliers of electricity for light, heat, motive power, traction, communication or otherwise, generators, accumulators, distributors and suppliers of electricity, to construct, lay down, establish, and fit all necessary power stations, cables, wires, lines, accumulators, lamps, and works. The signatories (with one share each) are :—W. R. Smith, 6, Lawley Street, Lower Clapton, N.E., solicitor's clerk; C. A. Warter Wilson, 5, Norfolk House Road, Streatham, S.W., clerk; C. Anning, Ellerslie, Sylvan Road, Snaresbrook, clerk; J. Barnes, 7, Walcot Gardens, Kennington, S.E., accountant; H. I'Anson Jones, 62, London Wall, E.C., solicitor; F. D. Billett, 5, Blurton Road, Lower Clapton, N.E., clerk; W. R. Tompkins, Morecroft House, Brampton Road, St. Albans, clerk. Minimum cash subscription, 500 shares. The first directors (to number not less than two or more than seven) are O. H. Valpy, 36, Sloane Court, S.W.; J. H. P. Berthon, 16, Randolph Road, W.; E. H. Lyddon, 122, Bute Street, Cardiff; H. T. Harrison, 11, Victoria Street, S.W.; and S. G. Leech, 91, York Street, Westminster, S.W. The two last named are managing directors; qualification, £100; remuneration, £50 each per annum (£25 extra for chairman). Registered office, 91, York Street, Westminster, S.W.

Universal Cable Code (Parent) Co., Ltd. (124,148).—This company was registered on September 6th, with a capital of £4,000 in 2,500 7 per cent. cumulative preference shares of £1 each and 30,000 ordinary shares of 1s. each, to produce, advertise and publish (yearly or otherwise) a publication to be called the "Universal Cable Coding System," and to adopt an agreement with C. Rutherford. The subscribers (with one share each) are :—B. A. Biddulph, 11A, Frederica Road, Chingford, superintendent; H. Horne, 61, Stanwick Mansions, West Kensington, W., superintendent. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first director), £25; remuneration as fixed by the company. Registered office, Halton House, 20-23, Holborn, E.C.

Landis & Gyr, Ltd. (124,087).—This company was registered on September 3rd, with a capital of £2,000 in £1 shares, to carry on the business of electrical and general engineers, manufacturers of and dealers in all kinds of plant, machinery, engines, appliances, apparatus and implements used in connection with generation, distribution, supply, accumulation and use of electricity, &c. The subscribers are :—K. H. Gyr, Zug, Switzerland, manufacturer of electrical apparatus, 400 shares; L. R. Lester, Rosemary Cottage, Chipstead, Surrey, engineer, 200 shares. Private company. The first directors are K. H. Gyr, L. R. Lester and H. Landis. Registered office, 28, Denman Street, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electrical and Industrial Investment Co., Ltd. (122,256). Particulars of two series of £100,000 debenture stock, with interest at 5½ per cent. and 4½ per cent. respectively, and secured by trust deeds dated August 12th, 1912, pursuant to Sec. 23 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property: The company's undertaking and property, present or future. Trustees: Electric and General Investment Co., Ltd.

"Cedes" Electric Traction, Ltd. (109,698).—Return dated July 13th, 1912 (filed July 20th). Capital, £20,000 in £1 shares; 3,000 shares taken up; £3,000 paid. Mortgages and charges: Nil.

Clontarf and Hill of Howth Tramroad Co.—The report of the directors for the year ended December 31st, 1911, shows a balance available for division of £1,279. It is proposed to pay a dividend for the past half-year at the rate of 3 per cent. per annum, with one shilling per share bonus out of the accumulated surplus profits over and above the dividends paid during the past five years, and to carry forward £279 to next account. An interim dividend at the rate of 3 per cent. per annum was paid in respect of the half-year ended June 30th, 1911.

Winnipeg Electric Railway Co.—The directors have declared a quarterly dividend on the capital stock (exclusive of the recent issue of new shares) at the rate of 12 per cent.

Russian Schuckert Co.—The accounts of this St. Petersburg company for 1911-12, after allocating £6,700 to depreciation, as against £6,600 in 1910-11, show net profits of £16,592, as compared with £15,070 in the previous year. A dividend at the rate of 5 per cent. has been declared, this contrasting with 4 per cent. in 1910-11. It is now proposed to increase the share capital from £200,000 to £300,000 by the issue of new shares at the price of 106 per cent.

CITY NOTES.

Capital Expansion in Germany.

The board of the Berlin-Hagen Accumulator Works Co. contemplate an increase of £200,000 in the ordinary share capital, thus raising it to £600,000. Although the present quotation for the shares exceeds 500 per cent., the directors have decided to grant a considerable bonus to the shareholders by offering them the new shares at par value. The company possesses practically a monopoly of the trade in secondary batteries by reason of its agreements with the large manufacturing firm, and the dividend paid in 1911 was at the rate of 25 per cent., as against 15 per cent. in the preceding year.

The Siemens-Schuckert Works, whose ordinary capital of £4,500,000 is jointly held by the Siemens & Halske Co. and the Elektrizitäts Gesellschaft vorm. Schuckert & Co., propose to make a fresh issue of £1,500,000 in 4½ per cent. obligations, which are to be taken over by a banking syndicate which has already applied for the admission of the loan on the Berlin Stock Exchange. Two loans, totalling £2,500,000, are at present in circulation, and the further emission will increase the amount to £4,000,000. In addition, the two proprietary companies have advanced £2,500,000 in the form of a 6½ per cent. non-terminable loan, so that the combined share and loan capital will soon amount to £11,000,000. No official statement has yet been issued regarding the purposes to which the loan is proposed to be devoted, and it is, therefore, assumed that the proceeds are intended to strengthen the financial resources of the company. At the same time, it has to be borne in mind that the company took over £425,000 of shares in the Bergmann Electricity Works Co. a few months ago at the price of 110 per cent.

The directors of the Allgemeine Elektrizitäts Gesellschaft announce that they have under consideration the question of proposing an increase of £1,250,000 in the ordinary share capital at the general meeting in November. Presumably, the new shares will participate in the dividend as from July 1st, 1912, and be offered to the shareholders in the ratio of one new share for seven existing shares at the price of 210 per cent., whilst the balance remaining will be disposed of for the account of the company. The augmentation of capital is intended to maintain the liquidity hitherto prevailing, notwithstanding the very considerable extension of the works and the growing volume of business. This announcement had been expected for some time past, and the realisation of the scheme will raise the total share capital to £7,750,000. The preferential right of subscription granted to shareholders represents £925,000, leaving £325,000 to be placed otherwise, and the total issue will produce over £2,500,000. It is calculated that the cash proceeds from the issue of shares since 1883 have yielded a premium of £4,250,000, inclusive of the impending emission, but leaving entirely out of consideration the large blocks of shares which have been exchanged for shares in other undertakings in the course of years. The ordinary capital expansion is illustrated by the following table :—

Year.	Ordinary share capital.	Price of issue.
1883	£250,000	—
1887	600,000	122 per cent.
1889	800,000	150 ,,
1889	1,000,000	165 ,,
1895	1,100,000	165 ,,
1896	1,250,000	175 ,,
1897	1,750,000	190 ,,
1897	2,350,000	
1899	3,000,000	200 ,,
1904	4,300,000	—
1905	5,000,000	194½ ,,
1910	6,500,000	200 ,,
1912	7,750,000	210 ,,

The present price of the shares slightly exceeds 267 per cent. Apart from the ordinary shares the company has loan capital amounting to £4,000,000, of which £1,500,000 was issued last year, and the grand total represents the nominal sum of £11,750,000. During the past 12 months the company has entered upon numerous undertakings of various kinds, and the new issue of capital is presumably intended to provide funds so as to be ready for the future development of railways, overland central stations and other enterprises.

Dundee, Broughty Ferry and District Tramways Co., Ltd.—The profit for the year (including the sum brought forward from last year), after providing for interest on debenture stock, amounts to £5,471. From this there falls to be deducted the interim dividend on the preference shares for the half-year to January 31st, 1912, at the rate of 6 per cent. per annum, which absorbed £1,500, leaving a balance of £3,971. The directors propose to deal with this sum as follows :—Final dividend on preference shares, £1,500 ; to renewals fund, £600 ; to sinking fund for redemption of debenture stock, £600 ; to pay dividend on the ordinary shares at the rate of 2½ per cent. per annum, £718 ; and to carry forward to next account, £552. Receipts for the year show an increase of £735, and the expenditure an increase of £470.

Shawinigan Water and Power Co.—At a meeting on September 3rd the issue of $5,000,000 additional capital was authorised. The capital stock is now $25,000,000.

German Electrical Companies.

The Kabelwerke Rheydt, after making provision for reserve and depreciation funds, proposes to pay 8 per cent. on the share capital of £250,000 for 1911-12. This result compares with a slight loss on the preceding year.

[illegible] £15,500 in 1911-12 on an ordinary share capital of £150,000, as compared with £14,700 in the preceding year, and a dividend of 8 per cent. has been declared, as against 7½ per cent. in 1910-11. This company owns and works various overland central stations whose business is constantly increasing, and the results are very satisfactory having regard to the class of stations in question.

[illegible] increase in the volume of trade in 1911-12, although the pressure of competition caused sale prices to further decline. The provision made for depreciation is £6,800, as compared with £5,600 in 1910-11, leaving net profits and balance forward of £15,300, as contrasted with £15,000. A dividend of 10 per cent. has been declared, this being the same rate as in 1910-11.

The accounts of *Brown, Boveri & Co.*, of Mannheim, show that the sum of £27,000 has been allocated to depreciation in 1911-12, as contrasted with £21,000 in the previous year, the net profits being returned at £21,700, as against £17,500 in 1910-11. A dividend of 5 per cent. has been declared on the share capital of £300,000, as compared with 4 per cent. in the former period. According to the directors' report, the considerable increase in the production was solely responsible for the better results, as the improvement in prices was only slight and was more than equalised by dearer raw materials and advances in wages. The largest share of the total output was again taken by steam turbines, which had a greater sale. The departments for electrical machinery and apparatus were also fully employed, mainly with plant for mines and ironworks and allied branches. Very favourable results were obtained with the company's system of main shaft winding installations, and many fresh orders were received. The recently introduced safety and governing apparatus had met with special recognition and led to the hope of considerable orders in the new year. As to the future prospects, the report states that the company entered the present financial year with a large stock of orders, which will provide full employment during the year.

The report for 1911-12 of the *Wolfram Lampen A.G., of Augsburg*, which has not paid any dividend since the undertaking was established in 1906, states that the company was compelled to make further reductions in prices in the second half of the year, in consequence of the action taken by several leading competitors, and trade competition has recently become aggravated, particularly in the export business. The introduction of drawn wolfram wire had also proved unfavourable to the company, as the working up of stocks bought at high prices, either resulted in a loss or yielded no profits. Employment was fairly satisfactory, and the turnover increased by 40 per cent., as compared with the previous year. The competition of the three principal firms with drawn-wire filaments had been met by the invention of a new lamp, which has not a drawn filament. It is claimed that the metallic-filament of this lamp when in constant use, is more durable than a drawn filament, although the manufacture of drawn wolfram filaments has also been undertaken, as it enables the cost of production to be considerably reduced. After placing the sum of £14,300 to depreciation in 1911-12, as compared with £11,500 in the preceding year, the accounts indicate a loss of £26,000, as against a loss of £4,200 in 1910-11. The reserve fund of £6,100 is drawn upon to meet a portion of the loss, leaving a large deficit to be carried forward. It is now proposed to reconstruct the company by reducing the share capital from £150,000 to £30,000, so as to extinguish the deficit and further provide for depreciation, and then to increase the capital to £60,000.

Stock Exchange Announcements.—The Committee has appointed Thursday, October 3rd, a special settling day in Empire District Electric Co. fully-paid scrip for $1,500,000 first mortgage 5 per cent. sinking fund gold bonds.

British Insulated and Helsby Cables, Ltd.—According to a financial daily the directors have declared an interim dividend at the rate of 8 per cent. per annum, less tax.

STOCKS AND SHARES.

Tuesday Evening.

Another wild outburst of buying of some of the Underground Railway stocks stands out as the prominent feature of the week in the electrical markets. Metropolitans have been especially conspicuous. The Metropolitan Electric Lighting group remains as "hard as nails," to speak colloquially. There is a good deal of business doing in one section and another, the pressure of a little monetary tightness in New York and London failing to affect prices to any appreciable extent.

Metropolitans, after rising no less than 6 since last week, reacted to 63, making a gain of 2 on balance, and this latest advance comes, of course, on the top of an earlier movement in the same direction. Indeed, the stock is 15 points higher than it was at one time this year. Rumour still attaches the company to one of its bigger brethren, which is supposed to be angling for control, the *quid pro quo* being reported as a 3½ or 4 per cent.

guaranteed dividend on the present Metropolitan stock. Some official notification is expected hourly, and the market is on the tip-toe of expectation for something of this sort. Districts have followed more leisurely, but the price is higher on the week. City and South London rose 2, this being another case in which rumours of absorption are playing an important part. Central London stocks are better, the Preferred being 2 higher at 85. Underground Electric Railways issues have come into further prominence, and long-sighted investors are buying the Company's £10 shares, while the Income bonds are being picked up by people with a speculative turn of mind, who look for a full dividend next year. There is a lively gamble going on in the "A" 1s. shares, and the price has risen to 15s. 9d.

The extraordinary developments of the London General Omnibus Company supply the motive power for these rises in Underground Electric shares, and it must be admitted that the strides made by the 'Bus Company have been nothing short of phenomenal.

There is a better tone also for Metropolitan Electric Trams and British Electric Traction issues. The Tramway Deferred shares are once more 5s. middle, and the demand for British Electric Tractions has extended to the 6 per cent. Preferred. Attention has been drawn to the 4½ per cent. Debenture of the Yorkshire West Riding Company, the return on which is nearly 5½ per cent., while the security is not at all bad. It is naturally a lock-up investment, not likely to move either up or down with any degree of rapidity. London United Tramways Debenture stock has lost a point.

The list of English electricity supply shares contains several rises, of which 30s. in City of London Ordinary is the principal. Speculative buying of these has wiped out the loss of the past fortnight, and vague reports are already being circulated again. County Ordinary at 11¾ *ex* dividend are 6s. 6d. higher. Metropolitans and Kensingtons rose ¼, and the market is considerably harder than might appear from the quotations in the Official List. Judged from the list of bargains officially recorded, it might not be supposed that there was any interest being taken in this market; but, in point of fact, it is being keenly watched, and any shares that come in are readily taken. Meanwhile, proprietors are holding tenaciously to their shares, many of them, no doubt, in the expectation of something coming of the rumours which have begun to crystallise in regard to a linking-up scheme through the Metropolis. Probably there is nothing more in this idea than there has been for the past two years, but amalgamations are the fashion of the day. Fortunes have been made out of working agreements in the shipping and other markets just lately, and the words themselves have come to bear a magical meaning, to which the full charm of sentiment lends its weight.

The Telegraph department is quietly steady, with Great Northerns 10s. up, and Eastern Ordinary better to the same extent. Westerns are also in request by reason of their good yield, but the Anglo-American descriptions are a trifle irregular. The demand for South American Telephone shares is unabated. Chile Telephones and United River Plate Telephones are both higher on the week. Reuters gained ⅛, being now 10½ middle, and the new shares are better at 5. Marconis, after wide fluctuations, show very little change, and National Telephone Deferred parted with 30s. of its previous substantial gain.

One of the new introductions is the Common stock of the Columbia Gas and Electric Company, the $100 fully-paid shares being quoted at 18½. The Company operates, not in Columbia, as might have been expected, but in West Virginia, Kentucky and Cincinnati, and its activities cover a wide scope. The shares can only be regarded as a thorough speculation. Their hopes of dividends lie in a big expansion of the present profits, which are, however, going ahead at a rapid rate. The Mexican group is inclined to be easier, both Mexican Light and Power and Mexico Tramways giving way in consequence of the unsatisfactory news with respect to the rebellion in the country. Mexican Electric Fives are 2½ down. Rio Trams, on the other hand, are better, and Sao Paulos recovered the dividend deducted last pay-day. Brisbane Tramway shares and stocks are stronger, but rather a feature is a fall of ⅜ in Madras Ordinary. Baltimore Gas and Electric Ordinary and Preferred continue to creep up, gains of 2 and 1 respectively occurring this week.

The Manufacturing division shows another rise of 10s. in India-Rubber shares, the expectation being that the Ordinary shares of the company will re-enter the dividend list at an early date. Telegraph Constructions and Henleys are both better. Rubber shares are a dull and somewhat disappointing market in consequence of the sagging of the price of the raw stuff. The rise in metals other than gold has brought about active dealings in the shares of all the mining companies concerned, and City promoters are busily searching Cornwall and Devonshire for likely tin mines. As usual in a rise, the prices of all the metals are being talked better, the "bulls" of lead being particularly hopeful.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the half-year to June 30th.

Direct Spanish Telegraph Co., Ltd.—The board have decided to pay, in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, and payable on October 1st.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Sept. 11	3,416	+ 196	16	24,548	— 175	14·4	..
Ayr	" 14	610	— 30	17	7,668	+ 122	8	..
Bath	..	..	..	..	..	..	..	..
Birkenhead.. ..	..	..	..	..	..	..	..	..
Birmingham Corp.	" 7	21,392	+3,406	23	243,029	+56,521	57·17	..
Blackburn	" 11	2,447	- 135	24½	29,444	— 14	14·62	..
Blackpool Corp. ..	" 12	6,418	— 360	..	50,589	+ 4,934	11·87	..
Blackpool-Fleetw'd	" 14	3,412	— 15	10	18,468	— 1,019	8	..
Bournemouth ..	" 11	4,953	+ 180	23½	48,075	+ 1,110	21·95	..
Bradford	" 7	10,869	— 130	23	199,922	— 2,367	56	1·2
Brighton	" 15	2,440	— 171	24	27,724	— 1,075	9·5	..
Bristol	" 18	15,350	+1,135	..	256,169	+18,731	80·5	..
Brit. Elec. Trac. Co.								
Airdrie	" 6	656	+ 199	36	10,655	+ 2,841	3·65	..
Barnsley	" 6	397	+ 27	"	6,352	— 274	..	..
Barrow	" 6	859	+ 55	"	13,937	+ 2,875	5·37	..
Devonport ..	" 6	1,095	— 60	"	19,422	+ 1,487	8·85	..
Gateshead ..	" 6	2,180	+ 50	"	37,191	— 165	11·25	..
Gravesend ..	" 6	470	— 15	"	7,512	— 214	6·5	..
Greenock.. ..	" 6	1,901	+ 192	"	29,235	+ 3,041	7·25	..
Hartlepool ..	..	..	..	..	..	..	..	..
Kidderminster ..	" 6	277	— 19	"	4,425	+ 26	..	..
‡Leamington ..	" 6	441	— 69	"	6,884	+ 336	..	..
Merthyr	" 6	440	+ 4	"	7,166	— 401	2·9	..
Metropolitan ..	" 6	18,432	—1,441	"	318,018	+ 525	[illegible]	..
Middleton ..	" 6	699	30	"	12,155	— 409	8·5	..
Mid.Joint Com'tee	" 6	7,014	+ 274	"	117,165	+ 5,215	..	..
Oldham—Ashton	" 6	1,240	+ 13	"	21,993	+ 1,305	9·18	..
Peterborough ..	" 6	304	— 17	"	4,979	+ 312	5·81	..
Potteries	" 6	3,999	+ 89	"	67,624	— 1,377	29	..
Rothesay	" 6	829	+ 75	"	9,097	+ 307	2·75	..
Southport ..	" 6	662	— 86	"	11,050	— 330	8·17	..
S. Metropolitan..	" 6	1,763	— 267	"	30,876	— 927	..	..
Swansea	" 6	2,471	+ 17	"	41,499	+ 53	12·5	..
Tynemouth ..	" 6	689	— 90	"	9,314	- 975	3·75	..
Weston-s-Mare ..	" 6	654	— 252	"	5,763	— 1,218	8	..
‡Worcester ..	" 6	685	— 56	"	10,740	— 76	5·75	..
Wrexham	" 6	876	+ 149	"	4,135	+ 484	..	..
Yorks. Wool. Dist.	" 6	2,199	86	"	38,883	+ 878	17	..
Miscellaneous ..	" 6	515	— 19	"	8,434	+ 86	..	..
Burnley	" 14	3,199	+ 134	..	..	.	12 4	1
Burton-on-Trent ..	" 15	534	— 42	24	6,642	- 498	6·6	..
Bury	" 8	1,270	- 70	23	30,512	- 800	22·5	..
Cardiff	Aug. 24	2,600	+ 159	21	51,725	— 2,847	17·35	..
Chatham and Dist.	Sept. 12	1,794	- 210	57	31,670	371	14·98	..
Cork	" 12	1,019	— 204	[illegible]	17,945	— 901	9·89	..
Croydon	" 6	3,535	— 230	23	42,757	— 1,198	11·6	·75
Darlington.. ..	" 7	230	— 2	23	5,217	+ 41	4·87	..
Darwen	" 13	587	12	24	6,799	+ 131	4·36	..
Dover	" 7	610	— 83	23	6,222	— 469	4·75	..
Dublin	" 13	12,270	— 96	..	36,490	— 9,837	54·25	..
East Ham .. .	" 14	2,120	— 108	24	25,806	- 411	7·87	..
Exeter .. .					.			..
Glasgow	" 14	38,413	—2,313	37	211,942	- 4,669	98	..
Hastings	" 16	2,765	317	..	..		19·3	..
Huddersfield ..				..			.	
Hull	" 14	5,925	+ 232	24	69,688	+ 526	13·5	—1
Ilkeston	" 12	254	25	24	2,615	656	..	..
Ipswich	" 7	1,053	— 90	23	11,115	- 173	10·5	..
Kilmarnock . ..	" 14	315	+ 4	17	2,943	226	4·25	..
Lancashire United	" 11	2,969	— 54	39	49,527	— 521	[illegible]	..
Leeds	" 14	15,671	+ 236	24	188,515	+ 5,290	112·7	..
Leicester	" 14	5,030	— 1	37	93,901	+ 2,670	20	..
Leith	" 14	1,317	— 22	17½	12,687	+ 70	8·72	..
Liverpool	" 7	24,331	+1,269	35½	429,964	+19,454	117	1
‡L.C.C.	" 4	80,376	—6,135	.	952,191	—47,994	141·1	—·5
London United ..	" 14	12,676	—1,578		235,639	—12,893	..	..
Lowestoft	" 14	620	229	50	10,280	— 850	8·5	..
Manchester ..	" 14	33,455	+ 727	24	404,758	+12,710	105	..
Newcastle	" 14	8,693	+ 435	..	105,023	+ 733	31·3	..
†Newport	" 7	743	+ 21	23	15,377	- 761	7·25	..
Oldham	" 15	3,831	63	25	51,899	+ 2,735	28	..
Pontypridd	" 14	900	+ 91	24	9,330	— 744	5·5	..
Portsmouth.. ..	" 14	4,797	— 466	24	56,347	— 4,658	16·75	..
Preston	" 11	1,709	+ 42	24	20,351	+ 911	10	..
Rotherham	" 11	1,595	+ 179	23½	17,179	+ 985	12	..
Salford	" 9	10,164	+ 314	23	118,006	+ 2,603	41	..
Sheffield	" 17	18,448	+ 771	25	165,001	+ 5,471	40	..
Southampton ..	" 11	2,721	— 135	23	30,895	— 107	11	..
Southend-on-Sea ..	Aug. 28	2,503	+ 213	22	19,749	+ 2,152	7	..
South Shields ..	Sept. 14	1,295	+ 33	24	15,567	— 211	10·25	..
Tyneside	" 11	985	— 37	11	5,878	— 889	11	..
Wallasey	" 14	2,269	— 108	23½	28,163	— 485	8·72	..
Walthamstow ..	" 14	1,460	— 125	24	18,913	— 639	9	..
West Ham . ..	" 5	5,255	— 240	22½	60,801	— 2,215	16·45	1·2
Wolverhampton ..	" 11	1,995	— 10	24	24,436	+ 249	13·75	..
Cen. London Rly...	" 14	9,251	+ 613	11	47,752	+ 434	6·78	·5
City & S. Lon. Rly.	" 15	5 597	— 691	11	31,274	— 2,308	7·26	..
Dublin-Lucan Rly.	" 13	841	— 8	11	1,790	— 138	7	..
G.N. and City Rly.	" 7	1,318	— 19	10	13,320	+ 88	8·5	..
L'pool Overh'd Rly.	" 15	8,286	+ 19	..	18,682	+ 1,635	6·6	..
Llandudno-Col. Bay	" 13	1,384	+ 152	41·5	13,739	+ 608	6·5	..
Lond. Elec. Ry. Co.	" 14	24,005	+ 715	..	182,100	+ 4,605	21·25	..
Mersey Railway ..	" 14	8,895	+ 572	11	22,489	+ 2,721	4·5	..
Metropolitan Rly...	" 15	82 880	+ 581	11	182,837	+ 5,014	25·75	..
Met. District Rly...	" 14	23,948	+2,332	..	129,768	+11,578	25	..
Anglo-Argentine ..	" 16	104,282	+8,442	87	1,871,653	+67,255	..	..
§Auckland	Aug. 2	18 853	+2,154	5	21,858	+ 5,659	23·81	..
Bombay (B.E.T.) ..	" 22	4,782	+ 106	83	101,051	+ 4,768	..	..
§Brisbane	Aug.	27,680	+3,030	8	158,394	— 5,126	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 14	8,697	+ 651	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Aug.	3,387	..	..	25,587	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 15	1,785	+1,638	..	28,355	+ 3,165	13·5	·6
§Montevideo ..	Aug.	26,249	+2,234	10	290,107	+39,834	..	..
Perth (W.A.) ..	Sept. 13	3,664	+ 525	..	68,672	+ 9,746	29	..

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* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 17th.	Rise + or Fall	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	9¾— 10¼	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8¾— 9¼	..	4 12 1
Do. Second 6 % Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	10†	8¾— 9¼	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	7¾— 8¼	..	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4¾— 5¼	+ ¼	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝— 4⅞	+ ⅛	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾— 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5	4¾— 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	8	17 — 19	+1	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	5	6	11 — 12 xd	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅝— 12⅜ xd	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅞— 1⅛	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾— 5¼	..	5 14 8
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 15 8
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	9	7½— 8	..	5 12 6

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 17th.	Rise + or Fall	Present Yield p.c.
	*	1910	1911			£ s. d.
Kensington & Knightsbridge, Ord	5	9	9	7¾— 8¼	+ ¼	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2½	1 — 2	+ ⅛	3 15 0
Do. 6 % Pref.	5	6	6	5 — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4	4 — 4½	+ ¼	4 14 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 4⅞	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅝— 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16 2
Notting Hill, 6 %, Non-Cum. Pref.	10	..	6	10 — 11	..	5 9 1
Oxford	5	7½	7½	6 — 6½ xd	..	5 16 0
St. James' and Pall Mall, Ord.	5	10	10	9¼— 9¾	..	5 5 3
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	+ 2	3 19 7
Smithfield Markets, Ord.	5	Nil	2	1⅛— 1⅞	..	..
South London, Ord.	4	5	5	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1¼— 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	£3	5	..	½— ¾	..	..
Do. 5 % Cum. Pref.	5	5	2	2½— 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½— 88½	..	5 1 8
Westminster, Ord.	5	10	10	8¾— 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5½	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼— 5¾	..	5 4 4
Calcutta, Ord.	5	8½	8½	7½— 8	..	5 6 3
Do. 5 % Pref.	5	5	5	4 15/16— 5 5/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95½— 97½	..	5 2 7
Canadian Gen. El. Com.	$100	7	7†	114 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	121 —125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	8	8†	1⅜— 1⅞	..	3 4 0
Do. 5 % Deb.	100	5	..	96 — 99	+1	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	— ½	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	[illegible]	+ [illegible]	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	..	..	1½— 2	— ⅜	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½— 88½	2½	5 13 0
Mexican Lt. & Power, Common	$100	4	4	95 — 98	—1	4 0 10
Do. 7 % Cum. Pref.	$100	7	7	109 —112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98	— ½	5 2 0

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Montreal, Lt., H. and Power	$100	7	8	232 —237	..	3 7 6
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42	..	..
River Plate, Ord.	Stock	10	10	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	101 —103	..	4 17 1
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	152 —157	+1	3 3 8
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	+ ½	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 95	..	5 5 3
Victoria Falls Power, Pref.	1	Nil	11⅞d.	31/32— 1 1/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼— 7¾	..	5 8 3
Do. 5 % Deb. Red.	Stock	5	5	95½— 97½	..	5 2 7
American Telep. & Teleg., Cap.	$100	8	8†	147 —149	— ½	5 7 5
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph	Stock	3¾	3	67½— 69½	..	5 7 11
Do. 6 % Pref.	Do.	6	6	113½—114½	+ ¼	5 4 10
Do. Def.	Do.	30/-	30/-	26¼— 26¾	+ ⅛	5 12 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	..	7½— 7⅞	+ ⅛	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	83½— 85½	..	4 13 7
Cuba Telegraph	10	6	6†	9½— 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾— 7¼	— ¼	6 17 11
Direct United States Cable	10	4½	5	7½— 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 —133	+ ½	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	..	3 18 10
Eastern Extension	10	7	7	13⅛— 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	98½—100½	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97½—100½	..	3 19 7
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12¾— 13¼	..	4 10 7
Great Northern Telegraph	10	18	18	28¾— 29¾	+ ½	6 1 0
Indo-European Telegraph	25	13	13	57 — 59	..	5 3 5
Mackay Companies Common	$100	5	5	87 — 91 xd	—1¾	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	68 — 70 xd	— ½	5 14 4
Marconi's Wireless Telegraph	1	5	20	5 7/16— 5 9/16	— 1/16	3 11 2
Do. 7 % Cum. Partic. Pref.	1	16	17	4¾— 5	..	3 8 0

Monte Video Telephone, Ord.	1	6	6	1 1/32— 1 3/32	..	5 6 8
Do. 5 % Pref.	1	5	5	13/16— 15/16	..	5 6 8
National Telephone Def.	Stock	6	6	155 —157	—1½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100½—101½	..	4 8 8
Oriental Telep. and Elec.	1	8	8	[illegible]	..	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 3/32— 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	3 18
Reuter's	[illegible]	5	5†	10¼— 10¾	+ ⅛	3 14 5
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 13 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	8	7⅜— 7⅝	+ ⅛	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅜— 5⅝	..	4 8 11
West Coast of America	2½	2½	2½	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	1½	½	3¼— 3¾	— ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10¼— 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾— 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	100½—102½	..	4 17 7
Western Telegraph, Ltd.	10	7	7	13¼— 13¾	+ ¼	5 1 10
Do. 4 % Deb.	Stock	4	4	96 — 98	−1	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 17th.	Rise + or Fall —	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 17th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.		*	1910.	1911.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	$\frac{3}{16}$ — $\frac{5}{16}$	..	Nil	Metropolitan Railway Consol. ..	100	1⅜	1⅞	62¾— 63½	+2	2 11 5
Do. 5 % Pref.	1	5	5	$\frac{11}{16}$ — $\frac{13}{16}$	..	6 8 1	Do. Surplus Lands	100	2¾	2⅞	64 — 66	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5	Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	+1	..	Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. Do. Deferred ..	100	..	..	6 — 8	..	..	Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Do. Do. 6 % Cum. Pr'f.	100	..	6	89 — 92	..	6 10 5	Metropolitan District Ord. ..	100	Nil	Nil	42½— 43	+1	Nil
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	+1	..	Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 5 % Perp. Deb. ..	100	5	5	98 —101	..	4 19 0	Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2	Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Central London Railway, Ord.	100	3	3	77 — 79	+1	3 15 11	Do. 4½ % First Pref.	100	3¼	4½	89 — 91	..	4 19 0
Do. Pref.	100	4	4	84 — 86	+2	4 13 0	Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Do. Def.	100	2	2	77 — 79	+1	2 10 8	Metropolitan Elec. Trams, Ord.	1	5½	6	1$\frac{1}{32}$— 1$\frac{3}{32}$	+ $\frac{1}{32}$	5 1 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5	Do. Def.	1	Nil	..	$\frac{7}{32}$ — $\frac{9}{32}$	+ $\frac{1}{32}$	Nil
City & South London, Ord. ..	100	1½	1⅝	39½— 40½	+2	3 7 11	Do. 5 % Pref.	1	5	5	$\frac{13}{16}$— $\frac{15}{16}$	..	5 6 8
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7	Do. 4½ % Deb.	100	4½	4½	97 — 99	+1	4 10 11
Do. Do. 1896	100	5	5	103 —105	..	4 15 3	Do. 5 % Deb.	100	5	5	100 —103	..	4 17 1
Do. Do. 1901	100	5	5	103 —105	..	4 15 3	Potteries, Ord.	1	2	..	$\frac{5}{16}$— $\frac{7}{16}$	..	..
Do. Do. 1903	100	5	5	102 —104	..	4 16 2	Do. 5 % Pref.	1	5	5	$\frac{17}{32}$— $\frac{23}{32}$	..	6 19 0
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3	Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
Dublin United Trams, 6 % Pref.	10	6	6	10½— 11½	..	5 2 2	South Metro. Trams, 6 % Pref.	1	6	..	$\frac{11}{16}$— $\frac{13}{16}$	..	7 7 8
Great Northern & City, Pr'f. Ord	10	Nil	..	2 — 2¼	..	Nil	Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Hastings Trams, 6 % Pref. ..	1	Nil	6	½— ¾	..	8 0 0	Underground Elec. Railways	10	..	..	4½— 4¾	+ ¼	Nil
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5	Do. "A"	1/-	..	..	¾— $\frac{13}{16}$	+ $\frac{1}{16}$	..
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼— 2¾	..	4 11 0	Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0	Do. 6 % Income	100	1	1½†	90 — 92	+ 1	..
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6	Yorkshire (West Riding), Ord.	5	Nil	..	¼— ¾	..	Nil
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6	Do. 6 % Pref.	5	Nil	3	2⅞— 3⅜	..	4 9 0
London United Trams, 5 % Pref.	10	Nil	..	4½— 5¼	..	..	Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5
Do. 4 % Deb.	100	4	4	71 — 75	—1	5 6 8							

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5	5½	5¼— 5½	..	5 2 4	La Plata Elec. Trms, Ord. ..	1	..	..	⅜— ⅝	..	..
Do. 2nd Pref.	5	5	5½	4⅞— 5⅛	— $\frac{1}{16}$	5 7 4	Do. Pref.	1	6	6	$\frac{29}{32}$— 1	..	6 0 0
Do. 4 % Deb.	100	4	4	93½— 95	..	4 4 3	Lisbon Elec. Trams, Ord. ..	1	5½	6	1$\frac{1}{16}$— 1$\frac{3}{16}$	+ $\frac{1}{16}$	4 11 5
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3	Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1	Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Auckland Trams, 5 % Deb. ..	100	5	5	103 —105	..	4 15 3	Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾— 12	..	5 0 0	Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	..	5 7 6
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11	Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Do. 5 % 2nd Deb.	100	5	5	98 —100	+1	5 0 0	Mexico Trams Com.	$100	7	7	126 —129	—1	5 8 6
Brisbane Trams Invt., Ord. ..	5	8	8	7½— 7¾	+ ⅛	5 4 11	Do. Gen. Con. 5 % Bonds ..	..	5	5	98½—100½	— ½	4 19 6
Do. 5 % Pref.	5	5	5	5 — 5⅜	+ ⅛	4 13 0	Do. 6 % Bonds	100	6	6	102½—104½	— ½	5 14 10
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0	Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7½ — 7¾	..	6 7 0
B. Columbia Elec. Rly., Def. ..	100	8	8	143 —148	..	5 8 1	Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. Pref. Ord.	100	6	6	120 —125	+1	4 16 0	Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 1	Perth (W.A.) Elec. Tr., Ord. ..	1	2½	..	1⅛— 1⅜	+ $\frac{3}{32}$	1 16 4
Do. 4½ % 1st Mort. Deb. ..	100	4½	4½	99½—102½	..	4 7 10	Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9	Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼— 5¾	..	5 4 4
Do. 4½ % Con. Deb.	100	4½	4½	101 —103 xd	..	4 7 5	Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Calcutta Trams, Ord.	5	6	7	6⅛— 6⅜	..	5 5 8	Rio de Janeiro Trams	$100	4½	5†	152 —154	+1	3 4 11
Do. 5 % Pref.	5	5	5	4$\frac{15}{16}$— 5$\frac{3}{16}$	..	4 16 5	Do. 1st Mort. 5 % Bonds ..	..	5	5	103¼—104¼	+ ¼	4 15 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3	Do. 5 % Mort. Bonds ..	100	5	5	101 —102	+ ½	4 18 0
Cape Electric Trams	1	Nil	2½†	⅝— ¾	..	..	Sao Paulo Tram, Lt. and P. ..	$100	10	10†	261 —266	..	3 15 2
City Buenos Aires Trams (1904)	5	5	5	5½— 5¾	..	4 6 11	Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 14 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0	Singapore Trams, 5 % Deb. ..	100	5	5	84 — 87	..	5 15 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0	Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1	Un. Elec. Trams Monte Video ..	5	6	7	5⅝— 6⅛	..	5 14 3
Kalgoorlie Elec. Trams	1	Nil	..	$\frac{1}{32}$— $\frac{3}{32}$	..	Nil	Do. 6 % Pref.	5	6	6	4⅞— 5⅜	..	5 11 7
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0	Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Do. 6 % B Deb.	100	5	3	35 — 43	..	6 19 6	Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½—103½ xd	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	⅝— ¾	..	8 0 0	Crompton & Co.	3	Nil	Nil	⅛— ⅜	..	Nil
Do. 6 % Pref.	1	9	6	1⅛— 1$\frac{3}{16}$	..	7 7 8	Do. Deb...	100	5	5	66 — 66	..	7 11 6
Babcock & Wilcox	1	26	28	3½— 3$\frac{9}{16}$	+ $\frac{1}{16}$	4 2 10	Dick, Kerr	1	5	5	¾— ⅞	..	5 14 3
Do. Pref.	1	6	6	1$\frac{7}{16}$— 1$\frac{9}{16}$	..	3 16 10	Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
British Aluminium, Ord. ..	1	..	..	$\frac{9}{16}$— $\frac{13}{16}$	..	..	Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Do. 6 % Cum. Pref.	1	..	..	⅜— ⅝	..	..	Edison & Swan, A, £3 paid ..	5	Nil	..	$\frac{9}{16}$— $\frac{13}{16}$	..	Nil
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2	Do. fully paid	5	Nil	..	1⅝— 2⅛	..	Nil
Do. Deb. Stk.	100	5	5	85 — 88	..	5 13 8	Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
B.I. & Helsby Cables	5	10	10	7¾— 8¼	..	6 1 3	Do. 5 % Second Deb. ..	100	5	5	74 — 77	..	6 9 10
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1	Electric Construction	2	2½	3¾	¾— 1	..	7 10 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7	Do. Pref.	2	7	7	1¾— 2	..	7 0 0
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9	Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
British Westinghouse, Pref. ..	3	Nil	..	$\frac{9}{16}$— $\frac{13}{16}$	..	Nil	Do. Deb...	100	5	5	92 — 94	..	5 4 2
Do. Deb...	100	4	4	60 — 63	..	6 7 0	General Electric, Pref. ..	10	5	5	10 — 11	..	4 10 11
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3	Do. Deb...	100	4	4	92 — 97	..	4 2 6
Browett, Lindley, Ord.	1	Nil	..	2/- —3/-	..	Nil	Henley's, Ord.	5	15	10†	12¼— 13	+ ¼	5 15 5
Do. Pref.	1	Nil	..	4/6 —5/-	..	Nil	Do. Pref.	5	4½	4½	4¾ - 5	..	4 10 0
Brush, 7 % Pref.	2	Nil	..	0 — ¼	..	Nil	Do. Deb...	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0	India-Rubber, G. & T.	10	10	..	11½— 12½	+ ½	..
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8	Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0	Telegraph Construction.. ..	12	20	10†	34 — 36	+ ½	6 13 4
Callender's Cable	5	15	10†	10¼— 11	..	6 16 4	Do. Deb...	100	4	4	97 — 99	..	4 0 10
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7	Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Deb...	100	4½	4½	99½—101½	— ½	4 8 8	Do. Pref.	5	Nil	..	½— 1	..	Nil
Castner-Kellner	1	17½	20	3¾— 3⅞	..	5 3 3	Do. Deb...	100	4	4	58 — 60	..	6 13 4
Do. Deb...	100	4½	4½	102 —105	..	4 5 9							

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent., August 29th, 1912.

CHARACTERISTICS OF METAL FILAMENTS.

By DANIEL H. OGLEY, B.Eng., Royal Technical College, Salford.

It has long been known that for a given change in pressure the percentage variation in candle-power of a carbon lamp was much greater than that of an equally rated metal lamp.

The question naturally arises as to the extent of the variations, and during an extended series of tests on a number of the most modern metal-filament lamps on the market, the following figures were arrived at.

The first relation analysed was that between power consumption and impressed voltage. Steinmetz, testing a single lamp, stated that the power consumption varied as the 1·6th power of the voltage, and so followed a law analogous to that of the hysteresis loss in iron. In the latter case the power lost varies as the 1·6th power of the induction, or—

$$w \propto \beta^{1 \cdot 6}.$$

In the lamp case—

$$w \propto \text{volts}^{1 \cdot 6},$$

or

$$w = k\,v^{1 \cdot 6},$$

when w = power in watts; k = constant; v = impressed volts.

The results of the tests on four modern lamps are as under :—

Lamp I.

Test.	Candle-power.	Volts.	Amperes.	Watts.	Watts calculated.	Diff.
1	8·2	90	·15	13·5	13·49	—
2	10·23	95	·155	14·7	14·71	-
3	12·6	100	·16	16	15·85	— ·9 %
4	14·24	105	·166	17·4	17·28	— ·7
5	16·7	110	·169	18·6	18·60	—
6	19·97	115	·174	20	19·97	—
7	24·46	120	·179	21·5	21·38	— ·5

Power characteristic.—Watts = ·01008 volt$^{1 \cdot 6}$.
Lamp.—Osram, 110 volts, 17 watts.

Lamp II.

Test.	C.P.	Volts.	Amperes.	Watts.	Watts calculated.	Diff.
1	10·1	100	·14	14	13·84	— 1·1 %
2	11·6	105	·144	15·1	14·96	— ·9 %
3	14·5	110	·147	16·2	16·12	— ·5 %
4	16·18	115	·15	17·3	17·3	—
5	19·7	120	·154	18·5	18·52	·1 %

Power characteristic.—Watts = ·00873 volt$^{1 \cdot 6}$.
Lamp.—A.E.G., 110 volts, 16 C.P.

Lamp III.

Test.	C.P.	Volts.	Amperes.	Watts.	Watts calculated.	Diff.
1	5·58	85	·17	14·4	14·47	+ ·5 %
2	7·1	90	·178	16	15·87	— ·8 %
3	9·07	95	·182	17·3	17·3	
4	11·2	100	·188	18·8	18·78	— ·1 %
5	13·46	105	·194	20·4	20·31	— ·4 %
6	16·5	110	·2	22	21·9	— ·4 %
7	19·56	115	·205	23·6	23·5	— ·4 %
8	22	120	·208	25	25·12	+ ·4 %

Power characteristic.—Watts = ·01185 volt$^{1 \cdot 6}$.
Lamp.—Brimsdown, 110 volts, 16 C.P.

Lamp IV.

Test.	C.P.	Volts.	Amperes.	Watts.	Watts calculated.	Diff.
1	7·43	90	·15	13·5	13·49	—
2	8·8	95	·154	14·6	14·71	·7 %
3	11·26	100	·16	16	15·85	— ·9 %
4	12·5	105	·163	17·1	17·28	— 1 %
5	15·5	110	·168	18·5	18·61	— ·6 %
6	18·6	115	·174	20	19·97	— ·15 %
7	22	120	·179	21·5	21·38	— ·5 %

Lamp.—Wotan, 110 volts, 16 C.P.
Power characteristic.—Watts = ·01008 volt$^{1 \cdot 6}$.

In all cases the calculated watts were obtained by employing the law: watts = constant × volts$^{1 \cdot 6}$; and it is interesting to note that the greatest variation is only of the order of 1 per cent.

The difference between the several constants is only to be expected when dealing with several makes of lamp, and conforms with the variation in the hysteretic constants of various samples of iron.

When dealing with one particular make of lamp frequent determinations of k might form a check on the manufacture, as variations would indicate a change in the filament.

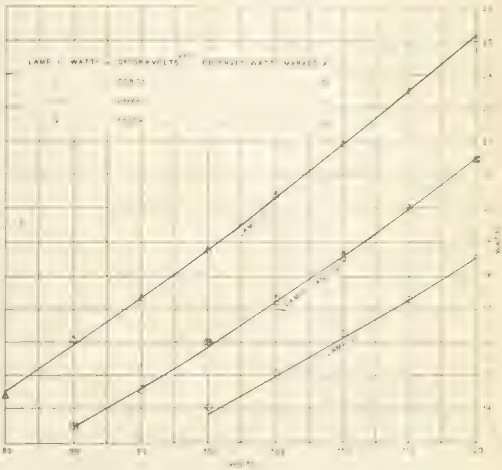

Fig. 1.

The creeping-in of errors in the process may thus be readily detected.

As a result of the tests it seems clear that "the watts vary as the 1·6th power of the impressed volts" is a law for the various metal-filaments listed.

In the diagrams, fig. 1, the curves showing the relation between volts and power are plotted. The observed watts are also indicated, and all lie practically on the curves.

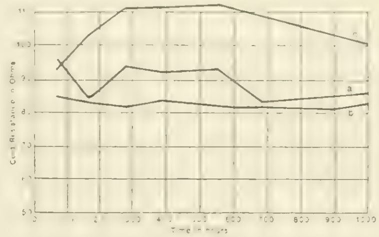

Fig. 2.—Resistance-Time Curves: Drawn-Filament Lamps.

The increasing numbers of metallic-filament lamps, coupled with the more or less extravagant claims of the rival manufacturers of drawn and pressed filament types, cannot but make the task of would-be purchasers a difficult one, and published comparative life and efficiency tests of the several makes are rendered almost a necessity.

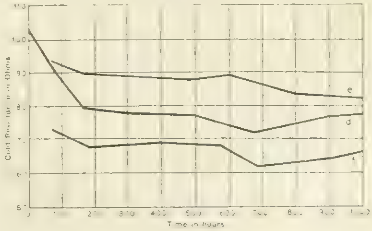

Fig. 3.—Resistance-Time Curves: Pressed-Filament Lamps.

We are familiar with the "1-watt per candle lamp," and the fact that such-and-such a lamp saves 70 per cent. or more of energy, from the advertisements, but, as regards actual experience, are these facts? Again, the saving in energy is obviously the result of comparison with a carbon lamp, although this is generally not stated, so that the question arises as to the saving that results due to using one metal-filament lamp in preference to another.

To obtain some such information useful from the user's point of view, the following series of tests were undertaken :—

A batch of lamps of each of the best known makes was purchased over the counter in the usual manner, and arrangements were made for running them on a constant voltage circuit. Frequent candle-power and resistance tests were made, the latter with the object of ascertaining what change, if any, took place in the filaments.

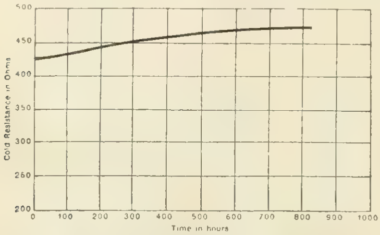

Fig. 4.—Resistance-Time Curve: Carbon Lamps.

As a result of these observations, it seems clear that both drawn and pressed filaments become entirely crystalline after use, and that when in this condition no difference in strength exists between the two. The only question is as to the period of time that elapses before the crystalline state is attained; it appears that the drawn filaments crystallise more slowly, and, therefore, are stronger at the beginning and during the initial stage of the run.

This increased strength at the commencement will obviously assist in the manufacturing process, and render breakages in handling and transit less numerous.

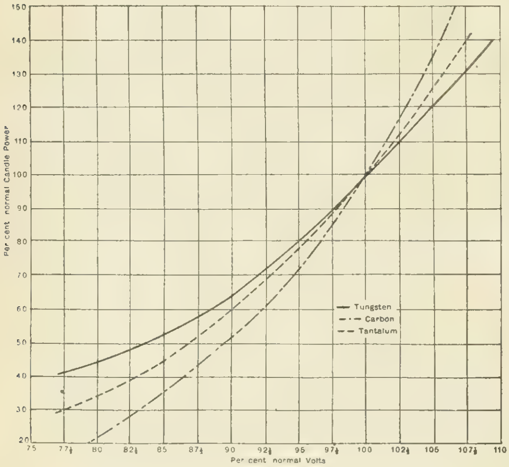

Fig. 5.—Relationship Between Candle-Power and Volts.

The crystalline nature of both types of filament is evident from a study of the resistance-time curves, figs. 2, 3 and 4, where fig. 2 refers to several drawn filaments, fig. 3 to various pressed ones, and fig. 4 to some Robertson carbons. The latter were included to serve as a general check on the results, since their characteristics are well known.

At no two periods were the resistances identical. An increase or decrease in the case of the metal lamps seems a matter of chance, and this clearly could only occur when the subject under examination was of a crystalline nature. A high resistance would indicate a bad connection between adjacent crystals, and since such occur more frequently in the drawn lamps, the presence of smaller crystals seems to be indicated.

The steady increase of the carbon filament is to be noted as a proof of its continuity; the filament becomes thinner, the bright steely surface disappearing, and a rougher black untreated surface appearing. This new system being a better radiator than the old one, the result is a lowered temperature and decreased efficiency. The rough surface also increases the radiating area and further lowers the temperature and efficiency.

It is often stated that metallic-filament lamps are less susceptible to pressure variations than are carbon ones. In this case permanent variations only are meant, since, if the pressure is flickering or varying momentarily, the metal lamps, by reason of the low specific heat of the filaments, will respond much more readily to the changes than will carbon ones.

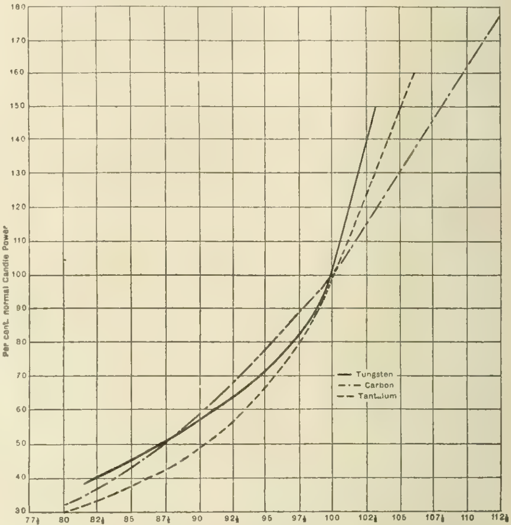

Fig. 6.—Relation of Candle-Power to Current.

As regards permanent increases, the various voltage and current indices were ascertained by the following tests :—

The lamp to be tested was arranged in series with a resistance, so that the lamp pressure was capable of considerable variation. Standard instruments were used, and the candle-power was ascertained by Lummer-Brodhun photometer and standard lamp, the latter being periodically tested against a pentane standard.

In fig. 5 is shown the relation between candle-power and terminal volts, and the voltage index obtained for the various types is given as follows :—

Lamp.		*Volts index.*
Tantalum	...	4·1—4·3
Tungsten	...	3·5—4·1
Carbon	...	6·7—7

The superiority of the metal lamp as regards a permanent change in voltage is clear. Since relatively slight reductions in pressure produce large decreases in candle-power, the importance of close regulation is apparent, while, although a correspondingly great increase in candle-power results on an increase in pressure, the rapid deterioration of the filament renders the practice a costly and unwarranted one.

The index for a particular lamp, it should be noted, is not constant for equal pressure changes, but varies slightly according to the candle-power.

In fig. 6 is shown the relationship between candle-power and current, the index obtained for each make being as under :—

Lamp.		*Current index.*
Tantalum	...	5·5—5·8
Tungsten	...	5—6·5
Carbon	...	5·2—5·4

The variation among the tungsten filaments is considerable, probably due to the different manufacturing processes.

The carbon in this respect is equal almost to the best tungsten and superior to the tantalum.

From the above, it would appear that the practice of running lamps, when used for sub-standards in making photometric measurements, at a fixed current is the correct one. A potentiometer method is, of course, the one that ought to be adopted in maintaining a constant current.

The variation of candle-power with power supplied is interesting; in the case of the metal lamps, both tantalum and tungsten, the index is practically the same—*i.e.*, 2·4. It is not, however, constant throughout the test, but varies considerably at low candle-powers.

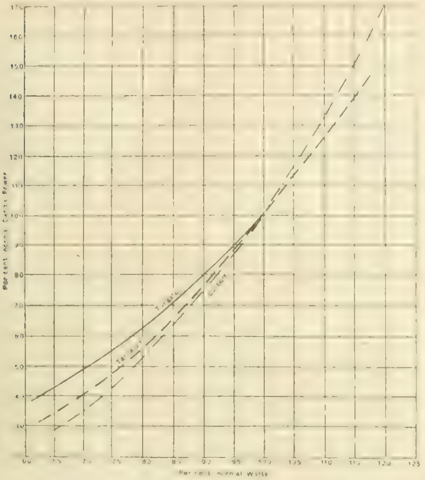

Fig. 7.—Relationship Between Candle-Power and Watts.

With regard to the carbon lamp, the index is 3, or the candle-power varies as the cube of the watts. And here, again, the index is not constant, but varies throughout the test.

In fig. 7 is shown the relationship between candle-power and power supplied, the close agreement between the tungsten and tantalum lamps being apparent.

The life tests indicate that the candle-power varies considerably during the first 50 hours or so of the run, and that this interval of time constitutes a period of instability.

For some of the lamps the period was even shorter, and when what might be called the true candle-power was attained, in most cases it remained fairly constant for several hundred hours. The gradual decline that is noticed in the case of all carbon lamps, and which was also a noticeable feature of the life of metal lamps (*Proceedings* I.E.E., February, 1907, paper by the author) is in many cases absent.

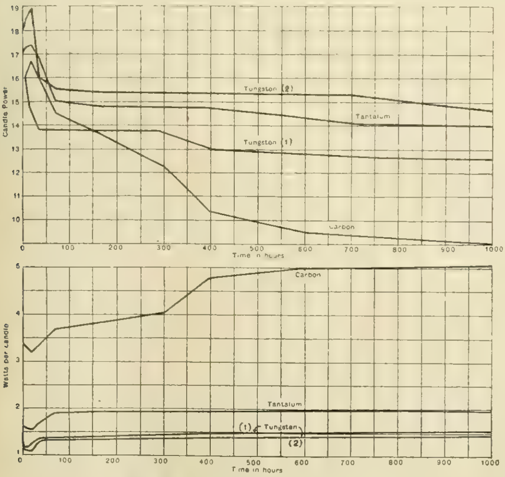

Fig. 8.—Typical Life Curves.

The smashing point in the case of metal lamps will now in general be determined by the rupture of the filament, since the usually accepted 20 per cent. drop in candle-power does not take place within its life.

In fig. 8 are shown some characteristic life and efficiency tests.

A study of these curves reveals the fact that the efficiency of the metal-filament lamps remains practically constant for the greater portion of their lives.

It seems that such lamps would serve admirably as photometric sub-standards, as the curve for the carbon lamp is varying continuously.

Two curves for tungsten lamps are shown, Nos. 1 and 2. No. 2 is seen to be much superior to No. 1 as regards candle-power and slightly as regards efficiency. No. 1 is not a chance curve, but is closely resembled by all the curves for lamps of the same batch. It seems that the tungsten lamps vary widely amongst themselves, and surely in the consumers' interest it is time that the manufacturers' names were not so religiously suppressed when publishing results of this nature.

RELIANCE ON EMPLOYER'S MEASUREMENTS.

[By our Legal Contributor.]

It is safe to say that there is no more prolific source of disputes between an employer and a contractor than the practice of relying upon the measurements, &c., supplied by the employer. To rely entirely upon the figures supplied without verification is an easy, and, to all appearances, an economical way of preparing a tender; but in the long run it may turn out to be very much the reverse. Take, for instance, the erection of a large generating station. The employer, to use a term which may conveniently be applied to the company or local authority which has obtained a provisional order, has been compelled to choose a particular site. In his endeavour to secure the erection of the necessary buildings and plant, he is not likely to draw particular attention to the difficulties which must be overcome. Transport may be expensive; and foundations may be difficult to lay; but the burden of all these eventualities has to be borne by the contractor. Were he the only starter in the race for the contract, he might protect himself by adding a considerable sum to his tender in order to provide for emergencies; but the stress of competition makes it necessary to cut prices very fine.

How far, then, can the contractor legally rely upon the accuracy of the statements made in the specifications, and the figures which are given by the employer?

As a general rule, the employer's engineer tries to protect his employer as far as possible from errors in specifications. To this end he frequently inserts a stipulation that the contractor shall satisfy himself as to the dimensions, levels and nature of all existing works and other things connected with the contract; that the employer does not hold himself responsible for the accuracy of the information as to the sections or foundations of existing walls and works; and that no charges for extra work or otherwise will be allowed in consequence of incorrect information or inaccuracies in the drawings or specifications.

Again, a common form of contract (applicable more especially to the building trade) provides that the builder shall be accountable "for the full performance of this contract, and, by signing hereof, admits that the said plans, elevations, sections and specifications, descriptions and particulars before referred to, are sufficient for their intended purpose, and that without any additional or extra work, other than the works set forth thereby, or necessarily inferred to be done from the general nature and tendency of the plans and descriptions aforesaid."

Further, in order to protect himself against any error in the bills of quantities, the employer frequently insists upon the insertion of a clause to the following effect:—

"The bill of quantities upon which the tender of the contractor is based was prepared for the purpose of assisting persons tendering for the works in making their calculations, but it does not profess to give actual cube measurements or to be otherwise than approximate in the figures therein stated, and the employer will not be responsible for the accuracy of such quantities, and the builder is not to be entitled to any claim for extras based on any alleged error therein, but is responsible for the completion of the entire works, as described in the plans and specifications, at the contract price.

A notable example of the way in which a contractor may be put to loss and expense owing to implicit reliance on the measurements, &c., of the employer's engineer, is furnished by the well-known case of Thorne *v.* Lord Mayor of London (1876), L.R.I.A.C. 120. There the Corporation of London invited contractors to tender for the execution of certain works for the building of Blackfriars Bridge according to plans and specifications prepared by the engineer to the Corporation. The specification provided that the contractors were to take out their own quantities, and that the accuracy of the plans was not guaranteed by the Corporation. The contractors were warned particularly that they must satisfy themselves as to the nature of the ground through which the foundations had to be carried. Iron caissons were specified to be used in the construction of the works, but when the contractors whose tenders was accepted proceeded to use the caissons as designed, it was found that they would not resist the pressure of the water, and the plan of the work had to be altered and the use of the caissons abandoned. The contractors claimed for loss occasioned to them in attempting to use caissons according to the specification. The House of Lords held that no warranty could be implied. The following passage from the judgment of Lord Chelmsford has become historic. He said: "There can be no doubt the the plaintiff in the exercise of common prudence, before he made his tender, ought to have informed himself of all the particulars connected with the work, and especially as to the practicability of executing every part of the work contained in the specification according to the specified terms and conditions. It is said that it would be very inconvenient to require an intended contractor to make himself thoroughly acquainted with the specification, as it would be necessary upon each occasion for him to have an engineer by his side. . . . But if the contractor ought prudently and properly to have information of the nature of the work he is preparing to undertake, and the advice of a skilful person is necessary to enable him to understand the specification, is it any reason for not employing such a person that it would add to the expense of the contractor before making his tender? It is also said that it is the usage of contractors to rely upon the specification, and not to examine it particularly for themselves; if so, it is a usage of blind confidence of the most unreasonable description."

While Thorn *v.* Mayor of London may be regarded as a leading authority, the facts capable of proof in another case may not tally with it. In Pearson *v.* Dublin Corporation, 1907 A.C. 357) it was laid down that if the specifications or plans contain or involve statements of fact which are false to the knowledge of the employer, the question of fraud enters into the matter, and the contractor may be in a position to claim relief. In this connection it should be mentioned that a statement made by a person recklessly and without caring whether it be true or false, is deemed fraudulent in the eye of the law. In that case there was a contract to execute certain sewerage works. The plaintiffs covenanted to do the works described in the drawings, specifications, &c., and the defendants covenanted to pay for the works on receipt of the certificate in writing of their engineer as provided by the conditions. The specification provided, *inter alia*, that the plaintiffs must verify all representations and not rely upon their accuracy. The works in question involved the transformation of an old harbour in the Liffey into a sewerage tank. On completion the plaintiffs claimed £36,574 from the defendants on the grounds—first, that the plans showed a certain existing wall extending some 9 ft. below the ordnance datum line, which could be utilised for the purpose of the works; that this wall did not exist, and consequently the plans for the works had been altered, and the plaintiffs at the direction of the engineer, had completed the works at this extra cost; secondly, that the defendants had fraudulently misrepresented the structure and existence of this wall, and had thereby induced the plaintiffs to enter into a contract to their detriment. The defendants relied upon the absence of a certificate from their engineer, and on the conditions of the specification, and they denied the making of any representation and any fraud.

It was held that the specification only protected the defendants in respect of honest mistakes by themselves or their agents, and it was for a jury to say whether it was fraud or not. In giving judgment, the Lord Chancellor pointed out that evidence was adduced at the trial from which the jury might, if they thought right, conclude that the plaintiffs were induced to enter into the contract by statements made on behalf of the defendants. There was also evidence for the jury that those statements were made with a knowledge of their falsity, or (which was the same thing) with a reckless indifference whether they were false or true, on the part of the engineers employed by the defendants to make the plans which were submitted as the basis of the tender. Having referred to the clauses which pointed out that the plaintiffs were not to rely on the plans, he said: "Now, it seems clear that no one can escape liability for his own fraudulent statements by inserting in a contract a clause that the other party shall not rely upon them. I will not say that a man, himself innocent, may not under any circumstances, however peculiar, guard himself by apt and express clauses from liability from the fraud of his own agents. It suffices to say that, in my opinion, the clauses before us do not admit of such a construction. They contemplate honesty on both sides, and protect only against honest mistakes. The principal and the agent are one, and it does not signify which of them made the incriminated statement, or which of them possessed the guilty knowledge."

Upon this case the observation arises that if anything in the nature of legal fraud can be alleged against the employer or his engineer, he will not be allowed to take advantage of it. But he who alleges fraud must strictly prove it, and the proof of fraud is a serious and difficult matter.

Perhaps the time will some day arrive when contractors will be in a sufficiently strong position to be able to say to employers:—"We will not tender unless you will take some responsibility for unforeseen difficulties." No such position has yet been attained. Indeed, the employer—particularly when he is a local authority—appears to have it all his own way. The writer recalls a case in which a local authority were inviting tenders for the laying of a sewer. Instead of having a set of bores made on their own account, they referred the would-be tenderer to a firm of surveyors who were willing to supply certain information in their possession; but it was expressly provided that the local authority was not to be responsible in any sense for the accuracy or inaccuracy of the information so obtained. In point of fact, the information so obtained was misleading in the sense that it wholly failed to disclose the presence of a bed of wet sand which threw the contractors out in their reckoning. In the event, the contractors were practically ruined. That is a contingency—the probable ruin of the contractor—to which the employer will do well to have regard. The cost of making proper investigations may be great in the first instance; but it is nothing to the loss which may accrue if the contractor is rendered insolvent by the onerous burden of a contract.

Gas Ignition by Lamp Breakages.—The question whether fire-damp will be ignited by the fracture of an incandescent lamp bulb while the lamp is in operation is of growing importance because of the increased use of low-voltage portable electric lamps employing tungsten filaments. Technical paper No. 23 just issued by the United States Bureau of Mines gives the results of 131 tests made for the purpose of throwing some light on the problem. Mixtures containing as little as 5 per cent. of gas and others containing as high as 12·4 per cent. of gas were ignited by 1½ C.P., 3½-volt, 3—10 ampere miniature lamps, which were smashed while operating at rated voltage. Out of the total of 131 tests, 78 caused ignition.—*Electrical World.*

TRADE STATISTICS OF ROUMANIA.

The following statement, showing the imports of electrical and similar goods into Roumania in 1910, is taken from the official trade statistics which have recently been issued; the figures for 1909 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1909. Kilogs.	1910. Kilogs.	Increase or decrease. Kilogs.
Electric insulators of faience and porcelain even combined with other materials.			
From Austria	32,000	63,000	+ 31,000
„ Germany	37,000	79,000	+ 42,000
„ Italy	—	1,000	+ 1,000
„ Other countries ...	1,000	3,000	+ 2,000
Total ...	70,000	146,000	+ 76,000
Boilers.			
From Great Britain ...	2,000	26,000	+ 24,000
„ Austria . .	92,000	86,000	— 6,000
„ France	30,000	7,000	— 23,000
„ Germany	179,000	421,000	+ 242,000
„ Other countries ...	20,000	1,000	— 19,000
Total ...	323,000	511,000	+ 218,000
Iron wire, galvanised, &c.—			
From Great Britain ...	62,000	48,000	— 14,000
„ Austria .. .	51,000	103,000	+ 52,000
„ Belgium . .	15,000	9,000	— 6,000
„ France	2,000	—	2,000
„ Germany	261,000	330,000	+ 69,000
„ Holland	86,000	2,000	— 84,000
„ Other countries ...	1,000	1,000	
Total ...	478,000	493,000	+ 15,000
Electric incandescent lamps.—			
From Austria	5,000	6,000	+ 1,000
„ Germany	13,000	16,000	+ 3,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	18,000	23,000	+ 5,000
Copper wire.			
From Great Britain ...	—	66,000	+ 66,000
„ Austria	20,000	22,000	+ 2,000
„ Germany	104,000	83,000	— 21,000
„ Other countries ...	3,000	3,000	—
Total ...	127,000	174,000	+ 47,000
Steam engines.—			
From Great Britain ...	30,000	7,000	— 23,000
„ Austria	129,000	69,000	— 60,000
„ Germany	1,415,000	2,398,000	+ 983,000
„ Other countries ...	64,000	50,000	— 14,000
Total ...	1,638,000	2,524,000	+ 886,000
Petroleum engines.—			
From Great Britain ...	932,000	817,000	— 115,000
„ Austria	475,000	600,000	+ 125,000
„ Belgium	93,000	163,000	+ 70,000
„ Germany	1,462,000	1,159,000	— 303,000
„ Switzerland ...	237,000	257,000	+ 20,000
„ Other countries ...	42,000	87,000	+ 45,000
Total ...	3,241,000	3,083,000	— 158,000
Gas, compressed air, &c., engines.—			
From Great Britain ...	45,000	62,000	+ 17,000
„ Austria	85,000	27,000	— 58,000
„ Germany	343,000	165,000	— 178,000
„ Switzerland ...	58,000	7,000	— 51,000
Total ...	531,000	261,000	— 270,000
Dynamo-electric machines, electric motors, converters, transformers, &c.—			
From Great Britain	2,000	1,000	— 1,000
„ Austria	22,000	20,000	— 2,000
„ Belgium	15,000	9,000	— 6,000
„ France	1,000	5,000	+ 4,000
„ Germany	557,000	711,000	+ 154,000
„ Other countries ...	16,000	3,000	— 13,000
Total ...	613,000	749,000	+ 136,000
Accumulators and spare plates.—			
From Austria	133,000	226,000	+ 93,000
„ France	1,000	1,000	—
„ Germany	34,000	22,000	— 12,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	168,000	251,000	+ 83,000
Arc lamps.			
From Austria . .	1,000	1,000	
„ Germany .. .	13,000	8,000	— 5,000
„ Other countries	1,000		— 1,000
Total	15,000	9,000	— 6,000
Electric apparatus for telegraphy and telephony.			
From Austria	1,000	2,000	+ 1,000
„ Germany	15,000	8,000	— 7,000
„ Other countries ...	7,000	2,000	— 5,000
Total ...	23,000	12,000	— 11,000
Insulators for transmission of power and light, &c.			
From Austria	1,000	2,000	+ 1,000
„ Germany	12,000	18,000	+ 6,000
„ Other countries ...	2,000		— 2,000
Total ...	15,000	20,000	+ 5,000
Interrupters, &c.			
From Austria	7,000	7,000	
„ Germany	63,000	72,000	+ 9,000
„ Other countries	1,000	3,000	+ 2,000
Total ...	71,000	82,000	+ 11,000
Cables for transmission of electric power, insulated, &c.			
From Great Britain ...	27,000	1,000	— 26,000
„ Austria	18,000	51,000	+ 33,000
„ Germany .	342,000	692,000	+ 350,000
„ Belgium . .	3,000	18,000	+ 15,000
Other countries ...	—	4,000	+ 4,000
Total ...	390,000	766,000	+ 376,000
Rails for tramways and railways.			
From Austria	356,000	1,373,000	+ 1,019,000
„ Belgium	2,193,000	1,031,000	— 1,162,000
„ Germany	2,162,000	4,442,000	+ 2,280,000
„ Holland	1,747,000	1,258,000	— 489,000
„ Russia	5,635,000	6,216,000	+ 581,000
„ Other countries ...	125,000	87,000	— 38,000
Total ...	12,218,000	14,407,000	+ 2,189,000
Locomobiles.—			
From Great Britain ...	409,000	1,010,000	+ 601,000
Austria	457,000	1,143,000	+ 686,000
„ Germany	824,000	1,096,000	+ 272,000
„ Other countries ...	16,000	19,000	+ 3,000
Total ...	1,706,000	3,268,000	+ 1,562,000
Electric apparatus for bells.—			
From Austria	2,000	2,000	—
„ Germany	3,000	3,000	—
Total ...	5,000	5,000	
Electric batteries for medicine and chemistry.—			
From Austria	1,000	1,000	
„ Germany	3,000	2,000	— 1,000
Total ...	4,000	3,000	— 1,000

The Electric Smelting of Iron Ore in Norway.—

H.M. Consul at Christiania (Mr. E. F. Gray) reports that the Hardanger Electric Ironworks were started in November, 1911, and during a short spell of activity they produced rather over 300 tons of raw iron, which were exported. The ore smelted came from the Klodeberg Mine, near Arendal, containing 40 to 45 per cent. of iron. The ore furnace is calculated for a maximum of 3,500 H.P. Further experiments were to be made with ore from Rödsand. A new electric mass furnace is being made, to act at first as a reserve furnace, and an electric steel furnace will probably be constructed during 1912.

The Arendal Fossekompagni has projected iron smelting works near Arendal, and is to employ 8,000 H.P. It is hoped to begin working on ore from the fields near Arendal and Lyngör in the spring of 1913. The Tinfos Ironworks for electric smelting will soon begin producing, but have been delayed by a lock-out and other causes. The Stavanger Electric Steel Works for the manufacture of steel from old battleships, &c., will probably not start working before the latter half of 1912; they will employ some 1,000 to 1,500 H.P. Hammering works are under construction.

Several new works of the kind are already under consideration.—*Board of Trade Journal.*

GERMAN TRANSFORMER WAGONS.

The installation of rural power transmission plants has placed electric current at the disposal of farmers for the operation of all kinds of agricultural machinery even in fields situated at a considerable distance from the farm. The high-pressure distributors are generally provided with connections for this purpose, which allow a transformer to be connected up to them. Since this transformer is employed at a number of different points, it is mounted on a wagon and can be transported from place to place. As a substitute for the primitive arrangements hitherto in use, the A.E.G. has designed a special outfit which complies with the most exacting requirements with regard to safety.

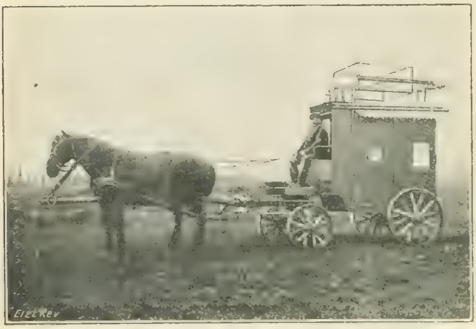

Fig. 1.—Transformer Wagon for Farm Use.

In view of the apparatus it contains, the A.E.G. transformer wagon is mounted on good springs, and in order to ensure satisfactory earthing of all parts it is constructed of iron. The apparatus contained in the interior is conveniently accessible at all times through suitably arranged doors. The current is led to the wagon through a bow collector which can be lowered during transport. A protective lattice which surrounds the current collector serves as a support for the latter in the lowered position and keeps it steady when in the raised position.

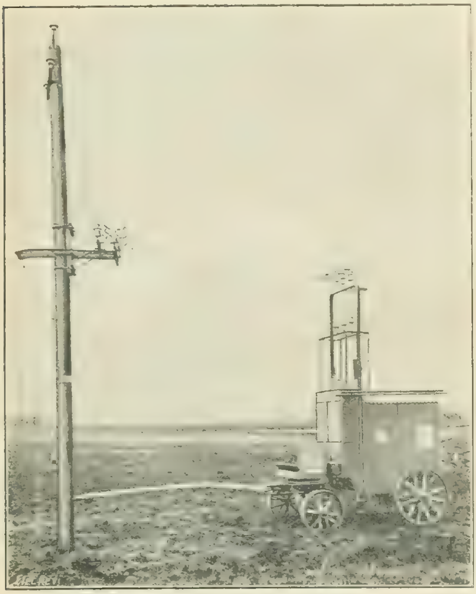

Fig. 2.—Transformer Wagon Coupled to Transmission Line.

In this position the connection with the high-pressure distributor is carried out by means of the field connection (fig. 2). This is specially designed for its purpose and consists of three fixed insulators and three insulators which can be hinged down some distance. The latter carry the hooks for the connection of the portable conductor, which can only be hung in position when the current is switched off. Inside the protective cover the high-pressure leads conduct the current by means of leading-in tubes to the fuses, choking coils, oil switches, &c., and thence in a very simple manner to the transformer.

The high-pressure equipment can be chosen according to requirements. The low-pressure equipment consists of the meter, the fuses, the excess-voltage fuses, and the terminal box. A portable cable leads to the current-consuming apparatus, and may be several hundred metres in length. For example, in the case of ploughs, it may be as long as 1,000 m. For this reason, the portable transformers are designed on the low-pressure side for pressures ranging between 220 and 380 volts in the case of short distances, and from 500 to 1,000 volts for long lengths of cable.

These transformer wagons, which are built for 40 or 80 k.v.a., in spite of the high pressures adopted, ensure the greatest reliability in operation and afford adequate protection for persons employed directly or indirectly in their neighbourhood. The portable transformers are used for the operation of ploughs, threshing machines, drainage and irrigation pumps, &c. The use of a portable transformer in connection with rural power transmission plants enables a considerable reduction in the no-load losses and the production costs to be effected.

THE RECENT WORK OF MR. CARL HERING.

An advantage always accrues to a community when one of its number devotes himself specifically to one particular object. For this reason, it is of interest, in view of the rapid advances which are now being made in the design and operation of electric furnaces for the production and refining of steel and other metals, to refer to the researches of Mr. Carl Hering, in order to gain some clear appreciation of the bearing which the work of this well-known American pioneer in electrometallurgy, has upon the general problem of the application of electricity to the working of metals.

Two features in electric furnace work need to be kept in mind in order to see the position. The first is, that modern furnaces are now being made of increasingly large capacity as the electrical process is emerging from the experimental to the practical stage, and therefore the currents dealt with are increasingly powerful. The second point is, that the molten masses in the electric furnaces present themselves as conductors of electricity which are in a fluid condition, and, therefore, their power of mechanical cohesion is small. The result is that the presence of unsuspected internal forces in a conductor due to the current carried by it has been found, and the value of Mr. Hering's former work was in demonstrating this presence. The "pinch phenomenon," which term describes the tendency of a current to contract the cross-section of the conductor, and even to produce rupture of the circuit, which becomes evident when the conductor is liquid, was discussed in 1907 before the American Electrochemical Society, and in 1909 the practical bearing of this phenomenon upon the design of electric furnaces was shown before the same society in a paper on "The Working Limit in Electric Furnaces due to the Pinch Phenomenon."

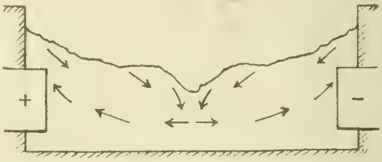

Fig. 1.

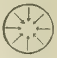

Fig. 2.

It seems, however, a perfectly natural supposition that if a conductor contracts in cross-section under the influence of the pinch effect, the material so displaced must move somewhere else, and, as a matter of fact, as indicated in fig. 1, taken from a publication by Mr. Hering in the *Journal* of the Franklin Institute, the material moves lengthwise to the conductor near the central axis with considerable force. Mr. Hering argues in this article on "The Stretching of a Conductor by its Current," that the current is subjected to a longitudinal stretching force in addition to a transverse compressive one. He supports this view by several observations. One of these is the action of an arc, which is a perfectly flexible conductor, in wandering about when between vertical electrodes, and even crawling up the side of the electrode, as if it were trying to lengthen itself. He also cites the case of a flexible bent conductor trying to straighten itself, and argues that the forces exerting the straightening action still exist when the conductor is straight, and hence tend to lengthen the conductor. The well-known trough experiment of Ampere and the action of the current passing through a "U"-shaped copper bar in two mercury cup terminals in forcing the bar out of the cups when the current is strong enough, point the same way. As like magnetic lines of force repel one another, and as every current-carrying conductor is encircled by like circular lines of force, these lines must repel each other in the direction of the axis of the conductor, and therefore produce a stretching force. Other experiments are also cited in this paper tending in the same direction.

Mr. Hering likens the conductor carrying a current to a wire surrounded by stretched rubber bands like umbrella rings which are also crowded together laterally. Their contraction produces an analogue of the "pinch" effect, while their lateral expansion represents the lengthening effect on the conductor. He suggests that the stretch of the conductor carrying a current follows as a consequence, if it is true that a line of force is rigid with the material of the conductor carrying the current which produces it. He calls attention to three imperfections in the usual text-book statements, arguing firstly, that it is not *currents* that attract and repel one another, but the *material of the conductor* which is attracted or repelled: secondly, that the material in and about which large lines of force are generated is moved, or affected, by these forces, this statement being preferable to the usual one that like *forces* repel, and unlike, attract; and, thirdly, that the generation of electromotive force is not produced by cutting the *circuit* by lines of force, but the *material* of that circuit which is cut. If a circuit, but not the material, is cut, there will be no induction. He, therefore, deduces the following conclusions which may be taken verbatim from the paper referred to :—

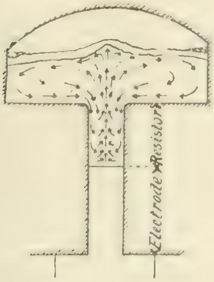

Fig. 3.

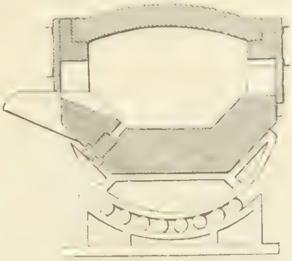

Fig. 6.

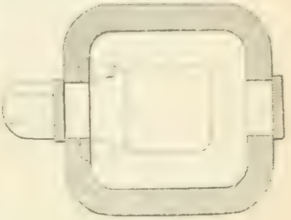

Fig. 7.

"In a conductor free from all external influences a current exerts a stretching force, due to its magnetic effect, which is independent of the direction of the current or of the length of the conductor, and is presumably proportional to the square of the current, and inversely proportional to the cross-section; it continues to act no matter what length the conductor has been stretched by it, and is, therefore, not of the nature of a strain; it is affected by neighbouring currents, and becomes less as these neighbouring currents neutralise the magnetic effect of the current, being zero in a perfectly non-inductive circuit; when it produces motion a counter electromotive force is produced; when such motion is reversed by a stronger opposing mechanical force, a direct electromotive force is produced."

It has been necessary to discuss at such length the author's more or less theoretical investigations in order to appreciate the work which underlies the design of a new type of electric furnace, which was described in a paper by Mr. Hering before the American Electrochemical Society in New York. In referring to the "pinch" effect, Mr. Hering illustrates a method whereby this effect is put to good use. In fig. 2 the circle represents the cross-section of a cylindrical conductor, the forces of the "pinch" effect tending to act radially as shown by arrows. If the conductor were made to be the electrical column of liquid, as, for example, the portion marked "resistor" in fig. 3, consisting of a hole in a non-conducting material closed at the bottom by an electrode, and filled with liquid, then these forces act horizontally and perpendicularly to the axis along the whole length. The mutual attraction of the parallel electric currents in such a conductor, act on the material constituting the conductor, and the liquid particles are moved bodily from the circumference to the central axis, and therefore a suction is created at the periphery and a pressure at the centre. By hydraulic action the radial forces in turn produce corresponding longitudinal forces at the centre and at the periphery, and the action is shown by arrows, a species of fountain being formed. The direction of this hydraulic flow is the same for direct or alternating current, and hence a valveless electromagnetic pump is formed. This phenomenon, known as the "squirt" phenomenon, has been adapted as a basis for the liquid resistor furnace.

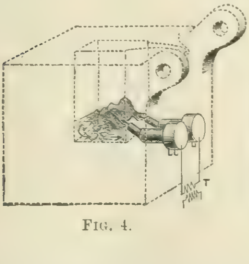

Fig. 4.

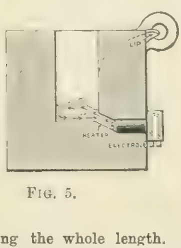

Fig. 5.

In the *Journal* of the Franklin Institution, Mr. Hering describes this furnace in more detail. The liquid columns or resistors, of which there are two (one for each electrode), are so proportioned that the whole heat for the furnace is generated in them, and the diameter and current are so proportioned that the "pinching" force is sufficient to produce the desired circulation. In turn each particle of the liquid enters the resistor, and it is here immediately highly heated and ejected, being in the resistor only about one second. There the heated metal is forced to the top where, in the case of steel refining, it comes into intimate contact with a blanket of slag, the chemical action taking place there. The cooler material on the bottom flows in the resistor, and is in turn heated and ejected. Where three-phase current is used there are three similar resistors and electrodes. In order to show how this principle may be applied, figs. 4 and 5 show a small type of crucible tilting furnace, which tilts round the lip, so as to pour directly into the moulds. Various ways of starting it may be adopted. A small liquid charge may be put into it, just enough to connect the ends of the electrodes when the crucible is tilted; a small charge may be melted in the crucible by means of an oil flame, or a casting may be made to fit the bottom, and this casting may be subsequently melted electrically, or a small charge may be always left in the crucible, and in this case the charge can be readily melted with the current when it has become frozen. In order to show how these resistors or squirting tubes and their electrodes may be applied to the usual form of tilting furnaces, figs. 6 and 7 may be studied. The former is a vertical section through one of the two electrodes and tubes, while the latter shows a top view of a horizontal section at about a level with the doors. It is claimed that with this type of furnace, there is a very quick action, which results in a large output per day and less stand-by losses per ton, also a rapid refining action, owing to the continual renewal of the surface in contact with the slag. There is rapid purification of the suspended matter, such as slag, oxides, gases, &c., as these are freed as the liquid reaches the top and deposits such matter in the slag. The rapid and systematic circulation produces practically perfect homogeneity, while the temperature is reduced to the lowest possible value necessary for the chemical reaction, thus diminishing loss due to excess of temperature. The method also tends to certain improvements in design, such as heating from the bottom, which is a rational method; the possibility of making the hearth deep and narrow instead of shallow and broad, this reducing loss of heat from the walls; the use of metal electrodes, which lose less power than those of carbon or graphite; no consumption of the electrodes, thus eliminating an important item of cost in arc furnaces, and also the necessity for continual adjustment of the electrode and contamination of the material with that of the electrode. Looked at from the electrometallurgical point of view, the furnace can be easily and accurately regulated by varying the voltage of the transformer. Heat can be added at the top in the form of gases for preheating the cold material and producing low temperature heat, so obtaining increased economy; and there is no reduction in the power factor, as the current is generated in a separate transformer. From the maintenance point of view, the simplicity and compactness of the construction itself, ease of operation and the facility with which repairs of the tubes can be made, makes the operating cost very low, and it may be stated that the larger the furnace, the better does the principle apply, while it is capable of application to existing open-hearth furnaces.

The furnace described was, some time ago, run daily in order to carry out certain experiments and to determine some interesting constants, and these experiments were all very satisfactory. Another furnace is now being built, and it is expected that, when particulars of this type are made public, some very interesting developments will be shown relating to yet another physical phenomenon, which reveals itself and becomes powerful under conditions of high current densities.

Manchester Electro-Harmonic Society.—The season 1912-13 will be opened by a smoking concert next month. The secretary (Mr. I. Hill, 24, Brazennose Street, Manchester) will be very pleased to forward application forms for membership to any gentlemen who are desirous of becoming members. There are at present about 100 members, and the committee is anxious to receive as many applications as possible before the opening concert.

ELECTROLYTIC CONDENSERS FOR THE PREVENTION OF SPARKING AT CONTACTS.

It has long been known that sparking at contacts can be prevented by the use of condensers, but the expense of the large capacities involved even for circuits of quite small power when the voltages are low, has proved a bar to their widespread use hitherto.

In an article in the *E.T.Z.* for August 29th, Dr. Karl Siegl describes the successful use of a cheap form of iron-alkali electrolytic condenser in connection with electric clock contacts. He prefers to introduce the condenser in series with the contact and the supply battery, rather than as a shunt to the contact, as the former arrangement greatly simplifies the construction.

After a great deal of experimenting, Dr. Siegl found that only electrodes of mercury or of iron were suitable for the purpose, and these gave the best results in a concentrated solution of caustic potash or caustic soda. Since solid iron electrodes are more easily dealt with than liquid mercury ones, iron has generally been adopted. Provided the current density is kept moderate, no chemical action whatever takes place, and no gas is given off, so that the whole can be hermetically sealed and requires no attention.

When such a cell is subjected to a voltage of from ½ to 1 volt, a momentary current flows (lasting from a few hundredths of a second to many seconds, according to the size of the plates), and is then absolutely cut off automatically by the rapid formation of an oxide coating on the anode. On reversing the voltage a similar momentary current flows in the opposite direction, and so on at every swing of the clock pendulum carrying the contacts.

The arrangement usually adopted is indicated in fig. 1 : p is the seconds pendulum of any standard clock. The pendulum spring P F is fixed at its ordinary supporting point into a piece of metal M, about 5 cm. long. This piece is itself supported from a very short spring f; M carries two contacts, only just free to move between the two contact screws K_1 and K_2, so that on breaking with one screw it makes contact with the other.

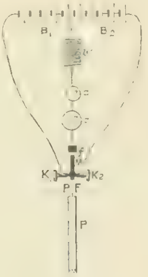

FIG. 1.

The ends of the battery B_1 B_2 are connected to the two contact screws, whilst the middle point of the battery leads to the condenser or valve cells v, and thence through the clock electromagnetic mechanism z z. By choosing the area of plate in the valve cells correctly the current impulses can be made of sufficiently short duration to enable the contact to be broken every time at zero current, and, therefore, without any sign of sparking.

Thus, if the area of plate is very small (small iron wires), the current rush is over in a few hundredths of a second ; but, at the same time, the initial resistance is too great to allow enough current for operating the clock mechanism to pass. Also the high current density causes gas evolution and possible destruction of the oxide coating, accompanied by a needle-like black deposit. If the area of plate is increased to 1 or 2 sq. cm. gas is no longer given off, but the resistance is still too high.

At the other extreme, with plate areas of 50 sq. cm. or more, the resistance of the cell becomes so low that a quite small battery passes sufficient current, but, owing to the large capacity, this current continues for too long a period. Experience showed that, for second clocks with a circuit resistance of under 100 ohms, plate areas of from 20 to 40 sq. cm. were suitable, and enough current could be got through these with 4 or 5 volts. As a rule, the ratio of number of valve cells to number of battery cells connected across them is made two, but for specially perfect protection of the contacts it may be made three or more. The valve plates are sometimes made up in the form of concentric sheet iron tubes ; more often the plates form the sides of narrow troughs, both sides of the plate being thus available and giving the whole arrangement a very compact form.

The valves gradually increase in resistance for the first 10 or 20 hours of working, so that the best number of cells should not be finally determined until after this time has elapsed.

The length of time for which the current impulse lasts depends, in the first place, on the relation of the capacity of the cell to the initial resistance of the cell and the resistance of the outside circuit, and, in the second place, on the relation of the number of cells to the voltage applied. By suitably changing these various factors either minute or second impulses can be equally readily obtained.

THE FAILURE OF A TRAMWAY UNDERTAKING.

FROM A LEGAL CONTRIBUTOR.

Signs are not wanting that those sections of the Tramways Act, 1870, which relate to tramways which it is found impossible to run at a profit, may soon have to be called into operation in certain parts of the country. In the department of electric traction as in other departments which are of interest to the electrical world, there is sometimes over-production. In a burst of enthusiasm, enterprising persons may have found the money for laying tramways in a district which, contrary to expectation, never develops even under the stimulus of electric traction. Receipts fall off, the cost of repairs and renewals has to be met, and the heavy burden of maintaining the track has to be borne as a first charge upon the undertaking. In the result, the tramway company may be forced to face the music of liquidation. Failures of this kind only become publicly known where the undertaking is in the hands of a private company. If a local authority owns the trams, the loss, if any, is borne by the ratepayers. Nor is there much outcry raised about the failure of the undertaking in such circumstances, because it can always be argued that, although there is a loss, the undertaking is conferring benefits upon the poorest of the poor.

An interesting and instructive example of the entirely blameless failure of a private company is afforded by the case of the Scarborough trams. The following epitome of facts is derived from a report of a case which was heard at the Scarborough Petty Sessions in January (see ELECTRICAL REVIEW, January 20th, 1911, page 90): The Scarborough Tramway Co. were summoned at the instance of the Corporation for failing to provide a reasonable service of trams, as provided by Sec. 92 of the Scarborough Tramways Act, 1902. It appeared that the trams started running in October, 1904, and continued to run until October, 1910, when the directors of the company, finding that the undertaking was being carried on at a loss of £2,000 a year, decided to suspend operations. An application which they made to the Board of Trade, to be allowed to suspend traffic during the winter, was refused. The solicitor who appeared for the company urged that the proper remedy of the Corporation was to take advantage of Sec. 42 of the Tramways Act, 1870, which provides that if after inquiry by the Board of Trade, the promoters were found insolvent, their powers should be at an end at the expiration of six months, unless the concern was taken over by the local authority. Eventually the magistrates made an order imposing a penalty of 10s. a day upon the company for 28 days, although it was pointed out that there was nothing upon which the penalties could be levied, inasmuch as a Receiver had already been appointed to receive the tolls on behalf of the debenture-holders.

The ultimate fate of this unfortunate undertaking cannot be predicted with any certainty ; but it serves to draw attention to those sections of the Tramways Act, 1870, which make provision for the case of an insolvent tramway company, to which, for the benefit of companies who may find themselves in the like parlous condition, we now propose to draw attention.

Sec. 41 of the Act provides that if at any time the promoters discontinue the working of a tramway or any part thereof for three calendar months (such discontinuance not being occasioned by circumstances beyond the control of such promoters, for which purpose the want of sufficient funds will not be considered a circumstance beyond their control), the Board of Trade may declare that the powers of the promoters in respect of the tramway shall be at an end. Thereupon the powers of the promoters are to cease and determine, unless they are purchased by the local authority in accordance with the compulsory purchase clause of the Tramways Act. If such an order is made, the road authority of the district may, within two months, remove the discontinued tramway at the cost of the promoters, and if the promoters fail to pay the cost, the road authority may sell the materials of the tramway either by public auction or private sale, and reimburse themselves out of the proceeds of such sale. The balance remaining over is paid to the promoters.

Upon this section the question arises, what are "circumstances beyond the control of the promoters?" It is conceived that a failure by lessees of the undertaking would not be a failure on the part of the promoters, and could not have made the subject of an order. The road authority are not obliged to remove the tramway, but no one but the promoters would have power to work it.

Sec. 42 of the same Act specifies the remedy for the insolvency of the promoters. It provides that if after the opening of a tramway it appears to the local authority that the promoters are insolvent, so that they are unable to maintain the tramway or work the same with advantage to the public, and a representation to that effect is made to the Board of Trade, the Board may direct an inquiry by a referee into the truth of the representation. If the referee finds the promoters to be insolvent, the Board may declare that their powers shall come to an end within six months unless they are purchased by the local authority. Thereupon the road authority may remove the tramway upon terms similar to those specified in the preceding section :—

It was held in one case (Pontypridd and Rhondda Valleys Tramways Co., Ltd. (1889) 58 L. J. Ch. 536), that an inquiry of this kind may be set on foot, even after a company has gone into liquidation.

It remains to consider the conditions in which a tramway company may be wound up. A tramway company may be wound up in the ordinary way if registered under the Companies' Acts, or it may be wound up as an unregistered company if it consists of more than seven members, and is not registered under the Companies' Act, inasmuch as it is not a railway company within the exception contained in Sec. 268 of the Companies Act, 1908. The fact that the preamble of the Tram Company's Act states that the construction of the tramway would be to the public advantage does not preclude a winding-up order, although this will make the Court more careful not to make the order until it is assured that such order is the best or only way out of its difficulties. Nor will an order be refused because the undertaking could not be sold without an application to Parliament, as such an application may be sanctioned by the Court.

The application for the order may be made by the company itself; by other persons entitled in the ordinary way to ask for such order, and by the debenture-holders in virtue of their rights as ordinary creditors, in spite of their previous exercise of their remedies as debenture-holders.

Debenture-holders, however, are in the event of default by the company entitled only to the appointment of a receiver of the undertaking of the company, and the net earnings thereof, and not to an order for the sale to the undertaking or to the appointment of a manager. The Court fully recognises the jurisdiction to wind up tramway companies, even on the application of debenture-holders, but debenture-holders are not promoters and have no right to exercise the statutory powers of promoters.

ELECTRIC IRON SMELTING.

In our issue of July 12th we published a summary of the results obtained during the first six months' work with the electric iron smelting furnace at Trollhättan, Sweden. The experience gained during that time naturally led to various improvements, and the furnace was, therefore, shut down to effect the necessary alterations. It was again started in September, 1911, since which time it has been in continuous operation.

The alterations related mainly to improved means for cleaning and circulating the furnace gas. Round electrodes were also introduced, in order to permit of their being joined end to end. Through this arrangement the waste of electrodes has been reduced to practically nil.

The results have shown a marked improvement through reduced current consumption and reduction of the quantities of charcoal and electrodes. Different kinds of ore have been tried, and long series of tests made with varying proportions of lump ore and concentrates. These show that any larger proportion than 30 per cent. of concentrates interferes with the smooth running of the furnace owing to the compactness of the charge, which prevents the passage of the gas.

On account of the varying and, for long periods, unfavourable conditions under which the furnace has worked, the average results during the entire period of working do not represent the actual efficiency of the furnace. We, therefore, select as typical the results of one month's working, when the conditions may be regarded as having been normal. These results are as follows:—

	1911.
Pig-iron produced, tons	537·9
Quantity of slag, tons	88·9
Iron in the ore, per cent.	67·65
Iron in the ore and lime, per cent.	65·02
Quantity of slag per ton of iron, kg.	165
Charcoal used per ton of iron, kg.	339·9
Average load, KW.	1,407
Average power, H.P.	1,913·5
*Current used per ton of iron, KW.-hours ...	1,749
†Iron produced per KW.-year, tons	5·01
Iron produced per H.P.-year, tons	3·68
Average CO_2 contents in gas, per cent.... ...	29·27
C per cent.	3·64
Si " "	0·36
Mn " "	0·40
S " "	0·009
P " "	0·018

* According to instruments at the furnace.
† Estimated on the basis of 8,760 KW.-hours per KW.-year.

The practical success of the process is shown by the number of plants built or planned. These are:—

Completed—		
Trollhättan, Sweden,	1 furnace	2,500 H.P.
Domnarfvet, "	1 "	3,500 "
Hagfors, "	2 furnaces, at 3,000 H.P.	6,000 "
Hardanger, Norway	1 furnace	3,500 "
Under Construction or Planned—		
Hagfors, Sweden,	1 furnace	3,000 H.P.
Nykroppa, "	3 furnaces, at 3,000 H.P.	9,000 "
Hardanger, Norway	1 furnace	3,000 "
Arendal, "	3 furnaces at 3,000 H.P.	9,000 "
Switzerland	1 furnace	2,500 "
	Total, furnaces for	42,000 H.P.

The Hagfors and Nykroppa Works, Sweden, both belong to the Uddeholm Co. The working of the first furnaces at Hagfors proved so satisfactory that the company have decided to substitute electric smelting for their present blast furnaces at both works. They are expending about £330,000 for the new plant and for harnessing sufficient water-power. The report of the directors states that the electric smelting has been found more economical and gives a better product. Besides this, two-thirds of the present consumption of charcoal will be saved, and consequently a large quantity of wood will become available for the company's sulphite pulp works and other purposes.

We are indebted for the above information to Electro-Metals, Ltd., 9½, Union Court, Old Broad Street, London, E.C., who have acquired the rights to this process for the British Empire, the United States and Mexico.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Volt" writes:—"The tenants of a private estate require a supply of electricity from an electrical company working under Parliamentary powers—the estate being within the area of supply.

"Before erecting poles for the purpose of supplying such consumers, is it not necessary for the company to first obtain the consent of the owner of the estate, or, failing that, to apply to the Board of Trade for compulsory way-leaves?"

⁂ It is clear that poles cannot be erected on, nor can wires be suspended over, the land of any person without his consent; nor has the Board of Trade any power to grant compulsory way-leaves. Sec. 10 of the Electric Lighting Clauses Act, 1899, provides that undertakers shall not, without the express consent of the Board of Trade, and where the local authority are not themselves the undertakers, of the local authority also, place any electric line above ground, except within premises in the sole occupation or control of the undertakers, and except so much of any service line as is necessarily so placed for the purpose of supply. It would seem as if "Volt" can only proceed to obtain his way-leaves by agreement with the land-owner concerned.

"Lex" writes:—"I should be much obliged if you would inform me whether it is a fact that municipal authorities are compelled by law to advertise for tenders for work involving the outlay of £100 or more; also whether they are obliged to publish the amounts of such tenders, or at least to disclose them to any ratepayer who may apply for the information. It seems to me that in the absence of such compulsory publication, there is no check on improper transactions, which would be detrimental both to the public welfare and to that of the honest tenderer."

⁂ Except in the case of an urban authority there does not appear to be any necessity for a local authority to advertise for tenders, although the practice is generally adopted.

Urban authorities are compelled by law to offer certain contracts for public tender. Thus it is provided by Sec. 174 (4) of the Public Health Act, 1875, that before any contract of the value or amount of £100 or upwards is entered into by an urban authority, ten days' public notice at least shall be given, expressing the nature and purpose thereof, and inviting tenders for the execution of the same, and such authority shall require and take sufficient security for the due performance of the same. Interesting questions have arisen in practice as to the legal effect of this provision. Thus in one instance (see the Electrical Review, March 2nd, 1906), a certain municipal council, having resolved to extend its electrical plant, sent out to a number of electrical manufacturers a specification in which a special type of engine (one firm's exclusive speciality) was asked for, the type of the generator being left open. The matter was not advertised. A firm of engine builders not making the type specified by the engineer obtained permission to tender, but, contrary to the specification, they quoted for their own type of engine. Their price was lowest, but they were ruled out as having failed to comply with specification.

The following points arise: (1) Should the matter have been settled with the contract being publicly advertised? (2) Was the engineer acting within his rights in specifying a particular type of engine—a fact which conceivably might allow the price being increased, because of a "monopoly" given to that favoured type? It is a frequent practice for dynamo builders to submit alternative tenders for their machines driven by different types of engines. In this way the engineer can obtain his end without leaving an opening for unfair competition. Bearing in mind that the local authority in question was a municipal body, the legality of this particular method of obtaining tenders would seem to be open to question. The object of the legislation is manifestly clear; it is to give the public an assurance that there shall be no favouritism, and that the ratepayers' money shall be expended as economically as possible. A further question has also arisen. Is a municipal body at liberty to state that no tender will be considered unless it include a particular type of engine? Although there does not appear to be any direct authority on the point, it constitutes, in the writer's view, an abuse of the powers which are conferred upon local bodies by Parliament, and opens the door to unfair dealing.

It is a common practice for local authorities and other bodies inviting tenders to draw special attention to the fact that the lowest tender will not necessarily be accepted. The knowledge that the job will not as a matter of course be handed over to the lowest bidder tends to encourage offers from firms of repute, who need not fear that mere stiffness of price spells instant rejection. Where, however, the party inviting tenders is a local authority, it seems that there may be a *vis a tergo*, in the shape of a Government office, to be reckoned with. Thus, when a local authority, such as a County Council, desires to spend money upon some object which comes within the purview of the Home Office, the sanction of the Home Secretary must be obtained.

A veto will be exercised in a proper case. It appears that the Essex County Council, being minded to build a new county lunatic asylum at Colchester, delegated to their Committee of Visitors the duty of obtaining tenders. Messrs. Waring & White's tender, which amounted to £193,139, was accepted, although it was not the lowest. The committee had, however, made it clear that they did not bind themselves to accept the lowest or any tender. Mr. Gladstone refused to sanction the contract on the grounds (1) That the tender was not the lowest; (2) That other firms were not offered the same opportunity of reconsidering their tender as was afforded to Messrs. Waring & White; and (3) That the acceptance of this firm's tender involved a system of sub-contracting which, in Mr. Gladstone's opinion, was in itself a serious objection. In spite of the fact that the committee stated that the successful firm were not, in fact, invited to reconsider their tender, the Home Secretary refused to reconsider his decision.

It would not, of course, be wise to lay down the general principle that local authorities shall always accept the lowest tender, but tenders are often accepted for indirect reasons. A particular contractor is chosen because he pays Trade Union wages, or because he belongs to a particular section. Again, the practice of accepting a higher tender on the mere ground that it gives employment to local men is one which may lend itself to every kind of abuse. In intervening to prevent the growth of any such abuse, the Secretaries of State would perform a useful service. It may be hoped that the fact that the Home Secretary has intervened—whether rightly or wrongly—may lead the President of the Local Government Board to intervene in suitable cases which come within his range.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,963. "Magneto-electric machines." O. Bartschi. September 2nd.

19,980. "Fuses for use in electrical circuits." Siemens Schuckertwerke G.m.b.H. (Convention date, September 2nd, 1911, Germany.) September 2nd. (Complete.)

20,076. "Electrical insulator and binder." A. Watkins. September 3rd.

20,101. "Chemical generators of electricity." O. Sozzi. September 3rd. (Complete.)

20,113. "Electric motor-starters, controllers and the like." F. J. Moffett and N. B. Rosher. September 4th. (Complete.)

20,116. "Means of grinding up motor and dynamo commutators." W. J. Davey. September 4th.

20,154. "Electric wiring systems." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. September 4th.

20,161. "Electric lighting device for railway carriages." C. Kolbe. September 4th.

20,180. "Electrolytic pickling of metals." P. Marino. September 4th. (Complete.)

20,185. "Driving self-propelled and electrically-driven agricultural machines." W. Wortmann. September 4th. (Complete.)

20,191. "Electrically-heated hot-air douches." A. Schaeffer. (Convention date, December 223rd, 1911, Germany.) September 4th. (Complete.)

20,196. "Telephonic transmitting appliance." J. K. Rhodes. (Convention date, April 6th, 1912, United States.) September 4th. (Complete.)

20,224. "Brush-holder." A. E. Berdon. September 5th. (Complete.)

29,225. "Direct-current generators." A. E. Berdon. September 5th. (Complete.)

20,244. "Motor-actuated extension ladders for fire-escapes and the like." "Cedes" Electric Traction, Ltd., and E. Clifford. September 5th. (Complete.)

20,247. "Electro-magnetically operated switches, particularly adapted for controlling electric motors." E. Schattner. September 5th. (Complete.)

20,248. "Spark plugs." J. J. Thompson. September 5th. (Complete.)

20 252. "Electric resistance grids." Electric and Ordnance Accessories Co., Ltd., G. Ralph and W. G. H. Cox. September 5th.

20,269. "Electrically-operated suction cleaners for the extraction of dust and the like." Armorduct Manufacturing Co., Ltd., W. C. Jeary and J. P. Arnacker. September 5th. (Complete.)

26,270. "Electrical switch." J. G. Doran. September 5th.

20,285. "Means for receiving wireless telegraph signals." Marconi's Wireless Telegraph Co., Ltd., and C. S. Franklin. September 5th.

20,290. "Ignition plug having stationary electrodes for explosion motors." K. Lindenmann. September 5th. (Complete.)

20,293. "Memorandum and like appliances for use in connection with telephones and other purposes." E. F. M. Bransom and F. H. Bowden, trading as Branson & Bowden. September 6th.

20,295. "Wall and like plugs." W. W. Timewell and S. Sheen. September 6th.

20,345. "Telephone meters." G. L. Bates. September 6th.

20,357. "Electrical connections." W. E. Lake. (Soc. Anon. Le Carbone, France.) September 6th.

20,361. "Incandescent electric lamps." C. Joly. September 6th.

20,366. "Electrically self-winding clocks." F. H. Walker. September 6th. (Complete.)

20,401. "Engine tell-tale or alarm mechanism for use in connection with engine-room telegraphs." H. Smith. (John Dawson Smith, High Seas.) September 7th.

20,442. "Photo-telegraphy." T. T. Baker. September 7th.

20,446. "Safety arrangements for overhead electric railway or tramway systems." J. E. Pollak. (Elektromotoren-Werke Hermann Gradenwitz, Germany.) September 7th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

Electrical Conduit Junction Boxes. T. G. Gatis. 15,866. July 8th.

Envelopes or Supports for the Resistances in Electric Heating Apparatus. C. O. Bastian. 16,143. July 12th.

Machine for Winding Wire or the like upon Hose Pipes, Insulation upon Cables, and for Analogous Purposes. W. Furstenberg. 17,998. August 8th.

Application of Electric Currents for Preventing the Corrosion of the Tubes of Surface Condensers. A. Harris. 18,220. August 11th.

Electrical Heating Element. T. Judd. 18,334. August 14th.

Manufacture of Metal Filaments for Electric Lamps. F. R. Grote. 18,351. (Cognate application, 27,290 of 1911.) August 14th.

Manufacture of Filaments for Incandescent Electric Lamps. H. Hoge and "Z" Electric Lamp Manufacturing Co. 18,392. August 14th.

Sparking Plugs of Internal-combustion Engines. F. A. L. Johnson. 19,800. (Cognate application, 23,960 of 1911.) September 6th.

Electric Heating Apparatus. C. M. Holmquist. 21,026. September 23rd.

Electrically-heated Sad-irons. H. J. C. Forrester. (Diamond Electric Co.) 22,111. October 7th.

Fittings for Incandescent Electric Lamps. F. Gunn and W. T. Nicholson and Clipper Co. 26,377. November 23rd.

Electric Safety Lamp. H. Sefton-Jones. (Electric-Exporte Werke Ges.) 27,826. December 11th.

Switches for Mono-rail Telpher Tracks and the Like. R. Dempster and Sons, Ltd., and W. Mitton. 29,062. December 23rd.

Wiring of Contacts of Telephone Switches. Western Electric Co., Ltd. (Western Electric Co.) 16,868. July 22nd.

Protecting Coverings for Electric Conductors or Cables. W. C. Blackett and W. C. Mountain. 18,212. August 11th.

Telegraph Instruments. British Insulated and Helsby Cables, Ltd., and G. W. Moore. 19,065. August 25th.

Regulators for Electrically-driven Ring Spinning and Doubling Machines. Siemens Bros. Dynamo Works, Crowley and S. Gowan. 19,084. (Addition to 23,641 of 1910.) August 25th.

Regulators for Electrically-driven Ring Spinning and Doubling Machines. Siemens Bros. Dynamo Works, Crowley and S. Gowan. 19,085. August 25th.

Electric Battery Lamp. Van Raden & Co. and M. Metz. 19,194. August 28th.

1912.

Mechanical Connectors for Electric Cables. F. Neave and Callender's Cable and Construction Co. 163. January 2nd.

Method for Applying an Electrically conductive Layer upon an Electrically Non-conductive Surface. H. E. Goldberg. 3,644. February 13th.

Manually or otherwise Operated Electric Switches with Automatic Releasing Mechanism. E. T. R. Murray. 6,112. March 11th.

Electric Motor for Transmitting Angular Movements with an Auxiliary Motor which Controls the Successive Displacements for it. R. Girardelli. 6,496. March 15th. (March 15th, 1911.)

Alternating-current Electricity Meters. Siemens-Schuckertwerke Ges. 6,647. March 18th. (March 18th, 1911.)

Method of Restraining the Augmentation of an Electric Current and Contrivance therefor. A. N. Hazlehurst and Longstreth's, Ltd. 6,882. March 20th.

Electricity Meters. Isaria Zahlerwerke Akt.-Ges. 8,075. April 3rd. (April 3rd, 1911.)

Ferro-concrete Pole, especially for Supporting Electric Conductors. P. Rose and A. Oldenburg. 8,088. April 3rd.

Oil-brake Electric Switches. R. H. Barbour and T. G. Travis. 10,528. May 3rd.

Electric Switches. H. G. C. Fairweather. (Hart Manufacturing Co.) 10,704. May 6th.

Clutch Gear for Hughes Telegraph Apparatus. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 12,313. May 24th.

Electric Switches. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 12,980. June 3rd.

Power from Rills.—It is surprising how much there is to be learnt by the engineer when on a holiday, by simply keeping his eyes open. A correspondent recently paid a visit to Huelgoat, a pleasure resort in the heart of Brittany, about 40 miles to the east of Brest. Describing it, *à la* guide book, he says "it is picturesquely situated in the midst of a dense forest of pines, which at one time covered a vast tract of country. The wild boar still roams at large in what is left of the forest." To chase this beast is forbidden; a very unnecessary monition, because owing to his innate ferocity the *sanglier* generally does the hunting himself. In a lovely valley some way below the town, a power station is to be found; but the casual visitor looks in vain for the lake or reservoir from which the water supply is drawn. The secret is discovered if he makes his way through the pines, bracken, and osmunda fern which clothe the mountain sides. At an elevation of about 600 ft. he will discover a canal about 5 ft. wide, and not more than 2 ft. deep, which runs right round the valley for a distance of about 4 miles. It is fed by a myriad of rivulets which find their way into it from beneath the undergrowth. The intake is placed above the generating station. Owing to the fact that streams are more constant in a wooded country, the supply appears to be perennial, and enough power is generated for the purposes of a silver and lead mine which is worked in the valley. Here, then, in an out-of-the-way part of Brittany, one finds the forces of nature pressed into the service of man in a manner which combines efficiency with economy; but, as if to show that the Breton has not wholly accepted the teachings of modern science, you pass into the next valley to find a threshing machine worked by eight horses; the animals are urged to further exertion by a man who sits on a revolving pedestal in the centre.

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H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

RAILWAY TRAIN LIGHTING.

THE shocking accident which took place at Ditton Junction last week, when a number of unfortunate passengers, imprisoned in the wreckage of the telescoped coaches, were not merely killed, but tortured to death by fire, once more draws attention to the frightful dangers entailed by the use of gas for lighting and cooking on railway trains. It is not as if there were no alternative; the remedy lies ready to hand. Electricity is perfectly capable of performing all the functions now fulfilled by gas, with the exception that it cannot be accused of roasting the passengers, and the preference still exhibited by some of the railway companies for the older system is attributable only to a tender regard for the pockets of the shareholders, arising from the belief that a slight economy can be effected by its use. Whether even the last-named advantage is realised is highly questionable, as evidenced by the fact that some companies have adopted electric lighting on a considerable scale, and are extending its employment; but even if it could be demonstrated that gas was the cheaper, the fact would not have any material bearing on the question, for the safety of the passengers ought to be the first and paramount consideration.

The Board of Trade inquiry has not yet been held, and it may be urged that there is no proof of the accusation levelled against gas; but it is admitted that five of the coaches were lighted by gas, and two by electricity; the latter were not burnt, but two of the former were, and the conflagration is ascribed by the railway Press either to gas or to hot coals from the locomotive. We have on a previous occasion pointed out that it is practically impossible for burning coals to escape from the firebox of a locomotive in a head-on collision; red-hot ashes might be projected forwards from the ash-pan, but are we to believe that they were sufficient in quantity, and sufficiently distributed, to cause the immediate ignition of two coaches and their rapid destruction? Moreover, in this case, the locomotive ran against a bridge and the coaches ran past the bridge and piled up at the platform. On the other hand, even if the gas tanks remain intact, the gas pipes are practically certain to be broken in a collision, and a torrent of gas is thus released, providing ideal conditions for the disastrous holocausts with which we are so cruelly familiar. To argue that the gas was not to blame is to fly in the face of reason.

Twelve of the 17 victims who lost their lives were burnt. Had it not been for the fire, which prevented their rescue, it cannot be doubted that some at least of these would have been saved; and even if the railway directors regarded the matter only from the sordid standpoint of pounds, shillings and pence, would not their outlay on compensation have gone far towards covering the difference in cost?

For many years past the Inspectors of the Board of Trade have consistently urged the desirability of substituting electricity for gas, and have on various occasions definitely attributed fires to the use of gas. But nothing further is done, and the railway companies ignore the recommendations which are not backed up with compulsion. The public sleepily looks on, and the lay Press roundly abuses the companies for three days—then all is quiet until the next horrible disaster.

Our contemporary, the *Gas World*, dolefully says, "One felt sure it would happen"—namely, that the fire would be attributed to the use of gas—and proceeds to abuse the daily papers which pointed out the wickedness of persisting in that dangerous practice. Curiously enough, the day before this lament appeared, an explosion in an office, which resulted in the death of a passer-by and burns to a clerk, was also ascribed to escaping gas, owing to the singular coincidence that just before the explosion a clerk had been investigating the source of an unpleasant "gassy" odour with the aid of a lighted match. One cannot but regret that indiscreet and sensational journalists should thus hastily jump to conclusions so obviously unwarranted by the facts and cast aspersions upon an innocent illuminant. Clearly, the explosion must have been due to hot coals.

The British Association.

The meeting of the British Association at Dundee has been a memorable one for several reasons. At the concluding meeting, in passing votes of thanks to those who had contributed to the exceptional success of the event, the President, Prof. Schäfer, said with truth that the Association had never met with more generous hospitality or a warmer welcome. The number of visitors exceeded all expectations, and the usual social entertainments were carried out on a most lavish scale, concluding with a ball, to which practically the whole Association was invited. The serious side of the work was also better supported locally than for years past. The greatest credit was due to the organisers who were responsible for the arrangements; with numbers swelling to the last moment until a grand total of over 2,500 Members and Associates was reached, it will be well understood that their task was heavy.

The meetings of the Sections were well supported throughout, and there were present many of the foremost men in the various branches of science; there was, perhaps, less of the sensational and spectacular than usual, and a much closer attention to serious work. Each of the Sections was presided over by a man of the very first rank, and it seemed that the papers had been selected with more than the usual care. The evening discourses and popular lectures were most successful, and the attendance proved that the interest taken by the people of Dundee was genuine and intelligent. There was a feeling of sincerity throughout the meeting to which the local Press, by its surprisingly able and critical reports, greatly contributed.

In one matter alone were the arrangements open to criticism, and that was in the very small numbers invited to inspect the industries of Dundee. This may be due to the fact that the jute industry is very highly specialised, and if the manufacturers were not ready to throw open their establishments to considerable numbers of visitors, it is hardly surprising; though it was certainly disappointing to many of the visitors. It remained to a jute manufacturer, however, to put the coping stone on the vast edifice of satisfaction built up for the British Association in the unprecedented gift of £10,000 given unconditionally to the Association by Dr. J. K. Caird. It was stated, whether correctly or not we do not know, that the largest previous gift to the Association in its whole history was £30. That this magnificent sum will be properly applied to produce the greatest possible advancement of science may be taken for granted, and we hope the first result will be to make the task of Prof. Perry, the general treasurer, in dealing with applications from the Sections for grants in aid of original research a little less difficult.

The British Association does not in these days, as a rule, get the first announcement of notable discoveries in any branch. These go first to the special societies. But it records year by year the general advance of knowledge, and diffuses it abroad. And one great advantage that it possesses above all the other institutions is that it brings together all the branches of science, and not only promotes useful and fruitful friendships between men working in fields remote from each other, but it is every year obtaining good results from joint discussions between the Sections. A notable instance of this was the very valuable combined debate between Sections G (Engineering) and A (Mathematics and Physics), on wireless telegraphy, which we have reported fully.

Another quite unique feature of the British Association is the large attendance of foreign experts from all parts of the world. No other institution attracts such a number of foreign scientific men.

The British Association meets next year under the Presidency of a distinguished engineer, Sir Wm. White, at Birmingham, on September 10th, but we have no hesitation in saying that even the Midland Metropolis will find it difficult to surpass the success of the Dundee meeting. In the following year, 1914, the meeting is to be in Australia, and Mr. Fisher, the Prime Minister of the Commonwealth, recently stated that about 50 per cent. more members are now expected than was at first thought possible. Lavish arrangements are being made for an extended tour throughout Australia.

There is also an invitation under consideration at the present time for those members who do not go on the Australian trip to attend a meeting of the French Society for the Advancement of Science, in 1914, at The Havre, and thus make it a joint meeting or "Entente Cordiale" of science. Considering the vast debt which science owes to the French nation, this invitation should not be refused, unless there exists some absolutely insurmountable difficulty.

Sane and Sound Tramway Policy.

In his presidential address to the Municipal Tramway Association Convention which comes to a close to-day, Mr. Blain makes the following remarks on sound business management:—

"Grants in aid of rates should be unknown until the undertakings have such adequate reserve funds as shall build their position on the solid rock. Election pressure for unripe extensions, undue fare concessions, or unreasonable labour conditions, should be resisted without fear of personal consequences, and I have never yet known an electorate which failed to appreciate a straightforward statement of honest, business-like policy, laid before it by an honest, straightforward and business-like representative."

Wise words of counsel these. The strong and sound policy here outlined in so few words, if followed, may save some of our tramway undertakings from getting into the deplorable condition in which too many electricity supply systems have fallen, because they have neglected the warnings and advice respecting financial soundness, reserves and depreciation, business management, and so forth, that have been so continuously given to them in our own pages and in other quarters.

Gas Propaganda in Germany.

Some time ago, an Association was formed in Germany to promote the consumption of gas; from a note in the *Gas World*, it appears that the results have been highly satisfactory, for "The German Gas Promotion Centre says the effect of the gas propaganda has been remarkable; the attitude of the public mind seems to have quite changed, and the manufacturers are very busy, their orders having in some branches increased as much as sixfold." The Centre also remarks that "a thoroughly good canvasser is a most valuable member of the staff of the gasworks, but he is not to be met with every day"; he ought to be specially trained, and the Centre is taking steps to carry out such training. The experience of the Gas Promotion Centre is directly applicable to the supply of electricity also, and we commend this example of successful collective effort and enterprise to the notice of British central station managers.

Competition in Buenos Ayres.

It was reported a short time ago that an Italian-Argentine company was in negotiation with the Buenos Ayres municipal authorities with a view to obtaining a concession for the supply of light and power in that city. As the largest supply undertaking in the Argentine capital, although not possessing an absolute monopoly, the German Transmarine Electricity Co. became somewhat disturbed at the prospect of possible competition, and addressed a memorial to the city authorities on the subject. It was pointed out that the company's charges for light and power in 1915, when the contemplated rival would be able to start a supply, would be actually lower than the prices proposed by the Italo-Argentina company, and it was therefore submitted that no commercial basis existed for the authorisation of the latter. Before sufficient time had elapsed for the consideration of the memorial, a fresh rival appeared in the form of the existing Lacroze Tramways Co., which has suddenly discovered a clause in its concession which permits the company to furnish energy for lighting and industrial purposes both in the city and the province of Buenos Ayres. At present the tramway company supplies power for the operation of its tramways, and is engaged in extending its works so as to be able to deal with the concession which the company obtained a year ago for the construction of underground railways in Buenos Ayres. The company has secured the authority of the National Government to carry into effect the hitherto unexercised clause for supply for public and private purposes, and it only remains for it to arrange with the municipal authorities in regard to the laying of cables, but the Government stipulates that the conditions are not to hinder the working of the clause in question.

The Monopoly Question in Germany.

The Aix-la-Chapelle Chamber of Commerce raises this question in its annual report from two points of view. In the first place, it is stated that notwithstanding the efforts put forward by the special electrical firms and the Union of Installation Firms to combat the monopolistic endeavours of the large firms in installation work and the supply of materials for the construction of overland central stations, it is only with difficulty that conditions can be inserted in the agreements so as to exclude a hidden monopoly from the holders of the concessions. A desperate fight is proceeding in the electrical market between the special works and independent installation contractors on the one hand, and the large firms on the other, and this will finally be decided in favour of the latter unless the Government adopts energetic measures for the protection of the smaller establishments. The second problem, to which attention is probably directed for the first time, refers to the acquisition of leases of electric supply works. The report submits that offers to take over municipal or communal electricity works have been made by the large firms in recent times in the most varied localities, and it is contended that if these firms are able to secure a lease of these neutral supply works, their strength will become so great as to cause the German industry to mature into the American trust system.

Southport Electricity Supply.

Far be it from us to rejoice over the troubles of our friends; much rather would we rejoice with them in their prosperity. But when we see an undertaking in such a plight as that of the Southport electricity estate, we cannot refrain from lamenting that the Electricity Committee, ignoring our friendly advice, and seeking only a fleeting popularity, applied large sums of money to the so-called "relief of the rates," instead of first building up a substantial reserve and depreciation fund to provide against those eventualities, which, as we have continually pointed out, sooner or later were bound to arise.

Now, the crisis has arrived; the sins of the municipality have found it out, and, according to the report of Mr. S. J. Watson, of Bury Electricity Works, who was appointed by the Southport Corporation to investigate the matter, the ratepayers are liable for about £20,000 for depreciation in the value of the assets of the Electricity Department. During the 14 years' existence of the undertaking no reserve fund has been formed, although the undertaking has been robbed of £27,000 in aid of rates.

It is one of the chief drawbacks to the municipal control of such an enterprise, that all questions of management are liable to be subordinated to party politics by time-serving politicians, and the true interests of the business are sacrificed to the desire to catch votes. Unfortunately, too, the punishment, when at last it falls, rarely alights upon the true culprits, though those who take up the reins and allow so rotten a policy to continue are, no doubt, as blameworthy as the original sinners.

We cordially endorse the views expressed by Mr. Watson, and agree with him that depreciation should be provided for each year without fail, even if the doing so involves a contribution *from* the rates. We have consistently maintained this principle for very many years, and have suffered much abuse in consequence thereof; but it is now generally recognised that the policy we advocate is sound and in the best interests of electricity supply undertakings, and we trust that those who still hold out against it will take speedy warning from such cases as that of Southport—which, by the way, does not stand alone.

NOTES FROM CANADA.

[From our Special Correspondent.]

In the Province of Saskatchewan the towns of Humbolt and Canora have recently decided to spend £6,000 and £4,000 respectively in establishing electric lighting plants, while in Regina it is proposed to spend some £120,000 on improvements to the municipal tramway system.

The Western Canada Power Co., it is reported, has secured a contract for the supply of 40,000 h.p. to the British Columbia Electric Railway Co., and probably extensions to the plant of the former company will be required.

It is reported in the daily papers that owing to the immense amount of water power available, it is not improbable that at some future time the motive power for the Hudson Bay Railway will be electricity. Tenders for the construction of the last section of this line, viz., that reaching to the seaboard, are already in the hands of the Government. A more extended plan for the utilisation of the water-powers mentioned above is also proposed. This is to supply power to the Western Provinces in very much the same manner as is being done in Ontario by the Hydro-Electric Power Commission.

The Ontario Commission just referred to has recently been devoting a good deal of time and energy to educating farmers in the many ways in which electricity may be of service to them.

The Chairman (the Hon. Adam Beck) is very enthusiastic in this matter, and is of the opinion that the use of electricity on the farm will go far to solve the labour problem, which, out here, is a serious one, owing to the difficulty of obtaining help and the consequent high wages. A special motor-wagon has been equipped by the Commission recently, and by its means, on a number of farms, a practical demonstration of what electricity can do for the farmer has been given. Threshing, pumping, ironing, cooking and heating have all been demonstrated, and a good deal of interest has been aroused in agricultural circles. In addition to this, the Canadian National Exhibition, a few particulars of which appeared in these notes some time ago, afforded an opportunity for an exhibit of various electrically-operated farming and domestic appliances.

It is probable that this effort on the part of the Commission will be watched by many communities outside of Ontario with great interest, and, if it turns out successfully, will be copied in many places.

News from Ottawa states that a claim has been filed against the Hydro-Electric Power Commission for about £600,000 for damages arising out of the expropriation of the Chats Falls property. The cost of this property to the owners was about £400 a few years ago. The Commission intends to utilise the falls for power purposes; according to the Conservation Commission, there is a possible development at this point on the Ottawa River of 58,000 h.p., and with regulated water and a canalised river, of 150,000 h.p. The available head is 48 ft.

THE BRITISH ASSOCIATION.—IV.

The Féry Bomb Calorimeter.

By Robert S. Whipple, M.I.E.E.

(Section G. Abstract.)

The instrument which I bring to your notice is one designed by Prof. C. Féry, of the Ecole Municipale de Physique et de Chimie, Paris. It is not dissimilar to the well-known Mahler calorimeter, with the exception that the bomb is much lighter and there is no water jacket. Fig. 2 shows the construction of the instrument. The bomb A, in which combustion takes place, is a cast-iron vessel weighing about 1 kg. and having a capacity of about 250 cb. cm. It is supported by two constantan disks, K and K, about 1 mm. in thickness, the disks being soldered both to the bomb and to the brass surrounding vessel B. The cover of the bomb is held in position by means of the collar (shown in section), which fits over the top of the bomb in a somewhat similar manner to that in which a breech fits a modern gun. The coal to be tested is placed on the small tray C, and is ignited by means of a piece of cotton resting on the nickel-chromium heating wire connecting the two terminals in the cover, the latter being connected to the battery P. Oxygen at 200-lb. pressure is introduced into the bomb through the needle-valve *p*.

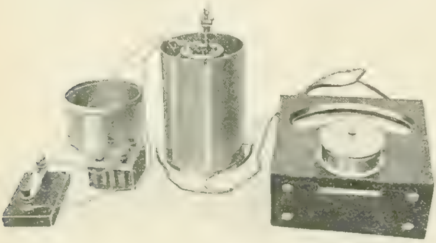


Fig. 1.

Thermo-couples made of constantan (an alloy of copper and nickel) and iron are largely employed commercially, giving an E.M.F. of about 40 micro-volts per degree Centigrade. In this instrument the constantan disks and the bomb act as a thermocouple, the iron of the bomb forming the hot junction, the brass surrounding vessel the cold one. The E.M.F. thus generated is measured by the voltmeter V.

In the Mahler calorimeter the weight of the bomb is about 3·5 kg. and the weight of the water is about 2·5 kg.; in the Féry instrument the weight of the bomb is only 1 kg. and there is no water, so that its water equivalent is in comparison very small. As a result, the temperature rise due to the combustion of 0·5 gramme of coal is 20° C., as compared with 2° C. in the older instrument. The pointer galvanometer employed gives approximately a deflection of 60 mm. for 800 microvolts (20° C.), so that it is possible to estimate the temperature rise to within 0·2° C., or to $\frac{1}{300}$ of the total rise in the temperature of the bomb. The simplicity of this method of reading the temperature as compared with the difficulty of reading finely divided mercury thermometers will be appreciated by all who have worked with the latter.

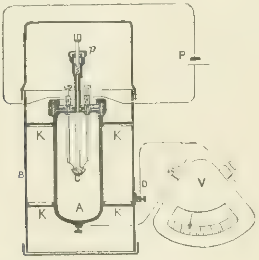


Fig. 2.

The loss of heat from the bomb is due to three causes:—

1. Conduction along the constantan disks.
2. Convection by the air currents in the space surrounding the bomb; and
3. Radiation from the walls of the bomb to the surrounding shell.

Considering the first cause—conduction would simply tend to lower the temperature to which the bomb would rise if the supporting disks were non-conductors. The rate of loss of heat by conduction may be assumed to be proportional to the difference in temperature between the centre and circumference of the disks.

Convection currents are not easily established in a closed space. When established, the heat losses due to this cause are approximately proportional to the square of the difference in temperature between the bomb and the surrounding air.

The losses due to radiation at the comparatively low temperature to which the bomb is heated are very small. In the small range of temperature (not more than 30° C.) Newton's law of cooling must be an excellent first approximation; this means that the rate at which heat passes by radiation from the walls of the bomb to the surrounding vessel is practically proportional to the difference between the temperatures of these two bodies. The losses due to convection and radiation are negligible as compared to those due to conduction.

The coal under examination is placed on a small tray in the bomb, the latter being filled with oxygen at about 200 lb. pressure. The coal is fired electrically, the maximum temperature rise on the galvanometer taking place about 1½ minutes after ignition. Experiments show that the gas pressure can be varied from 150 lb. to 250 lb., and the weight of coal burnt from 0·2 to 0·7 gramme, without any difference in the results obtained. The instrument is standardised by burning either sugar, carbon, or standardised coal briquets, the calorific values of which are known.

Experiments have been made with materials of largely differing calorific values, and the results have been found to agree excellently amongst themselves. The deflections of the galvanometer are proportional to the calories dissipated in the bomb. In the case of the instrument tested the dissipation of 100 calories gives rise to an E.M.F. of 105 microvolts, and this value per 100 calories is found to be practically constant up to 10,000 calories.

As now constructed, the bomb is made of cast-iron unprotected by any lining such as enamel or platinum. There should be no difficulty in fitting such a protective device, the only drawback being that such arrangements are apt to introduce temperature lag.

The calorific value of paraffin or petrol is determined in the manner originally suggested by Dr. Rosenhain, viz., by soaking a wad of filter paper (which has been weighed and the calorific value of which is known) in the liquid under test. The sample is then weighed, being suspended by a cotton thread which is afterwards hooked on to the electric ignition wire of the calorimeter. In the case of petrol or liquids which evaporate rapidly a piece of tinfoil (the calorific value and weight of which has also been determined) is wrapped round the saturated wad.

The scale of the galvanometer is divided in millivolts, and also in calories on the assumption that a sample weighing 0·5 gramme has been burnt. There is thus no necessity to determine the water equivalent of the calorimeter nor to read the rise in temperature (as is usually done); the calorific value of the coal is found by a single observation. A slide rule will readily convert the values obtained if a slightly different weight of coal has been used. It will be found that if the sample of coal has been weighed previously a complete experiment can be made in less than five minutes.

The instrument is easy to handle, there are no fragile parts, and it is essentially a practical tool.

The Scientific Theory and Outstanding Problems of Wireless Telegraphy.

Discussion.

(Concluded from page 409.)

Dr. W. H. Eccles summarised a long communication describing some of the outstanding phenomena met with in the transmission of electric waves, artificial and natural, over great distances, and examining how far they might be explained on the hypothesis of refraction or reflection of electric waves by masses of ionised air. The favourable influence of the ionisation of our atmosphere by the sun on the propagation of electric waves round the globe was first drawn attention to in a paper read in June last before the Royal Society by Dr. Eccles, in which he showed that the presence in the atmosphere of charged ions of molecular magnitude produced such alterations of the velocity of electric waves through the medium as would have appreciable effect on waves that travelled over long distances. Ions of various sizes were, no doubt, produced by solar radiation. The researches of Leonard and Ramsauer especially had proved that ultra-violet light had a direct action on air, and that, in particular, electrical carriers of molecular size were generated with absorption of light. These carriers, besides, had not nearly so great a power of causing condensation of water vapour as had the "condensation nuclei," usually uncharged, which were produced simultaneously and independently and with comparatively small absorption of light. These uncharged condensation nuclei were formed only where there was water vapour, which probably implied only at low levels of the atmosphere, and had insignificant effect on the velocity of electric waves, while the electrical carriers, which he assumed were found abundantly at high levels where the solar radiation was still unweakened by absorption, had great influence on the velocity of propagation.

The concentration of the ions due to solar radiation must increase as distance from the earth increased, and it was not unreasonable to assume that practically all the ions in the middle parts of the atmosphere were due to solar radiation. A consequence of this was that the velocity of electric waves would increase as height above the earth increased. It followed that a nearly vertical wave front would tilt forward as it travelled horizontally through the middle portion of the atmosphere, or, in other words, a ray travelling nearly horizontally in the middle atmosphere would follow a trajectory curved in the same sense as the earth's surface. In the lower atmosphere, where the ionisation and its rate of variation with height were small, the ray might not be bent appreciably. Thus, an electric ray starting from a point of the earth's surface in a direction inclined slightly upward, would pursue a straight path in the lower atmosphere and a slightly bent path with its concavity downward in the middle atmosphere. If its curvature here was on the average greater than that of the globe, the ray would be turned down to the lower atmosphere, and again traverse a straight line; but in the other event it went farther and farther from the earth's surface and was lost to us.

It was obvious that, at or above any particular place on the earth's surface, the ionisation in the middle and lower atmosphere increased up till noon and diminished after noon. At sunset most of the ions formed by the sun would disappear rapidly by recombination, and this would leave the atmosphere un-ionised except in so far as local electromotive force might have sifted positive from negative ions during the day. At sunrise there would be great formation of ions. Thus, at the boundary of light and darkness in the atmosphere, there was a more or less abrupt change in the electrical conditions of the medium through which waves had to pass. This region of twilight might be expected to have a much greater influence on the propagation of waves coming from a great distance than on that of waves coming from distances which were not large compared with the height of the well-ionised layers.

Scarcely any of the phenomena to be described could be explained without assuming that there existed in our atmosphere some permanently ionised upper layers capable of reflecting electric waves. This hypothesis was put forward by Heaviside in 1900, but had as yet not been supported by any direct evidence. Besides the implicit evidence in favour of the hypothesis scattered through this communication, Dr. Eccles adduced some considerations from quite another quarter. In 1901 Newcomb made photometric measurements in America of the total light received at the earth's surface from a clear sky on a moonless night, and compared it with the sum total of the measured light from the stars. He discovered that the light actually received greatly exceeded that from the stars. This result had been confirmed by other observers, notably in 1907-8 in Holland, by Yntema, who found the extra light to be perceptibly greater near the horizon than at the zenith. Yntema suggested in 1909 that the extra light might be due to a sort of permanent aurora in the upper atmosphere. It was well known that W. W. Campbell showed in 1895 that the green auroral line λ 5,770 could be seen on clear moonless nights in any part of the sky. This extra light had lately been measured on Mount Whitney by Abbott (August, 1910), with results similar to the preceding. Discussing this "earth light," as it was called, Dr. W. J. Humphreys, in the *Astrophysical Journal* of May, 1912, put forward and supported plausibly the new suggestion that the outermost layers of our atmosphere were kept permanently ionised by bombardment with dust of cosmical origin. An ionised upper layer such as this was exactly what was demanded by many of the facts of wireless telegraphy; but it was very doubtful whether Humphreys' views would be admitted by students of terrestrial magnetism.

In a very important discussion of the degree of conductivity required in the upper atmosphere to justify his theory of the diurnal variations of terrestrial magnetism, Prof. Schuster arrived at a conductivity of the order 10^{-13} electromagnetic units at heights about 100 km. On this basis in the daytime the downward refraction of electric rays at the respective heights named would be so sharp as to be tantamount to reflection. Much lower conductivity than that demanded by Prof. Schuster might suffice to produce beneficial bending of long waves round the earth by ionic refraction in the day.

Turning to the phenomena that had up to the present been revealed by long-distance transmission, the prime fact was the discovery by Marconi in 1902 of the difference between day and night signalling. He found that signals which were readable at night up to 2,000 miles across the Atlantic were not readable in daylight beyond 800 miles. The author explained this by supposing that at night the permanently ionised upper atmosphere acted as a reflecting surface somewhat in the manner of a whispering gallery, while in the day it was put out of action by the ionised middle atmosphere.

Another phenomenon was first brought prominently into public notice by P. E. Schwartzhaupt in the *Elektrotechnische Zeitschrift* of February 3rd, 1910, though it had been previously well known to wireless telegraph engineers. During a voyage from Naples to Genoa and from Genoa past Gibraltar to the English Channel, he measured, roughly, the intensity of certain noon and midnight signals from the Telefunken station at Norddeich. The fact brought out very clearly in these observations was the profound effect of mountains on waves of frequency of the order 1,000,000 per second during the daytime.

Similar observations had been made in various parts of the world.

It was now common engineering knowledge that the evil effect of hilly country on day signals was very much less, being sometimes almost negligible on waves of, say, frequency 100,000, than those of frequency 1,000,000. How were these truths to be accounted for? It was only necessary to assume that in the night the Heaviside layer reflected waves of all frequencies equally well; that the sky was, in an electrical sense, lighted up by the radiation from the sending station and sent rays into the valleys beyond the mountains, the effectiveness of the transmission being greater when the stations were not too close under the hills. In the day the ionised middle atmosphere veiled the reflecting layer, and, to some extent, refracted the waves over the mountains. This refraction was 100 times more potent with a frequency of 100,000 than with a frequency of 1,000,000.

The transition from day to night conditions marked out a period of the greatest interest. The facts given by Marconi were as follows: Waves of length about 4,000 m. (75,000 frequency) crossing the Atlantic from west to east, yielded strong and steady signals all day at Clifden, which gradually weakened after sunset at Clifden, till a minimum strength was reached about 1½ hours after sunset. The signals at Clifden then gradually increased in intensity till after sunset at Cape Breton, when they attained a maximum which was occasionally very high. During the night they were very variable in strength, flickering from very weak to very strong. Slightly before sunrise at Clifden, the signals grew stronger, and sometimes passed quickly to a high maximum. They dwindled to a marked minimum about two hours later, and then returned to the normal day strength. The facts brought out by measurements on the Clifden signals received at the author's laboratory in London were as follows: During the day, signals were weak and not very steady; during twilight, they sank to a minimum intensity at about 20 minutes after sunset at London—that is, when the sun was setting at a place half-way between London and Clifden. After other and erratic fluctuations in strength, they kept increasing in intensity till well after sunset at Clifden. Sometimes at about 10 minutes after that sunset, there came a short interval filled with huge flutterings of signal strength, the sounds in the telephones alternating from faint to loud with great rapidity, just as if the medium conveying the signals were stirred with a vast commotion; and then the signals quickly settled to their normal night strength, which, it must be noted, was always greater than their normal day strength. Similar phenomena, less pronounced, might be witnessed at sunrise.

It would be well to offer an explanation of these phenomena. In the first place, it was clear that when at sunset the rotation of the earth carried a region of the middle or upper atmosphere out of the sunlight, recombination of ions must take place on a vast scale. Similarly, at sunrise formation of ions would take place. The regions in which these changes were occurring formed a great circular belt round the globe which was inclined to the meridian at an angle depending on the season. This belt of electrical disturbance was, of course, perpetually revolving round the globe. The ionisation occurring in the sunrise half of the belt, and the recombination occurring in the sunset half, might both be expected to take place with some degree of irregularity even in a still atmosphere, with the result that patches or banks of ionised air, analogous to the banks of fog met at sea, would transiently overhang the parts of the earth's surface that were in dusk. It was probable that these irregularities were greater in the sunset half of the belt than in the other, for it was not unlikely that considerable separation of ions of opposite sign might take place in the course of the day under local electromotive forces. In any event, the effect of such patches of heterogeneously ionised air on waves propagated through the region was, in view of the connection between the velocity of the waves and the concentration of the ions, to produce scattering by repeated refractions. Hence it was to be expected that the regularity of transmission through the steady ionised horizontal strata of the illuminated air would be greatly disturbed by the arrival of the twilight transitional patches, with the ultimate consequence that the signal sounds heard in the receiving telephones would be weakened. The author's own observations on the influence of ordinary cloud on signals proved that the ionically turbulent belt was above the ordinary cloud level, and thus it might be regarded as a sort of curtain enringing the earth and occupying the middle atmosphere without reaching the lower. It affected, therefore, the trajectories of waves received from great distances, and not those from small.

In the language of this hypothesis, Dr. Eccles expressed these facts of trans-Atlantic telegraphy by saying, first, that during the day refraction in the ionised middle atmosphere bent some of the rays from Cape Breton directly to Clifden, perhaps with absorption; second, that after sunset at Clifden, but before sunset at Cape Breton, the radiation from the latter was refracted along a curved trajectory in the part of the middle atmosphere still illuminated, penetrated the twilight belt, and was assisted further round the bend of the earth in the dark by the Heaviside layer; third, as the twilight belt moved westward, it marked the annihilation of a refracting structure in which propagation was good, and the establishment of a reflecting structure in which, also, propagation was better than in the belt itself. There would be, therefore, a position for the belt that would bring about a minimum of signal strength, and this was, in fact, reached when the belt was not very far below the horizon of the receiving station; and, fourthly and finally, when the twilight belt had passed above or behind the sending station, it appeared that it could strengthen signals in a fitful, fluttering way by a process of reflection, or, less probably, by some lens-like action. It might be added that if the principle of optical reversibility were applicable here, then signals in each direction should show simultaneous ups and downs in intensity; but there was not any information available on this point. Taking, now, his own observations on the propagation from Clifden to London, about 440 miles, he found that propagation in daylight was always worse than in the dark, which was quite contrary to trans-Atlantic experience; and he might interpret this as showing that the Clifden radiation passed in daylight high above places at distances like 400 miles to descend again at distances of 1,000 or 2,000 miles. When the twilight belt passed behind Clifden there were great fluctuations in intensity, possibly due to reflections, just as in the trans-Atlantic case. All these remarks on sunset phenomena might now be translated into corresponding statements about sunrise.

The natural electric waves that diverge from lightning strokes or other atmospheric discharges, often travel long distances over the globe, and therefore exhibit the effect of the twilight belt. These natural electric wave trains make themselves evident in wireless telegraph apparatus by knocking or clicking sounds in the operators' telephones. These strays as they are called for short, are in our latitude usually more frequent at night than in the day, both at land stations and at ship stations, and near sunrise and sunset the day conditions merge, of course, into the night conditions. The transition at sunset was carefully observed by Dr. Eccles during passages across the Atlantic in the summer of 1909. It was found that the transition was usually abrupt and at about 10 minutes after sunset. In November, 1909, he started making records of the strays received near sunset at his laboratory in London, and immediately came across a remarkable phenomenon, which, it turned out, happened also at dawn. Starting to listen about a quarter of an hour before sunset on a favourable afternoon in late autumn or winter, the strays heard in the telephones were few and feeble, as they had been all day; then at five minutes after sunset a change set in, the strays slowly got rather fewer and feebler, till at 10 minutes after sunset a sudden distinct lull occurred and lasted perhaps a minute. Often at this period there was a complete and impressive silence. Then the strays began to come again, they quickly gained in number and force, and in the course of a few minutes they settled down into the steady stream of strong strays proper to the night. The lull was sometimes very pronounced, and sometimes there was no lull at all, but merely the change from one condition to the other. The latter seemed to be the more usual event at dawn. He believed that most of the strays in temperate latitudes had their origin during the cold season in the tropics, and that, in consequence, the bulk of those arriving at his laboratory in London came from a southerly direction. In this case they had to traverse the twilight belt of electrically-disturbed air very obliquely, with the result that he observed a short-lived, but very complete, cessation of strays while the belt passed approximately over London. In the same paper he attributed the relative feebleness of the day strays to dispersion occurring in the ionised middle atmosphere with, possibly, absorption. This stray minimum had been independently discovered and investigated by Dr. Marconi and his research staff.

During the progress of the solar eclipse of April 17th last a record was made of the strays received at the author's laboratory in London. The results agreed with the deduction already drawn from the stray minimum at sunset; and, taking it as an established fact, they might conclude from these eclipse observations that the re-combination of the atmospheric ions on the grand scale proceeded much more rapidly than the making of ions; which in its turn threw light on the fact that the sunset stray minimum was more marked than that occurring at dawn. Marconi in his recent Royal Institution discourse had pointed out that the attainment of extraordinary distances was more common in the north-south direction than in the east-west direction. Dr. Eccles thought the cause of this lay in the probable ionic irregularities left in the wake of the twilight belt as it passed round the globe. If the positive and negative ions became separated to any extent in the day, as was quite possible, their complete immediate re-combination at twilight was rendered impossible, and therefore patches of ionised air were left behind. It was clear that these patches were likely to have a general disposition parallel to that of the twilight belt of which they were fragments, having the form of irregular ribbons that followed the meridians more or less closely according to the season. Their presence would make east-west propagation rather more difficult than north-south. These floating ribbons or streaks of ionised air which he had postulated offered, if they really existed, an easy explanation of the perpetual variations in strength of long-distance signals during the night. Indeed, on listening to the rising and falling of intensity on a bad night, it was impossible to resist the thought that colossal semi-transparent screens were being moved about between the sending station and the listener.

There seemed to be no doubt that signals passed badly through an area in which a great storm was raging. It was obvious that violent winds might destroy the uniformity of the electrical stratification of the middle atmosphere in the day, and might similarly affect the position and condition of the upper reflecting layer.

The last phenomenon he need refer to in this section was the effect of the aurora on the propagation of waves. Mr. C. H. Taylor worked with some stations of the American Marconi Co. near the Arctic circle some years ago throughout three winter months. He found that the aurora exercised a most profound effect on signals, and always a favourable one. Sometimes when signals were too bad to read, the arrival of an aurora instantly brought good communication. The effects were greatest when the aurora extended all round the zenith. Since then it had been remarked that even as far south as Montreal, freak ranges were most common on nights of brilliant auroral displays. If it were permissible to identify the upper conducting layer of Heaviside with the strata in which the aurora formed, this connection between auroræ and signals proved positively that the upper layers did come strongly into play even in the distance of about 100 miles worked over by Mr. Taylor. The question of the height of the aurora was of interest in this connection. Störmer determined the height photographically as varying from 40 km. to 370 km. Accepting this, it seemed to be proved that electric waves travelling 100 miles at night might be affected by the state of affairs in regions of the atmosphere more than 25 miles high.

Prof. Howe, of the Imperial College of Science, described his method of teaching the principles of wireless telegraphy by treating it as though it were a power circuit with a transmitter as the source of energy and the receiver as the motor at the other end.

Prof. S. P. Thompson said that in 1894, at Oxford, Sir Oliver Lodge showed them the wireless transmission of signals from one building to another, across several stone walls, and as Sir Oliver's name had not been mentioned in this discussion, he would like to point out how absolutely impossible would have been the diagrams on the walls or the practical transmission of signals for 1,000 miles and upwards without his work. It was very undesirable that they should lose sight of the fact that Sir Oliver Lodge was entitled to great credit for what had been accomplished in long-distance telegraphy.

Lord Rayleigh, President of the Royal Society, said that, since he first heard of the wonderful results obtained by Mr. Marconi in signalling across the Atlantic, he had always felt there was a difficulty to be explained that could not be explained so long, at any rate, as they regarded the earth as a perfect conductor and the air as a simple dielectric. He thought that view seemed now to be generally accepted, and the only thing was now to see in what direction they could look for an explanation of signalling round, so to speak, the corner of the earth. They had the theory of Sommerfeld, who came to the conclusion that the imperfect conductivity of the earth facilitated the curvature of the waves round the surface, and so would help towards explaining the difficulty. That might be so. For himself he would look along the lines of Dr. Eccles. It seemed to him that the facts required some such explanation. The differences between night and day, and N. and S. and E. and W. signalling, could hardly be explained on the comparatively simple principles adopted by Sommerfeld. It seemed to him that these complications required a more variable element than they could argue from the imperfect conductivity of the earth. They were very easily explained by certain changes going on in the atmosphere, and he hoped that in that direction a complete explanation would ultimately be found. There was one point which Prof. Fleming referred to, namely, the difference found between the sending and receiving antennæ. There was a general mechanical principle, the principle of reciprocity, which this would seem to contradict. He thought it would be worth while for those who were pursuing these subjects to try to make out more clearly whether the best sending antennæ were not also the best receiving antennæ as the principle of reciprocity would suggest.

Prof. Kennelly, of Harvard, said he would confine his remarks to conjectures on the daylight disturbance effect, for which purpose he showed a number of slides. One showed the relative intensity of signals received at different hours of the day as given by Dr. Pickard. Another slide showed the observations taken more recently in the neighbourhood of Boston. What they wanted, he said, was an organised arrangement for making observations. Up to the present time all information they had on this point had been obtained from amateurs, and not from professional radio-telegraphists. Amateurs might be able to perform very valuable services under a committee of the association.

Prof. A. G. Webster remarked that the difficulties of receiving were most easily to be solved if they took the analogy of sound which was conveyed through the medium of the air, and considered how they were to depend on homogeneity if they were to have any success at all. How could the interior of the earth be expected to be homogeneous throughout thousands of miles? He did not see how they were to get on with any theory which said nothing about the surface conditions in considering the interior of the earth. If there was one phenomenon about wireless which struck one more than another, it was how good it was over the sea and how bad over the land. The sea was homogeneous. Of course, the fact that the daylight had such an effect showed that there was a good deal going on above the surface of the earth. Prof. Sommerfeld had been obliged to make certain approximations. Were these approximations correct? Lord Rayleigh said he could not tell in two weeks; he (Prof. Webster) could not tell in two years! These calculations of Sommerfeld had been made with great mathematical skill. He had great hopes that co-operation in the matter would lead to more success than they had yet attained.

Major Squier said there was a gap between the wire art and the wireless art which needed to be attacked, and he wished to call attention to some experiments undertaken by the United States War Department some time ago. The view taken in carrying out those experiments was that frequencies below the present wireless frequencies could be studied by using them on the wires by means of the wireless apparatus—in other words, using wireless methods in conducting experiments on wires. Such experiments had been conducted, and he had the pleasure of reading a paper on the results at a meeting at Chicago. It was found that they had to have a source of sustained oscillations, and for this purpose a high-frequency alternator was designed. By using a storage battery they could have available oscillations that would not die down for hours at a time. Experiments were made with frequencies of 20,000 to 100,000 on actual lines. The first thing noticed was that within this range the energy required to transmit was extremely small compared with the use of wireless antennæ. In fact, the present antenna system was ridiculously low in efficiency. The advantage of attacking the problem in this way was that experimental data were easily obtained without interfering in the least with the ordinary telegraphic signals passing over the lines. They had no trouble with the daylight, and the variations of an air circuit were avoided.

Dr. J. W. Nicholson said with regard to Sommerfeld's theories that he had occasion some time ago to go very carefully through those calculations. It was a difficult matter. There was one point where they might be at fault. Lord Rayleigh suggested that it hardly seemed likely that imperfect conductivity could give a better effect than perfect conductivity, but remarked that first impressions were not always right. He (Dr. Nicholson) was tempted to believe now that it was a case where they were right. The point in doubt was whether they could really extend the analysis to an actual curved surface. He was very much tempted to accept Dr. Eccles's explanation, which attracted him very much, and he thought it was the key to the greater part of the explanation.

Mr. S. G. Brown explained some experiments he had carried out He said sometimes they could only signal with very great difficulty, and then all at once the waves would brighten up enormously without any apparent reason. The difference between night and day sometimes had nothing to do with it, and the weather had not changed.

PROF. BAILY said the earth waves must necessarily exist. They were part and parcel of the Hertzian waves. In connection, however, with the resistance of the earth, he had been doing experiments which convinced him that they could regard the earth as an imperfect conductor. But oscillations would only penetrate some distance, less than 50 miles, which, compared to the size of the earth, was a mere skin effect, and at about 60 miles deep the conductivity of the earth increased with considerable rapidity.

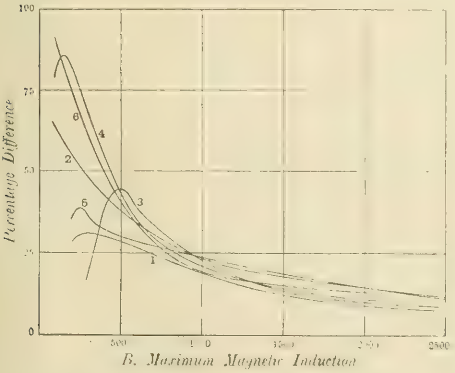
PROF. FLEMING said they had no existing data about the radio-telegraphic condition of the atmosphere as to ionisation, &c., and, therefore, he ventured to think that much valuable work could be done by a radio-telegraphic committee to carry out experiments rather than by theorising on the subject. A number of necessary facts were still conspicuous by their absence. He again urged that a Committee should be at once appointed for the work.

On the Importance of Previous Magnetic History to the Engineer.

By ERNEST WILSON, B. C. CLAYTON and A. E. POWER.

A GOOD deal has been written upon the subject of previous magnetic history and the present paper compares results obtained from a 3-KW. 60-frequency transformer with those obtained by the ballistic galvanometer method. By aid of a point-to-point method the curves of impressed voltage and current in the primary coil of the transformer were observed. The frequency in all cases was 59 and the transformer was not loaded. The transformer in any one experiment was first carefully demagnetised by gradually reducing the current in its primary coil from a value corresponding to the previous history force to a very small value and then allowing the alternator to slow down and come to rest with its exciting current still on. Care should be taken with the frequency in such tests that the voltage of the transformer is not raised beyond safe limits. The curves of impressed voltage and current were then obtained for the given chosen value of the maximum magnetic induction B. The alternating current was then cut off, and such a current passed through the secondary coil from a set of storage cells that the force H was about 26 C.G.S. units. This force was then removed and the alternator again switched on, and curves of impressed voltage and current again observed. The value of B in this last case was not exactly equal to that in the former, but this difficulty was got over by plotting curves and interpolation.

In the figure the Curves 1 and 2 show the percentage increase in the watts and primary magnetising current respectively in terms of the maximum magnetic induction B after the application of the previous magnetic history force. The effect is so stable that no change was produced after running the alternator for the purpose of observing the curves, and it is possible that in certain cases, for instance, in the current transformer, these effects may have considerable importance. It will be seen that the watts due to magnetic hysteresis and eddy currents are increased 30 per cent. or more and the magnetising force is increased by nearly 50 per cent. when the magnetic induction has a value of about 300. So far as ordinary power transformers are concerned, in which higher values of B are used, the effect is less pronounced. With the value of B 5,300 the percentage increases in the watts and magnetising current respectively are 1·4 and 9·5.



Watts	Transformer	Curve	1
Ergs	Stalloy ...	,,	3
,, ...	Lohys ...	,,	5
Magnetising current ...	Transformer	,,	2
,, ,, ...	Stalloy ...	.	4
,, ,, ...	Lohys ...	,,	6

FIG. 1.

Turning to ballistic galvanometer experiments, in the case of Stalloy and Lohys it will be seen from the figure that the percentage increase in the ergs per cycle per cubic centimetre and the magnetising current due to the application of a previous history force of about 26 C.G.S. units, vary very much in the same way and confirm the results obtained with the transformer. In Stalloy the ergs increase by as much as 45 per cent. for B 500, and the magnetising current 85 per cent. for B 150, on the values these magnitudes would have if the effects of previous history force were wiped out by careful demagnetisation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Prevention of Corruption.

It seems, from inquiries which have reached me, that the provisions of the Prevention of Corruption Act, which forbids under heavy penalties of fine or imprisonment, the asking for, or receiving, the offering, or giving, of bribes or secret commissions, are still unfamiliar.

Many persons in the electrical industry appear to be equally unaware of the existence of the Secret Commissions and Bribery Prevention League (Inc.), (president, the Right Hon. Sir Edward Fry, G.C.B.), which was formed to enforce the Act, to advise, warn, and if necessary, to prosecute, and has a large and influential membership.

The British Electrical and Allied Manufacturers' Association is affiliated to the League, and therefore any company or firm belonging to the Association may join the League at the minimum subscription of one guinea. The subscriptions of all members who join now are available for the period ending December 31st, 1913.

If any of your readers desire any information which it is within my power to give, I shall be glad if they will communicate with me.

The Secretary of the
Secret Commissions and Bribery Prevention League (Inc.).

3, Oxford Court,
Cannon Street, London, E.C.

Industrial Engineering.

Now that the question of scientific shop management, under various systems, is receiving some attention, perhaps the following comments may interest your readers.

The industrial engineer, as such, is practically unknown in England, although I believe that in America industrial engineering is a recognised branch of the engineering profession.

The duties of the industrial engineer consist, principally, in the handling and organisation of labour, and in the economic production of parts from the raw material to the finished article, by some manufacturing process.

It is frequently urged in engineering discussions that the works manager, shop superintendent, or whatever he may be called, is not an engineer in the true sense of the term. This is quite true in the majority of cases. It is the duty of these men to superintend the production of apparatus or plant from a manufacturing and also from a commercial standpoint.

To accomplish this, the works manager—particularly in a large concern—must have a good knowledge of mechanical engineering, as regards machine work, a good knowledge of shop costing and accounting systems, and also a fair knowledge of the particular branch of work for which the manufactured article is used. Needless to add, he must be a capable organiser and a man of some personality.

Is not this man, then, as important as the engineer whose duty consists in designing or improving designs? By all means; for of what use is the design unless the article can be produced in the most economical manner, particularly in these days of keen competition and cut prices?

I am not aware of the existence in England of an association or other body of industrial engineers.

Having in mind the great part which industrial engineering must play in the future, particularly in the electrical industry, I think that there should be some association or body formed which shall have for its main objects the bringing together of works managers and other men having control of manufacturing operations, and to discuss (1) labour problems ; (2) labour-saving devices ; (3) factory planning and organisation, and the many other problems which face the manufacturer of to-day.

I should be glad of the opinions of readers whom this may interest.

H. N. Munro.

London, *September* 20th, 1912.

Switchboard Fires.

No one will deny the knowledge which Mr. Hubert Berry possesses of the merits of the productions of his own company, and his letter in the "Correspondence" columns of your current issue is evidence of his assiduity in imparting his knowledge to other people. Such being so, one would have hoped that he would have disdained the assistance obtained by trotting out the old fetish as to the alleged advantage of a switch in which the current does not "pass through its hinges." Instead of this being necessarily an advantage, it is, other things being equal, a disadvantage. If the volt-drop be measured across the contacts of a modern knife switch, it will be found that the "hinge" contact has a better conductivity than the break contact ; a superiority which might be claimed for a switch in which the current does not pass through the hinge, is that in the off position the blade is dead. This, however, does not apply with an ironclad switch, and on an open type of board the source of supply, if the design of the board be good, is connected to the top (or break) contact. It follows, therefore, that this advantage does not amount to much. Moreover, it may be taken as a universal truth that the simpler an apparatus is the better. Any requirement, therefore, which prevents a simple construction, without any good reason, is strongly to be deprecated.

Charles C. Garrard.

Sutton Coldfield, *September* 23*rd*, 1912.

The Textile Institute.

I shall be obliged if you will allow me to reply through your columns to the many applications I have had from your readers for particulars of membership of the Textile Institute.

Membership of the Institute is open to anyone engaged in the textile and allied trades, which, of course, include all who are interested in furnishing power, light, and all kinds of textile machinery. It was frequently stated by engineers who spoke at our Hawick Congress that the Institute had justified its existence even if it had done nothing else but form a common platform on which steam, gas, oil, and electrical engineers could meet and discuss power problems from a common point of view. The series of papers which were given at Hawick are only the beginning of a complete investigation which this Institute purposes to make into the whole subject of "Mill Driving." I use the term "Mill Driving" not only to include prime-movers, but also the various methods of distributing power. An early opportunity will be taken of having a series of papers on this latter feature, in which an opportunity will be given for those interested in the various forms of power distribution to state their cases.

May I take this opportunity, Sir, of thanking you for the excellent report you have given of our Congress proceedings, and of expressing the hope that our work may continue to merit such recognition ? I shall be very pleased to send a circular giving details of what the Institute is, and what it is doing, to any of your readers.

Geo. Moores,
Secretary, The Textile Institute.

14, Cross Street, Manchester.
September 24th, 1912.

LEGAL.

Earnshaw v. Braulik.

In the City of London Court, on Thursday last week, before Judge Rentoul, K.C., and a jury, Mr. S. W. Earnshaw, 64, Carlisle Road, Hove, claimed £21 against Mr. G. Braulik, manufacturer of electrical supplies, 8, Lambeth Hill, Queen Victoria Street, E.C., for three months' salary. Mr. Gervase Rentoul appeared for the plaintiff and Mr. Harold Morris for the defendant. Plaintiff's case was that he was employed by the defendant in March last as a traveller. He had had no previous experience in electrical supplies, and was paid 35s. a week, 7s. 6d. for daily expenses, third-class railway fares, as well as 2½ per cent. commission on the business which he did. Defendant stipulated that he should agree not to join any competitive firm if he left the defendant for any reason, or forfeit £50. In that the plaintiff concurred. Plaintiff travelled for the defendant for some time, and was dismissed in May with a week's notice. As no term of notice had been agreed upon, plaintiff said he was entitled to three months' notice, that being the custom of the electrical trade. Defendant had since suggested that the plaintiff was engaged on trial, and that his travelling was disastrous. Plaintiff said that was quite untrue, and that the coal strike made business "terribly rotten." Defendant was sometimes short of stock. Defendant told him he would have to be responsible for bad debts that he made. He based his claim to three months' notice on "Law for the Million." Mr. Morris feared that that did not govern the Court. The plaintiff was engaged as a weekly servant, and was engaged on trial. It was a failure, and plaintiff was discharged. There was no custom about three months' notice. Defendant was never short of stock. Plaintiff's turnover was only £75, of which his expenses and salary came to £32. Business could not continue in that way. Plaintiff was only too glad to get his job ; but defendant did not mind plaintiff getting employment with any other electrical firm now.

Evidence was given in support of the plaintiff's case as to custom ; while, for the defendant, the assistant secretary of the General Electric Co., Ltd., said that in the case of commercial travellers no such custom existed.

The jury could not agree as to the custom, but they thought the plaintiff ought to have had six weeks' notice.

Judgment followed for the plaintiff for £8 15s., and costs.

Farsley U.D.C. v. Bradford Corporation.

At the Bradford West Riding Court on Monday the Bradford Corporation was summoned by the Farsley U.D.C. for payment of £13 15s., stated to be the balance due under the general district rate in respect of the tramways within the Council's area. It was stated that the Corporation had paid the poor rate in full, but only one-fourth part of the general district rate, the balance of the latter being withheld on the ground that it was liable to pay only a quarter under the Public Health Act of 1875.

Mr. F. Thornton, collector and assistant overseer at Farsley, said the summons had been taken out in order that the Council might be safeguarded. The contention of the Corporation had been upheld in a case that had been before the Courts, but an appeal had been lodged, and he asked for a remand pending the result of the appeal.

Mr. N. L. Fleming, deputy town clerk of Bradford, said the case referred to by Mr. Thornton was that between the Metropolitan Electric Tramways, Ltd., and the Tottenham U.D.C. The lines in the Farsley district were constructed as a light railway under the Light Railways Act, and the attitude of the Corporation was upheld by the decision of the House of Lords in the Wakefield case. The decision of the House of Lords in the Tottenham case would not apply in the present instance. In Tottenham there were two kinds of tramways—the tramway laid under the Tramways Act and the light railway—and in that case the rating authority called upon the tramway company to pay the full rate in respect of the tramway without contesting the question of the light railway, agreeing that a fourth of the rate was a proper figure.

The Magistrate's Clerk (Mr. W. B. Cragg) inquired whether the Corporation had not power, under the Tramways Act, to build the railway.

Mr. Fleming said they had a double order, but they constructed it under the Light Railways Act.

The case was adjourned for three months.

Brompton and Kensington Electric Supply Co., Ltd., v. Earl's Court, Ltd.

At the West London Police Court on September 18th, an adjourned summons was down for hearing, in which the plaintiff company sought to recover from defendants, the proprietors of Earl's Court Exhibition, the sum of £87 18s. 4d., balance of an account for the supply of electrical energy from July 1st to August 1st.

Mr. Lynch was for the plaintiffs, and Mr. J. Lamb represented the defendants.

It appeared from the evidence that in the early part of the year the companies entered into a contract for the supply by the plaintiffs of electrical energy to the defendants' exhibition for the purposes of lighting and power. After the exhibition was opened, however, the defendants opened the Electric Restaurant, where a large proportion of current was used for heating and cooking. For this purpose two subsidiary meters were connected with two of the primary meters in the building, each of them registering how much current had been used for heating and cooking, but all units passing through these subsidiary meters had, first of all, passed through the primary meters, and, of course, were charged for at the lighting rate. According to the agreement, electricity for lighting purposes was to be charged for at 2d. per Board of Trade unit up to 75,000 units; above that number at 1¾d. per unit, and above a further quantity at 1½d. per unit, while energy for power was to be charged for at the uniform rate of 1d. per unit. The plaintiffs now claimed the balance of an account of £132 for the month of July. For the defendants, it was contended that the current used for heating and cooking at the electric restaurant should be chargeable either at the power rate or at a reduced charge, the ordinary rates to general consumers being quoted to show that the rates for heating and cooking were two-thirds lower than those for lighting. Mr. Williams, the secretary of the plaintiff company, admitted that his company was interested in the electrical cooking exhibit, but was unable to say whether the company erected it. Mr. W. A. Woodhouse, managing director of Earl's Court, Ltd., stated that the exhibit was installed with the knowledge of the plaintiffs, who had an interest in it. The plaintiffs were aware also, he said, of the subsidiary meters, which, he added, were read by the plaintiffs' meter readers.

Mr. Fordham suggested that the parties should split the difference in the disputed charges, and that the defendants should pay 1½d. per unit for the current used for heating and cooking, but Mr. Lamb intimated that that course would raise a question as to previous amounts that had been paid.

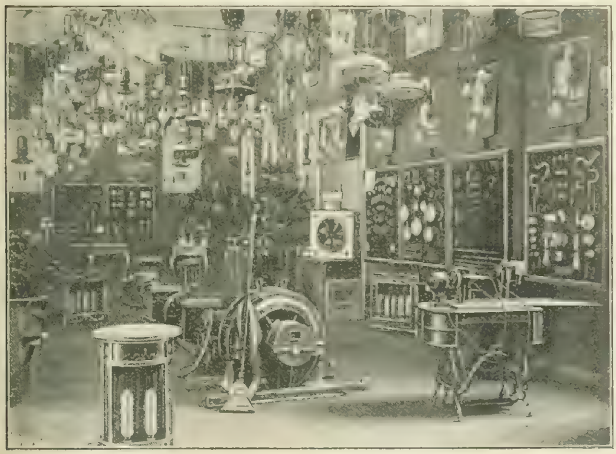
Mr. Lynch said he should ask for the full amount.

Mr. Fordham gave judgment for £26 4s. 6d., with two guineas costs.

Both parties asked his Worship to state a case, and Mr. Fordham agreed to do this if a point of law was placed before him at a later date.

ELECTRICAL EXHIBITION IN BAHIA BLANCA.

To Mr. A. C. Kelly, the chief electrical engineer of the Ferro Carril de Buenos Ayres al Pacifico, Buenos Ayres, we are indebted for the accompanying picture showing an Electrical Exhibition which was held in the South American Hotel at Bahia Blanca, from August 6th to 20th. The exhibition was carried out by the South American Light and Power Co., which is managed by the electrical department of the above railway, and was, it is believed, the first exhibition of its kind in Argentina. The exhibits were intended to illustrate to the people of Bahia Blanca the many domestic uses to which electricity might be put, and they included small-sized motors, various types of heating and cooking apparatus, hot-plates, kettles, ozone generators, irons, vacuum cleaners, &c. A special feature was made of electric cooking, which was shown in operation, but the collection of this apparatus does not appear in our photograph, being further to the left than our picture shows.



Electrical Exhibition at Bahia Blanca.

Mr. Kelly is of opinion that there ought to be a good field for electric cooking in Argentina, as the cost of fuel is very high, whilst the cost of electricity in general is fairly reasonable. He adds, however, that electric cooking apparatus will have to be robust, simple and cheap, and, above all, the design must be so arranged that renewable heating elements, which must be interchangeable, can be readily fixed without requiring very high-grade labour. Mr. Kelly expects to be in London at the end of this year, when he will go further into this matter, as he proposes to start a hiring-out system for electric cookers.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Novelties.

The General Electric Co., Ltd., have lately brought out several new devices, presenting considerable novelty. Amongst these is the adjustable reading lamp illustrated in fig. 1. The lamp can be fixed in any desired position so as to produce the most comfortable effect, without removing screws or bolts, and it is provided with a revolving shade which enables the light to be projected in any direction, whilst also protecting the eyes from direct glare.

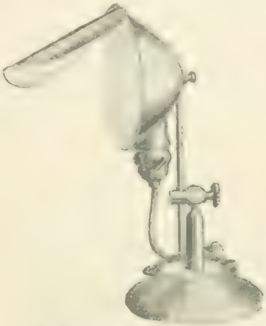


Fig. 1.—G.E.C. Adjustable Reading Lamp.

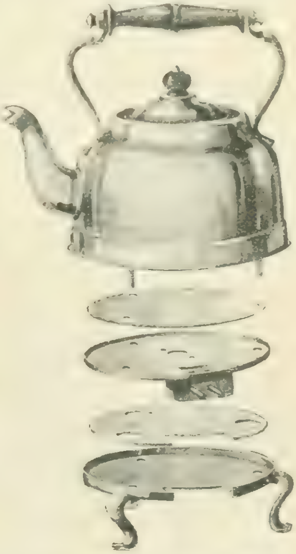


Fig. 2.—G.E.C. Electric Kettle.

Another novelty is an electric kettle, fig. 2, in which all parts are standardised and are perfectly interchangeable; the heating element is readily replaceable, and is held in position against the bottom of the kettle by a stout clamping plate which carries the connecting socket, with the aid of three little bolts. An insulating sheet between the plate and the external protecting case prevents downward flow of heat, and the cover is so arranged that the vital parts are protected and hidden from sight. The kettle is made in two sizes holding 2 and 3 pints, and for 100-120 or 200-250 volts.

We illustrate in fig. 3 a new electric iron, the "Magnet," which also is composed of interchangeable parts: the heating element is practically indestructible, and is in close contact with the sole of the iron, care being taken to ensure that the point of the latter is kept hot. A couple of nuts hold the parts of the iron together, and the connections are made automatically when the iron is screwed together. It is made in 4-lb. and 6-lb. sizes.

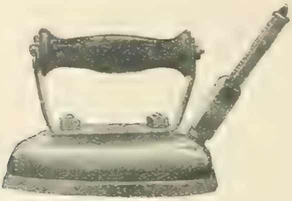


Fig. 3.—The G.E.C. "Magnet" Electric Iron.

Bell Transformer.

Our illustration, fig. 4, shows a patent bell transformer for primary voltages up to 250 and three different secondary voltages (3, 5, and 8), which has been placed on the market by the Indestructible Cable Co., of 20, High Holborn, W.C. The transformer weighs only 1 lb. 12 oz. and can be supplied for a higher primary pressure; it is suitable for operating any class of bell circuit.

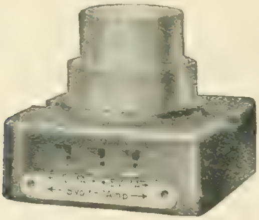


Fig. 4.—Variable Voltage Bell Transformer.

G.E.C. Home Office Fuses.

In order to comply with the Home Office Regulations regarding fuses, the General Electric Co., Ltd., have recently produced a patented adaptation of their well-known "Bobbin" fuse. The new fuses are made up of porcelain holders, with heavy brass castings giving ample contact area and radiation surface. The lignum vitæ handles are protected from any possible arcs by fire-proof megorin shields, and are made in two slightly different styles, for "open type" and "iron-case" mountings, the latter being arranged so that shallow cases only are required. They are made up in single water-tight cases or in larger ones to form multi-way distribution boxes. Fig. 5 shows the appearance of the open type.

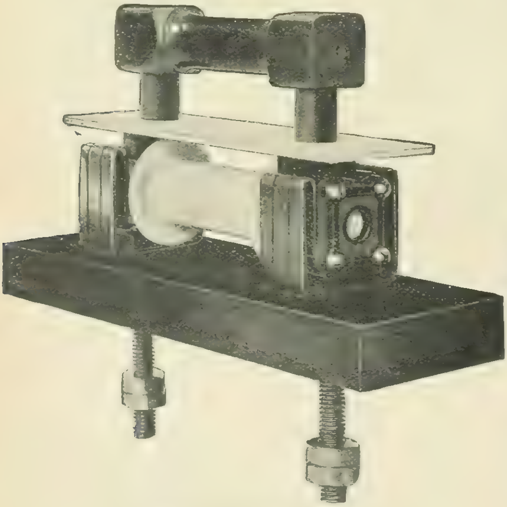


Fig. 5.—New G.E.C. Fuse.

G.E.C. Miniature Immersion Heater.

The G.E.C. electric immersion heater, fig. 6, which can be readily attached to any electric lamp socket, is a very handy little device, somewhat like a stout pencil, measuring 7 in. in length, and with a diameter of ¾ in. All that is necessary to heat a cup or glass of any liquid is to plunge this G.E.C. immersion heater into it, and switch on the current. Within a short time, water, tea, coffee or milk can thus be heated, and eggs can also be boiled. The heater is a straight, smooth cylinder, without corners or projections, heavily nickel-plated; it is perfectly sanitary, as it has no crevices and can, therefore, easily be cleaned. It should prove invaluable for the nursery or sick room, and it is claimed that travellers will also find it of great use.

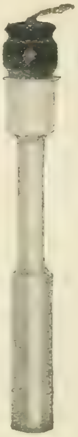


Fig. 6.—G.E.C. Immersion Heater.

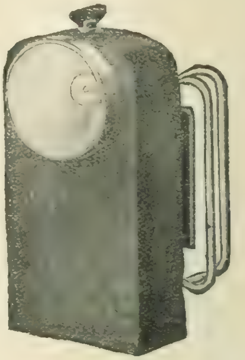


Fig. 7.—"Municipal" Police Lamp.

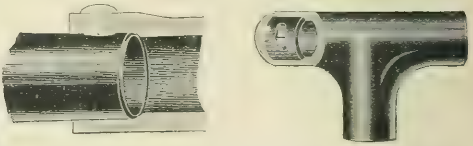
Police Electric Lamp.

Messrs. Ward & Goldstone, of Springfield Lane, Salford, have sent us particulars of their latest portable electric lamp for the use of the police, called the "Municipal" lamp, which we illustrate in fig. 7.

It consists of a strong pressed steel case, with a strap hook and collapsible handle, and is fitted with an efficient reflector and a 4-volt metal-filament lamp. A dry accumulator, automatically making its own connections, is housed inside the case, and a brilliant light is obtained when the switch on the top of the lamp is turned. The lamp is built for strength and reliability, and ought to be found a vast improvement on the old-fashioned hot and smoky lanterns still generally used by the police, for whose purposes the electric lamp is ideally adapted.

The Anchor Patent Grip.

Messrs. Electrical Conduits, Ltd., of Anchor Works, Walsall, have introduced a new continuity grip for slip conduit work, which we illustrate herewith. It will be seen that the fittings are bored through a thickened part, and an ordinary bifurcated metallic rivet is inserted and hammered home, the points being thus spread apart; at the same time the enamel is removed from the surface of the tube, and the rivet makes firm metallic contact with the latter. Should it be necessary at any time to withdraw the rivets, this is effected with a specially shaped pliers. The advantages claimed for the device include simplicity, neatness, quickness in fixing, perfect electrical continuity and a strong mechanical joint at trifling cost.



Figs. 8 and 9.—Sectional Views showing the Anchor Grip in use.

The P. & G. Electric Cooking Plate.

The cooking plate here illustrated is supplied by Messrs. Perry and Grinsell, Ltd., of Leopold Street, Birmingham, and is listed in three sizes, taking respectively 600, 800-200 and 1,500-375 watts. They are substantially constructed of cast-iron, and the outer disk completely covers the whole of the element, which is thereby protected from moisture, &c. Each plate is supported by point contacts on a suitable stand, and may be used with perfect safety without fear of burning the table. A suitable switch (Diamond II) is provided, which is mounted on a cast-iron arm, and sufficiently far from the plate to avoid spilt liquids. All the connections are well protected. The makers, having met with a demand for a cooking plate suitable for hiring out, have developed this design especially for the purpose.

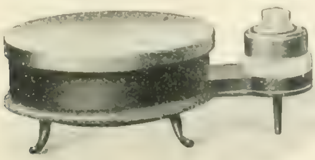


Fig. 10. P. & G. Electric Cooking Plate.

New Glassware.

We understand that the British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, London, E.C., are shortly placing on the market two new patterns of glassware, which will be known as "Opalux" and "Veluria." These reflectors are made in several forms to give varying distributions of light, and are said to be extremely beautiful in appearance both when lighted and unlighted. Tests made on them show that as regards reflection and distribution of light they are highly efficient.

BUSINESS NOTES.

Consular Notes. Tripoli.—The American Consul at Tripoli, reporting on the possibilities of trade resulting from the Turkish-Italian war, states that the most important industrial enterprises to be established here since the occupation are the electrical companies, Societa Commerciale d'Oriente and the Esercizi Elettrici della Libia; the former is a Venetian company, the latter a Milan enterprise. The first took over the small plant that was installed last year by the Banco di Roma, and added at once an engine by which it has been able to develop 110 H.P. It will shortly have in working order three Diesel sets, each with a capacity of 200 H.P. Space is provided for the addition of three turbines of 1,000 H.P. each, if the demand should develop. The Milan company is installing a Diesel set with a capacity of 150 H.P. It has already secured more than 200 customers for lighting.

Mexico.—The American Consul, reporting from Mexico at the end of June, stated that the Mexican Telephone and Telegraph Co., an American-owned concern with headquarters in Mexico City, had been granted a concession by the city of Guadalajara to put in an entirely new telephone system and give this city a service modern and up-to-date at a cost of about $250,000 gold, with wires underground throughout the city. Work will commence at once, and the system will be in operation in about 1½ years; as American capital controls the company, American methods, apparatus, and material will be used wherever possible. The company also plans to connect Vera Cruz on the east coast with Manzanillo on the west, thus giving long-distance telephone service between the connecting cities, which include some of the most important in the Republic—Orizaba, Puebla, Mexico City, Queretaro, Celaya, Guanajuato and Guadalajara.

China.—The American Consul at Shanghai recently reports that an interesting feature of the present industrial development of Shanghai is the growing use of electrical power. Over 2,000 H.P. are connected to the mains, but prospects are that this will be about trebled. There are plans which will practically double this consumption immediately and within the next 18 months the further development mentioned may be looked for. The cause of this expansion is largely the increase of industrial activity in Shanghai. Among the new customers for power will be the rice mills now being erected. Along the banks of the Soochow Creek these are springing up. Their busy season is from October to March, while during the rest of the year they are intermittently at work. The orders for these mills will put a load of 500 extra horse-power on the mains. Besides rice mills, cotton mills under construction call for a considerable further extension. One Chinese mill of comparatively small size is to have an electrical power installation of 280 H.P., and a second mill of larger capacity has ordered 450 H.P. Two other mills have in contemplation the installation of electrical plant. One of these is for 1,000 H.P., and the other for 1,500, and as these will require the power in the course of next year, it will be seen that there will be a full demand upon the producing capacity of the works. The new works are expected to be ready about November, and with these orders, as well as gauging the demand from past experience, it is anticipated that by the time they have been in operation for 12 months they will be required to work at their full capacity.

Spain.—The American Consul at Madrid, reporting on the trade of his district, states that there are many waterfalls and rivers in Catalonia, most of which will soon be utilised for the production of electricity. A company was established in October, 1911, with a capital of about £5,000,000, held mostly in Canada, England, France and Belgium, for the development of electricity. This company acquired the electric railway between Barcelona and the suburbs of Sarria and Vallvidrera, which will be extended 25 miles, and the 40,000-H.P. plant of the Compania Barcelonesa de Electricidad. The falls of the Ebro River and some waterfalls in the Pyrenees will be used to develop about 120,000 H.P., which will be brought to Barcelona along double electric lines at 85,000 volts. Construction work has already started, and a number of American engineers recently arrived to carry it on. The head of the company is in New York City.

Next in importance in this field is the Energia Eléctrica de Cataluna, established in November, 1911. A third company has been formed under the name of Fuerzas Motrices de Cataluna, by a combination of the Compania Catalana de Gas y Electricidad with an important private firm of Barcelona. This company will utilise the Esera Falls, in the northern part of Huesca Province, and will supply about 30,000 H.P. of electricity to Barcelona.

The Consul considers that there will be excellent opportunities for the supply of the large amount of electrical material for the construction of the hydraulic and steam plants. The factories operated by machinery in Barcelona and its surrounding towns utilise steam to the amount of 180,000 H.P., while the consumption of electricity for lighting in the principal cities is considerable, and is increasing steadily.

United States.—The British Consul at St. Louis reports that with the completion in July, 1913, of the Keokuk dam on the Mississippi River, the expense of the different generating stations will be eliminated, and it is expected that many factories, old and new, will make use of the supply for manufacturing purposes. The current will be carried by six cables on steel towers 75 ft. high and about 800 ft. apart, for which a right of way 100 ft. wide has been bought. It is estimated that 200,000 delivered H.P. can be produced. The Mississippi River Co. which is building the dam and power houses is capitalised at over £5,000,000, and it is hoped to provide power not only to St. Louis, but to Kansas City on the South-West and Chicago on the North-East, as well as to many small towns in the vicinity, and that manufactories will spring up along the line of cables, especially when the added advantage of river transportation will be available. The dam at Keokuk is of solid concrete masonry, and will be 4,700 ft. long in connection with a concrete wall on the Iowa side, with a dry dock and locks. The spillway section of the dam will be 4,400 ft. long, and will carry 116 flood gates to control the water flow. The power house will be 1,400 ft. long, and will contain 30 sets of a rated capacity of 10,000 H.P. each. The present Government locks in the Des Moines Rapids Canal will be replaced at the expense of the company by one large dock and a dry dock, and river navigation will not be interrupted during the construction. The power house, which is of concrete, is 700 ft. × 936 ft., and will contain the wheel chambers and water passages, which will conduct the water to the Francis turbine wheels. The power to be developed is at first 120,000 H.P., of which 60,000 H.P. has been contracted for by the St. Louis Public Utilities under a 99-year contract, contracts to be graduated every ten years according to the price of coal. The lock will be 110 ft. wide × 400 ft. long, with a lift of 40 ft. at low water. The dam contains 119 arch spans, each 36 ft. long, and with an average height of 53 ft. above the bedrock bottom of the channel. Each pier is 6 ft. thick, and 42 ft. wide at the base and 36 ft. at the top. This dam will make a lake of over 1 mile wide and 60 miles long.

A New British Factory for Diesel Engines.—As our readers are already aware, extensive Diesel engine works are being built at Ipswich by the Consolidated Diesel Engine Manufacturers, Ltd., London. This factory will be devoted exclusively to the manufacture of Diesel engines for ship propulsion and for stationary purposes. Situated in a most convenient quarter of the town, with lines from the Great Eastern Railway running direct into the buildings, the new works will be equipped completely with the latest types of machinery and plant. From the inauguration, employment will be given to several hundred workmen; and provision has also been made to secure additional land in order to cope with the increasing demand for Diesel engines. We are informed that all preparations are well in hand, and it is anticipated that the works will be in full swing in the early part of the coming year.

New Works at Runcorn.—A correspondent states that the British Insulated & Helsby Cables, Ltd., are making arrangements for establishing another branch at Runcorn. Some 160 young women belonging to Runcorn travel every day to the Helsby works, where they are employed in processes connected with the manufacture of telephone wire. It is proposed to carry on the work at the branch in Runcorn, and as the company has been in the habit of paying the girls' railway fares, it is estimated that a saving of £500 a year will be effected.

Theatre Installations.—Messrs. T. W. Vaughan and Co., Ltd., of Islington, N., are at present engaged carrying out electrical installations at the following: His Majesty's Theatre, Manchester; Palace Theatre, Westcliff-on-Sea; Electric Theatre, Palmer's Green; Electric Theatre, Canning Town; Princes Hotel Piccadilly; Electric Theatre, Poland Street.

Private Arrangements.—Walter Stanley Bracher, electrical engineer, &c. (trading as F. & W. Bracher), 65, Redcliff Street, Bristol, and High Street, Malmesbury. A meeting of the principal creditors of the above was held in London on Tuesday, when a statement of affairs was presented showing the position as at September 19th last. According to this the liabilities expected to rank amounted to £2,517, of which £1,632 was due to trade creditors and £200 to a cash creditor. A sum of £205 was owing in respect of arrears of rent, and there was an overdraft at the bank of £354, while Mr. F. Bracher, a brother of the debtor, was scheduled for £126, the amount due under the agreement for the dissolution of the partnership. There was also a fully-secured creditor for £455, who held securities of the estimated value of £650, or an apparent surplus of £195. Valued on the basis of a going concern, the net assets were returned at £2,008, or a deficiency of £509. On a realisation basis the assets were estimated to produce £1,623, less £101 for preference claims, leaving net assets of £1,522, or a deficiency of £995. It appeared that the business was started in partnership by Messrs. W. S. & F. Bracher, in 1885, both the partners having a capital of £250. The partnership was carried on up till June, 1907, when a dissolution took place. The dissolution was duly gazetted. Accounts were then prepared, and it was agreed that the retiring partner (Mr. F. Bracher) should receive a sum of £350. That debt had never been fully discharged, and Mr. F. Bracher was now a creditor for £126. The branch business at Malmesbury was purchased some time prior to the dissolution of the partnership. It was purchased for £350, but it had been a dead loss, and efforts had been made to dispose of it. The books had not been properly written up, and the usual trading figures could not be presented. In 1908 the turnover of the business was £3,020, while in the following year it increased to £3,986. In the succeeding 12 months the turnover declined to £3,200, but last year it rose to £3,924. Up to September 19th last the turnover during the present year had amounted to £3,750. The wages appeared to have been too heavy for the business, having been at the rate of £2,080 per annum, or £40 weekly, while the drawings of the debtor had been £5 a week. The business had shown gross profits of over £600 per annum. The present position was largely due to the losses which had been made on the Malmesbury business. In that direction over £800 had been lost. The Malmesbury business was being discontinued, and it was believed that the venture could then be made to pay. It was further stated that the debtor wished to continue the business, and he made an offer of a composition of 10s. in the £, payable by four equal quarterly instalments. Owing to suing creditors, a deed of assignment had previously been executed. A resolution was passed confirming the deed already executed, and it was also decided to accept the offer made, provided certain family claims were withdrawn for the time being. A Committee of three of the principal creditors was also elected. The following are creditors:—

Rowe Bros. & Co., Ltd.	£310	Sperryn & Co., Ltd.	£36
Hannan, S. J., Ltd.	51	Gardner, Sons & Co., Ltd.	27
Coulthurst & Harding	[illegible]	Hiller & Crinks	29
Simplex Conduits, Ltd.	183	Hall, S. J., & Bros.	44
Henley's Telegraph Works Co.	26	Newtons, Ltd.	21
Walters, L., & Sons	[illegible]	Stork & Tidmen	25
Shield, Bush & Co.	[illegible]	Veritys, Ltd.	84
Wilmer & Sons	30	Hall, John, & Sons	35

Catalogues and Lists.—Messrs. A. P. Lundberg and Sons, 477 to 487, Liverpool Road, Islington, London, N.—New "special circular" of 10 pages relating to tumbler switches for the control of heating and cooking appliances. Full details and diagrams of a number of controls are given, and the list is very fully illustrated, both the switches and diagrams being shown. An article dealing with these controls appeared in the Electrical Review for August 2nd, 1912.

Messrs. Ferranti, Ltd., Hollinwood.—A collection of illustrated price lists, put together with a neat binding cover, detail the firm's electric heating and cooking apparatus—electric irons, disk stoves, electric ovens and accessories. A loose list fully particularises their time switches, and contains diagrams of connections.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Several new lists in the company's usual form have been issued as follows:—The use of aluminium in the rubber trade, aluminium coach fittings, and torsion joints for aluminium overhead conductors.

The Mirrlees-Watson Co., Ltd., Scotland Street, Glasgow.—Catalogue of 16 pages, containing a finely and fully illustrated description of the Mirrlees-Leblanc rotary air-pump in marine work; also two pamphlets, one of which describes the Mirrlees-Leblanc multi-jet condensing plant, the other similarly dealing with small unit type jet condensers for engines or turbines.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—New catalogue No. 527 (Section II) of about 60 pages, entitled "Automatic Telegraphic Apparatus." Excellently produced illustrations, together with descriptive information and prices, appear, relating to Wheatstone apparatus, station sets, direct motor-driven apparatus, and spare parts. A number of pages are devoted to diagrams of connections and a telegraphic code. Catalogue No. 528, describing electric bells of all kinds, indicators, pushes and other accessories.

Messrs. Diesel Engine Co., Ltd., General Buildings, Aldwych, London, W.C.—Four-page circular drawing attention to the advantages of the Diesel engine for electric generating plants for ship lighting purposes. The necessity for emergency ship lighting has been brought prominently forward by the *Titanic* disaster. The facility of a Diesel plant for being placed in connection with a Marconi wireless installation is pointed out.

Messrs. Heathman & Co., Parson's Green, Fulham, London, S.W.—A batch of new illustrated lists of telescopic ladders and trestles, fire escapes, hydrants, and other similar lines.

The British Thomson-Houston Co., Ltd., Rugby.—A 16-page little pamphlet with a green cover, entitled "Lighting News," has been issued as a piece of B.T.-H. publicity literature (No. L (M) 2,297). The style of a "penny weekly paper" in miniature form (4¾ in. × 3½ in.) has been adopted throughout. Notes and brief articles, in small but clear type, and with small illustrations, deal with different aspects of the illumination question. The pamphlet is written mainly for the instruction of the general public, and contractors can have numbers overprinted with their names and addresses for distribution.

Messrs. Ward & Goldstone, Springfield Lane, Salford.—Price list of "Vclex" portable electrical appliances, such as pocket, hand and police lamps, and various novelties.

Messrs. Joseph J. Armfield & Co., Vale of Avon Ironworks, Ringwood, Hants.—Illustrated catalogue showing the "British Empire" turbines for various powers and heads, both vertical and horizontal types, Pelton wheels, regulating gear, pipes, &c., and illustrations of a number of installations carried out by the company.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, London.—Illustrated leaflet (No. S—3) containing a description, with prices and dimensions, of their new E.A.C. ironclad double-pole switch, all sizes listed being kept in stock.

Messrs. August Reichwald, Ltd., Finsbury Pavement House, E.C.—Card showing illustrations of springs made from flat cold rolled band steel.

The C. W. Hunt Co., West New Brighton, New York.—Catalogue relating to Manila rope for transmission and hoisting purposes, and giving formulæ, tables and data for use in mill engineering.

The International Time-Recording Co., Ltd., 151, City Road, London, E.C.—Pamphlet containing copies of letters from satisfied users of the company's automatic time-recording system.

Roumania.—Konstantza.—The projected erection of two pipe lines, each 300 km. long, for the conveyance of raw petroleum and lighting oil respectively from the Prahova petroleum fields to the port of Konstantza, together with the erection of electrically equipped pumping stations at Ploesti and Zandari, will provide opportunities for European and American manufacturers to tender for the machinery and material required. Subject to contingencies, a third pipe line may be subsequently required.

Strong Osrams.—Recently a motor-omnibus collided with a lamp-post in Marylebone Road. The force of the impact was so great that the post broke in two and the lantern was dashed to the ground, smashing all the outer glass to pieces. Nevertheless, the Osram lamps were found to be intact, and when the current was switched on, they lit up with their usual brilliancy, not a bit the worse for the shock. The incident affords a striking testimonial to the strength of Osram drawn-wire lamps.

Office Lighting.—A Committee was specially appointed to determine the best method of lighting the five-storey office building of Messrs. Armour & Co., Chicago, and for this purpose trial installations of the following lighting systems were made:—Direct lighting with prismatic glass reflectors; semi-indirect lighting; indirect lighting with porcelain enamel reflectors; the "eye-rest" system of indirect lighting with X-ray silvered glass reflectors. These installations were given a practical working test over a period of seven months, and the following points were considered before a final decision was made:—First cost; current consumption; cost of lamp renewals and labour for cleaning; and the opinion of the workers. The Committee found that as regards first cost and current consumption, there were only negligible differences between the systems. In respect of the cost of labour for cleaning, the "eye-rest" system of indirect lighting proved decidedly more economical than any of the others. By actual test it was shown that the "eye-rest" fittings and their reflectors could be cleaned in about a third of the time taken for a corresponding installation of direct or semi-indirect units. In regard to the quality of the illumination produced, none of the other systems approached the "eye-rest," which gave diffused illumination, free from "glare" and shadow, and received the unanimous vote of the employés. The Committee decided that by reason of its superior illumination, lower cost of maintenance, and approximately equal first cost and current consumption, compared with other lighting systems, the "eye-rest" system should be employed throughout the offices in question.

Bankruptcy Proceedings.—Henry Hallifield Oxley (otherwise known as Oliver Huxley), consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex.—The adjourned public examination of the above-named debtor was held at the Court House, Half Acre, Brentford, last Tuesday week, when the debtor stated that he was now the manager of the British and Foreign Investments Corporation, Ltd., and he was supposed to receive a salary of £500 a year, though he actually received about £6 a week. For the last week or two he had been getting nothing, because he had been away, but he expected to get it when he went back. The Official Receiver: On your preliminary examination you said you were receiving a salary of £500 per annum. Are you prepared to agree to an order setting aside a portion of your salary for the benefit of your creditors?—Yes. How much will you agree to?—£100 a year. Questioned as to the expectations he had of being able to pay the debts when he contracted them, the debtor said he had no idea that he was in difficulties until the Official

Receiver pointed it out. He had kept no books of account because he did not consider it necessary. The Official Receiver said that the debtor had not made a full disclosure of his liabilities. Debtor admitted that a Mr. Aken was a creditor for £1[illegible] under a promissory note, made on April 24th, 1912. It was made in consideration of "value received," but he denied that he had the money. He owed Aken about £20, and as he (Aken) was in straitened circumstances, the debtor did not wish to keep him without money, and gave him the promissory note to enable him to go to a moneylender. He did not return him as a creditor in his statement of affairs, because he came to him at the time, and said he was hard up. The Official Receiver read a letter of August 15th last, in which debtor wrote to Aken stating that he would be thinking shocking things about his not having replied earlier, and he also read another letter to a man named Forcett, in which the debtor promised to pay £2 until Aken was cleared. Debtor admitted that he had not kept his promise. The debtor said he did not consider it as a legal debt, he was doing it out of friendship. He further admitted that there was another creditor, named George Stone, a cabinet maker, and although he made himself responsible for the whole of the debt, he was not liable, as the debt was only contracted on the understanding that another man paid his full share. The Official Receiver said he must have further information about the furniture, and therefore ordered the case to stand adjourned

A. P. Parker, electrical engineer, 8, Mary Street, Burnley October 4th is the last day for the receipt of proofs for dividend. Trustee: Mr. C. H. Plant, 13, Winckley Street, Preston.

Dissolutions and Liquidations. District Electric Co., Ltd.—This company is winding up voluntarily, with Mr. J. W. Hinks, 115, Colmore Row, Birmingham, as liquidator.

Kjellberg Syndicate, Ltd.—This syndicate is winding up voluntarily, with Mr. J. B. Hamilton, 15, Little Trinity Lane, E.C., as liquidator.

Bohm Lens Lamp Co., Ltd. A meeting is called for October 26th at 15, Great St. Helens, London, E.C., to hear an account of the winding-up from the liquidator, Mr. E. S. Neave

Book Notices.—*Canada for the Investor and the Industrious Millions of Great Britain.* By T. W. Sheffield. Bristol: J. W. Arrowsmith, Ltd. 1s. net.—The author of this little book, from his experience in this country, followed by some years' life in Canada—for part of the time as an industrial commissioner for Regina—should be able to interest those in need of information regarding Canadian resources and opportunities. He has combined the information gained as the result of personal observation with material obtained from Government departments, the Board of Trade, the Press, and so on. After a brief opening chapter, in which, among other things, the author refers to the apathy of British manufacturers and merchants, he deals with different parts of the vast territory in geographical order, and reproduces a number of interesting photographs. Mr. Sheffield's idea has been to bring out the main features of the places mentioned in so far as they are likely to be of interest to his fellow countrymen at home. It is impossible either for the trader or the worker nowadays not to be impressed with the coming greatness of Canada, but it would doubtless be useful to any of our readers who are casting eyes that way if they made a study of this little book.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 9. September, 1912. New York: The Institute. Price $1.00.

"*Transactions* of the Concrete Institute." Vol. IV, part 2. July, 1912. London: The Institute.

"*Prospectus* of the Borough Polytechnic Institute, 1912-1913." London: The Institute.

"How to Manage the Dynamo." By A. R. Bottone. London: Whittaker & Co. Price 9d. net.

"Engineering and Metallurgical Books, 1907-1911." By R. A. Peddie. London: Grafton & Co. Price 7s. 6d. net.

"La Tecnica delle Correnti Alternate." Vol I. By Ing. G. Sartori. 1913. Milan: Ulrico Hoepli. L. 12.

"Statistik über Starkstromanlagen Allgemeiner Teil Zentralanlagen Kategorie A pro 1910." "Jahresheft des Schweizerischen Elektrotechnischen Vereins für das Vereinsjahr, 1911-1912." 1912. Zurich: Fachschriften-Verlag und Buchdruckerei A.-G.

Shipwrecked Lamps.—The British Thomson-Houston Co., Ltd., inform us that salvage operations on the sunken P. and O. liner *Oceana* resulted in the recovery, amongst other things, of cases containing 600 Mazda lamps. On examination, it was found that, of 500 25-watt 100-volt lamps, 22, or 4·4 per cent., were broken, and of 100 25-watt 55-volt lamps, only two, or 2 per cent., were broken. The remainder were returned to Rugby in perfect condition. Considering the rough treatment which the lamp cases must have received, the proportion of breakage is remarkably small.

Trade Announcements.—Messrs. Siemens Brothers Dynamo Works, Ltd., of Dalston, inform us that under the new Post Office system their registered telegraphic address is "Siemodyn, Kinland, London." The indicator word "Kinland" will not be charged for.

The Emanda Engineering Co., Ltd., owing to the rapid growth of their business in switch, distribution and fuseboards, switch boxes, &c., have removed to Emanda Works, Sumner Avenue, Peckham, London, S.E. A leaflet which they have issued illustrates some of their manufactures.

Mr. John T. Murray, electrical engineer and contractor, of Halifax, has removed from Rawson Street to 3, Lord Street.

With reference to our notice regarding the affairs of Mr. A. E. Martin, trading as the Midland Electric Supply Co., 39, Great Charles Street, Birmingham, we are asked to point out that the Electrical Trades Supply, Ltd., also of Great Charles Street, is in no way connected with the Midland Electric Supply Co., and has never been in any sense associated with the latter firm.

Mr. Stephen Workman, electrical engineer, of Updown Hill, Windlesham, near Bagshot, announces that he is relinquishing business.

Messrs. Safety Light, Ltd., have removed to 118, Queen Victoria Street, London, E.C.

The Edison and Swan United Electric Light Co., Ltd., have opened a depôt in Bristol (at 71, Victoria Street), with Mr. F. W. Fifield as district superintendent, for the convenience of their West of England customers. Large stocks of their metal-filament lamps will be carried.

"Robbialac."—At the Tramway Exhibition at West Ham, a tramcar of the West Ham Corporation was on view which had been treated with Robbialac enamel paint supplied by Messrs. Jensen & Nicholson, Ltd., Goswell Works, Stratford, E. This paint is widely used by tramway and railway authorities. The firm had on show at their stand their ultra-high-resistance insulating composition, "Wattlac," for which they claim an actual breakdown strength of 28,000 volts per mm. A selection of metal underbody parts was also shown, treated with their anti-rust and corrosion-proof composition, "Ferroradium."

Newcastle Electrical Exhibition.—Messrs. Berry, Skinner & Co. inform us that their fool-proof ironclad fused switchgear has been employed at the above exhibition on the main switchboard, and for controlling the lighting of the entrance and the electric sign, the Provincial Laundry, cookery exhibits, electric water heating and the café.

The Shops Act.—Morecambe Corporation has made a closing order under the provisions of the Shops Act for the retail electrical trades in the town. The closing day is Wednesday. Morecambe, of course, takes advantage of the privilege extended to seaside holiday resorts of disregarding the order in the summer months.

Silica Lamps.—Messrs. Ashworth & Parker, of Bury, have decided on the adoption of Silica lamps for the lighting of their recently-completed extensions. The electric lighting and power installation for Messrs. Tatham & Co.'s new works at Rochdale is in the hands of the Rochdale Electric Co., and the premises here are also being lighted throughout with Silica lamps. These lamps have further been adopted for the surface lighting of the Alloa Coal Co., Bannockburn Colliery, Stirlingshire.

LIGHTING and POWER NOTES

Aylesbury.—The U.D.C. has appointed four persons outside the Council to act with a Committee to consider a scheme for electric lighting for the town under the newly-obtained provisional order.

Baildon.—The U.D.C. has decided to ask the Bradford T.C. to agree to one of the following alternatives in connection with the proposed tramways:—To supply current to Baildon in bulk: to pay 1¾d. per unit if the electricity is supplied by Shipley; or to find its own current for running the Baildon tramcars. Shipley U.D.C. has offered to supply current at 1¾d. per unit, but preferred the supply to be obtained elsewhere if possible.

Barking.—A letter has been received from the L.G.B. with reference to the Council's application for sanction to a loan of £11,200 for the purpose of extensions to the electricity works, stating that the Board was not satisfied that the scheme submitted was the most suitable for the purposes of the Council's undertaking, and that it was not prepared to sanction the loan. In consequence of this decision the Committee has decided to submit an amended application to the Board for approval involving an expenditure of £8,335, made up as follows:—Diesel engine and D.C. generator 250 KW., £4,000; foundations, £240; rotary converter, £800; switchgear, £260; steam recorder, &c., £105; connections (cable, &c.), £140; tools and spares, £150; boiler feed pump and connections, £180; rearranging position of present plant, £60; clerk of works, £75; contingencies, £250; loan costs, £75; mains and services, £2,000. It has also directed the engineer to prepare specifications, &c., and to invite tenders for the supply and erection of the necessary plant. With regard to the tenders which were provisionally accepted for the original scheme, the firms are to be notified of the L.G.B.'s decision.

Barnsley.—The Yorkshire Electric Power Co. is proposing to erect a waste heat station for the generation of electricity from coke-oven gas at Barugh, near Barnsley, and at the half-yearly meeting of the company, it was suggested that an extra £50,000 of preference capital should be raised, and that £25,000 of this should be devoted to the new work. Last year's profit had decreased by £800 as compared with 1911, but was £810 in advance of that of 1910. The new station was very necessary, as there had been an increase of 20 per cent. in the amount of electricity sold from the power station.

Belfast.—At the meeting of the Tramways and Electrical Committee, the electrical engineer submitted his reports on the question of installing Diesel engines in connection with the proposed extension of the electricity undertaking and as to the establishment of sub-stations.

Blackburn.—The Electricity Committee has under consideration a report by Mr. Wheelwright, the borough electrical engineer, on the question of new works for the electricity department.

Cleckheaton.—The District Council reports a net loss of £406 on the last year's working of the electricity undertaking. This is mainly due to the increase in cost of generation, coal and repairs and maintenance of works. *Per contra*, the price of current has been more satisfactory to the Council, and the number of units generated has increased from 908,044 to 1,159,272. The increase in the cost of generation has been met by the transfer of a small balance from the reserve fund and £347 from the general district fund.

Continental Notes.—Denmark. A company is reported to be in course of formation to establish a large electricity generating station near Krise, in South-East Seeland, for the supply of current for lighting and power purposes to a number of small towns and villages in the district.

East Barnet Valley.—At the last meeting of the District Council, Councillor Ford moved: "That the North Metropolitan Electric Power Co. be asked if it will be possible to lay their main cables throughout the district of the Council by October, 1913, and, if so, at what cost they would be prepared to light the public roads." He stated that there was a great demand for electricity for lighting and power purposes throughout the district. He was prepared to go any length to encourage the electrical company, if it were only to break down the monopoly of the Gas Co. in the district. It was a disgrace to pay money to have the district lighted when the result was practically semi-darkness. After further discussion bearing upon the extremely bad lighting by the Gas Co., the motion was carried *nem. con.*, and a committee was appointed to go into details.

Edinburgh.—At a meeting of the Treasurer's Committee of the T.C. on Friday last, Councillor Harrison moved that the electric lighting surplus be applied to the relief of rates, and this motion was carried against a proposal by Councillor Bruce Lindsay, that the Committee recommend that the surplus be not appropriated. This recommendation will now come before the Town Council.

Epsom.—The U.D.C. has received from the L.G.B. sanction to a loan of £2,800 for additional generating plant and £500 for mains.

Glasgow.—The minutes of the Electricity Committee of the T.C. contain a report by the engineer that Messrs. Harland and Wolff had applied to the burgh of Govan for a supply of electrical energy for their ship-building yard in Govan. The supply, which would be of large extent, would be required in a few months, and it would be necessary to connect the Corporation's system of distribution with that of Govan to enable it to be given. The town clerk reported that as a result of meetings of the sub-committee on the Boundaries Act with representatives of the burghs of Govan and Partick, the T.Cs. of the latter towns agreed to the connection of their electricity undertakings with that of the Corporation, and that the Corporation Electricity Department should supply the current required. The engineer was authorised by the Committee to have the proposed connection made.

Helsby.—The P.C. has decided to canvass the district in order to ascertain the probable number of consumers of electricity for domestic purposes. The information is needed by the Mersey Power Co. before it can quote for public lighting.

Ilford.—A serious fire occurred on Tuesday afternoon at the electricity works of the U.D.C., causing a complete stoppage of the supply and of the local tramway service. The origin of the fire was behind the main switchboard, where the flames broke out suddenly with great violence, and at once ignited the roof. The fire brigade was quickly on the spot, but it took an hour's work to subdue the flames, and then all but one of the dynamos were soaked with water. A part of the tramway service was re-started with power from East Ham, but various large works supplied from the Ilford power station were shut down. The supply was partially resumed by 8.30 p.m.

Leeds.—A proposal of the Corporation to establish a department for the hiring-out of electric motors is meeting with strong opposition on the part of local electrical firms. The Corporation proposes to borrow £10,000 for the purpose, and the opposition asserts that not only is it unfair to institute this municipal competition with private traders, but it would be impossible for the Corporation, with the suggested outlay, to provide a service anything like equal to that which would be displaced, and also that the authorities, in their limitations as to stocking varieties of types and parts, would run the risk of wasteful speculation on makes of motors which might become obsolete at an early date, or prove useless under a changed system of supply. The opposition includes practically all the local firms, and an influential deputation recently waited upon the Tramways and Electricity sub-Committee and entered a protest. A deputation is also to attend the next meeting of the City Council.

Llandudno.—In a statement as to the progress of the Corporation electricity undertaking, at the meeting of the T.C. on September 20th, Mr. S. Chautrey (chairman of the Electricity Committee), said that the year ending March 31st last was the first following the installation of a coal conveyor and an induced draught system. The induced draught apparatus was a step of a speculative nature, but it had proved a great success. Not only had it stopped the emission of smoke, but it enabled mechanical stokers to be employed, with a resultant saving of £1,112 in fuel. The year's trading resulted in a net surplus, after paying interest and redemption on loans, of £884, and this notwithstanding that the price of current had been reduced by ½d. per unit. Unfortunately, there had been a decrease in the supply of current to the tramways company, but now that the track was doubled for a considerable distance, the probability was that the current year would show better results, and that the traction consumption would steadily increase.

London.—Bethnal Green.—In connection with the Electricity Committee's recommendation, reported in last week's issue, advising the Council to adopt its suggestions with regard to the taking of a supply of electricity from Stepney, the matter was again referred back to the Committee, at the meeting of the Council last week. At this meeting a letter was read from the town clerk of Stepney to the effect that after consulting the borough electrical engineer and treasurer he was of opinion that his Council would be prepared to undertake the maintenance and administration of the electrical supply in Bethnal Green upon the basis of the following proposals:—For repairs and maintenance of mains, house services, meters and other apparatus on consumers' premises, maintaining and supervising sub-station plant, reading meters monthly, rendering a monthly statement to the Bethnal Green treasurer with all information necessary to enable him to render and collect consumers' accounts, establishment charges and management expenses, a charge of 0·2d. per unit for each unit sold in excess of a certain quantity which was not mentioned publicly at the meeting. Capital work (if any) on plant, mains, house services, &c., executed by Stepney for Bethnal Green to be charged for on cost basis plus 10 per cent. for use of tools, &c., establishment charges and supervision. Such proposals are subject to confirmation by the Stepney Council. A letter was also read from Mr. J. F. C. Snell, the Council's consulting electrical engineer on the subject of the above letter. In this letter Mr. Snell stated that he considered the terms offered to be very favourable indeed to the Bethnal Green Council. The figures quoted result in less annual charges than he had included in his estimates. He was of opinion that there could be no chance of the Council losing on the undertaking, but that, on the other hand, it would be a source of considerable profit, apart from the great convenience to the ratepayers of the borough. In the discussion which followed the motion for the adoption of the Committee's report, Councillor Brookes, whilst holding to the principle of electricity supply, urged that it would not be right for the Council to come to a decision that night without the Committee having had an opportunity of considering the letter from Stepney, which bore the previous day's date, and had been received only that day, and therefore had not been under the consideration of the Committee, and moved that the whole matter be referred back to the Committee for consideration. He was opposed to the present Council, at the last meeting but one before the elections, pledging its successors to a great expenditure of £21,000. As stated above, Councillor Brookes's amendment was adopted by 13 votes to 12.

Fulham.—The Electricity Committee reports the receipt of a communication from H M. Electrical Inspector of Factories upon the Council's electricity works, stating that many things were not in accordance with the requirements of the Electricity Regulations under the Factory and Workshop Act, and suggesting alterations. The Inspector's report, the Committee states, has received the consideration of the borough electrical engineer, and the less important matters are being attended to. The only suggestion involving serious alteration is in connection with the high-tension switchboard, which, to meet the requirements of the Regulations, will have to be remodelled and reconstructed. The electrical engineer is to at once issue to a number of experienced firms a general outline of the essential requirements, and invite each of them to prepare and submit for consideration a complete scheme, together with an estimate of the cost of carrying out the proposals.

Lowestoft.—The T.C. has fixed a flat rate of 1d. per unit for current for cooking and heating, and has decided to expend £100 on cooking and heating stoves and electric irons for hiring out. The charges for current for power supplied to factories and workshops have been reduced to 2d. per unit for the first 500 units per quarter, and 1½d. per unit beyond.

Quarndon.—The P.C. has appointed a Committee to consider the advisability of adopting electricity for public lighting. The Committee will confer with the Derby Borough electrical engineer, Mr. Wilmshurst, who has already outlined a scheme.

Rochford.—After protracted discussion, the B. of G. has, by 14 votes to 8, adopted a scheme for lighting the Workhouse by electricity in place of gas. With the heating scheme the expenditure is estimated at £6,320. The matter, however, will again come forward, as notice has been given to rescind the adoption of the scheme, on the ground that it is too expensive for a building of the size of the Workhouse. At present gas is supplied at 3s. 9d. per 1,000 cb. ft., and the consulting engineer, Mr. Dolby, had advised that electricity will be cheaper than gas.

Sevenoaks.—Mr. Cecil E. Currie, who is applying for a prov. order for E.L., has informed the R.D.C. that the whole of the parishes in the Council's area will be included in the application.

South Africa.—At a special meeting of the Wellington (Cape Province) municipal Council, at which representatives of the public were present, it was decided to provide an electric lighting installation for the town. Two schemes were submitted, but some further information is required before the project can be taken in hand and the plant erected. The installation will supply a long-felt want, especially in the many boarding establishments.

We understand that an agreement has been arrived at between the Wynberg Council and the Cape Town Council for the purchase by the former of the electricity distributing system and the various rights acquired in Wynberg by the City as the result of its purchase of the undertaking of the Cape Peninsula Lighting Co. The agreement is of the nature of a compromise, the purchase price being fixed at £8,000.

Southend-on-Sea.—The T.C. has applied to the L.G.B. for a loan of £3,900 for an additional 500-KW. steam generating set, for which tenders are to be invited. The L.G.B. has also been asked to allow the expenditure of an unexpended loan, amounting to £3,745, granted for cables, on ordinary extensions.

Southport. The report of Mr. S. J. Watson, of Bury, who was called in as an expert to investigate the electricity undertaking, was presented to the Corporation on Saturday. A report upon the tramways is to be furnished at a later stage by Mr. Mallins, of Liverpool. The outstanding feature of the electricity report is the financial position, dealing with which Mr. Watson says that the undertaking is over-capitalised. The capital expenditure of £110,577 on the generating station is equal to £45 per KW. installed. In many other undertakings of similar size the expenditure is only £25 per KW., and at prices that obtain to-day equivalent value could be obtained at £15 to £18 per KW. The expenditure of £75,854 on mains, services and arc lamps is also excessive for an undertaking of its size, even after making allowances for the special character of the district and the class of customer supplied. The £20,811 expended on transformers and meters is out of all proportion to the actual value of the appliances which the sum is supposed to represent. No provision has been made for depreciation or for the replacement of plant or apparatus. A casual inspection shows that the useful life of much of the plant and appliances must be considerably less than the period granted for the repayment of the loans. Although no reserve or depreciation fund has been established during the past 14 years, the sum of £27,000 has been transferred from the revenues of the undertaking to the relief of the rates. "At the present time, therefore," the report proceeds, "there exists what amounts to a liability on the ratepayers for about £20,000 for depreciation in the value of the assets of the electricity department." Mr. Watson suggests that no further contributions whatever should be made to the rates until an adequate reserve or depreciation fund has been established.

Mr. A. S. Black (borough electrical engineer and tramways manager) commenting on this report, makes a remarkable suggestion. Before additional expenditure on tramway plant is decided upon, he thinks the whole question of the tramways should be considered. The whole of the Corporation tramways track will have to be renewed before long, and he suggests that it would be more satisfactory to abolish the present system. and substitute a petrol or petrol-electric service of motor-cars.

The report will be discussed at the next meeting of the Council.

Wellingborough.—The U.D.C. has decided to make no offer for the undertaking of the Electric Supply Co. until it has been inspected by an expert, and that it would not be worth the expense of expert advice unless the company reduces its offer to about two-thirds the sum recently named, and published at the time in the ELECTRICAL REVIEW.

West Ham.—Application is to be made to the Local Government Board for sanction to borrow £7,600 for transformers, and £6,000 for services. The B. of T. is to be asked to give its consent enabling the Council to give a supply of current to Messrs. Pearson, the contractors for the Port of London Authority Docks' extensions, for consumption outside the area of West Ham. An agreement has been entered into with the Charing Cross Supply Co., enabling it to continue for a further period of three years to take from the Council a supply of current at the Bow generating station. The India-Rubber, Gutta-Percha and Telegraph Co., Ltd., has signed an agreement with the Council for taking a supply of about 2½ to 3 million units per annum, at 150 to 600 KW. maximum demand.

Weymouth.—The L.G.B. has forwarded to the T.C. sanction to a loan of £3,880 for generating plant, £700 for extensions of buildings, £800 for mains, and £1,700 for services.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—On the recommendation of the Tramways Committee last week, it was decided to specially adapt six cars as an experiment, to the P-A-Y-E system, in connection with the Corporation Tramways, and to make supplication to the B. of T. for sanction to introduce a front entrance on cars for the upper deck passengers.

Blackpool.—An innovation was introduced on the tramways last week. By arrangements with the Postmaster-General, letter boxes are now attached to certain cars on each of the four routes, thus enabling the public in the outlying portions to post letters after ordinary collections from pillar boxes and sub-offices, and avoid a special journey to the central office. Letters may be posted at any stopping place, but if a car is stopped expressly for the purpose of posting only, a charge of 1d. is made to remunerate the Corporation.

The Corporation has under consideration a further scheme for extending the promenade at South Shore to Squire's Gate. The proposal which provides for the construction of a tramway track and carriageway is estimated to cost £18,000.

Broughton.—The Wrexham and District Electric Tramway Co. has informed the P.C. that it cannot at present consider the project for extending the tramway through New Broughton, Brynteg and Pentre Broughton, as such an extension would not justify the expenditure.

Canada.—In connection with its line to Vancouver, B.C., the Canadian Northern Railway is to enter the city by means of a four-mile tunnel, and in connection with this about 18 miles of route between Vancouver, New Westminster and Port Mann will be electrified.

Continental Notes.—RUSSIA.—The shares of the Société des Tramways de Reval, which owns the horse tramway system in the Russian port of Reval, have all been acquired by the Société Generale Tramways et d'Applications d'Electricité, of Liége, who propose to electrify the lines.

Dundee.—The railless electric traction system installed recently by the Corporation has been inspected by Mr. A. Campbell, city engineer, Edinburgh, and Mr. Laidlaw, a director of the Edinburgh Tramway Co. Mr. G. M. Stuart, chief city engineer, Bloemfontein (who is studying the various systems with a view to establishing a tramway system 12 miles in extent in Bloemfontein), and Mr. Donald M'Coll, manager of the Shanghai tramways, have also visited the town.

Edinburgh.—In connection with the scheme for extending the tramways, the sub-committee on new tramways, with the burgh engineer, has been requested to report on the three systems—railless, self-propelled cars, and motor-omnibuses—giving at the same time particulars as to cost.

Halifax.—In connection with the Bill which the Corporation is promoting for tramway extensions, it has been decided to take tramways to Wainstalls and Siddal, outlying portions of the borough.

Keighley.—The fate of the motor-'buses, which, in conjunction with the Corporation tramways, serve the out districts of Keighley, hangs in the balance. The controversy which has for some time past waged around the fact that they have not directly paid their way, was brought nearer to a head last week, when, at the T.C. meeting, Alderman King moved the entire discontinuance of the service. but admitting the fact that they undoubtedly acted as useful feeders for the tramways in the rough, hilly parts to which electric trams had not access, that they brought outside trade into the town, and that changes in the department were promised by the Committee concerned, he also moved that consideration of his motion be deferred for a month. This latter was carried, despite an amendment to the contrary.

Lancashire and Yorkshire Electrification.—The Lancashire and Yorkshire Railway Co. are about to commence the electrification of the system from Town Green to Ormskirk. The old rails are being replaced, and in the course of another month a start is to be made with the construction of buildings for an electric sub-station and battery station at Ormskirk. The company, encouraged by the success of the electrified system in the Liverpool district, feels confident that the consequent improved train service will in time more than compensate for the outlay. It is expected that as a result of the immediate start in connection with the extension, building developments on an appreciable scale will follow.

Llandudno.—The Light Railway Co. having announced a desire to double the track in certain parts of the district, a Committee of the local D.C. has been appointed to meet the representatives of the company to discuss the project.

Mytholmroyd.—The D.C. has expressed its willingness to enter into an agreement with the Halifax Corporation, provided the terms are acceptable to both parties, whereby it is proposed to postpone the Council's powers under Sec. 43 of the Tramways Act, 1870, to acquire the tramways now worked by the Corporation within that district, until the expiration of 31 years from the date of the Royal Assent to the Halifax Corporation's (proposed) Tramway Bill.

Newcastle-on-Tyne.—The Tramways Committee has referred to a Sub-Committee a scheme for reconstructing the bogie cars at an estimated expenditure of £10,000.

Oswaldtwistle.—At the Council meeting on September 19th, Mr. Hargreaves again referred to the rating of the tramways, and the action of Accrington Corporation in deducting three-quarters of the rate. Criticising figures given by Councillor J. C. Lupton, of Accrington, Mr. Hargreaves said it was one of those cases where they could make figures prove anything. He did not question the legality of the action taken by

Accrington in making deductions from the rates, but contended that the reduction was a violation of the ordinary principles of equity. The minutes showed the receipt of a letter from the general manager of Blackburn Corporation asking for the return of a portion of the rate paid by the Corporation respecting its undertaking in the Oswaldtwistle area. The matter was left over until a decision had been given in the appeal case affecting tramway rating.

Soyland.—The D.C. has decided in favour of the extension of the Halifax tramways to Ripponden, on terms to be arranged between the Council and the Halifax Corporation.

U.S.A.—With a view to the more rapid advancement of the electric motor vehicle in the New York district, the New York Electric Vehicle Association has just been organised in that city. It is stated that there are at the present time no fewer than 400 electrical vehicles of the pleasure type in use in New York, in addition to 1,400 industrial vehicles.

Wharfedale.—At the Otley R.D.C. on Friday, a deputation representing the Leeds Corporation Tramways Committee was heard as to the running of railless cars from Guiseley to Otley, and an extension of the service through Burley to Ilkley. Mr. Jackson (chairman of the R.D.C.) said it was a question that would require serious consideration. Mr. Redshaw pointed out that they would do a great service to the public, as at present the railway company had a monopoly and could run a train when they liked. The chairman said the ratepayers might be helping the City Corporation, which had a monopoly as well. Ultimately the matter was referred to the Menston Parish Council, which was interested in the proposal.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Commonwealth Budget Estimates for 1912-13 include provision for the expenditure of £789,000 for telegraphs and telephones, and £41,000 for wireless telegraph installations.—*Board of Trade Journal.*

Brazil.—The Government intends to extend the wireless telegraph system in the Northern part of Brazil. The three stations now existing at Para, Manaos and Santarem are to be supplemented by five others, of which three are now completed, whilst the other two are being built. Two of the stations, those at Cruzeiro do Sul and Senna Madureira, will be high-powered ones, whilst the one at Rio Branco will only have a quarter of the power of the two former. The distance between Cruzeiro do Sul and Senna Madureira is 450 km., and between Senna Madureira and Rio Branco 156 km. It will be possible to get into communication across the Andes with Cristobal, near Lima, and Iquitos, from the stations at Cruzeiro and Senna Madureira, though the distances range from 500 to 1,000 km.

Cable Rates.—The Western Union Telegraph Co. is now taking Press messages for Australia *viâ* the Pacific Cable at 7½d. per word for ordinary and 4½d. per word for deferred messages.

France.—A wireless telegraph station with a transmitting power of only 250 miles is to be erected at Harfleur, near Cherbourg, for the exclusive use of the French naval authorities when communicating from the shore with vessels of the fleet in the Channel. This step has been taken because it has been found that serious danger might arise in war from the use of the big wireless station at Rouges-Terres, for the communications between the staff of the First Maritime District and the stations along the coast or the ships in the Channel, as, owing to the powerful transmitting apparatus at Rouges-Terres, the messages sent by its agency might easily be tapped by foreign ships cruising in the Atlantic or North Sea.—*Daily News.*

New Companies.—A new joint-stock company is being constituted by the Hochfrequenzmaschine-fabrik für Drahtlose Telegraphie, of Berlin, which will undertake the international working of the Goldschmidt high-frequency patents. German, French and American capital and industries will share in the venture. The capital proposed is 10,000,000 fr., 25 per cent. of which will be called up. The new company will start operations with the erection of a trial system between Germany and America, for which a tower is to be built near New York and another in Hanover by the German company.—*Zeit. des Oest. Ing. & Architekten-Vereines.*

Secret Wireless Telegraphy.—It is reported that a trial is to be made in the Channel of a system of tuned wireless telegraphy devised by Messrs. Johnson and Varley, depending upon the use of accurately tuned vibrating reeds.

United States.—The Government is about to institute proceedings for the dissolution of the American (Bell) Telephone and Telegraph Co., which is alleged to have violated the Anti-Trust Act, and to have maintained a virtual monopoly in telephony by absorbing independent companies in all parts of the country. The company has a capital of about 100 millions sterling.

Telegraph Rates.—On October 1st the Eastern Telegraph Co. will reduce the Press rates between Great Britain and India and Burma, from 9d. to 4d., between Great Britain and Ceylon, from 9½d. to 4½d., and between Great Britain and British North Borneo, from 1s. 8d. to 6d. a word.

Wireless in the Antarctic.—The *Australian Mining Standard* states that the wireless installation on Macquarie Island, in the Southern Ocean, has shown how favourable surroundings enable enormous distances to be covered by an ordinary ship's set, which is able to pick up messages from Fremantle and repeat them to Fiji. A ship, as a rule, can only get messages from 200 or 300 miles away, but there in the long stretches of ocean and the absence of disturbing meteorological conditions they deal with far greater distances. The station is also used as a "repeat station" to New Zealand. The wireless plant which Dr. Mawson carried with him to the Antarctic, in the hope that by means of the installation at Macquarie Island it would be possible to keep in constant touch with the expedition, unfortunately was smashed before it had been erected, through falling off a crag of ice, and the wireless operator and mechanician were unable to repair it.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—October 16th. N.S.W. Government Railways. Two 5-ton electrically-driven travelling cranes, for the Randwick workshops. Specification No. 365 (5s.). Electrical Engineer's Office, 61, Hunter Street, Sydney.

South Australia.—October 22nd. Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" September 13th.

October 23rd.—100 common-battery table telephones, for the P.M G.'s Department. See "Official Notices" September 13th.

December 17th. Three sections of common battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" September 13th.

November 12th.—Deputy P.M G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 19th.—One mercury vapour condenser, for the P.M.G.'s Department. See "Official Notices" to-day. Also two batteries, and a 4-K.V.A. single-phase transformer. High Commissioner in London.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—October 24th. Electric installation in the workshops and material warehouse at Gmünd. Particulars of the Bahndirection, Gmünd.

October 4th.—The Austrian State Railway authorities at Linz are inviting tenders for an installation of electric lighting at the railway station at Ried.

Belgium.—October 1st. Tenders are being invited by the municipal authorities of Montegnée (province of Liége) for the concession for the supply of electrical energy for lighting and power purposes in the town.

Crete.—The municipal authorities of Candia, in the Island of Crete, have lately invited tenders for the concession for the electric lighting of the town during a period of 40 years.

France.—October 15th. The French State Railway authorities in Paris are inviting tenders for an installation of electric lighting at the railway station at La Pallice. Tenders are to be sent to, and particulars may be obtained from, Le Service Electrique des Chemins de Fer de l'Etat, Rue de Rome, Paris.

Paris.—October 4th. Tenders are required for the installation of the electric light at Evreux railway station. Particulars from the Bureaux du Service Electrique (1st division), 40, Rue de Rome, Paris.

Paris.—October 17th. Offers will be received, in two lots, for (1) the supply and erection of the motors, pumps and dynamos needed to raise the water of the Seine for the high-service supply at Auteuil and Passy, and for the low-service of the Bois de Boulogne and the XVIth Arrondissement; (2) dynamos, motors and centrifugal pumps, to lift the sewage water of the XVth Arrondissement to the collector on the right bank of the Seine. Particulars, Bureau des Eaux, Canaux, et Egouts, Hôtel de Ville.

Great Western Railway.—October 14th. Stores for a year. See "Official Notices" to-day.

Greenock.—October 2nd. Electric lighting work at Finnart School. Mr. A. F. Niven, clerk to the School Board, Municipal Buildings. (Schedules, £1.)

Isle of Thanet.—General stores for a year, for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 20th.

Leeds.—October 7th. The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depot, Leeds. Mr. J. B. Hamilton, general manager.

London. — SOUTHWARK. — October 2nd. 440 yd. or 880 yd. of 1 - 0·5 - 1, and 440 yd. or 880 yd. of [illegible] cable, for the B.C. See "Official Notices" September 20th.

Lossiemouth.—September 28th. Gas producer plant, engines and dynamos, battery, crane, overhead mains and public lamps, for the T.C. See "Official Notices" September 6th.

Manchester. — October 1st. Permanent way points, tongues, and hardened steel centres, for the Tramways Committee. Specifications and forms of tender (£1 1s. returnable) from Mr. J. M. McElroy, general manager.

Mersey.—October 4th. The Mersey Railway Co. are inviting tenders for electrical and other stores. Specifications and forms of tender from Mr. J. Shaw, engineer and manager, Central Station, Birkenhead.

Mexborough. — October 5th. Turbo-generator, condenser and switchgear, for the U.D.C. See "Official Notices" September 13th.

Nuneaton.—September 30th. Cast-iron and steel pipework, valves and accessories, for the Corporation. See "Official Notices" September 20th.

Rosslynlee.—The Midlothian and Peebles District Asylum, Rosslynlee, invite offers for supplying electric fittings. Mr. R. Addison Smith, 19, Heriot Row, Edinburgh.

Spain.—October 4th. The municipal authorities of Puebla de Guzman (province of Huelva) are inviting tenders for the concession for the electric lighting of the town during a period of 20 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Puebla de Guzman (Huelva).

November 9th. The Spanish Ministerio de Fomento, in Madrid, are inviting tenders for the concession for the construction and working of electric tramways between Vigo and Lavadores, and between Vigo and Arratales. It may be added that a project has, in each case, been submitted by a would-be concessionaire, the concession being only put up for tender in accordance with the practice in Spain.

Tenders have just been invited by the municipal authorities of Boadilla del Camino (province of Palencia) for the concession for the electric lighting of the town during a period of eight years.

Sweden. — October 15th. Tenders are invited for machinery required at the Porjus Power Works, viz.:—(1) Electric lift for passenger and goods; (2) two electrically-driven oil pumps; and (3) three electrically-driven water pumps. For further particulars see this column last week.

Watford.—September 30th. The U.D.C. is inviting tenders for one electrically-driven pumping plant. Specifications and forms of tender (£2 returnable) from Mr. D. Waterhouse, Engineer and Surveyor, Watford.

October 15th.—One 500-KW. steam alternator and a switchboard machine panel for the U.D.C. See "Official Notices" to-day.

CLOSED.

Aberdare.—Messrs. Clough, Smith & Co., Ltd., have secured from Messrs. Wm. Griffiths & Co., Ltd., contractors for the complete tramway and railless systems for the U.D.C., the following sections:—Overhead line equipment, tramways; overhead line equipment, railless; overhead feeder cables and underground mains.

Australia.—"The question of the extent of preference to local manufacturers had to be decided by the Minister for Home Affairs in connection with the power plant to be erected at the Federal capital site. Messrs. Thompson & Co. offered to carry out the work on a 10 per cent. basis, but presumably the Minister desired a straight-out quotation, and it is understood the local manufacturers' price was £5,000 higher than that of the British manufacturers. The Minister has now practically approved of the following tenders:—Boiler house plant, Babcock and Wilcox, Ltd., £5,706; engine room plant, Price & Martyn (Belliss and Morcom), £3,816; alternator and electrical exciter, Gilbert Lodge & Co. (Brush Electrical Engineering Co.), £1,204; total, £10,756."—*Tenders (Mining and Engineering Review.)*

Ayr.—The tender of Messrs. Bruce Peebles & Co. has been accepted by the T.C., at £525, for the supply of a motor-generator.

Barnsley.—The T.C. has accepted the tender of Messrs. Turner Bros., of Barnsley, for 3,000 tons of Hickleton main slack coal for the electricity works.

Burslem.—The Governors of the Haywood Hospital have accepted the tender of Messrs. W. Wadsworth & Sons for the provision of an electric lift.

Canterbury.—The B.C. has accepted the tender of the A.E.G. Co., of Canterbury, for electrical work for six months.

Continental.—For supply and erection of electrical equipment of transformer sub-stations at Dieghem, the following tenders were submitted:—

(A) Ateliers [illegible]
A.E.G., Brussels, 121 176 fr. and 118,800 fr.
[illegible]
[illegible]
[illegible]

(B) Supply of copper electric connections for a year:—

[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

Erith.—The U.D.C. has accepted the tender of Messrs. H. W. Clarke & Co. for 5,500 tons of wharf screenings for the electricity works at [illegible] per ton.

France.—The French Post and Telegraph authorities in Paris have just given out contracts as follows:—

[illegible] conductor ditto, at £4,379.
[illegible]

G.P.O.—The G.P.O. has again awarded the contract for supplying electric lamps during the current year to the Osram Lamp Works.

Glasgow.—The Arc Lamp Lowering Gear Co., Darlington, has received a further repeat order for 350 sets of complete lowering gear equipment in connection with the improved street lighting in Glasgow referred to in our issue of September 6th.

The T.C.'s Committee on Electricity has accepted the offer of Messrs. Johnson & Phillips for the supply of 400 additional flame lamps. The same Committee, on a report by the engineer, has recommended the Corporation to accept the offer by the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of two additional 500 KW.-rotary converters and switchgear on conditions relative to their running contract.

The T.C.'s Committee on Works and Stores recommends acceptance of the following:

[illegible] and J. Johnstone & Beath.
D.C.C. copper wire. British Insulated and Helsby Cables.
Galvanised corrugated sheets.—Smith & M'Lean.

London.—HACKNEY.—The Electricity Committee of the B.C. has accepted the tender of the Strand Building Co., at £18,657, for carrying out extensions to the generating station.

FULHAM.—The B.C. has accepted the tender of Messrs. H. Windsor & Co., at £178, for executing alterations and repairs to the economiser building at the electricity works.

Mersey.—The Mersey Docks and Harbour Board has accepted the tender of Messrs. Higginbottom & Mannock, Ltd., for the supply of an overhead electric travelling crane for the Gladstone Graving Dock engine house.

Newcastle-on-Tyne.—The Tramways Committee has placed an order with Messrs. Parsons & Co., for the erection of a new turbine, at an estimated cost of £7,000.

Southend-on-Sea.—The T.C. has accepted the tender of the Westinghouse Cooper-Hewitt Co., Ltd., for eight mercury vapour lamps for lighting the exterior of the car-shed, at £5 0s. 10d. each; and that of the Municipal Appliances Co., Ltd., of Bamber Bridge, for a sand drier, at £49.

Wallasey.—The tender of Messrs. Sykes & Sugden, Ltd., has been accepted by the Corporation for a supply of boxes, switches, and cut-outs; as has also the tender of Messrs. British Insulated and Helsby Cables, Ltd., for cable, boxes, &c.

West Bromwich.—The T.C. has accepted the tender of the Electrical Engineering and Equipment Co., Ltd., for a supply of cable.

Worksop.—Messrs. E. Bennis & Co. have received a repeat order from the U.D.C. for [illegible] stokers [illegible] self-cleaning compressed air furnaces for the electricity works.

FORTHCOMING EVENTS.

North Eastern Counties Electrical Exhibition.—Open daily to Saturday, September 28th inclusive. I.E.E. Conference at Exhibition on Monday, 30th inst. At the Exhibition Hall, St. Mary's Place, Newcastle-on-Tyne.

Municipal Tramways Association Conference and Exhibition. At West Ham Friday, September 27th. Last day of the Conference. For programme see our issue of August 23rd, page 305.

Iron and Steel Institute. Monday, September 30th, to October 4th. At Leeds. Autumn Meeting.

Society of Engineers.—Monday, October 7th. At 7.30 p.m. At the I.E.E., Victoria Embankment, W.C. Paper on "Town Planning from an Engineering Aspect," by Mr. E. R. Matthews.

International Engineering Exhibition.—October 4th to 26th inclusive. At Olympia.

NOTES.

New Uses for Tungsten.—Tungsten is finding an increasing use in the electrical arts outside its application in incandescent lamp filaments. On account of its high surface tension, the metal is well adapted for sparking or arcing terminals. In some of the newer Crookes or X-ray tubes which are designed to work at enormous intensities, being capable of absorbing 10 KW., and taking "snapshot" skiagraphs of even the thickest parts of the human body, tungsten has been used as the anode target for the cathode rays, the rare metal being backed up with copper to convey away the heat developed. Although rendered molten by even this instantaneous impact of electrons, the great surface tension of the tungsten prevents its loss or change of shape. Tungsten electrodes have also been used for gas-engine spark-gaps and show longer life than those made of other metals of equivalent cost.—*Electrical World.*

Resuscitation after Shock.—At the recent Convention of the Pennsylvania Electric Association, reported in the *Electrical World*, a paper read by Dr. Charles A. Lauffer, of Pittsburg, described the prone-pressure (Schäfer) method of resuscitation as recommended by the National Electric Light Association. The author emphasised the fact that time should not be consumed in removing the body to another place, and that the work of resuscitation must be begun the instant the body is removed from the circuit, even though other places in the neighbourhood may be cleaner. He also stated that in a great majority of cases it was not necessary to know whether the victim's mouth was open, merely that the nose and mouth were free from extraneous obstruction, since the pressure on the floating ribs would force the air out of the nostrils even if the mouth were closed, and breathing could be re-established in this way. Dr. Lauffer stated that the duration of the efforts at artificial respiration should ordinarily exceed an hour, and should be prolonged indefinitely if there were any evidences of returning animation by way of breathing, speaking or movement. Evidences of life were liable to manifest themselves within 25 minutes in patients who would recover from electric shock, and although the chances for recovery of a patient who showed no evidences of life within 25 minutes were rather dubious, the speaker said that where there was doubt the victim should have the benefit of it and no relaxation in the effort at resuscitation should be made so long as the least hope of success remained.

In the discussion which followed, Mr. Liversidge cited a case where victims died from electric shock on 110-volt circuits because they were taken away in an ambulance before any method of resuscitation could be applied. Mr. Conklin asked about the legal responsibility of a company which refused to allow a patient to be taken away by an ambulance surgeon, and Mr. Muller showed the shortcomings of the medical profession in the case of a man who was resuscitated after the physician pronounced him dead.

"Electrolytic Volts."—That electrical engineers have much to learn about electricity, says the *Electrical World*, is indicated in the following account of electrolytic action, which appeared recently in a Montgomery (Ala.) paper: "Harmful as electrolysis may be, it is one of the most interesting freaks that develop in the use of electricity. Electricity is measured by volts and amperes, volts denoting the quantity of the current and amperes its quality, or strength. It is possible for volts to escape from a distributing point, from a trolley car in the rain, and in almost any manner where the wiring may be out of order. They may come down the trolley pole of a street car in rainy weather, be picked up on the damp floor in a woman's silk petticoat, left on the metal plate of a stores door, picked up by the steel tire of a vehicle, but invariably they find their way back to the current-generating dynamo. Left awhile on a piece of metal, the stray volts will feed on it, destroying it, the destruction in such circumstances being known as electrolysis. The 'disease' is something that every institution using metal pipes is constantly on guard against, as far as it can guard, but usually, as in the present instance, the damage is not found out until it is done."

New Westinghouse Club Building. — Building operations have commenced in connection with the erection of a new Westinghouse Club, in Moss Road, Stretford. When completed the club will embrace a miniature rifle range in the basement, a lecture hall, billiard room, two bowling greens and tennis court, and all the means of social and intellectual recreation, the estimated cost being about £3,000. The club will be open to all mployés of the British Westinghouse Co.

The Thomas Transmission System.—In our issues of May 5th and June 23rd, 1911, we described at length the above system of electro-mechanical transmission for vehicles, particularly in reference to a Leyland lorry. The firm has, however, extended its activities in directions other than road cars, and, as has been mentioned in this journal, a Leyland rail car, equipped on this system, has been in use on the South African Railways during the year.

This coach has undergone its official trials on the Pretoria-Pienoors route, an 85-mile stretch, with a climb of 1,000 ft. in 42 miles. The results, with 10 stops per double journey, and a gross weight of 23½ tons, show maximum speed on level 50 M.P.H.; average speed, 33 M.P.H.; 9·2 miles per gal. of petrol down hill, and 8·1 miles per gal. up hill, or an average of 8·6 miles per gal. for the double journey. Tests made with the same car hauling a trailer (gross weight 40 tons) on a 90-mile route showed a maximum speed of 45 M.P.H., and an average of 33 M.P.H.; petrol consumption average 5·7 miles per gal.

A letter from Mr. W. W. Hoy, general manager of the South African Railways, states that the acceleration is rapid, a speed of 30 M.P.H. on the level being reached in 48 seconds. Gradients of 1 in 80 can be climbed on the direct drive, and the transmission is such that after starting from rest on a 1 in 80 grade, speed can be increased until the direct drive is attained. Mr. Hoy attributes the good results obtained to the transmission system, and gives the following interesting table showing the ratios in which the power is transmitted mechanically or electrically at the different controller notches. The drive on Nos. 8 and 11 notches is purely mechanical, and no electrical losses are involved: the drive is direct from engine to track wheels without intermediate loss of power.

	Notch.	Speed in M.P.H.	Power transmitted Electrically.	Power transmitted Mechanically.
	1	8	0·5	0·5
	2	12	0·45	0·55
	3	16	0·4	0·6
	4	19	0·35	0·65
	5	22	0·3	0·7
	6	24	0·2	0·8
	7	27	0·1	0·9
Direct	8	33	0·0	1·0
	9	35	0·1	0·9
	10	38	0·3	0·7
Direct	11	48	0·0	1·0

Notches Nos. 1 to 4 are purely starting notches, and are never used under running conditions. Under ordinary circumstances, practically the whole of the running would be done on notches 8 or 11, at which points the greatest efficiency is obtained. When the direct drive is in operation at No. 11 notch, the speed can be regulated down to 25 miles per hour by use of the throttle.

The fuel consumption in ton-miles per gallon disclosed by these tests is 228; the best result obtained with a pure petrol-electric vehicle of 42 tons weight, according to German authorities, was 150 ton-miles, while a 30-ton vehicle with mechanical change gear, according to the makers, gives 90 ton-miles.

Mr. Hoy has recommended this type of car and transmission for use on the New Zealand railways.

Glow Lamp Sales in the U.S.A.—According to a report of the Lamp Committee of the National Electric Light Association at its Annual Convention at Seattle, Washington, in June last, carbon lamps show a steady decline, and have been replaced by Gem and tungsten lamps. The sales of tantalum lamps formed only a small proportion of the total, and reached their maximum in 1910, since which year they also show a steady decline. The total sales of domestic lamps of all standard types for the year 1911 were, roughly, 89,000,000 lamps. This is an increase since 1907 of 33⅓ per cent., the increase being over the year 1909, 20 per cent.; 1910, 12·4 per cent.; and 1911, 8·45 per cent. The percentage of carbon lamps has fallen from 93 per cent. of the total in 1907 to 53 per cent. of the total in 1911. The sales of Gem filament lamps, on the other hand, have increased from 5·88 per cent. in 1907 to 19 per cent. in 1911. The tungsten lamp has increased from an insignificant proportion in 1910 to over 25 per cent. of the total in 1911. The report is also interesting as showing the general adoption of the rating and sizing of lamps in total watts in place of candle-power.

Newcastle Electrical Exhibition Conversazione.—We are asked to draw our readers' attention to a conversazione which has been arranged for the Newcastle Scientific Associations at the Electrical Exhibition, St. Mary's Place, Newcastle-on-Tyne, on Monday next, September 30th, commencing at 6.45 o'clock p.m. This function has been promoted by the Committee of the Newcastle Local Section of the Institution of Electrical Engineers, and members of the kindred scientific associations are invited to attend with their friends. A programme has been arranged for special lectures and demonstrations at definite times on "Wireless Telegraphy," by Prof. Henry Stroud, M.A., D.Sc.; "Electric Cooking," by Messrs. Norman Miller and W. A. Gillot; "Illuminating," by Mr. Haydn Harrison; "Electric Automobiles," by Mr. W. H. Lloyd-Watson; "Electric Signalling," by Mr. James Pigg, electrical engineer for the N.E. Railway. Special arrangements have also been made with the Bros. Dustoffski for their lecture on "Spring Cleaning: Ancient and Modern." An orchestra will give selections during the evening, and light refreshments will be provided. The price of gentlemen's tickets will be 2s. 6d., and ladies' 2s., for which application should be made at once to Mr. H. W. Clothier, Hawthorn Villas, The Green, Wallsend. The President of the Institution of Electrical Engineers, Mr. S. Z. de Ferranti, will receive the guests.

(*Continued on page 505.*)

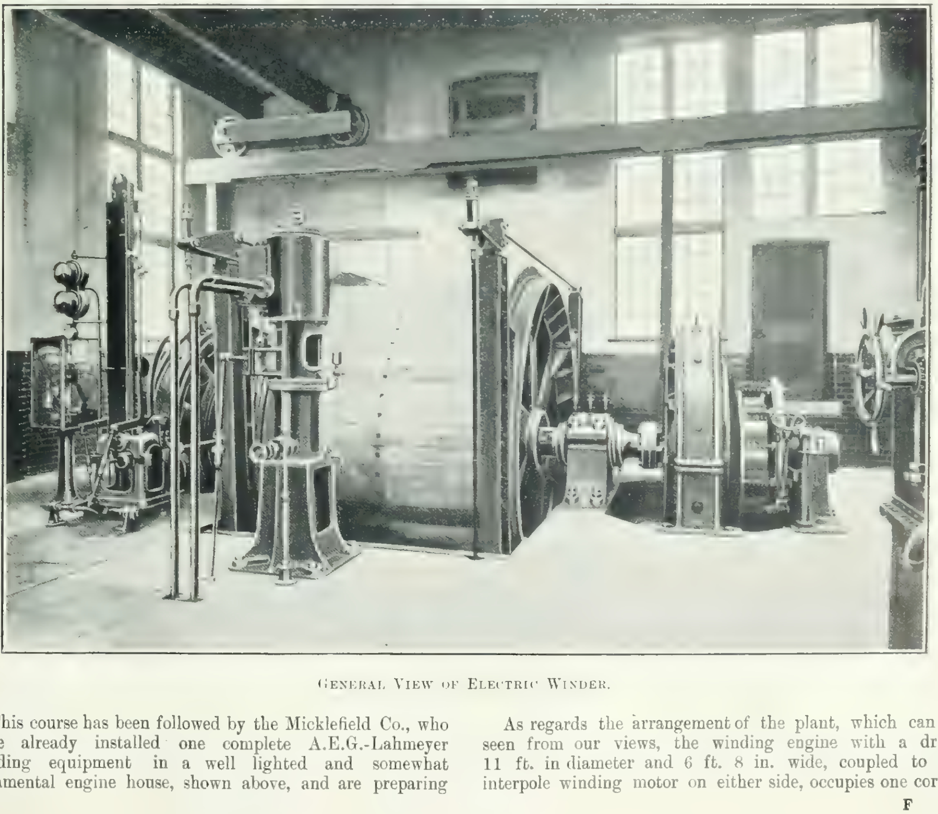
ELECTRIC WINDING PLANT AT KIPPAX.

As mentioned in the Electrical Review some time ago, the Micklefield Coal Co. are opening new pits at Kippax, some $1\frac{1}{2}$ to 2 miles distant from their existing colliery at Micklefield, Yorks.

Certain stipulations in the lease under which the firm are undertaking this development are of very great interest to electrical engineers, as foreshadowing a policy which may eventually be commonly adopted in the case of new collieries situated in the neighbourhood of large towns, or where it is desired to retain the rural or residential character of the locality.

The conditions in this case provide that no chimney shaft shall be permitted after the sinkings are completed, and also provide for an ornamental winding-engine house and the planting of the dump with trees and shrubs—and obviously point to the adoption of electrical plant, supplied with energy generated in some other locality.

The First Electrical Winding Engine-House and Compressor Building, Kippax.



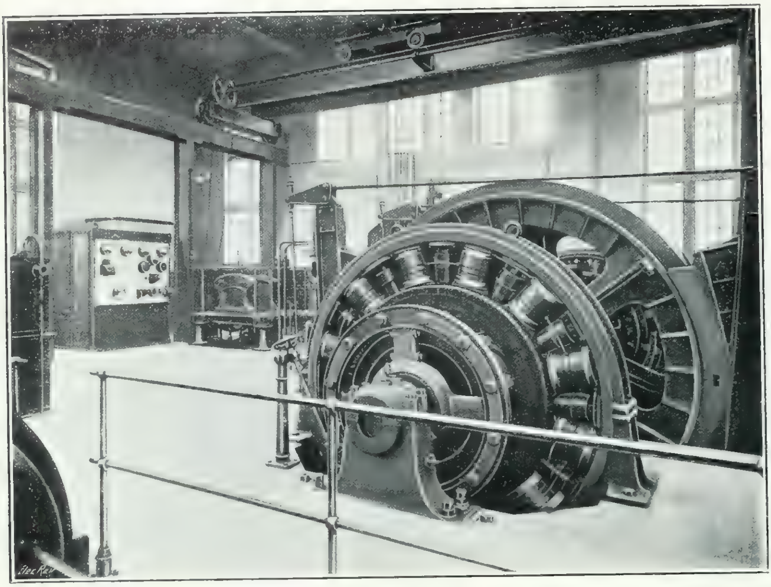
General View of Electric Winder.

This course has been followed by the Micklefield Co., who have already installed one complete A.E.G.-Lahmeyer winding equipment in a well lighted and somewhat ornamental engine house, shown above, and are preparing to erect a duplicate engine house with a slightly modified and improved equipment almost alongside it, an electrical compressor house coming in between the two. Three-phase 50-cycle current at 10,000 volts is delivered by the Yorkshire Power Co., over duplicate mains, to a sub-station erected in one corner of the existing engine house, and transformed down to 2,000 volts for use on the winding plant.

The erection and setting to work of the first equipment was carried out by the A.E.G., Leeds. The winder was constructed for the following conditions: To deal with 1,500 tons in 10 hours, with net loads of 36 cwt. per lift, and with a winding depth of 300 yards.

The weight of the cage, &c., is 55 cwt., and of the three trucks (per cage) 5·5 cwt. empty, each truck to carry 12 cwt. of coal; the rope diameter is $1\frac{1}{2}$ in., and a balance rope is used. The number of winds per hour is specified to be 8·5.

As regards the arrangement of the plant, which can be seen from our views, the winding engine with a drum 11 ft. in diameter and 6 ft. 8 in. wide, coupled to an interpole winding motor on either side, occupies one corner



End View of Winder, also Driver's Platform and Winder Switchboard.

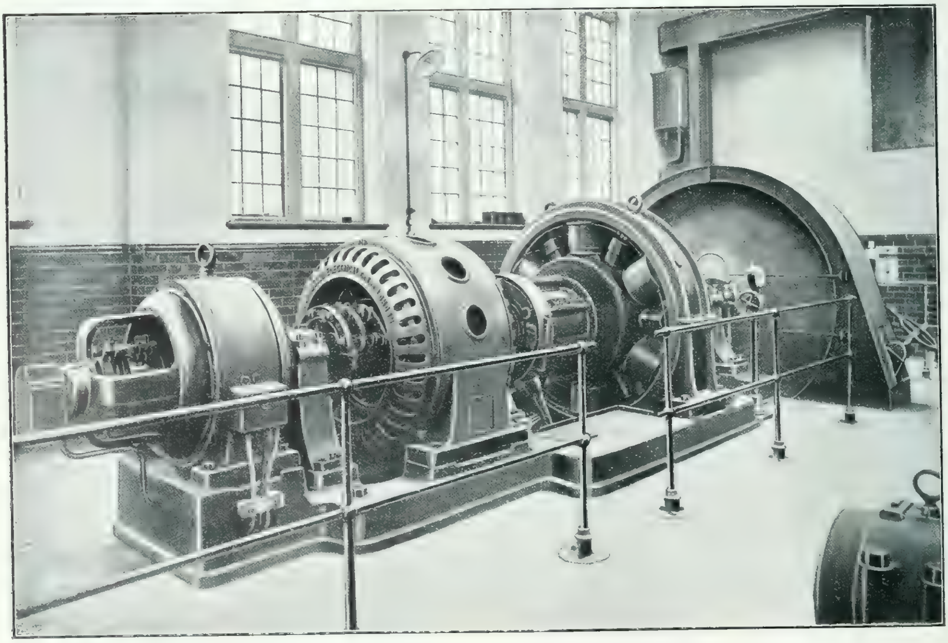
of the building, with the fly-wheel converter, and slip regulator on the right hand, the driver's platform, with two levers for the electrical and brake control respectively, and the winder switchboard, being, of course, immediately behind the winder, as shown herewith.

The converter includes a 300-h.p. motor, operating on the 2,000-volt 50-cycle three-phase supply received from the sub-station, within speed limits of 730-640 r.p.m., allowing a slip of 12 per cent.; this machine is coupled on one side to an interpole dynamo, giving a pressure range of 500-0-500 volts, and a 9-ton fly-wheel, and on the other side to a small exciter, the latter being sufficient for the excitation of the dynamo, and of the two winding motors with a drop in speed to 500 r.p.m. With this drop in speed a full wind could be performed even if power were cut off.

The fly-wheel, which is calculated to deliver 5,580 h.p.-seconds with a slip of 12 per cent., has a maximum circumferential speed of 100 metres per second at the synchronous speed of the motor; it revolves in a housing, and is flexibly coupled to the converter shaft, and provided with a band brake, in order to bring it to rest in case of emergency, such as a hot bearing.

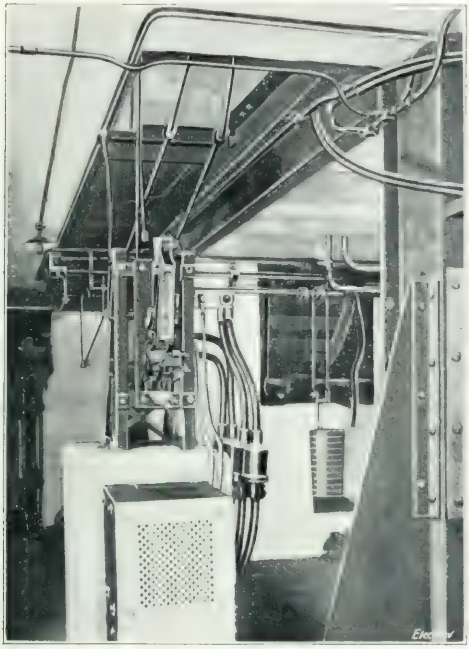
Duplicate bearing lubrication systems are provided—ring lubrication, and a gravity circulation system by means of a small rotary pump and elevated tank, so that the ring lubrication is practically an emergency system.

As regards the winding engine, either motor can, in case of emergency, continue winding operations with reduced loads. The normal revolutions are 71 per minute, and the maximum rope speed 12·5 metres per second, the motors being, as previously mentioned, of the interpole type, shunt-wound and arranged for reversing.



Fly-wheel Converter, Kippax Winder.

The slip regulator, of standard A.E.G. manufacture, which can be seen in some of our views, is of the liquid type, the electrodes in the tank being lifted or lowered according to the load by means of the small series



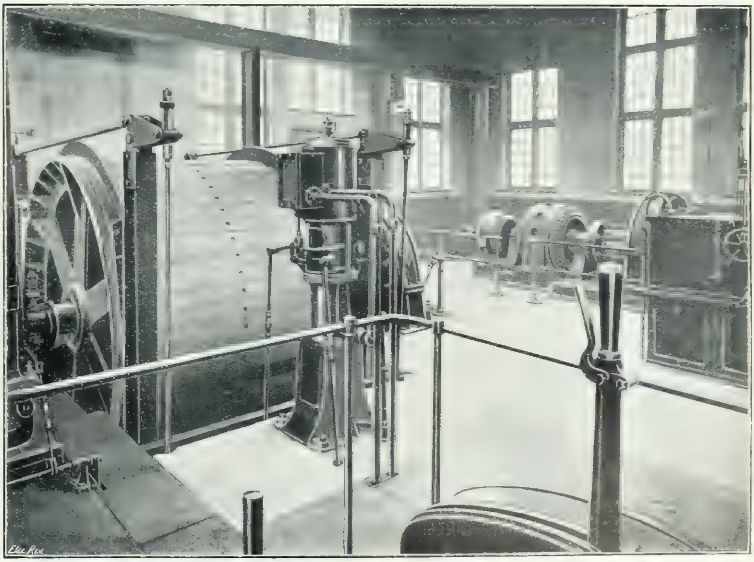
Control Switch for Fly-wheel Machine (Situated under Driver's Platform.)

induction motor mounted on the top, which is operated from a three-phase current transformer in the main supply circuit to the converter motor.

The transformer has three terminals for each phase, to allow of adjusting the current at which the slip regulator works, and thus regulating the maximum power taken from the mains in conformity with the required output of the winding plant.

The control levers for the engine-man are two in number, one for regulating and reversing the voltage of the converter dynamo by means of a field rheostat under the driver's platform, and the other for operating the manœuvring brake on the winding drum, which is of the post type applied by weights and released by compressed air, the latter being supplied from an automatic electrically-driven compressor in the basement.

The weights also apply the brakes in connection with an emergency braking device operated (*a*) by the driver through a foot pedal; (*b*) from the depth indicator; and (*c*) in case of failure of the excitation voltage.



Engine House from Driver's Platform: Fly-wheel Machine and Slip Regulator on Right.

The switchboard consists of two panels, one containing the instruments and operating switch for the driving motor of the motor-generator, and the other, the instrument and switch for the exciter, two field switches for the winding motors and certain other switches for auxiliary services.

An automatic voltage regulator is provided for the exciter, in which a contact arm is moved to and fro over a series of contacts by means of a screw, motor-driven in either direction by means of open and crossed belts and clutches. The clutches are electromagnetically operated by relays, which, according to the rise and fall of pressure, close one or other of two contacts which close the clutch circuits; the regulation is within 2 or 3 per cent.

It is expected that the winder will operate on 1·64 kw.-hours per ton of coal raised, measured at the incoming meter.

If the winder is not used to its full capacity, it can be worked without the fly-wheel, still avoiding excessive peak loads, due to the method of control, while if running at two-thirds capacity and assuming 15-sec. intervals between successive winds, it is expected that the maximum demand will not exceed some 320 h.p.

We may add that the second winder, to operate under similar conditions, is being installed by the A.E.G. entirely to their own designs. We are indebted to this company, and particularly to Mr. W. Kobs, of the Leeds branch, for enabling us to prepare this short description of the plant.

COAL-HANDLING PLANT AT THE WIGAN ELECTRICITY WORKS.

Coal is brought to the Corporation electricity works at Wigan in barges, which are unloaded at a point about 80 ft. away from the boiler house.

It became necessary in the interests of economy to provide some effective mechanical means of conveying the coal from the canal to the boiler house. A scheme was, therefore, devised and decided upon, which has recently been put into operation, the results obtained being eminently satisfactory to Mr. J. Slevin, the borough electrical engineer.

The coal is trimmed by hand from the barges into skips, which are hooked on to a travelling electric transporter running along an overhead track, extending between the boiler house and the canal. The transporter raises the loaded skips, and carries them along the overhead track, after which they are emptied into a receiving hopper placed above an automatic weighing machine (fig. 4). The weight of the coal is automatically recorded, and it passes on into a second hopper with two outlets.

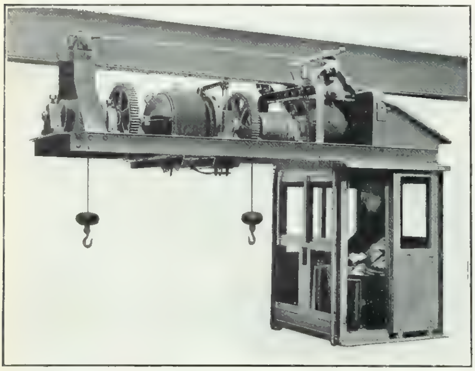


Fig 1.—Bennis Transporter at Wigan Electricity Works.

The overhead coal bunkers are in two separate sections, in line with each other and about 100 ft. apart; the coal is conveyed to these bunkers by two "Bennis" U-link steel chain conveyors (fig. 2).

These conveyors receive the coal through the two openings in the hopper before mentioned, and are so arranged that both conveyors can run simultaneously or independently of each other, as may be desired.

The conveyors are inclined for the first portion of their length, in order to raise the coal to the level of the top of the bunkers. The remaining portion of the conveyor is horizontal, and passes over the top of the bunkers.

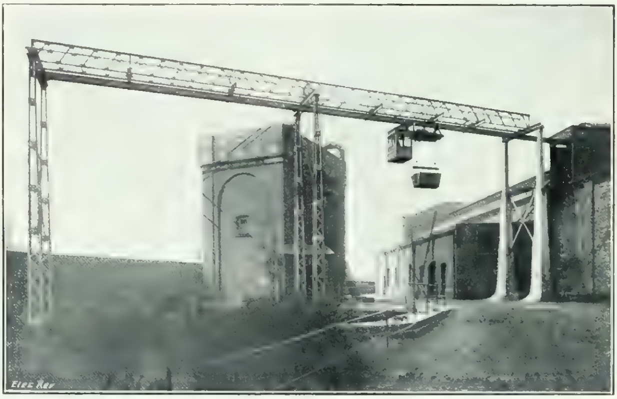


Fig. 3.—Transporter on Overhead Track.

Openings provided with cut-off slides are placed at intervals in the conveyor, through which the coal can be dumped at any desired point.

Each conveyor is driven through suitable reduction gear by a separate motor, independently of the other, and has a capacity of about 20 tons of coal per hour. A gangway runs along at one side, giving easy access to the various parts of the plant.

The "Bennis" U-link steel chain conveyor is shown in fig. 2; it consists of a chain built up of mild steel links, each bent into the form of a "U," and runs in a cast-iron trough.

The electric transporter consists of a travelling hoist, having separate motions for lifting and travelling. Each motion is operated by a separate motor. All the operations of hoisting, travelling and lowering are under the direct control of a single attendant, who travels with the hoist (fig. 1).

The transporter runs on a track which is formed by the base flanges of an "H" section steel joist. The wear is taken by replaceable mild steel flats, which are fastened to the lower flanges of the joist by means of countersunk rivets. The joist is supported on a structure consisting of lattice girders carried on latticed trestle supports, two of these columns being reinforced by ferro-concrete (fig. 3).

The clear height of the track above the ground level is 33 ft. 9 in. The structure is built in three spans, the longest of which is about 48 ft.

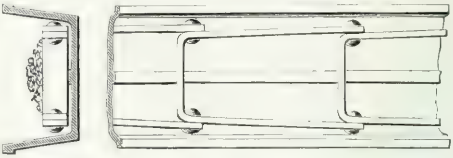


Fig. 2.—Plan and Section of Bennis U-Link Conveyor.

The bunkers are rectangular in shape, each being 7 ft. 6 in. wide × 7 ft. 9 in. high × 80 ft. long, and are constructed with a framework formed of rolled-steel sections with the intervening spaces filled in with panels of brickwork and concrete, the whole being braced together to form a rigid structure.

Small hoppers are built in the bunker floor, above each chain-grate stoker, and the coal passes by gravity from the bunkers to the stokers through a series of chutes. Each chute is arranged to swing back to admit of access to the boiler tubes. The bunkers are supported on rolled steel joists, built into the boiler-house wall, at one end, and supported on stanchions at the other end.

The power required to drive each conveyor at its maximum load is from 3 to 4 B.H.P., and for driving the transporter 5 B.H.P.

The whole of the coal-handling and storage plant, including the transporter, lattice and structural steel work, conveyors, coal bunkers and chutes, was supplied and erected by Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton.

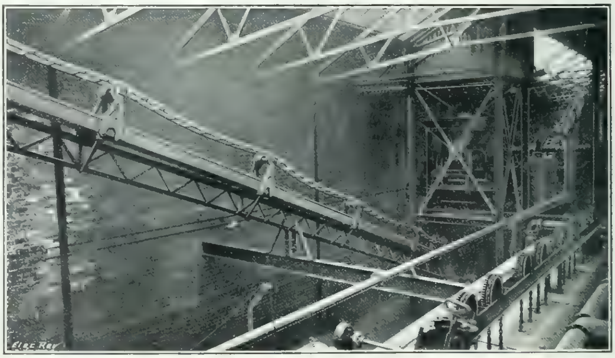


Fig. 4.—Automatic Weighing Machine and Conveyors.

THE MUNICIPAL TRAMWAYS CONFERENCE.

The eleventh annual Conference of the Municipal Tramways Association was opened on Wednesday morning last at the Town Hall, West Ham, where the members were cordially welcomed by the Mayor of that borough, which, as many of our readers are aware, is honoured this year in that the manager of its tramways, Mr. H. E. Blain, occupies the presidential chair.

The Conference extends over three days, the last of which (to-day) contains a larger proportion of pleasure than of business, being principally given up to a motoring excursion to Epping Forest and Rye House.

The Exhibition.

In connection with the Conference a representative exhibition of tramway material was held at the Greengate Street tramway depôt, Plaistow, at which some 60 firms took part, and much that is of interest to tramway people was on view.

There was a well-attended preliminary visit to this exhibition on Tuesday afternoon, and on the two following days set times were arranged in the programme for collective visits by members attending the meetings.

The collection of manufactures on view was considered to be a marked improvement on that at last year's Convention at Glasgow, doubtless due to the matter having been taken in hand at an earlier date, and with a greater zeal, this time. Mr. Blain personally acted as chairman of the Exhibitors' Committee, and the other members were: Messrs. F. Bland (Edgar Allen & Co.), C. Burnet (Tudor Accumulator Co.), A. S. King (United Electric Car Co.), W. L. Lorkin (Equipment and Engineering Co.), E. M. Munro (Brecknell, Munro and Rogers, Ltd.), J. S. Warner (Warner Engineering Co.), with Mr. W. Hopkins as hon. secretary.

An exhibition of this kind undoubtedly forms an added attraction for the tramway official, while it also affords manufacturers an opportunity of showing where they know they will get into close touch with the very men they want to reach. We believe that it will be found that the effort will be more than justified by the results secured by all parties. We can now only indicate broadly the nature of the exhibits in the following :—

A railless electric trolley vehicle (Cedes-Stoll) running from the West Ham tramway conductors outside the depôt, over a ¼-mile section.

A "Tilling-Stevens" petrol-electric 'bus.

A demonstration and exhibit of the Tudor arc welding process for making and repairing rail-joints.

A Thermit rail-welding exhibit and demonstration.

The "P.A.Y.E." tramcar.

Turner's point controller.

The Warner non-parallel axle rolling stock.

Taylor's tubular sanding device.

The Knowles oxy-hydrogen apparatus for rail cutting.

The "Celerity" rail grinder.

Dodwell's point controller.

Brake shoes for railless traction.

"T. and M." single magnet point controller.

Peckham trucks.

The Ackley adjustable brake.

Hadfield's "Hecla" tramway switches.

"United" semi-convertible car.

The Anger brake adjuster.

Barber's radial axle tramcar trucks (working models).

The Peacock wheel and track brake gear.

The "Norwich" portable track grinder.

In addition to these there were a number of exhibits of overhead construction material, electric meters (Chamberlain and Hookham and Ferranti); T.S. gears and pinions, the E.M.B. resistance and Vulcan electric soldering tools (Scholey & Co., Ltd.); Davis's acid fume resisting paint; Major's varnishes and paints; B.I. and Helsby trolley wire, fittings, rail bonds, and "Nephroin" insulation; Edgar Allen's steel points, Lorain "Tadpole" switches, route indicators, "Kyl-Fyre" extinguishers as used in many power stations, Atlas rail joints, Imeson & Finch control fingers, &c., and "Aetna" overhead line material (Watlington & Co., Ltd.). Jenson and Nicholson show their "Robbialac" paint, and "Wattlac" for cables, motors, &c.; the "Wimperis" accelerometer and gradient measurer (Elliott Bros.), P. and B. insulating tape and paints, &c. (Ruberoid Co.), Siemens Bros. "Wotan" lamps for traction service, Brecknell, Munro & Rogers's crossings and other overhead material, section insulators, signalling arrangements, &c.; Birkby's overhead line material (Fleming, Birkby & Goodall, Ltd.), Pinchin, Johnson and Co.'s insulating varnishes, cloths and tapes; an interesting display of aluminium for electrical tramway work by the British Aluminium Co., Ltd.; R. W. Blackwell & Co.'s overhead line insulators and other cognate supplies; carbon brushes (Morgan Crucible Co., Ltd.); weldless steel brake chains; motor spare parts (Dyer & Young); Gabriel lifeguards; insulating varnishes, &c. (Lewis Berger & Sons, Ltd.), also Bambridge flexible shafts, G. W. Green's overhead material, and a number of other general tramway supplies exhibits.

Presidential Address.

To return to the Conference proceedings, there are no aerial flights in Mr. Blain's presidential address, though, as would be expected from such a president, matters are put in a nice way. The address is a brief, businesslike summary of various matters affecting municipal tramway working which the last 12 months have brought into prominence, and some of which will doubtless figure again in subsequent addresses.

The following points may be selected as being of general interest :—

In referring to the interim report of the Corrugation Committee (which came up for discussion later on in the day), Mr. Blain points out the striking difference between the findings of this Committee and the theory which finds favour with many Continental investigators, that corrugation is inherent in the rail. The Committee is of opinion that, whilst a steel for rails can be obtained which is more durable and less liable to the development of corrugation than the ordinary varieties of steel at present mainly used, the chief cause or causes will be found to be external to the rail itself.

Apparently, this investigation has cost more than was expected, and, in view of additional financial assistance being needed, a Presidential suggestion for an increased subscription rate is made, while there also follows a hint that a permanent secretary and office must soon be provided.

The past Parliamentary Session in relation to tramway matters is briefly referred to—the recent trolley 'bus proposals, the L.C.C. fight on the question of trailers, and the future of the Light Railways Bill (1912), being the principal items of interest.

In connection with the Government acquisition of the National Telephone Co.'s business, Mr. Blain mentions that the policy of the company (co-operating with the tramway authorities) in abolishing bare overhead wires, is being reversed by its successors. This has naturally raised a strong protest on the part of the Tramway Executive, and a deputation is to exercise its persuasive powers on the Postmaster-General with view to ending the difficulty.

Mr. Blain touches on the effect of the Insurance Act on tramway undertakings. It has brought onerous financial responsibilities for such undertakings, and he regrets that in the drafting of the Act itself "some more defined and coherent basis covering the trades affected should not have been adopted." The president notes with satisfaction the additional representation of the Association on the Engineering Standards Committee, and the pecuniary benefits following on reduced tramway rating resulting from the Tottenham case.

The most important, and, one might add, the only immediately pressing matter referred to by Mr. Blain, is the question of motor-'bus competition in London. He says :—

"It is difficult for those of us whose work lies within the metropolitan area, where $13\frac{1}{2}$ million pounds have been invested in municipal tramway undertakings, to make any survey of tramway conditions, however limited, without a reference to motor-'bus competition. In the metropolitan area the tramway undertakings are now faced with an exceedingly keen motor-'bus competition, which selects only such routes as are of a distinctly remunerative character, which has no moral responsibility in the direction of providing facilities which are requisite, though not remunerative, which provides no unremunerative travelling facilities for workpeople, which has no legal liabilities in connection with road widenings and maintenance, and is subject to no rates other than those leviable on the buildings and garages it occupies. Whilst recognising to the fullest extent the rights of private enterprise, and the exceedingly valuable traffic facilities which have been furnished by motor-'buses in many areas, it is unreasonable and unfair that when competition of such magnitude exists, there should not be such central authority for the control of traffic as would be empowered to enact satisfactory street regulations, or the municipally-owned undertakings should not be at the enormous disadvantage (in competition with private enterprise) which is entailed by their road maintenance and rating responsibilities. The difficulty will have to be faced, and faced promptly, and I have never been able to see why, of all the users of the public highway, tramways alone should be called upon to pay so unfair a proportion of road maintenance. If competition is to exist on the public highway for the conveyance of the public, all such means of traction should pay a proportionate cost of road maintenance, should be rated on similar lines, and should be governed in the conduct of traffic by similar public regulations. Special legislation for London is inevitable, but in the interim, the strongest possible influence should be exerted to ensure that the petrol tax at present paid by the London Motor 'Bus Companies (which, to the tune of probably nearly £100,000 a year, is spent by the Road Board in developments in the provinces) should be applied, *pro rata* to the 'bus miles run, in each local authority in the London area over whose roads these companies now operate."

Undoubtedly, Mr. Blain voices the legitimate grievance of the London tramway authorities in this matter, but it seems questionable whether the £100,000 per annum would go very far in any case amongst the numerous authorities, not all blessed with tramways, which could lay claim to a share of it for road maintenance.

In some ways, the plaint of the tramway authorities, who have widened and paved roads, and thus enabled the 'bus to compete efficiently, reminds us of the railway companies' outcry of a few years back, that they were paying rates to provide tramway competition with their own trains. But suburban railway conditions invited competition, which cannot be said in general of present-day tramway facilities. Indeed, were it not for the monopoly of profitable street transit by the 'bus in the heart of the metropolis, the 'bus interests could not have entered into speculative competition with the tramways with any degree of assurance.

Councillor Neumann (Bradford), who followed with a paper on "Tramway Administration by Municipalities, &c.," is evidently one of the advanced school; he discusses both the advantages and disadvantages of municipal control, and quite logically comes to the conclusion that a committee selected for its ability—in fact, something in the nature of the much abused board of directors—is a necessity of the times, even for municipal work.

Both paper and discussion covered a wide field, and the latter in particular revealed a natural interest in the prospects of the motor-'bus, in which connection Mr. Luntley's experience with two or three 'buses, showing costs of 7½d. per mile, including 25 per cent. depreciation, will not tend to allay misgivings.

At the close of the morning's proceedings, the members and visitors were entertained to luncheon in the Town Hall by the West Ham Corporation, and subsequently the proceedings were resumed at the Plaistow tramway depôt, where the interim report of the Corrugation Committee came up for discussion. The findings of the Committee are of great interest, although, as a speaker pointed out, mainly of a negative character.

Positive evidence has, however, been obtained showing that slip and skid of car wheels take place always (and that a pure rolling motion rarely occurs at all), resulting in attrition and cold flowing of the rail material. We hope to refer to the work of the Committee at a later stage.

At the close of the discussion, many of the visitors adjourned to the Exhibition, and later in the evening a reception was held at the Stratford Town Hall.

(*To be concluded.*)

Apprentices' Strike.—According to the *Times* the engineering trade of the Manchester district has been considerably disorganised by a strike of apprentices On the 20th inst. the strike had extended to 45 firms, and 6,000 youths were idle. "The strikers demand an advance at the rate of 1s. a week, their contention being that, while all other rates of pay have been advanced considerably during the last 20 years, theirs have not Some firms have already granted the demands."

FUEL FOR DIESEL ENGINES.

In a letter to *Engineering* by Mr. J. Lane, the writer is reminiscent of the man in Scripture who, coming to curse, remained to bless, for he certainly succeeds in emphasising a favourable conclusion by the pessimistic tone he adopts in the early part of his letter. Mr. Lane has regarded the Diesel engine from a standpoint somewhat different from that of the engineer who looks on the engine merely as a very successful and efficient heat engine. Accepting the engine on this basis, Mr. Lane inquires rather into the status of the fuel question. Regarding petroleum as a rival of coal in steam raising, and taking the relative heat values of coal and oil as 1 : 1·4, he says that such oil cannot have much cash value. The heat ratio may be freely admitted, but this is not the true ratio, for oil permits of many incidental economies by way of labour in firing, cleaning, and in some cases in carriage.

Even with oil much dearer than the calorific value would indicate, the Diesel engine can produce power so economically, that it becomes a practical commercial motive power at sea. Speaking generally on crude petroleum, the bulk of the crude oils can be split up in the still into several fractions:—(*a*) Those which pass over up to 150° C., known generally as benzene; (*b*) those which pass over from 150° C. to 300° C., classable as lamp oils; (*c*) the solar oils, which are distilled up to 360° C., after which the balance is called residue. There are, of course, higher distillates, and any number of intermediate grades in each class. Of the fractions named, the first class are too costly and too light for use in the Diesel engine. The second, or lamp oil class, are perfectly suitable, but are too readily saleable for the specific purpose which gives them their class name. The solar oils are not produced in great quantity, so that there only remains residue for certain use, though solar oil is really the best technically that could be employed. The world's annual production of oil is about 45 million tons, of which about 29 million tons is residue, and this large figure shows the importance of the capacity of the Diesel to use it. These residues vary greatly in density, viscosity, and constitution, and it is important that every quality should be usable. The marine question is more serious than the problem ashore, for the reason that on land the engine cylinders can be cleaned of the deposits left by unsuitable oils. This cannot be done frequently at sea, and unless the marine engine could be made to secure perfect combustion of all the residual oils, its usefulness would be much cramped. Mr. Lane claims to have made experiments which conclusively prove that the Diesel engine can perfectly consume the heaviest residues, and continue working for a long time without interruption if only the oil contains no extraneous matter, by which is not meant asphalt.

Thus there have been burned the heaviest residue of Roumanian oil, and the liquid pitch from the Trinidad asphalt oil used for road-making, with a specific gravity of 0·98 and hardly fluid at ordinary temperatures. All this has been done without priming, and in an engine of only 100 h.p. with a compression of only 30 to 32 atmospheres, and the weight of fuel used per horse-power hour was practically the same as in the case of solar oil. But we are not told how it was done. It may be assumed that the fuel would be at least well liquefied by heat.

As regards sulphur, this is not regarded as serious if only it is kept dry after burning. But this is an old story. The sulphur in coal only does harm to the economiser where this is cold, and, if the feed water is not below 100° F., appears to be powerless to corrode cast-iron. There was considerable trouble with the early Diesel practice of spraying the oil with the exhaust gases, which were compressed by a small plunger in the engine itself. At least some of the exhaust gases remained in the cylinder, whence the small plunger drew them for its own second stage compression. This small plunger corroded badly, and the system was abandoned and air was compressed pure in the separate double-stage compressors now employed. A French writer in the *Génie Civil* refers to the methods of preparing tar oils for use in Diesel engines. These tar oils, though not possessing even the desirable minimum 10 per cent. of hydrogen, work quite satisfactorily, though only [illegible] per cent. of the stuff distils below 300° C., in place of 60 per cent. sometimes asked for. These oils are in regular use, and even crude tar has been experimented with, with considerable success.

There is much to be done before oil can become even seriously competitive with coal, but there are plenty of uses for oil in which it can show to advantage, and there should be a ready market for every ton of oil raised. Why should oil be so dear? Many ask this question. It either comes automatically to the surface, or is mechanically raised by pumps from no very great depths. It can be transported in pipes, pumped into a ship's hold or bunkers, and burned without much labour, yet its price is excessive. It is difficult to find ships to carry it, and difficult to find men who will use it. Yet it is excellent for steam raising and for internal-combustion engines and for metallurgy.

NOTES.

(*Continued from page 498.*)

St. Petersburg Waterworks Contract.—We recently drew attention to the huge undertaking contemplated by the municipality of St. Petersburg, involving the expenditure of no less than 10 million roubles, and including the largest plant for the sterilisation of water with ozone that has yet been projected. Tenders have been submitted for the work by three Continental firms and one English Co. (Ozonair, Ltd.), and from the Russian Press we gather that the former have submitted quotations considerably in excess of the amount voted by the Duma, while the English company has quoted a very much lower price. A St. Petersburg newspaper suggests that the three firms abovementioned are really in league with one another, and sounds a warning note with regard to the dangers of "syndicates" or rings formed to maintain prices at an unduly inflated volume. The allegation appears to have been the subject of discussion in the city council, and a commission has been appointed to consider the tenders in detail, under the chairmanship of Mr. Barashnikoff, who is referred to as a councillor who has gained the respect and sympathy of the public. Our contemporary urges the commission to clear up the question why the prices of the "syndicate" are so much higher than that of our British *confrères*. The intrusion of the latter, it is suggested, was not contemplated by the "syndicate," which took advantage of its supposed position as holding a monopoly and puffed up the prices.

Ferrantians.—It has been suggested that there should be another foregathering of past and present Ferrantians some time before Christmas. Interested readers should apply to the hon. secretary, Mr. W. E. Warrilow, Mildred Avenue, Watford.

Inquest.—On September 20th an inquest was held at Westminster into the death of Mr. Tinniswood Miller, aged 41, an electrical engineer, of Victoria Street, S.W., who was found shot in his office. The evidence went to show that the deceased's business was not prospering, and that modern taxation had got on his mind. The verdict was one of suicide during temporary insanity.

Fatalities.—On the 19th inst. an inquest was held at Sheffield on Walter Sydney Imisson, aged 18, an apprentice at the works of the Provincial Motor Co., Ltd., Gell Street, Sheffield, who was killed at the works on the previous Tuesday. Dr. P. Edwards, assistant house surgeon at the Royal Hospital, gave evidence that death was due to electric shock.

John Shemeld, a fitter at the works, said that on the morning of the accident he went into some disused closets at the works with another employé named Jepson. Imisson at the time was washing a car at the garage. Witness said that as they came out a gas pipe lay partly across the doorway in such a position as to cause one to step over it. It was leaning up against a wall. He stepped over it, and then went on picking up nuts and bolts. Later he heard a shout, and saw Imisson grasping this bar or pipe with one hand. He immediately put the other hand on, too. At the time witness did not realise what was the matter, but afterwards observing that deceased was getting a shock he ran to the power house and turned off both the main switches, and going back to Imisson expected he would be free. He was, however, lying on the ground in some water. Witness touched his hand to take it off the bar, and he also received a shock. Hammers were obtained, and the wires were broken. Imisson then gave three gasps and died before he was removed to the hospital.

In reply to the Coroner, witness said that until the Tuesday when the accident happened, he did not know that there was anything connected with electricity there. He had not noticed any switch in the place. In answer to further questions, witness said the current of electricity came through the wall from the premises of Messrs. Graves, next door.

Ernest Jepson, 128, Heavygate Road, gave similar evidence. In reply to Mr. A. Neal, who appeared for the Provincial Motor Co., he said he remembered, when he first went to work for the company, that the first door leading from the garage to the closets was nailed up but six months later it was re-opened. So far as the management of the garage was concerned, no one ever went into the closets.

There was an adjournment for further evidence, and on Friday the inquest was resumed.

Frederick Bolsover stated that when he worked in premises adjoining those in which the youth was killed he remonstrated with a workman who removed part of the tubing and left the wires loose, with the result that the wires began to fuse in witness's kitchen. At that time, said witness, the pipe that Imisson grasped was fitted to the wall of the lavatory, but afterwards it fell down.

The Deputy Coroner, in summing up, said it would now be almost impossible to find out how the order for the work was given, who did the work, and how he did it. If, as was not at all unlikely, an ordinary workman removed the fittings, he would not have electrical knowledge sufficient to make him responsible for the careless manner in which they were removed, and although it was a careless thing to leave naked wires, it was clear that at the time the cable was left it was not in the highly dangerous position in which it was found on the day of the accident.

The jury returned a verdict that the cause of death was an electric shock due to some person having negligently left an electric cable exposed, but that there was not sufficient evidence to determine who was responsible.

A public inquiry was held in Dingwall on Friday by Sheriff Hay MacWatt into the deaths of a ploughman's daughter, aged 12, and Mrs. Jessie Mackenzie, or Grant, widow, who were killed on August 26th through touching a live wire which conveys electricity to Dingwall. It appeared from the evidence that the wire had come in contact with a branch of a tree and fused, and that the girl, her curiosity aroused, touched the wire and was instantaneously killed. Mrs. Grant and the girl's mother ran to the rescue, when the first-named was killed, while the latter is still suffering from shock. The jury found that had the fuses at the generating station been in proper working order the accident could not have happened; but the accident was unusual, and no man could have foreseen it. They recommended that the whole system be inspected by an expert, to report if the wires are properly protected at all public places.

Will.—The late Mr. Wm. Yates, mechanical engineer (formerly of Yates & Thom), left £110,925 gross and £94,155 net personalty. Large bequests were made for Blackburn charities and mechanical engineering scholarships.

Educational Notes.—East London College.—A special course of lectures on "The Management of Public Electric Supply Undertakings" will be delivered by Mr. A. Hugh Seabrook, M.I.E.E., commencing on Monday, October 14th, at 6.30 p.m. The course will cover the relations between the public services and the public, and the objects to be aimed at in the management of public services, as well as the organisation of the staff, the relative importance of management and engineering, the functions of the general manager and engineer, the secretary, and the accountant, the conduct of the generating and distributing plant, the sales department, and tariffs. The lecturer's exceptional experience and well-known uncompromising views are a guarantee that the lectures will be interesting and instructive. Particulars may be obtained from the Principal, Mr. J. L. S. Hatton, at the College, Mile End Road, E.

Northampton Polytechnic Institute.—The new session opened on the 23rd inst. The "announcements" for the session give particulars of the evening classes in electrical engineering, in which department the Institute is exceptionally well equipped with high and low-pressure plant, and in electric wiremen's work. Dr. R. Mullineux Walmsley is the head of the department, and Mr. F. M. Denton, the Associate head. Mr. E. K. Scott delivers a course of lectures on Electrical Engineering Quantities and Estimates. Special evening classes in Telegraphy and Telephony are held by members of the staff of the G.P.O., and Dr. J. Erskine-Murray lectures on Radio-Telegraphy. The day classes commence on Monday next. The degrees of the University of London may be taken through the Institute.

The Polytechnic, Regent Street, W.—Notice is given in our advertisement pages to-day of the commencement on September 30th of technical classes in telegraphy and telephony.

Newcastle Exhibition.—Correction.—The name of the inventor of the electric water-heater mentioned on p. 516 should be Kratt, not Krabb.

Football.—We have received a card of fixtures of the E.A.C. (Electrical Apparatus Co.) Football Club for the season 1912-13. There are still five open dates, and the secretary, Mr. A. Chittenden, will be pleased to hear from other electrical football clubs in London in respect of these.

Taxes on Electric Motor Vehicles.—Hitherto electric motor vehicles have, for the purposes of the annual taxes imposed on automobiles in this country, been regarded as being of from 12 to 15 H.P., on which scale the annual tax is at present £4 4s. In the report issued last week by the Committee appointed in December last "to consider the Provisional Regulations which have been made under Sec. 86 (2) of the Finance (1909-10) Act for determining the horse-power of motor-cars and to report whether any amendments are desirable with special reference to the equitable treatment of steam cars and electric cars," it is recommended that "any motor-car deriving its power from an electric motor or motors shall be deemed to be of a horse-power exceeding 6½ but not exceeding 12." If the recommendation is adopted, the annual tax on electric vehicles will thus be reduced from £4 4s. to £3 3s.

An International Electro-Culture Congress in France.—An important meeting in connection with the application of motor traction and electricity to agriculture is to be held at Rheims from October 19th to 27th next, the programme comprising an exhibition of motor-propelled agricultural machines of all kinds and a demonstration of the same in practical use. From an electrical point of view, the principal event of the gathering is the International Congress of Electro-Culture and of Applications of Electricity to Agriculture, Viticulture, Horticulture, and to the Agricultural Industries generally. This will be held in Rheims on October 24th, 25th and 26th, and the work of the Congress will be divided into various groups. Section A will be devoted to "Natural Electricities," this including such subjects as atmospheric electricity and its influence on plants, the nitrification of the soil, its action on microbes, &c. Group B will deal with "Electricities Artificially Produced," these embodying current derived from primary and secondary batteries and other means of generation, their effects on plants and the consequent results being considered. Section C will take up the consideration of the influence of continuous and alternating current on plants and the germination of seeds. Another group will devote itself to applications of electricity in pest prevention, and another to the effect of electric light on plants and flowers and in the destruction of insects. Finally, there will be another section, which will treat generally of the uses of electricity in the various branches of agricultural work. As will be seen, the scope of the Congress is exceedingly wide, and it should give an impetus to the application of electricity to agricultural operations. Those interested in the Congress in this country can obtain full particulars from the Secrétariat General, 58, Boulevard Voltaire, Paris.

Institution and Lecture Notes.—The Electrical Association of New South Wales celebrated the attainment of its majority on August 16th at Sydney by a smoking concert. Special invitations had been issued, and according to the *Australian Mining Standard*, there was a brilliant assemblage, representatives being present from the principal kindred organisations in the State, leading electrical firms and Government departments. The concert was voted the most successful yet held.

INSTITUTION OF ELECTRICAL ENGINEERS.—Intending applicants for membership of the Institution, and existing members who are considering transfer from one class to another, are reminded that under the new Articles of Association substantial differences have been established in the matter of entrance fees and annual subscriptions payable by those admitted to the various classes of membership before January 1st, 1913, and those admitted on and after that date. Candidates will find full particulars in the new forms of proposal for election and transfer, which can be obtained on application to the secretary. As a long interval must necessarily elapse between the receipt of a form by the Institution and the date at which the election or transfer, as the case may be, can finally take place, those wishing to avail themselves of the lower rates are advised to send their forms to the secretary at the earliest possible moment, in order to enable the desired election or transfer to be effected before January 1st, 1912.

Two popular lectures will be given by Mr. Frederic H. Taylor at the Willesden Polytechnic, Priory Park Road, Kilburn, N.W., on October 2nd and 4th next, commencing each evening at 8 p.m. Tickets may be obtained on application to the Secretary at the Polytechnic. The titles of the two lectures are:—"The Training of the Engineer with special reference to Electrical Engineering," on the first evening, and "Recent Developments in Electrical Engineering and their Commercial Application," on the second evening.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The recommendation of the Harrogate Lighting Committee that the salary of the borough electrical engineer be increased by £50 a year (mentioned in the ELECTRICAL REVIEW last week), has been referred back to the Committee. In February, 1902, the T.C. passed a resolution as to the discontinuance of outside consultation by the electrical engineer, and promised "to further reconsider in a few years the question of compensation to be paid in consequence."

The marriage took place at Salem Church, Hebden Bridge, last week of MR. HERBERT H. SUTCLIFFE, assistant electrical engineer at Hebden Bridge, and Miss M. Hirst, of Fairfield.

At Barnwell last week, the marriage took place of MR. J. F. HALL, electrical engineer, of the Burton-on-Trent Corporation electricity staff, and Miss Margaret A. Ogilvie, youngest daughter of the late Mr. R. J. Ogilvie, of Barnwell.

The Tunbridge Wells General Purposes Committee on Saturday last recommended the appointment of MR. R. N. TORPY as borough electrical engineer. There were 83 applicants. Mr. Torpy has been deputy chief electrical engineer to the Wimbledon Corporation for the last 10 years.

The Bridlington Electricity Committee has appointed MR. F. FRENCH, mains superintendent, as chief assistant engineer at the electricity works, at £130 per annum, rising by £10 a year to £160. The Committee has also appointed MR. LESLIE A. THAIN, of Fleetwood, as charge engineer.

Tramway Officials.—The Burnley Corporation tramway staff has presented a Gladstone travelling bag and a silver-mounted umbrella to INSPECTOR HARTLEY, who is leaving to join the tramway staff at Newport.

General.—The *Glasgow Daily Record* says that MR. JAMES SIMPSON, telegraph superintendent, Post Office, Stirling, has retired. "He was one of the few remaining members of the staff taken over when the Government acquired the telegraphs."

At Doncaster Parish Church on September 19th, the marriage took place of MR. HENRY PARRY JONES, electrical engineer, of Dolgelly, North Wales, and Miss Mary Jones, second daughter of the late Mr. Robert Jones, also of Dolgelly.

The *Australian Mining Standard* reports that at the annual dinner of the Victorian Institute of Electrical Engineers, on August 9th, the hon. secretary, MR. E. H. W. WESTWOOD, was presented with a travelling bag. Mr. Westwood was leaving at the end of the same month on a business trip to Europe on behalf of the Union Electric Co., during which he will inspect the leading electrical installations and plants both in Great Britain and on the Continent.

The same Australian contemporary reports that MR. J. M. CRAWFORD has been appointed assistant electrical engineer on the central staff of the Postmaster-General's Department, his salary being £520 per annum. "Mr. Crawford was not previously in any Australian public service, but was until lately in the British postal department."

MR. ALAN WILLIAMS, who is shortly severing his connection with Messrs. Crompton & Co., after 23 years' service, is open to take up another appointment as engineer or manager.

MR. LEONARD F. S. SINGTON, of the Lord-Howe Electrical Engineering Co., Ltd., Liverpool, was married on September 24th at the Princes Road Synagogue, Liverpool, to Miss Eunice Solomon, eldest daughter of the late Louis Solomon, of Liverpool. The presents, which numbered over 300, included a magnificent rose bowl presented by the staff.

It is reported from Rome that MR. MARCONI has been injured in a motor-car collision while journeying from Spezia to Genoa. His injuries are stated to be slight.

NEW COMPANIES REGISTERED.

Bagdad Tramways and Electric Lighting Syndicate, Ltd. (124,213).—This company was registered on September 12th, with a capital of £3,105 in 3,000 "A" shares of £1 each and 600 "B" and 1,500 ordinary shares of 1s. each, to promote a company or companies for the purpose of constructing, establishing and working in the Ottoman Empire or elsewhere tramways, railways and undertakings for the generation, distribution, supply and employment of electrical energy, and to adopt an agreement with W. B. Cownie. The subscribers (with one "A" share each) are:—W. B. Cownie, 3, Laurence Pountney Hill, E.C., director; T. H. Evans, 4, Broad Street Place, E.C., director. Private company. The number of directors is not to be less than two or more than five; the first are W. Brodie and T. H. Evans; qualification, 50 "A" shares; remuneration, £100 each per annum (chairman £150). Registered office, 3, Laurence Pountney Hill, E.C.

Emanda Engineering Co., Ltd. (124,255).—This company was registered on September 14th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of engines, machines, instruments, tools, appliances and articles used in the electrical, mechanical, automobile engineering and boiler making trades, &c. The subscribers (with one share each) are:—W. E. Upton, 52, Tideswell Road, Eastbourne, engineer; F. Pratt, 13, Musgrove Road, New Cross, engineer's traveller; Mrs. R. Bradford, 13, Musgrove Road, New Cross. Private company. The first directors are W. E. Upon (managing director), F. Pratt, and Mrs. R. Bradford (all permanent); qualification, 25 shares. Registered office, Sumner Avenue, High Street, Peckham, S.E.

Duram, Ltd. (124,295).—This company was registered on September 18th, with a capital of £25,000 in 24,000 ordinary shares of £1 and 20,000 deferred shares of 1s. each, to carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity and electrical appliances, manufacturing chemists, machinery manufacturers, engineers, founders, smiths and machinists, &c., and to adopt an agreement with C. Gladitz. The subscribers (with one share each) are:—F. W. Warburton, 90, Cannon Street, E.C., merchant; W. A. Pearce, 1, Broad Street Place, E.C., chartered accountant. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, 100 shares; remuneration as fixed by the company. Registered office, 1¾, Broad Street Place, E.C.

Anglo-Colonial Engineering Co., Ltd. (124,316).—This company was registered on September 19th, with a capital of £1,000 in £1 shares, to carry on the business of mechanical, electrical and general engineers, manufacturers of and dealers in railway coach, tramcar, motor-car and carriage fittings and supplies, &c. The subscribers (with one share each) are:—Col. Vaughan Grimshawe, 16, Coleherne Court, South Kensington, S.W.; H. Brittain, 13, City Road, E.C., engineer; A. J. Smith, 3, Burgoyne Road, Harringay, N., secretary. Private company. The number of directors is not to be less than two or more than five; the first are Col. E. S. Vaughan Grimshawe, H. Brittain and A. J. Smith. Registered office, 13, City Road, E.C.

Williams Electric Co., Ltd. (124,357).—This company was registered on September 20th, with a capital of £20,000 in £1 shares, to carry on the business of a cable, telegraph, telephone and electric light company, and to adopt an agreement with A. Williams. The subscribers (with one share each) are:—F. A. Hole, 2, Draper's Gardens, E.C., stockjobber; A. Williams, Hotel Victoria, S.W., engineer. Private company. The number of directors is not to be less than three or more than seven; the first are A. Williams, J. Abernethy, and two others to be appointed by subscribers; qualification, 100 shares; remuneration (except managing director, if any), £100 per annum, divisible. Registered office, 20, Bucklersbury, E.C.

Sheffield Electric Steel Castings Co., Ltd. (124,289).—This company was registered on September 17th, with a capital of £4,000 in £1 shares, to take over the business of a steel merchant and steel manufacturers' agent, carried on by G. Fischer, as "The Sheffield Electric Steel Castings Co.," at Melbourne Chambers, Cambridge Street, Sheffield. The subscribers (with one share each) are:—G. Fischer, Villa Berg, Schaffhausen, Switzerland, steel manufacturer; P. Alterbach, Hochstrasse, Schaffhausen, Switzerland, manager. Private company. The first directors are G. Fischer and P. Alterbach (both permanent); remuneration, as fixed by the company. Solicitors, Newson & Burns, Melbourne Chambers, Cambridge Street, Sheffield. Registered office, Melbourne Chambers, Cambridge Street, Sheffield

Universal Radio Syndicate, Ltd. (124,355).—Registered September 20th, by Slaughter & May, 18, Austin Friars, E.C. Capital £100,000 in £1 shares. Objects: To adopt an agreement between Christopher Hage and Det Kontinentale Syndicat for Poulsen Radio Telegraf Aktieselskab, both of Copenhagen, of the one part, and this company of the other part, to apply for purchase or otherwise acquire and hold any patents and concessions relating to the production, treatment, storage, application, distribution and use of electricity; to carry on (subject to the licence of the Postmaster-General or the Board of Trade being obtained in all cases where necessary under any statute of the United Kingdom) the business of a wireless telephone, telegraph and electric light, heat and power supply company, in particular to establish, work, manage, control and regulate wireless telephone or telegraph stations and works, and to transmit and facilitate the transmission of telephonic and telegraphic communications; also to act as news distributors, press agents and district messengers, &c. The signatories (with one share each) are:—Henry A. Wallon, 55, Chapter Road, Kennington, S.E., clerk; Hugh Pettitt, 18, Austin Friars, E.C., solicitor. Private company. Shares may not be transferred to non-members so long as any member of the company or any nominee of the board is willing to purchase the same at a fair value (to be settled by the auditor in case of disagreement). The first directors (to number not less than three or more than seven) are to be appointed by the subscribers; remuneration as fixed by the company. No notice of registered office filed at time of incorporation.

Oil and Gas Turbine Syndicate, Ltd. (124,303).—Registered September 18th, with capital of £15,000 in 11,750 shares of £1 each and 6,000 founders' shares of 1s. each, to purchase or otherwise acquire any interest in any patents, brevets d'invention, licences, concessions and the like relating to the combustion, treatment, storage, application, distribution and use of fuel, and to carry on the business indicated by the title and that of manufacturers of motors, motor-cars, carriages and vehicles, with either steam, electric, petrol, oil or other power, &c. The subscribers (with one share each) are:—J. McCanna, Broad Street House, E.C., solicitor; R. H. Wheeler, 17, Gracechurch Street, E.C., merchant; D. O. Robertson, 17, Gracechurch Street, E.C., secretary; F. H. Bennett, 17, Gracechurch Street, E.C., clerk; S. E. Glisbey, 7, Narcissus Road, West Hampstead, N.W., clerk; B. Hunter, 4, Granville Road, Stroud Green, N., clerk; W. H. Rose, Broad Street House, New Broad Street, E.C., solicitor. Minimum cash subscription £7. The number of directors is not to be less than two or more than seven; the first are J. McCanna, R. H. Wheeler, D. O. Robertson, F. H. Bennett, S. E. Glisbey, B. Hunter and W. H. Rose (provisional directors). Registered by Rose, McCanna & Co., Broad Street House, E.C.

Liverpool Traction, Light and Power Investment Trust, Ltd. (124,301).—This company has been registered on September 18th, with a capital of £500 in £5 shares, to acquire and hold any stocks, bonds, debentures, shares, scrip or securities of any Government, State, Department, Sovereign or authority, supreme, municipal, local or otherwise, and any bonds, debenture stock, shares, stocks and securities of any company established for the purpose of any railway, tramway, gas, water, dock, electric lighting or power undertaking. The subscribers (with one share each) are:—J. Conybeare, 32A, Quinton Street, Earlsfield, S.W., clerk; A. P. Hollinshead, 29, Forthbridge Road, Clapham, S.W., clerk; H. Hurley, 25, Sidney Road, Stockwell, S.W., clerk; F. W. Davis, 39, Matham Grove, East Dulwich, S.E., clerk; W. J. Simpson, 35, King's Road, Willesden Green, N.W., clerk; G. E. A. Waller, 167, Brondesbury Park, N.W., clerk; F. Hurley, 2, Thornton Street, Brixton, S.W., clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £5. Registered by Linklater and Co., 2, Bond Court, Walbrook, E.C., solicitors.

Anglo Engineering Co., Ltd. (124,292).—This company was registered on September 18th, with a capital of £3,000 in 1,000 cumulative preference shares of 10s. each and 2,500 ordinary shares of £1 each, to carry on the business of electricians, mechanical and general engineers and manufacturers, workers and dealers in electricity or electrical appliances, motive power and light, &c. The subscribers (with 50 shares each) are:—E. B. Hartel, 183, Lauderdale Mansions, Maida Vale, W., engineer; H. G. Hartel, 32, Adelaide Road, South Hampstead, N.W., engineer. Private company. The number of directors is not to be less than three or more than five; the first are F. P. Wilson (chairman), E. B. Hartel, H. G. Hartel and H. Shakel. Registered office, 33, Kirby Street, Hatton Garden, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Potteries Electric Traction Co., Ltd.—Return dated April 12th (filed July 17th), 1912. Capital, £600,000 in £1 shares (300,000 preference and 300,000 ordinary); 245,000 ordinary and 245,000 preference shares taken up; £423,340 paid on 178,340 ordinary and 245,000 preference; £66,660 considered as paid on 66,660 ordinary. Mortgages and charges: £245,000.

Birmingham and Midland Tramways, Ltd. (19,077).—Return dated June 25th (filed July 8th), 1912. Capital £1,050,000, in 35,000 preference, 35,000 preferred ordinary, and 35,000 deferred shares, all of £10 each. 20,978 preferred, 35,000 preferred ordinary, and 35,000 deferred taken up; £10 per share called up on 20,978 preferred, 27,000 preferred ordinary and 35,000 deferred; £82[illegible],780 paid; £80,000 considered as paid on 8,000 preferred ordinary. Mortgages and charges: £354,893. (Since the date of the return, a new memorandum of association has been adopted, and the name has been changed to the Birmingham and District Power and Traction Co., Ltd.)

Aron Electricity Meter, Ltd. (58,650).—Return dated July 9th (filed August 23rd), 1912. Capital £350,000 in £1 shares (225,000 ordinary and 125,000 preference). 125,000 ordinary and 124,896 preferred shares taken up; £124,948 10s. paid, including £52 10s. on 104 preferred shares forfeited; £125,000 considered as paid on the ordinary. Mortgages and charges: £100,000.

Corona Lampworks, Ltd.—Issue on August 21st, 1912, of £1,450 debentures, part of a series of which particulars have already been filed.

Wellingborough Electric Supply Co., Ltd. (67,747).—Return dated August 2nd, 1912 (filed August 10th). Capital, £25,000 in £10 shares; all shares taken up and paid for in full. Mortgages and charges: Nil.

Wright Electrical Sales Co., Ltd.—Debenture dated September 4th, 1912, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. W. Newbould, 13, New Station Street, Leeds.

Telephone Co. of Egypt, Ltd.—Act of constitution of mortgage dated May 30th, 1912, created outside the United Kingdom (supplemental to trust deed dated July 27th, 1904, and indentures dated February 21st, 1905, March 4th, 1908, and October 27th, 1909, securing £200,000 debenture stock). The charge secures to the extent of £76,000, the amount owing on the debenture stock. Property charged: Company's immovable property in Egypt. Trustees: G. F. Braithwaite, Kendal, Westmorland, and H. J. Grewing, 26, Queen Anne's Gate, S.W.

Callender's Cable and Construction Co., Ltd. (48,915).—Return dated May 16th, 1912 (filed June 11th). Capital £500,000 in £5 shares (40,000 preferred); 35,000 ordinary and 40,000 preferred shares taken up; £5 per share called up on 15,000 ordinary and 40,000 preferred; £275,000 paid; £100,000 considered as paid on 20,000 shares. Mortgages and charges: £800,000.

British Thomson-Houston Co., Ltd. (47,582).—Return dated May 23rd, 1912 (filed June 12th). Capital £8[illegible] in £10 [illegible] 40,000 preferred. All [illegible] taken up; [illegible] and 40,000 preferred; £725,810 paid; £74,690 considered as paid on 7,469 ordinary. Mortgages and charges: £249,2[illegible].

D. Hulett & Co., Ltd. (29,46[illegible]).—Return dated July 18th, 1912. Capital, £35,000 in £5 shares; 6,000 shares taken up; £5 per share called up on 1,900; £9,500 paid; £20,[illegible] considered as paid on [illegible]. Mortgages and charges: Nil.

Cryselco, Ltd. ([illegible]).—Return dated July 12th, 1912 (filed August 20th). Capital [illegible] 10,007 [illegible] paid [illegible]. Mortgages and charges: £[illegible].

Indicating Fuse and General Manufacturing Co., Ltd. Debenture dated August 26th, 1912, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. J. Seton, Trunk Cottage, Cove, Farnborough, Hants.

Hellyar & Sons, Ltd. Mortgage debenture dated August 23rd, 1912, to secure £800, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. L. Hellyar, 8, Meredyth Road, Barnes.

Hydro-Electric Light and Crane Co., Ltd.—Debenture dated September 9th, 1912, to secure £50, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: L. Mallison, The Green, Hampton Court, [illegible].

Bogota Telephone Co., Ltd.—A memorandum of satisfaction in full on July 31st, 1912—(*a*) of trust deed and first mortgage debentures dated May 30th, 1905; and (*b*) of trust deed and second mortgage debentures dated December 12th, 1906, securing £15,000 and £25,000 respectively, has been registered.

Ecuador Telephone Co., Ltd. Return dated June 26th, 1912 (filed July 30th). Capital £100,000 in £5 shares; [illegible] taken up; £5 per share called up; £25,000 paid. Mortgages and charges: Nil.

Chili Telephone Co., Ltd. Return dated July 25th, 1912 (filed August 16th). Capital [illegible] in £5 shares; [illegible] taken up; £5 per share called up on 14,0[illegible]; £22,[illegible] paid; £1[illegible] considered as paid on 22,000 shares. Mortgages and charges: Nil.

Dowsing Radiant Heat Co., Ltd. (59,842).—Charge on 4-5, Dorset Square, Marylebone, dated August 30th, 1912, to secure all moneys due, or to become due, from the company to the London and Provincial Bank, Ltd., 3, Bank Buildings, E.C.

Penarth Electric Lighting Co., Ltd. (52,912).—Return dated June 3rd, 1912 (filed July 30th). Capital £50,000 in £10 shares (2,500 preference); 2,500 ordinary shares taken up; £25,000 paid. Mortgages and charges: £15,937.

Perth Electric Tramways, Ltd. ([illegible]).—Return dated August [illegible], 1912 (filed September [illegible]). Capital [illegible] shares (10,000 preference); all shares taken up [illegible]. Mortgages and charges: £23,8[illegible].

Peterborough Electric Traction Co., Ltd. (74,562).—Return dated May 7th, 1912 (filed July 18th). Capital £60,000 in £5 shares (6,000 preference); 4,400 preference and 4,000 ordinary shares taken up; £5 per share called up on each; £44,000 paid. Mortgages and charges: £21,000.

CITY NOTES.

Buenos Ayres Port and City Tramways, Ltd.

Mr. G. Kitchin presiding at the meeting of this company held at Salisbury House, London, E.C., on 16th inst., said that for the year ended December, 1911, the total receipts were £69,422, an increase of £15,280, which was mainly attributable to the opening for traffic of the Avellaneda extension. Traffic expenses were £22,115, an increase of £4,450. The charge for electric current was increased in February, 1911, consequent upon the rise of coal, and the amount paid by this company to the German company rose from £7,767 to £11,932. The increased payment for current was quite out of proportion to the increased mileage, and a recent discovery of certain grave faults in the feeder cables probably threw some light on the matter. The net result was a profit balance of £16,256, which was insufficient to meet the interest on the first debenture stock and the extension first mortgage bonds by £8,861. After referring to the company's several concessions at some length, and to the advances made to the Buenos Ayres City and Suburban Tramways, Ltd., which took over some of its concessions for lines to Tigre, the chairman said that the ratio of working expenses had been 76·63, instead of, as they had hoped, about 65 per cent. The year's reduction was only 2·59 per cent., which was totally inadequate for their necessities. The floods—the worst for 20 years—decreased traffic and increased expenses in April and May, 1911. Early this year more capital was required to carry on the financing of the suburban company and for other matters; they therefore placed further extension bonds (£66,900), mainly with old friends of the company, but the proceeds were insufficient to meet the prospective liabilities, and they granted an option on 20,000 preferred unissued ordinary to a firm representing a group that was interested in the company, but the group by further purchases in the market and elsewhere, obtained a sufficient number of ordinary and preferred ordinary shares to give them the control of the voting power of the company. The group acted for Messrs. Lacroze, of London and Buenos Ayres, and alterations in the composition of the board followed. The new members of the board had only been in office a fortnight, so it was not possible to lay before them any statement of the course of action to be adopted with the advent of the new *régime*.

The report was adopted.

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. per annum on the preference stock for the quarter to September 30th, and the second quarterly interim dividend of 1¼ per cent. on the ordinary stock.

Underground Electric Railways Co. of London, Ltd.

THE Right Hon. Sir Edgar Speyer, Bart. (chairman), presided on Thursday, September 19th, at the Westminster Palace Hotel, S.W., over the half-yearly meeting of the above company.

THE CHAIRMAN in moving the adoption of the report (see ELEC. REV., August 16th), congratulated the shareholders on the substantial progress made during the period under review, which, he said, he thought would remain one of the most important periods in the company's history. He referred to the acquisition of the London General Omnibus Co. by the company, the consequences of which would only be fully felt as time went on. Progress, however, had not been confined to this fusion and the advantages that flowed from it. Both the London Electric and the District Railways had made good records—records all the more creditable considering the period of strikes that they had to face and having regard to the fact that their earnings had to compare with the abnormally large Coronation traffic of the corresponding period of 1911. As shareholders in these companies they would benefit in the near future from the expenditure that was being made in connection with the Charing Cross and Paddington extensions. These extensions should be ready within 12 months, and would afford excellent means of interchange between these railways at Charing Cross—viz., District, Bakerloo and Hampstead—and would also afford a splendid service of trains direct to the Paddington Station of the Great Western Railway. These improvements, if past experience was any criterion, would be taken advantage of by the public, and should prove a source of profit to the company. Further, the extension of the Bakerloo Railway from Paddington to a physical connection with the electrified suburban lines of the London and North-Western Railway at Queen's Park Station, and a through service of trains to Watford, would provide the Paddington and Kilburn districts with a much-needed service of trains, and also the increasing suburban population of Watford, Pinner, Harrow, Sudbury, Willesden, &c., with direct communication with the West-End and the entire underground system of London. The District Railway, too, would gradually reap advantages from the widened lines between Ravenscourt Park and Turnham Green, which permits of a greatly improved service to Ealing and the western lines. The development of its western territory generally was encouraging. As pointed out by Lord George Hamilton, the chairman of the District Railway, in spite of an increase of 640,000 miles in car-milage, the earnings per car-mile were 9·59d., an increase of ·19d. compared with the corresponding period of 1911. Lastly, they had to bear in mind that the advantages of the co-operation of the London General Omnibus Co. with these railways would only be gradually but increasingly felt. Services would be more and more co-ordinated, and 'buses used very largely to feed the railways, and traffic on the railways would be stimulated thereby, for traffic facilities begot traffic. These were all favourable factors which made for increased earnings on both the District and London Electric Railways. As regarded the latter, it should not be long before the 4 per cent. dividend on the preference stock was earned more than twice over. This was very nearly the case now, and under the circumstances this stock had now become an investment of a high order, which fact was a true measure of the London Electric Railways' advancing and enhanced credit, reached within a comparatively short space of time. As regarded the accounts, the revenue account showed total receipts of £215,714, an increase of £57,178, or about 36 per cent., on the first half of 1911, and the net revenue before allowing for income bond interest was £132,416, a gain of £92,950. The income derived from investments was £207,851, which was £101,876 more than in the corresponding half of the previous year. The income from investments included £113,590 income from their holding of ordinary stock in the London General Omnibus Co. This income was, of course, reduced by the interest on the income debenture stock and on income bonds issued by the company in exchange for the London General Omnibus stock. The rents of properties, less expenses in connection with same, rose from £1,798 to £2,407. These various increases in revenue enabled the company to pay interest on the income bonds at the rate of 4 per cent. per annum, and to carry forward a balance of £2,676, as compared with interest at the rate of 1½ per cent. and an amount of £246 carried to reserve in the corresponding period of 1911. The half-year under review had been charged with £2,110 for expenses in connection with the redemption of a portion of the 4½ per cent. bonds, as compared with an amount of £1,565 so charged in the last half-year in connection with the redemption of prior lien bonds. With regard to the balance-sheet, the credit side had been considerably simplified in consequence of the sale of the power house undertaking. The items referring to the power house and the various power house funds had, of course, disappeared, and the profit over the book value of the power house had enabled the directors to write off the item of preliminary and other expenses and the cumulative revenue deficiencies, besides enabling them to write down the item of commission and discount from about £818,000 to £474,000. On the debit side of the balance-sheet the unpaid calls were reduced by £104,000. It was expected that the interest, amounting to approximately £35,000 in respect of these calls, would be received very shortly. This amount, when received, with the exception of £13,000 for which credit had been taken in former half years, would be available for the revenue account of the company. Further, the £1,000,000 first power house debentures which had been paid off out of the proceeds of the sale of the power house, and also various suspense items, had disappeared. On the other hand, the liabilities had been increased by the income debenture stock and income bonds issued in exchange for the London General Omnibus ordinary stock acquired. With regard to the appeal in the Westinghouse case, the House of Lords had decided that the award was to be remitted to the arbitrator, and as the matter was therefore *sub judice*, they must await the arbitrator's further decision. The House of Lords had held that the question of the superiority of the Parsons turbines which they brought in mitigation of the damages caused by the Westinghouse turbines not being up to contract, was a relevant matter for the arbitrator's consideration. The London United Tramways did not really come under review at this time as their financial year did not end until December 31st. Through careful and painstaking management, the company was holding its own pretty well considering adverse circumstances, but that was all that could be said. Since the chairman of the London United Tramways addressed his shareholders on January 30th, the award regarding that company's lines in Hammersmith had been given by Mr. Elliott Cooper, the arbitrator appointed by the Board of Trade, but inasmuch as the London Council had given notice of an appeal it was not possible for him to make any definite statement at this time. They would be interested to know that the combined system of trams, railways and 'buses carried now about 700,000,000 passengers annually, and that the system's passenger earnings amount to over £4,000,000. They furnished this service more cheaply and more expeditiously, and, he thought they might claim, with greater comparative comfort, than any other city in the world. The public showed its appreciation of their performance by more frequent travel, as evidenced by the striking increase of journeys per head of population. It might not be amiss for him to say a word about the accident which occurred on the Piccadilly Railway on the 4th inst. While they deplored the accident, which fortunately did not result in any loss of life, but only very slight injuries to several of the passengers and staff, they could point with pride to the magnificent record made by these London railways, not only as regarded immunity from accidents to passengers and staff, but also in regard to the speed, regularity and closeness of service, which, in the opinion of those best qualified to judge, was not excelled, if it was equalled, by any other railway in the world. As they were no doubt aware, steel cars were exclusively used on the tubes, and it was satisfactory to state that the wisdom of the management in having adopted this material had been amply vindicated. As the cars withstood the shock remarkably well, and as they were immune from fire, they had proved a great element of safety. Since the opening of the London Electric and the electrification of the District Railways, 929,315,363 passengers had been carried, 41,109,664 train-miles had been run, and in the movement of the trains the signals had been operated over 2,400,000,000 times—all of which had been accomplished without a single fatality due to a failure either in the rolling stock or signal system. This was a splendid record, and should fully satisfy everyone as to the safety of these railways. The accident to which he had just referred was now the subject of an inquiry by the Board of Trade, and it was, therefore, unnecessary and out of place for him to say more at this time except that the public might be assured that everything that human ingenuity could contrive to make the railways absolutely safe would be adopted. The chairman proceeded to refer to the statement appearing in the Press that morning to the effect that the Associated Omnibus Co. had entered into an arrangement with the London General Omnibus Co. for the purchase of 55 motor-'buses which had been paid for by the issue of second debentures. The buses would be run by the General Omnibus Co., and a proportion of the earnings would be paid to the Associated Co. He thought the arrangement would prove satisfactory to both parties. Having commented on the acceptance of a seat on the board by Sir Herbert Jekyll and the fact that this would be the last half-yearly meeting the company would probably hold, the chairman said that when addressing them in February he ventured to express the opinion that the year 1912 would be a very prosperous one for London and the country generally, and that this prosperity would also favourably affect their companies. In spite of the various strikes his predictions had been realised, and it looked as if 1913 would equal, if indeed it did not surpass, its predecessor, and if they did not deceive them, these good times, bringing enhanced profits and greater living margins, would be reflected in more frequent travelling of the population of London, and consequently increased earnings to the system. They were justified therefore in looking forward to further progress and larger distributions in the not too distant future.

LORD GEORGE HAMILTON seconded the motion, and the report was adopted without discussion.

On the motion of MR. J. CULHAM POUND a vote of thanks was accorded the board.

United Electric Car Co., Ltd.

THE annual meeting was held at Preston on September 18th. MR. GEO. RICHARDSON presided, and said that the net profit for the year was £15,267, which was the best since 1907, although they had been considerably handicapped by railway and coal strikes, both in the difficulty of obtaining supplies and in high cost of materials. There was an available balance of £14,749, and the directors recommended that this be disposed of as follows: Preference dividend for the half-year to June 30th, £3,000; 5 per cent. on the ordinary shares, £7,500; carrying forward to next year, £4,249. There was a reduction in rent, rates and taxes of about £1,000, due to the disposal of the Trafford Park works. The debtors showed an increase of over £40,000, due to the increased volume of business transacted. Sundry creditors showed a decrease of about £13,000. With regard to the future, their order book was not very full. They could not rely on the home trade to keep them going, although the time must be approaching when corporations who has been running cars for 10 or 12 years would have to face the gradual purchase of new rolling stock to replace some of the earlier cars. They already saw signs that they were beginning to realise this fact. Moreover, the large English corporations who had erected works for the construction of new cars and repairs to old ones, had realised that it would pay them better to buy their cars and confine their works to the repair and upkeep of rolling stock. The chairman added that the Insurance Act would cost the company about £700 to £1,200 a year, according to the output. This would be a further handicap when competing with Belgian and German builders.

Mr. Mytchreest was informed that £25,000 of the debenture shares were to be redeemed.

The report was adopted. Messrs. Richardson and Boddington were re-elected directors, and the re-election of Mr. Kerr as a director was unanimously approved.

The Chairman said he was now 77. After that meeting he was going to resign the position of chairman. The knowledge of his retirement was lightened when he informed them that Mr. Barningham would succeed him.

German Electrical Companies.

The *Elektricitäts Gesellschaft vorm. H. Pöge, of Chemnitz,* after placing £15,000 to depreciation in 1911-12, as against £7,700 in the previous year, proposes to pay a dividend of 7½ per cent. on capital of £175,000, thus comparing with the same rate on £125,000 in 1910-11.

The *Bergmann Elektricitäts Lieferungs Gesellschaft,* which incurred a loss of £15,000 in the first financial year, are stated by the parent undertaking (Bergmann Electricity Works Co.) to have increased the loss in 1911-12. It has now been arranged that the latter shall take over the former's department which has hitherto been engaged in the execution of contracts, installations, &c., for other parties, and the subsidiary company will, in future, be substantially devoted to the development of its three overhead central stations, and one electric railway.

The *Brandenburger Carbid und Elektricitäts Werke, of Berlin,* report that the results in 1911-12 from the production of carbide and the sale of electricity were more favourable than in the preceding year, although the exceptionally dry summer in 1911 exercised a disadvantageous influence. The reduction in the output of carbide caused by the dry weather was counteracted by the acquisition of a large quantity of carbide from another producer, and the company was therefore able to deliver its full allotment in the carbide syndicate. As the contracts entered into before the formation of the syndicate had been completed, it was possible to obtain higher average prices. After placing the sum of £6,100 to depreciation the accounts show net profits of £7,900 for 1911-12, as compared with £5,700 in the previous year, and it is proposed to pay a dividend of 4 per cent., being the same rate as in 1910-11.

The directors of the *Moore Licht A.G., of Berlin,* state that the sales organisation in 1911-12 necessitated a further financial sacrifice, and the profits on the increased turnover did not suffice to meet the working expenses. A fresh loss was also incurred on the French business, which had been transferred to the Société d'Eclairage par Tubes Luminescents Système Moore, whilst the Spanish patents had also been disposed of at an acceptable price. The Russian licence had been withdrawn, and the company intended to develop that market. The accounts indicate a loss of £13,000, as contrasted with a loss of £17,000 in 1910-11, which was extinguished by the calling up of shares and by additional payments being made on other shares, leaving £9,800 to be transferred to the reserve fund. This fund has been absorbed by the further loss in 1911-12, and has left a debit balance to be carried forward.

Yorkshire Electric Power Co., Ltd.

Mr. A. G. Lupton presided on 17th inst. at the half-yearly meeting of this company held at Leeds. In moving the adoption of the report (see Elec. Rev., September 13th), he said that despite the coal strike their customers were kept fully supplied with current. The revenue for the period had slightly increased, principally owing to a steady growth in the H.P. of motors in works of customers already connected to the mains. They had a further 1,000 H.P. of motors for new customers waiting and pressing to be taken on, from which they would get a further increase of revenue in the last quarter of this year. It had been a difficult year, and had checked their growth, but the company were making real progress, and they were convinced that success was coming. In spite of the extra costs entailed, he thought that they would earn their full preference interest for this half-year, but in any case it was cumulative, and next year would show a great increase of revenue. Eighteen months ago the steady growth of net receipts seemed to be bringing the ordinary shares within measurable distance of a dividend. This, however, had been delayed by breakdowns of plant and by the coal strike, but with the extra plant now installed, and with the turbines fully at work again, before the end of the year the revenue for 1913 would show a very considerable increase, and the costs per unit would be proportionately decreased. The chairman, referring to the proposed new issue of £50,000 6 per cent. preference capital, said that it was proposed to erect a waste heat station for the generation of electricity from coke oven gas at Barugh, near Barnsley. This would be done by a separate company, the shares to be held by the power company. A prospectus would be issued shortly. During the past year there had been a 20 per cent. increase in the amount of electricity sold from the power station, and the new waste heat station was, therefore, imperative. It would give an independent supply, relieving the mains by feeding into them at their southern point, whilst the supply would be obtained at a lower cost of production, and would not be affected by the fluctuating price of coal. The provision of this station would absorb £25,000 of the £50,000 extra preference capital now proposed to be raised. The gross profit for the past six months was, he added, £800 less than in 1911, but £850 more than that in 1910 for the corresponding period.

Mr. T. O. Callender seconded the adoption of the report, and said he had the fullest confidence in the undertaking; he said that as representing the largest shareholders.

After questions the report was adopted.

An extraordinary general meeting which followed decided to issue a further 10,000 preference shares of £5 each, which existing shareholders and customers would have the privilege of applying for first.

Cleveland and Durham Electric Power Co., Ltd.—The report states (says the *Financier*) that during March, April and May last a direct loss of about £8,000 was incurred in consequence of the national coal strike. The gross profits for the year to June 30th amounted to £25,784, as against £20,973 for the previous year. The capital expenditure on works was £10,333. After providing for debenture and other interest, there remains a net profit of £6,720, which with £8,343 brought forward, gives a balance of £15,063 to be distributed as follows:—Dividend at 2 per cent. on the preference shares £6,674; in writing off discount on second debentures, £2,800; in transferring to depreciation and renewals account, £2,000; carrying forward £3,589. During the 12 months the company started to work additional waste-heat generating stations at the Lackenby ironworks of the Tees Furnace Co., the Horden and Shotton Collieries of the Horden Collieries, Ltd., and the Port Clarence ironworks of Messrs. Bell Bros., Ltd., Middlesbrough.

We have received a lengthy circular from Mr. A. Gemmell, a shareholder, and formerly secretary of certain associated companies, criticising the balance-sheet and setting out a number of points for "searching examination."

STOCKS AND SHARES.

Tuesday Evening.

The fine weather seems to have lured people and business away from the Stock Exchange. Markets have fallen into quietude, and although there is a fair amount of investment, speculators are not what may be called enterprising just now. In regard to the Electrical sections, business continues active enough in two or three of the Underground Railways stocks; but in the Supply market there is little going on, and the gamble in Marconi's has dwindled away to a shadow of what it was.

English Electricity Supply shares hold all the strength to which attention has been called lately, and there are further rises in City Preference and London Electric Ordinary this week. Paragraphs continue to appear in newspapers fanning the suggestion of linking-up the Metropolitan undertakings, and those of the borough councils, but there seems to be good ground for supposing that negotiations are no further advanced in this direction than they were some time ago, except, of course, that a lot of very useful spade work has been done in bringing ideas into harmony and establishing at least a knowledge of what is required by the various interests concerned.

It will be noticed that to our price lists over-leaf we have added a column giving the dividends for 1912. The records are necessarily imperfect until the autumn of any year, and, even so, a fair number of blank spaces remain to be filled in. Most of the announcements so far have been those of interim dividends, and we have endeavoured to show where this is the case. Time and care have been expended over the preparation of the table, and, in a silence as profound as profane, the widely differing periods during which companies make up their accounts have been diligently studied. As, however, it is very difficult to ensure absolute accuracy in this respect, we shall be grateful for corrections of whatever mistakes have eluded our vigilance and crept into the fair record.

The Home Railway market has been more absorbed in the gyrations of Metropolitans than in anything else. Each day has brought a crop of rumours and denials, upon the strength of which the price has bobbed up and down like an animated tennis ball. On balance the change is comparatively trifling, and up to Tuesday evening, when we write, no official announcement had been made with reference to the stock being taken over by one of the company's bigger brethren on the basis of a guaranteed dividend. Districts went back a little towards the end of the settlement, and Underground Electric Railways shares are easier in both classes. In some quarters the view is held that the Underground Railways Company is approaching its full capacity; and while it may be correct so far as the purely London lines are concerned, manifestly much scope remains in the direction of the suburbs. The penetration of the motor-'bus into such outlying districts as Burnham Beeches, St. Albans, Warlingham, and similar places, shows what an energetic management can do; and therefore it may be that the final circumference of the Underground Companies' activities is by no means attained even yet. Sir Edgar Speyer spoke with cheerful optimism at the company's meeting last week, and his speech had the effect of bringing in buyers for the income bonds, which are again a point to the good.

London United Tramways had a mysterious dip to 3¾, but rallied again to 4⅛, thus being ¼ down on balance. City and South London stock lost ½ on its last week's rise, and then regained it.

Central Londons retained their advances. East London Ordinary, after being 10½, reacted to 9¾—and the East London Railway, it may be mentioned in passing, is one of those said to be concerned in the working agreement proposals which are to embrace the Metropolitan. Great Northern and City Preferred fell back ⅛. Business has been marked at 40s. Dublin Tramways Preference were put up 30s. on a small inquiry from Dublin, this rectifying the quotation which for some time past has been left incorrect in the London list in consequence of the absence of dealing.

Foreign Electrical issues are steady to good. Important rises have taken place in Rio Trams, Sao Paulo Trams, Montreal Light, Heat and Power, and British Columbia Deferred. Any stock that comes to market is readily taken, and there is no difficulty in disposing of substantial amounts. Mexico Trams picked up the point which they lost last week, and Mexican Electric Light 5 per cent. bonds have started to recover part of their smart fall of a week ago. On the other hand, Mexican Light and Power Common is weak. Shawinigan Water Capital stock put on 2 : the price will be marked *ex* rights at the end of the week. Monterey Debenture yielded a little, and two or three of the other bond issues are slightly lower, but Vera Cruz at 95½ shows an improvement. Anglo-Argentine Tramways Second Preference are somewhat pressed for sale, and have receded a further $\frac{1}{16}$. Columbia Gas and Electric shares, the new introduction to the market last week, rose to 19, reacted to 17¾, and at the time of writing are 18¾. Two or three new issues are spoken of as likely to be made in this department before long. Victoria Falls Preference attracted a little buying in consequence of the opening of the company's first station at Vereeniging, and it is expected that the remaining three will be working shortly. The shares carry about a year's arrears of dividend still, and this the company should have no difficulty in paying off, possibly at the end of the year. The 5½ per cent. Debenture scrip is quoted about 96 ; there is a coupon of £2 9s. 5d. due in December, after which the full amount becomes due half-yearly.

In the telegraph market the feature is the strength of Anglo-American stock. Anglo "A" again shows a rise, and the Ordinary stock has moved up to 69. Apart from sentimental considerations, the relative quotations for the three stocks—Ordinary, Preferred and Deferred—ought to stand on much the same line ; and it will be noticed from the catalogue of yields that this level is being gradually attained. Submarine Cables Trust certificates are 1 higher. West Indian and Panama Debentures rose ½, and Amazon Debenture at 97 is a similar amount better. The only move in the Eastern group is ½ rise in Eastern and South African (Mauritius) Debenture. West India and Panama shares remain dullish, there being no life in the market for the moment.

National Telephone Deferred stock is unchanged, but the Marconi market is depressed. At one time, shares in the parent company were offered at 5⅛, though a subsequent recovery replaced part of the loss, and on the week the fall amounts to ¼ in both Ordinary and Preference.

Castner-Kellners at 3⅞ show a further improvement, on the anticipation of a good dividend, and Telegraph Construction Debenture has moved up to par as its top figure. Henleys and India Rubbers retained their rises, but British Insulated shares weakened a little, and British Aluminium Ordinary fell back $\frac{1}{16}$ to 12s. 6d. middle. The Rubber Share market has relapsed into depression due to the dwindling of the price of the raw material. The auction sales this week produced heavy shipments, and Mincing Lane has not got used to the marketing of rubber up to 800 tons per fortnight. It is stated in some quarters that the present quotation for rubber is more or less artificial, and that the big buyers are of set purpose holding back from appearing as purchasers ; but as to this it is hard for the layman to form any real judgment, seeing that the big buyers are widely scattered and their operations are hidden, except to the imagination. In the metal markets the strength of zinc, spelter and the like is causing a boomlet in the shares of the mining companies dealing with these materials, and the Stock Exchange views with complacency the prospect for further improvement. But then it must be remembered that the Stock Exchange very rarely sees—or admits that it sees—the chance of anything falling, so long as the market in that particular thing is exuberantly on the rise.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Bolton (Thomas) & Sons, Ltd.—£300,000 5 per cent. first mortgage debentures of £100 each (registered).

And to allow the following to be quoted in the Official List :—

Bombay Electric Supply and Tramways Co., Ltd.—60,000 ordinary shares of £10 each fully paid.

Georgia Light, Power and Railways.—$679,000 additional first lien 5 per cent. 30-year gold bonds of $1,000 each, Nos. 2,231 to 2,909.

The Committee has ordered the undermentioned to be quoted in the Official List :—

Oxford Electric Co., Ltd.—10,000 5 per cent. cumulative preference shares of £5 each fully paid, Nos. 1 to 10,000.

Puebla Tramway, Light and Power Co.—$3,000,000 prior lien 5 per cent. 50-year gold bonds, Nos. A1 to A1,000 of $100, B1 to B4,800 of $500, and C1 to C500 of $1,000 each, in lieu of the scrip.

Continental.—Russia.—The capital of the Société de la Fabrique Russe d'Accumulateurs Tudor, of St. Petersburg, is being increased from 1,200,000 to 2,400,000 roubles.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, September 25th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	,, Nitric	,,	22/-	..
a	,, Oxalic	per lb.	2¾d.	..
a	,, Sulphuric	per cwt.	5/6	..
a	Ammoniac Sal	,,	42/-	..
a	Ammonia, Muriate (large crystal)	per ton	£29 10	..
a	Bleaching powder	,,	£5 10	..
a	Bisulphide of Carbon	,,	£18	..
a	Borax	,,	£16 10	..
a	Copper Sulphate	,,	£26 10	£1 15 inc.
a	Lead, Nitrate	,,	£26 10	..
a	,, White Sugar	,,	£25 10	..
a	,, Peroxide	,,	£32	..
e	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a	,, Chlorate	per lb.	3½d.	..
a	,, Perchlorate	,,	4½d.	..
a	Potassium, Cyanide (98/100 %) .. (for mining purposes only)	,,	7½d.	..
a	Shellac	per cwt.	70/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers ..	,,	£6 10	..
a	,, Recovered	,,	£5 10	..
a	,, Lump	,,	£5 5	..
a	Soda, Caustic (white 70/72 %) ..	,,	£10 5	..
a	,, Chlorate	per lb.	3⅝d.	..
a	,, Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks ..	per lb.	3d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£82	£2 inc.
b	,, Wire, in ton lots ..	,,	£102	..
b	,, Sheet, in ton lots ..	,,	£120	..
p	Babbitt's metal ingots	,,	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	..
c	,, Tube (brazed)	,,	11¼d.	..
c	,, ,, (solid drawn) ..	,,	10d.	..
c	,, Wire, basis	,,	9¼d.	..
c	Copper Tubes (brazed)	,,	10¾d.	..
c	,, ,, (solid drawn) ..	,,	11¾d.	..
g	,, Bars (best selected) ..	per ton	£95	
g	,, Sheet	,,	£95	.
g	,, Rod	,,	£95	..
d	,, (Electrolytic) Bars ..	,,	£82 10s.	
d	,, ,, Sheets ..	,,	£100 10s.	
d	,, ,, Rods ..	,,	£89	..
d	,, ,, H.C. Wire	per lb.	10¼d.	.
f	Ebonite Rod	,,	5/3	..
f	,, Sheet	,,	4/9	..
n	German Silver Wire	,,	1/7	..
h	Gutta-percha, fine	,,	..	..
h	India-rubber, Para fine	,,	4/7½	2¾d. dec.
i	Iron Pig (Cleveland warrants) ..	per ton	66/10½	..
i	,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g	Lead, English Pig	,,	£22 10 to £23	£1 dec.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£8 5	..
e	Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e	,, ,, ,, medium	,,	3/6 to 6/-	..
e	,, ,, ,, large ..	,,	7/6 to 11/-	..
p	Phosphor Bronze, plain castings	,,	11d.	..
p	,, ,, rolled bars & rods	,,	1/0½	..
p	,, ,, rolled strip & sheet	,,	1/1	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	11d.	..
	Steel, Magnet, in bars	per ton	£55	..
g	Tin, Block (English)	,,	£230 to £230 10	£5 inc.
n	,, Wire, Nos. 1 to 16	per lb.	2/7	1d. inc.
p	White Anti-friction Metals ..	per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.)	,,	£31 2 6	10s. inc.

Quotations supplied by—

a	G. Boor & Co.	i	Bolling & Lowe.
b	The British Aluminium Co., Ltd.	k	Morris Ashby, Ltd.
c	Thos. Bolton & Sons, Ltd.	l	Richard Johnson & Nephew, Ltd.
d	Frederick Smith & Co.	m	W. T. Glover & Co., Ltd.
e	F. Wiggins & Sons.	n	P. Ormiston & Sons
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o	Johnson, Matthey & Co., Ltd
g	James & Shakspeare.	p	
h	Edward Till & Co.	r	W. F. Dennis & Co.

Folkestone Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income-tax, on the ordinary shares for the half-year ended June 30th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors announce an interim dividend for the quarter ended June 30th last of 2s. 6d. per share.

American Telephone and Telegraph Co.—The directors have declared the usual quarterly dividend of $2 per share.

Anglo-Portuguese Telephone Co., Ltd.—The directors have declared an interim dividend at the rate of 3 per cent., free of income-tax.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9¾ — 10¾	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾		4 12 4
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100	..	4 10 0
Brompton & Kensington, Ord.	5	10	9	8⅝ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	7¾ — 8¼		4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 — 100	..	4 0 0
Charing Cross, West End & City	5	5	5	4½ — 4¾		4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
City of London, Ord.	10	8	6†	17½ — 19	..	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	+	4 7 9
Do. 5 % Deb.	Stock	5	5	118 — 122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 3
County of London, Ord.	10	6	4†	11½ — 12 xd	.	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12½ xd	..	4 10 0
Do. 4½ % Deb.	Stock	4½	4½	106 — 108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 8 3
Edmundson's, Ord.	5	Nil		7/16 — 11/16		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6†	4¾ — 5¼	..	5 14 3
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9		7½ — 8	.	5 12 6

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1911	1912			£ s. d.
Kensington & Knightsbridge, Ord	5	9	..	7 — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½		1⅜ — 1⅝	+ ⅛	3 15 8
Do. 6 % Pref.	5	6	6	5¼ — 5¾	..	5 11 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4	4¼ — 4¾	..	4 11 2
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 — 102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4¾ — 5	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6	6¼ — 6¾	..	5 16 0
St. James' and Pall Mall, Ord.	5	10	10	8½ — 9½	..	5 5 3
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88		3 19 7
Smithfield Markets, Ord.	5	2	..	1½ — 1¾	..	..
South London, Ord.	4	5	..	3 — 3½		5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	.	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1¼ — 1½		5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil		¼ — ½	..	..
Do. 5 % Cum. Pref.	5	2		2½ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86½ — 88½	.	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼		5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5½	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5¾	..	5 4 4
Calcutta, Ord.	5	8½	..	7½ — 8	..	5 6 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95 — 97	— ½	5 8 1
Canadian Gen. El. Com.	$100	7	7	114 — 119	..	5 17 8
Do. 7 % Pref.	$100	7	7	121 — 125	..	5 12 0
Cordoba Lt., Power and T., Ord.	1	8	..	13/32 — 15/32	..	3 4 0
Do. 5 % Deb.	100	..		96 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 — 106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105	.	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87 — 89	+ ½	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	93 — 97	2	4 2 6
Do. 7 % Cum. Pref.	$100	7	7	109 — 112	..	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	91½ — 96½	—1½	5 3 8

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	86½ — 88½	— ½	5 13 0
Montreal, Lt., H. and Power	$100	8	9†	240 — 250	+ 10½	3 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5†	39 — 42	..	..
River Plate, Ord.	Stock	10		240 — 250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 — 114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	102 — 104	+ 1	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 — 101	..	4 9 1
Shawinigan Water, Capital	$100	5	5	154 — 159	+ 2	3 2 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 — 110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 — 106	..	4 5 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ — 101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	94 — 97	+ 1½	5 3 1
Victoria Falls Power, Pref.	1	11⅞d.	17½d.	1⅛ — 1⅜	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	.	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7¼ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	+ ½	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	149 — 151	+ 2	5 6 0
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph	Stock	3	3	68 — 70	+ ½	5 7 2
Do. 6 % Pref.	Do.	6	6	113½ — 114½	..	5 4 10
Do. Def.	Do.	30/-	..	26½ — 26¾	+ ⅛	5 11 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	.	4 16 2
Chili Telephone	5	7	8	7½ — 7¾	.	4 8 11
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	83½ — 85½	..	4 13 7
Cuba Telegraph	10	6	..	9½ — 10½	..	5 14 8
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	..	3¼ — 3¾	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	..	6 17 11
Direct United States Cable	10	5	4	7½ — 8	.	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 — 133	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½ — 101½	..	3 18 10
Eastern Extension	10	7	7†	13⅛ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	98½ — 100½	..	3 19 7
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	+ ½	3 19 8
Globe Telegraph and Trust	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12¾ — 13¼	..	4 10 7
Great Northern Telegraph	10	18	18	28¾ — 29¾	..	6 1 0
Indo-European Telegraph	25	13	.	57 — 59	..	5 3 5
Mackay Companies Common	$100	5	5†	87 — 91 xd	..	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	68 — 71 xd	..	5 12 8
Marconi's Wireless Telegraph	1	20		5 1/16 — 5 3/16	— ¼	3 15 6
Do. 7 % Cum. Partic. Pref.	1	17		4⅜ — 4⅝	— ¼	3 11 9

Monte Video Telephone, Ord.	1	6		1 1/32 — 1 3/32	..	5 6 8
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
National Telephone Def.	Stock	6		155 — 157	..	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100¾ — 101¾	+ ½	4 8 5
Oriental Telep. and Elec.	1	8		1 11/16 — 1 15/16	..	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	3 18
Reuter's	10	10		10¼ — 10¾	..	3 14 5
Submarine Cables Trust	Cert.	6	6	128 — 131	+ 1	4 11 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ — 101½	..	4 8 8
United River Plate Telephone	5	8	..	7½ — 7¾	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 1/32 — 1 3/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½		3¼ — 3¾	..	
Do. 6 % Cum. 1st Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 — 103	+ ½	4 17 1
Western Telegraph, Ltd.	10	7	7†	13¼ — 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 — 103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Paid in deferred interest warrants. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	..	..
Do. 5 % Perp. Deb. ..	100	5	5	98 —101	..	4 19 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	3	3	77 — 79	..	3 15 11
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2		77 — 79	..	2 10 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1½	1½	39½ — 40½	..	3 7 11
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	104 —106	+1	4 14 4
Do. Do. 1901	100	5	5	103 —105	..	4 15 3
Do. Do. 1903	100	5	5	102 —104	..	4 16 2
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	+1½	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞ — 2⅛	— ⅛	Nil
Hastings Trams, 6 % Pref. ..	1	6	..	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2½ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4½ — 5	— ¼	..
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Sept. 24th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅝	1½	63 — 63½	+ ¼	2 11 2
Do. Surplus Lands	100	2⅝	2¾	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	41¾ — 42¼	— ¾	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	..	1⅛ — 1¼	..	5 1 2
Do. Def.	1	Nil	..	[illegible]	..	Nil
Do. 5 % Pref.	1	5	5	15/16 — [illegible]	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	+1	4 10 0
Do. 5 % Deb.	100	5	5	100 —103	..	4 17 1
Potteries, Ord.	1	8	..	[illegible] — 7/8	..	..
Do. 5 % Pref.	1	5	5	[illegible]	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅜ — 4⅝	— ⅛	Nil
Do. "A"	1/-	..	..	[illegible]	— [illegible]	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	2†	91 — 93	+ 1	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — [illegible]	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	5¼ — 5½	..	5 2 4
Do. 2nd Pref.	5	5½	5½	4 15/16 — 5 1/16	— 1/16	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb. ..	100	5	5	103½ —105½	— ½	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	..	7¼ — 7¾	..	5 4 11
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103½	.	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	145 —150	+2	5 6 8
Do. Pref. Ord.	100	6	6	120 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	109 —112	..	4 9 1
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	+ ½	4 7 0
Calcutta Trams, Ord.	5	7	.	6¼ — 6¾	..	5 5 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams .. .	1	2½	..	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5½ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	

La Plata Elec. Trms, Ord. ..	1	Nil	..	¼ — ⅜	..	..
Do. Pref.	1	6	..	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	..	1 3/16 — 1 5/16	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	91 — 94	+1	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	127 —130	+1	5 7 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	98 —100	— ½	5 0 0
Do. 6 % Bonds	100	6	6	102½ —104½	..	5 14 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7½ — 7⅞	..	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½ —102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1½ — 1¾	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	156 —158	+ 4	3 3 3
Do. 1st Mort. 5 % Bonds ..	..	5	5	103 —104	— ½	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	101½ —102½	+ ½	4 17 7
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	266 —270	+ 4½	3 14 1
Do. 5 % 1st Deb.	$500	5	5	104½ —106½	..	4 14 0
Singapore Trams, 5 % Deb. ..	100	5	5	84 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅞ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½ —103½ xd	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	.	⅝ — ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	28	..	3½ — 3¾	..	4 2 10
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	[illegible]	— 1/16	..
Do. 6 % Cum. Pref.	1	Nil	..	[illegible]	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 13 8
B.I. & Helsby Cables	5	10	..	7½ — 8½	— ¼	6 3 1
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	9/16 — 13/16	..	Nil
Do. Deb...	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	1	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10¼ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	3 13/16 — 3 15/16	+ 1/16	5 1 7
Do. Deb...	100	4½	4½	102 —105	..	4 5 9

Crompton & Co.	8	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	..	¾ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 — 1⅛	..	5 6 8
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	[illegible]	..	Nil
Do. fully paid	5	Nil	..	1⅞ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	74 — 77	..	6 9 10
Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	4 10 11
Do. Deb...	100	4	4	92 — 97	..	4 2 6
Henley's, Ord.	5	17	5†	12¼ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4¾ — 5	..	4 10 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11½ — 12½	..	..
Do. Pref.	10	5	5	9¾ — 10¼	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13 4
Do. Deb...	100	4	4	98 —100	+1	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

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* **Unless otherwise stated, all shares are fully paid.** † **Interim dividend.**

Bank rate of Discount 4 per cent. August 29th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1912.

The August returns of electrical business, both as regards exports and imports, disclose a satisfactory improvement over the preceding month. The exports reached a total of £530,350, as compared with £419,898 in July; this represents over £460,000 worth of business exclusive of telegraphic material, and includes nearly £180,000 worth of machinery, and cable exports valued at £111,867—which latter amount is probably a record. Telegraphic exports for the month amounted to approximately £69,000, being practically the same as in July, while telephonic exports at about £65,000 were double those of the preceding month.

In the import section, the total of £194,090, compared with £180,702 in the preceding month, and lamp, machinery and telegraphic and telephonic imports were on a more extensive scale than in that month.

The re-exports at £23,741 were almost double those of the previous month.

Of our several customers, New South Wales occupied the premier position with a total of £75,576, this figure being, however, unusually high owing to a large purchase of telephonic material.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephone cable and apparatus and electric bell.	Telegraph cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,495	76	77	132	...	148	6,392	8,644	696	11	1,747	1,944	21,362
Germany	1,701	2,484	5	18	562	145	1,929	1,442	21	...	75	448	8,830
Netherlands, Java and Dutch Indies ...	739	1,518	107	...	...	3	381	367	7	11	51	769	3,953
Belgium	663	488	105	10	361	29	2,345	698	.	16	403	1,096	6,214
France	715	50	3,421	...	10	52	6,590	103	13	.	114	16,267	27,335
Portugal	28	20	...	18	...	20	176	19	62	...	599	63	1,005
Spain, Canary Isles and Spanish N. Africa...	100	771	862	..	...	797	3,617	640	75	10	68	6,486	13,426
Switzerland, Italy and Austria-Hungary ...	665	...	330	34	43	186	3,199	117	30	903	...	1,197	6,704
Greece, Bulgaria and Turkey	647	128	...	13	...	...	1,029	30	2	...	705	2,557	5,111
Channel Isles, Gibraltar, Malta and Cyprus...	50	30	4	79	...	118	2,162	...	4	...	11	71	2,529
U.S.A. and Philippines	1,379	...	203	140	..	47	616	276	218	...	..	20	2,899
Canada and Newfoundland	1,287	3,870	2,052	1,199	170	4,758	15,956	440	816	...	1,760	2,507	34,848
British West Indies and British Guiana ...	186	...	46	11	...	...	163	11	16	...	49	13	495
Mexico and Central America	901	67	...	...	...	...	874	24	26	...	105	32	2,029
Peru and Uruguay	41	13	269	18	20	...	712	...	...	24	..	99	1,196
Chile	199	59	296	51	13	207	4,829	550	59	28	63	10,396	16,750
Brazil	1,733	1,288	804	282	25	505	5,564	568	85	33	7,592	1,320	19,799
Argentina	2,412	8,693	829	242	30	185	8,185	3,309	4,079	339	3,077	4,655	36,335
Colombia, Venezuela and Ecuador	13	33	15	13	...	...	...	...	8	...	19	4	105
Egypt, North Africa and Persia	109	227	550	28	...	100	400	801	103	...	279	1,647	4,244
British West Africa	10	683	52	13	...	...	236	22	5	...	68	225	1,314
Rhodesia and Transvaal	2,091	410	304	1,284	16	6	5,292	—	173	...	446	211	10,233
Cape of Good Hope	1,475	8,044	706	413	241	523	1,452	431	441	...	71	1,847	15,644
Natal	1,113	2,316	1,148	171	11	16	2,872	143	115	13	24	1,230	9,172
Zanzibar, Brit. E. Africa, Mauritius and Aden	54	10	265	26	...	51	104	...	719	...	36	115	1,380
Madeira and Portuguese Africa	111	268	79	...	...	16	1,007	...	...	...	...	36	1,547
China and Siam	480	2,846	277	41	...	986	936	...	345	14	191	405	6,521
Japan and Korea	252	38,107	267	119	...	1,599	13,849	9,626	3,132	...	49	704	67,704
India	2,862	6,469	2,144	3,464	191	1,238	12,626	9,913	2,228	338	916	774	43,163
Ceylon	307	377	1,113	113	...	...	172	1,394	707	13	30	285	4,511
Straits Settlements and Federated Malay States	210	3,382	349	30	...	184	1,532	131	185	11	3,445	3,110	12,569
Hong Kong	13	242	49	49	...	...	457	701	31	63	17	54	1,676
West Australia	583	859	222	861	205	983	1,539	...	733	6	251	382	6,624
South Australia	45	418	111	546	...	123	998	...	27	...	962	5	3,235
Victoria	3,313	6,744	708	3,022	13	5	3,184	1,314	314	12	5,152	...	23,781
New South Wales	5,167	14,438	693	1,143	104	1,406	17,783	923	112	17	28,891	4,899	75,576
Queensland	439	222	49	389	...	436	2,540	453	108	...	1,819	893	7,348
Tasmania	56	229	208	...	...	...	329	48	...	...	1,010	...	1,880
New Zealand and Fiji Islands	1,723	5,988	756	1,265	...	930	3,353	...	330	...	4,841	2,077	21,263
Total, £	35,397	111,867	19,275	15,237	2,018	16,132	135,547	43,138	16,058	1,922	64,916	68,843	530,350

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	1,405	20	...	15	...	...	2,861	...	514	5	5,384	10,201
Germany	7,157	7,238	2,364	12,281	6,479	275	62,657	2,494	3,319	7,421	19,661	131,346
Holland	6	...	...	192	452	12	680	...	...	20	411	1,773
Belgium	818	1,298	9	183	100	...	1,664	88	444	864	3,274	8,742
France	84	200	725	635	559	1,071	141	980	998	3,661	1,279	10,333
Switzerland	69	1,697	...	19	100	...	1,017	...	...	...	1,312	4,214
Italy	75	615	...	...	...	...	1,158	20	...	...	2,936	4,801
Austria-Hungary	...	1,012	...	486	78	...	68	...	...	192	216	2,052
United States	1,770	20	665	240	846	30	9,828	6,133	66	106	364	20,068
Canada	20	...	...	...	...	...	91	...	75	...	18	204
Total, £	11,404	12,100	3,763	14,051	8,614	1,388	80,165	9,715	5,416	12,269	34,855	193,740

Additional imports: Spain, carbons, £350.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	10,278	810	...	642	237	...	7,480	...	289	427	3,578	23,741

Total Exports: £530,350. Total Re-Exports: £23,741. Total Imports: £194,090

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE USE OF MICA IN THE INSULATION OF ELECTRICAL APPARATUS.

By A. P. M. FLEMING, M.I.E.E., and R. JOHNSON, A.M.I.E.E.

(Concluded from page 446.)

Some attempts have been made to use annealed mica for commutator segment insulation, but, as already stated, there is very considerable tendency for this material to disintegrate, and thus far such experiments have not met with success.

With regard to the bushings insulating the commutator from the supporting frame, some manufacturers prefer to use paper instead of mica, partly on the score of cheapness, and partly because an even thickness, and consequently better bearing surface, is more readily obtainable.

Unless a very good fit is effected, so that the commutator remains rigid when running, "high bars," "flats," "high mica," and other troubles will be experienced. Moreover, with very high speeds where the stresses are great, an actual grinding action may take place on the insulating bushings, and these, if of mica, will be readily reduced to powder at the places where the grinding takes effect.

It is, however, only a matter of careful manufacture to make mica bushings as uniform in thickness as paper, and undoubtedly mica insulation possesses great advantages over paper for this work. Even when the commutator never attains a very high temperature, paper rapidly dries to extreme brittleness. Paper, moreover, loses its insulating value when subject to deposits of moisture, such as may occur when the conditions are such as to favour "sweating" of the commutator.

Mica bushings for commutators are moulded from stiff built-up sheet. Thin sheets are used for this purpose, and a considerable number employed to make up the total thickness required. These sheets are softened by heating them in an oven or on a steam plate. They are pressed by hand into the hot mould, the heated core then being inserted and screwed down.

Mica bushings are made in thicknesses from $\frac{1}{32}$ in. to $\frac{3}{32}$ in. according to the size of the commutator for which they are intended. When these bushings have been arranged in position in the commutator, it is the general practice to heat the whole commutator up in order again to soften the insulating cement, and thus allow the various parts to be tightly screwed up, and in this way properly bedded. For this reason a much larger percentage of cement is allowed to remain in the bushings than in the mica for the segment insulation.

4. *Other Applications of Mica.*—In addition to commutator work, mica is extensively used in the insulation of armature windings, especially those for high voltages, and also for moulded work of various kinds, insulating bushings, tubes, washers, &c.

For the insulation of oil-cooled transformers mica is not generally used, since the oil is liable to attack the binding cement.

For bushings and washers the principal value of mica lies in its permanence and heat-resisting nature, and in this connection it is well to remember that the insulating value of such bushings and washers depends mainly on the amount of creepage surface it is possible to provide, this often being entirely out of proportion to the breakdown value of the materials employed.

For mica tubes, particularly when of small diameter, a turn or two of paper both inside and outside should be used as a protection, otherwise there is a tendency for the mica to flake and to be easily damaged. It is still better to make the tubes of paper and mica throughout, this improving their mechanical strength considerably. With this method the insulating value is not seriously reduced, and if the tubes are well made by rolling the material on to mandrels under heavy pressure and heat, they are as fire-resisting as the all-mica tubes.

Specially constructed machines are now used for the manufacture of these tubes. The paper used for backing the mica usually amounts to 40 per cent. to 50 per cent. of the total weight of the finished tube. These tubes can be made circular, and afterwards re-softened by heat and blocked out to rectangular shape for the lining of armature slots, or they can be made directly to the shape required on suitable split steel mandrels.

For low-voltage armature coils, owing to the necessity for keeping the thickness of insulation in the slots down to the minimum possible, it is much more difficult to apply mica satisfactorily than the other kinds of insulation more commonly employed. Except for railway motor work where the temperature conditions are severe, it is very doubtful whether its use is justified. Insulations of prepared paper or cloth have proved perfectly satisfactory for low-voltage work, and are, of course, much cheaper.

For the insulation of low-voltage armature coils, the most satisfactory plan is to build the mica on to a backing of thin tough paper with flexible sticking varnish, and to wrap the sheets thus formed around the slot portions of the coils, holding the wrapping in place with a layer of tape.

A second method is to avoid the use of the paper by moulding hard troughs of mica to fit the slots and to push the coils down into these. There are two disadvantages in this method, the first being that since the troughs are open there is only a very short creepage path from the coils to the teeth of the armature, and the second, that in winding the coils into the troughs it is easy to fracture the insulation at the immediate ends of the slots. A similar method, designed to overcome the first of these weaknesses, is to mould the troughs with lips at the top. These troughs are sprung on to the slot portions of the formed coil, the lips overlapping, and in this way effecting a completely closed insulation. This is bound tightly in place with a layer of tape, and the coil thus insulated is then placed in the slots.

For high-voltage armatures the radial thicknesses of insulation necessary around the slot portions of the coils are sufficient to render it possible to make a sound mechanical job with a mica insulation, and there is no question as to the utility of the material for this class of work.

The mica is used with a backing of either treated cloth or paper, made up with flexible varnish and wrapped on by hand, or made up on a thin paper with shellac varnish and hot ironed on to the coils by machine. Coils insulated in either of these two ways can, of course, only be used in machines with open slots, or in closed slots when one end of the coil is left open so that the coil can be pushed into position, and the open end afterwards jointed up. When the coils are formed directly in the machine by threading the wires singly through the slots, the latter are lined with tubes made up of mica or paper and mica, as referred to earlier.

The most satisfactory insulation is that obtained by ironing the mica directly on to the coils, as in this way a solid thickness of material free from air pockets can be obtained. When applied to coils where the individual turns are separated from one another by mica strips or troughs, and the interspaces between conductors filled solid by impregnating with insulating compound, these coils are rendered best capable of resisting deterioration due to electrochemical action.*

Where severe mechanical stresses may be expected on the end connections of armature coils, as is sometimes the case in turbo-generators, the flexible cloth and mica insulation is preferable, unless the projecting portions of the coils are so heavily clamped as to prevent any movement.

The end connections of armature coils are generally insulated with treated cloth strips or cotton tapings. Some attempts have been made to use a mica tape for this work, such tape consisting of one or two layers of thin mica splittings built up with a flexible varnish on paper or cloth. Such a tape, however, will not stretch, and, therefore, buckles around the corners, the mica slipping or cracking, and its use has met with very little success.

The proportions of mica and paper or cloth in the wrappings used on high-voltage armature coils are usually such as to give about 40 per cent. by weight of mica in the finished insulation. Where very thin paper is used, as much as 70 per cent. of mica is sometimes obtained, but the insulation is usually not so good mechanically.

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* See paper on "Chemical Action in High-Voltage Armature Windings," by Fleming and Johnson, read before the Institution of Electrical Engineers, January, 1911.

IMPORTANT CASES IN THE LEGAL YEAR.

[FROM A LEGAL CONTRIBUTOR.]

THE legal year which came to an end in July has not produced many cases of great interest to the electrical world. Nevertheless there are a few decisions involving the discussion of various points of a more or less technical character, which it may be as well to recall to the attention of our readers. Some of them have been reported either briefly or at length in these columns, but others have only appeared in law reports which are not very accessible to the "lay" reader.

The liability of a contractor for the negligence of a sub-contractor has frequently to be considered and is by no means easy to determine. The sub-contractor is of course liable for the negligence of his own servants; but the contractor will in some cases also be liable for that negligence. He will not, however, be liable for the collateral negligence of a sub-contractor's servant. In the case of Padbury *v.* Holliday and Greenwood (28, T.L.R. 494) the defendants were employed to erect certain premises, and the contract involved the employment by the defendants of sub-contractors to execute the special work of putting metallic casements into the windows. While one of these casements was being put in, an iron tool was placed by a servant on the window sill; and the casement having been blown to by the wind, the tool fell and struck the plaintiff, who was passing along the street. The tool was not placed on the window sill in the normal course of doing the work which the sub-contractors were employed to do. The plaintiff sued the defendants, claiming damages in respect of his injuries. It was held that the injuries were caused to the plaintiff by the collateral negligence on the part of a workman who was the servant of the sub-contractors and not of the defendants, and that the latter were therefore not liable for the consequence of that negligence.

The law with regard to registration is such that it is by no means easy to say what will and what will not be registered as a design. In a case where a plaintiff alleged that the defendants had copied his design for triple-spoke wheels, Mr. Justice Parker laid down some general principles which will be of use to persons who are seeking to register designs in future. He said that a design to be registerable under the Patents and Designs Act, 1907, must be some conception or suggestion as to shape, configuration, pattern or ornament. It must be capable of being applied to an article in such a way that the article to which it has been applied will show to the eye the particular shape, configuration, pattern or ornament, the conception or suggestion of which constitutes the design. In general, an application for registration must be accompanied by a representation of the design—that is, something in the nature of a drawing or tracing, by means of which the design may be imparted to others. A conception or suggestion as to a mode or principle or construction, though in some sense a design, is not registerable under the Act. Inasmuch, however, as the mode or principle of construction of an article may affect its shape or configuration, the conception of such a mode or principle of construction may well lead to a conception as to the shape or configuration of the completed article, and a conception so arrived at may, if it be sufficiently definite, be registered under the Act.

There have not been many cases relating to trade names and their use, but in those which have been decided certain important principles were laid down. Thus it has been held that an exclusive agent for the sale of distinctive goods cannot maintain an action for damage to his trade by the alleged passing off of other goods in imitation of those dealt in by him.

Another case illustrates the fact that the Court will sometimes intervene to prevent a man making use of his own name if it be proved that he is doing so with a fraudulent object. It appeared that one, Thomas Kingston, who had been for some years in the employment of the plaintiff company, and had become skilled in his business, and obtained a reputation amongst its customers, left that company and took steps along with another person to promote the defendant company to carry on the same kind of business as the plaintiff company. The defendant company having been registered, the plaintiffs sought to restrain them from carrying on business under their registered name. It was held on the facts that the use by the defendants of the name of "Kingston" was likely to mislead or deceive the public into the belief that the defendants were the same company as the plaintiffs, and that as the defendant company did not incorporate the individual right which Thomas Kingston had to carry on business in his own name, and as he did not transfer to them a business and goodwill, but merely authorised the defendants to use his name, such use was not justified and must be restrained (Kingston, Miller & Co., Ltd., *v.* Thomas Kingston & Co., Ltd., 28 T.L.R. 246).

Although there have been many patent cases tried within the year there only appears to be one which involves the decision of any general principle in relation to the compulsory working of patents. It was there laid down that Sec. 27 of the Patents and Designs Act, 1907 (which provides that within certain time limits application may be made for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside of the United Kingdom), was passed for the benefit of the public, and is not primarily intended to confer benefits on individuals. In considering whether there is a proper case for revocation of a patent under the section, the Comptroller or the Court is bound to look primarily at the interests of the public. The non-application by the owners of a patent for a voluntary or compulsory licence to work the patent was held not to be a sufficient reason for revoking their patent under Sec. 27, where nothing they could have done in the way of working the patent in this country could have been done without exposing them to the risk of proceedings for infringement. (In *re* Taylor's patent (Parker, J.,) 28, T.L.R.)

In the domain of tramway litigation, there is one case to be recorded. We refer to that in which an important principle of rating was laid down. The appellants were the occupiers of, and worked as one connected system, a tramway and a light railway, constructed on certain highways. The tramway and the light railway were as to mode of construction and the materials used therein identical, and the same carriages were used on the tramway and the light railway. It was held that the land occupied by the tramway was used as a railway within the meaning of Sec. II, Sub-Sec. I (B) of the Public Health Act, 1875, and that the appellants were therefore entitled to be rated in respect of it in the proportion of one-fourth part only of its net annual value. Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority (1892) I.Q.B. 357 Overruled (Metropolitan Electric Tramways (Ltd.) *v.* Tottenham Urban District Council, 28 T.L.R. 234).

Another attempt was made during the past year to establish the principle that a municipal authority supplying electricity has the authority to deal in electric fittings. Mr. Justice Eve in the case of the Attorney-General *v.* Mayor, &c., of Sheffield (28 T.L.R. 266), laid it down that under the Electric Lighting Acts and Provisional Orders made thereunder a municipal authority has no power to carry on the trade or business of supplying electric fittings and wires for use by those to whom they supply electrical energy or by others. While a municipal Corporation may have a common law right to carry on such a trade or business, it has no power to use for that purpose funds raised under statutory authority for the purpose of supplying electricity.

Space does not admit of our dealing in this article with the numerous cases which have been decided in the settlement of disputes between master and servant. Mention may, however, be made of a point arising in relation to fidelity guarantees. By a fidelity policy the defendants undertook to reimburse the assured in respect of loss sustained by any act of larceny or embezzlement upon the part of their employé. It was held by Mr. Justice Hamilton that the word "embezzlement" in the policy was to be construed in the same way as it would be construed when used in an indictment (Debenhams, Ltd., *v.* Excess Insurance Co., Ltd., 28 T.L.R 505).

NORTH-EASTERN COUNTIES ELECTRICAL EXHIBITION.

The North-Eastern Counties Electrical Exhibition at Newcastle-on-Tyne concluded its second week on the 21st inst., and has already more than justified its inception, for, during the 13 days it had then been open, more than 80,000 visitors had inspected the display, and the last date named was characterised by the largest attendance, for it was close upon 9,000. The aim of the exhibition, as we have already mentioned, was to bring home to the householder the many uses to which electricity can now be put in the home, and to illustrate at the same time its true economy—its brightness, cleanliness, and, at least in the North of England and other favoured places, its cheapness. This object has been fully achieved; on almost every hand the standholders express their satisfaction with the results of the exhibition, so far as it has gone; inquiries have been reasonably numerous, as have, in several quarters, the sales, while the seed of knowledge of the potentialities of electrical domestic economy has been sown broadcast.

The aim of the promoters was to bring the recent developments of electricity in domestic matters to the cognisance of those householders who already use it for illumination, and to a very large extent that object has been achieved, for this has proved to be the most numerous and most prominent class of visitor making intelligent inquiries as to the adoption of electricity. It is also satisfactory to note that the organising manager and secretary, Mr. W. Peacock, has not had to deal with a single complaint. In leaving generalities it may be mentioned that the Exhibition is—almost needless to say—brilliantly lighted, charming from every prospect, pretty and attractive even to the least learned; it has proved a great attraction as a combination of instruction and pleasure, and each week an excellent military band has lent its own charm.

One of the most interesting, as most recent, of attractions, is the electric geyser or water-heater. This is the invention of Mr. Krabb, of Glasgow, and is exhibited by Mr. Vesey Brown on behalf of the K.P.H. Syndicate. Mr. Krabb uses a resistance of ordinary carbon granulated into small pieces, and packed into a container of porcelain or other material which has a low coefficient of expansion. The resistance is packed to suit the flow of water and temperature desired. In the examples shown here the current varies from 12 to 14½ amperes at 240 volts, and heats 1½ gallons to 120° F. from cold (56° F.) in four to five minutes. The consumption of energy is, therefore, about 1 B. of T. unit to every 5 gallons. Other patterns are made with circulating tanks to contain 20 to 25 gallons for baths, or small quantities suitable for restaurants and the like. With the geysers installed in a house, one cold-water pipe throughout, with a tapping of the heating circuit to the geyser, would be all that was necessary in each bedroom, dressing-room or lavatory. Not only does the geyser heat the water, but it also filters it in a very efficient way. As to the cost, having in remembrance that the Newcastle supply costs but little over ·75d. per unit, and at Sunderland it only costs ·5d. per unit, it is obvious that the district is one in which the invention might well be expected to find favour.

On the adjoining stand is one of the Marconi Wireless Telegraph Co.'s installations, and much prominence has been given to the utility of this means of communication as between ordinary cargo vessels. The ½-KW. pattern is erected in a space which illustrates how little loss of cargo room there is required for the installation of a really useful service calculated to meet all the requirements of the ordinary cargo steamer. The induction coil pattern has also attracted much attention, and in respect of each the firm has had several inquiries. Its adaptation for use on tugboats has formed the subject not only of comment, but inquiry, and the practical-minded visitor has seen great possibilities in its use on tugboats on a coast which has an evil reputation in times of stormy weather. In another regard much attention has been directed to wireless telegraphy, that is for field sets for military and quasi-military purposes.

One phase of the domestic use of electricity to which very much attention has been given is its employment as a means of cooking. The collection of appliances is very complete, and a very varied display is the result. The Ferranti oven, with its two-heat simmering plate, grill and single-heat disks is regarded with much favour; and the disk stoves for boiling, simmering and toasting proved their adaptability. Simplex Conduits, Ltd., of Birmingham, also are exhibiting many forms of cooker, from a simple electric toaster or a kettle, hot-plate or boiling plate, to a large oven. The same firm are drawing attention, with good results, to the Brimsdown "Wirum" lamps, which are packed in a novel carton which enables hundreds to be examined without unpacking and in a very short space of time. Other firms contributing to this excellent display are Messrs. Scholey and Co., Johnson & Phillips, Veritys, &c.

To show the process of electrical cooking, the use of the many appliances ready to hand, and the economy of its use, the Newcastle-upon-Tyne Electric Supply Co. are giving frequent demonstrations which are not only interesting in themselves, but in many cases prove little short of revelations to the visitors.

It has been a source of continual surprise to many visitors to learn how readily electricity can be converted into heat for ordinary heating purposes, but in scores of forms illustrations are being given of this use. Mr. F. T. Hanks, of Newcastle, has the "Bastian" heater, which is manufactured by the London Electrical Trading Co., and this compact form of heater has a special local attraction, as the spiral wires are enclosed in Vitreosil, which is made by the Thermal Syndicate, at Wallsend-on-Tyne. These heaters form but one feature on an attractive stand, which includes electric speed indicators, for giving the speed of the turbines at any part of the vessel, obviating the necessity of signalling to the engine room to ascertain the speed. The display of the colour-matching lamp has also proved attractive, and led to business. The Ferranti disk fire, with its ornate antique copper reflector, was much remarked upon. It is claimed that these can be worked locally for 1½d. per hour.

A very complete exhibit is the working electrical laundry of the Provincial Laundries, Ltd., Newcastle. Here are shown the whole of the processes — except the mere washing and starching—and for each operation electricity is utilised, the drying ready for polishing, the polishing by a rotary machine, the damping along the middle of the collar to prevent the linen breaking, and the shaping of the collar ready for use. Then there are shown various species of electric irons suitable for different classes of laundry work.

In an opposite corner of the hall is another stand which has a great attraction for a certain section—an electrical nursery. The little one's cot is gently rocked, the food is maintained at a suitable heat for use, the place is warmed and lighted, and baby's clothes are warmed, all with the aid of a little electricity. It forms altogether a good commentary upon the manner in which this new agency may enter into the most intimate of domestic relations.

The many modes in which electricity is made portable are illustrated in many ways, a striking exhibit being the Edison Storage Traction Co.'s motor-car (an elegant vehicle, which locally can be run for about ¼d. per mile), and a tradesman's electric "runabout," which latter is to be seen in the streets. The Chloride Electrical Storage Co., Ltd., have had many inquiries in respect of their accumulators, and they show a battery suitable for country house lighting, embodying their well-known rosette positive and box negative with wood separators. There is a large show of Exide and Clifton accumulators, suitable for motor-cars, wireless telegraphy on ships and yacht lighting.

The Float Electric Co. are showing their various types of portable lamps, and the facility with which these can be recharged with the electrolyte has been regarded with much favour.

On the stand of Messrs. E. Bevan & Co., of Newcastle, there is shown one use to which their portable air-blast plant may be put. The exhibit is a brazed overhead trolley wire. It was brazed with the Stellite apparatus and then tested at Armstrong College under a tensile stress, and fractured at 1·86 tons; the brazing never gave way. Before testing, the diameter was ⅜ in. approximately, and under the strain it tapered at the centre to about 3/16 in. where it broke. The apparatus is designed for producing gas and air blast to be delivered in an intense flame from a blow pipe burner, and has just been patented.

A good deal of curiosity and interest has been aroused by the Ozonair apparatus shown by Messrs. Robert Bowran and Co., Newcastle. The fresh invigorating air produced is so distinctive that few visitors pass without an inquiry.

Apart from what have been mentioned, which are in the main the more popular features of the Exhibition, there are innumerable stands of interest to those concerned with the use of electricity in works, and in its application to industries generally, but these are all more or less foreign to the primary object of the Exhibition, which is the illustration of the uses of electricity for domestic purposes.

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Kabul. After a series of delays due to various causes, active work is now taking place on the Kabul hydro-electric power scheme. Mr. Jewett, who is in charge for the contractors, Messrs. Osler, Ltd., has received instructions to proceed with all possible despatch, and he has been supplied with 400 Afghan sappers and miners to push on with the head work, dams and channel at Jabal Siraj. Four sub-stations will be built between this point and Kabul City, in which place the larger portion of the transmitted electrical energy will be used for power and lighting.

The new steam plant for H.H. the Amir's palace is already in operation under the charge of Mr. Mallett, who has recently been appointed chief electrical and mechanical engineer to the Durbar. In spite of a good deal of local conservatism, the Amir has had his way, and a new era may be said to be established in Kabul. At present there are four electrical engineers and three mechanical engineers busily occupied in carrying out engineering contracts in different parts of the Amir's kingdom. Bridge-building, road-making, workshop erecting, and electric power construction are all in active operation, and in a few years Kabul promises to be a busy industrial centre. Of late the Amir has taken to motoring; his practical mind soon grasped the fact that a motor-car would bring him into closer personal touch with his distant districts and their rulers, and it is characteristic of the Amir that strong conviction was soon followed by prompt action. Roads had to be made—the engineering section of his army and most of his prisoners were put to work. Rivers had to be crossed—contracts for bridges soon followed.

The contracting firms, both mechanical and electrical, who are at present carrying out this work have served him well and gained his confidence, and he is faithful to them in turn; and as no travellers are allowed into Kabul without his permit, it is extremely difficult for outside firms to procure work there. Catalogues and advertising matter are sent in voluminous quantities, but, owing to one cause or another, these seldom reach the right quarter.

Madras.—The Electric Supply Co. continue to extend their mains, with, of course, a consequent increase of load of both lights and fans. With regard to the latter, local wiring contractors are up against a discouraging problem; for, because of the competition of the electric lighting company itself, they find no market for their fans at present. Recently the supply company advertised locally that they were selling 2,000 Crompton ceiling fans at a "big sacrifice"; in fact, at less than cost price, in order to encourage their use. It is generally an accepted fact that wiring contractors are the unpaid commercial travellers of a supply company, and that the latter are as a rule content with selling electric energy; but things are done differently in Madras. A reason for this method of procedure might be given. The Crompton fan is a good one, and worthy of a better fate than throwing it away at "less than cost price *ex* godown."

Delhi.—The electrical work in the new temporary capital is proceeding rapidly. A large secretariat and numerous bungalows have sprung up with surprising rapidity. A high compliment has been paid to Mr. Pitkeathly, the former Electrical Inspector to the United Provinces, by the Government. For his splendid work at the Durbar he was created a Companion of the Victorian Order, and in further recognition of his great organising ability and his powers of quick despatch, he has been selected to superintend the carrying out of the new temporary Government buildings.

Indian Industries and Power says, in its August impression, that "There is much dissatisfaction among firms in Bombay who supply electrical plant and do electrical work, at the system under which electrical contracts for Government are given. It is a general practice in Government departments to put contracts involving large sums of money out to public tender." For some reason, this practice has not been invariably observed by the Electrical Department of the P.W.D. in Bombay, it being a well-known fact that many large electrical contracts have been privately arranged, and the news that some chosen firm is carrying out a certain contract is the first intimation received by others of the electrical profession, who would only be too willing to tender if invited. It is to be feared that Bombay electrical firms are not the only ones who suffer this unpleasant experience. It may be said to obtain in Calcutta as well; here no fewer than three large Government buildings have been practically handed over to firms without calling for tenders in the usual way. This is a reprehensible practice except under very special conditions, and should be taken notice of by the higher authorities in order that there should be no suspicion of unfair preference.

Calcutta Electric Supply Co.—The new generating station at Cossipore has been supplying energy to the mains for some weeks back, and everything is working admirably. The increased demand for energy for factory purposes, and the necessity of centralising the several smaller power houses, decided the supply company to build and equip an entirely new and modern station, replete with machinery, which is the last word in electric economy. The Hugli side at Cossipore was chosen because land was cheap, plenty of condensing water is available, and a convenient siding for coal was close by. The whole supply for the city and suburbs will come from Cossipore eventually, and the several present power houses will become transformer stations. Several new transforming stations are also being built at suitable distributing centres through the city.

The total B.H.P. will be about 13,000, made up as follows:—Three 3,000-H.P. sets and three smaller units of about 1,000 H.P. each; these machines are of the mixed-pressure turbine type, made by the Oerlikon Co. Current will be generated at 6,000 volts, three-phase, and transformed by means of motor-generators to 225 volts, direct-current, for lights and fans. The condensing plant is by Messrs. W. H. Allen & Co., Bedford. The boilers, five in number, each capable of evaporating 20,000 lb. of water per hour, are by the Stirling Co. Several boilers from the existing power houses are also to be installed when convenient.

The main switchboard is by the B.T.-H. Co., Rugby, as are also the switchboards in the sub-stations.

For the new scheme about 60 miles of Glover's cable has been laid; this brings the total mileage of the underground and overhead cable to about 400 miles in the city and suburbs. The total cost of the scheme is said by a local paper to be about £400,000.

Waste Gas from Oil Wells.—For several years the Pacific Light and Power Co. has used the waste gas on property in the Salt Lake oilfield for pumping, drilling and lighting, but millions of cubic feet have been allowed to escape into the air and be lost. To prevent part of this waste two gas engines, each of 250 H.P., have been installed, and a steam engine, burning gas underneath its boiler, has also been put to the work of producing electric power, the total plant giving 400 KW. A connection has been made to the company's power cable in Los Angeles, and if the small plant proves successful, it will be increased a hundredfold or more. The gas which will be so used is not 1 per cent. of the supply available to this company, and there are scores of other large sources in California.—*Financier.*

HIGH-FREQUENCY DISCHARGES IN HIGH-TENSION TRANSFORMERS.

By A. J. MAKOWER, M.A.

It is a well-known fact that, owing to the capacity of the windings of high-tension transformers, a breakdown of the insulation between the windings and the case is liable to set up high-frequency oscillations of a destructive nature in the transformer. Whilst these facts have been observed, yet it does not appear that any measurements have been made of the oscillatory discharges so produced. The following experiments were carried out with the object of gaining some information about these discharges.

A 2-K.V.A. 40-cycle oil-immersed transformer with a ratio of 100 to 4,000 volts was connected to the supply circuit and a short air-gap connected between one end of the high-tension winding and the case. It was found that continuous sparking was set up across the gap when its length was reduced to about 1 mm., and that the oscillation frequency, measured by a tuning circuit containing a variable capacity, an inductance and a thermo-galvanometer, and loosely coupled to the oscillating circuit, was 4,130,000 cycles a second. The connections are shown in fig. 1, in which W represents the high-tension winding, C the case, and S the spark-gap. The low-tension winding is not shown. G, L and K are the galvanometer, inductance and variable capacity constituting the tuning circuit, which was loosely coupled to the oscillating circuit by means of a few turns of wire. In order to estimate the electrical stresses existing between the different parts of the transformer before the sparking takes place, the following measurements were made:—

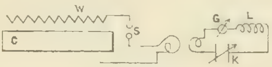

FIG. 1.

The capacities between the various parts of the transformer were measured by charging and discharging through a calibrated ballistic galvanometer. The result of these tests was to show that the capacity measured between the high-tension winding and the case was 5,000 cm.; that measured between the low-tension winding and the case, 3,150 cm.; and that measured between the high-tension winding and the case, with the low-tension winding connected to the case, 7,400 cm.

If we call K_1 the capacity of the high-tension winding to the case, K_2 the capacity of the low-tension winding to the case, and K_3 the capacity of the high-tension to the low-tension winding, then we have—

$$K_1 + \frac{K_2 K_3}{K_2 + K_3} = 5.000.$$

$$K_2 + \frac{K_1 K_3}{K_1 + K_3} = 3.150.$$

$$K_1 + K_3 = 7.400.$$

whence we obtain $K_1 = 4{,}080$; $K_2 = 1{,}340$; $K_3 = 3{,}320$ cm.

When the transformer was excited so as to give a secondary voltage of 4,000 volts, it was found by means of an electrostatic voltmeter that the potentials between the free ends of the high-tension winding and the case were 2,250 and 1,790 volts respectively, and that there was practically no voltage between the middle point of the high-tension winding and the case. Thus, before any oscillations are set up the full potential of the transformer is so distributed that a strain of about half the full voltage of the transformer exists between the ends of the high-tension winding and the case; this same strain would exist along the path formed by the capacity of the high-tension to low-tension windings in series with the capacity of the low-tension winding to the case, and so the strain of 2,000 volts would be distributed between these capacities in the ratio of K_2 to K_3. Thus, the voltage between the high-tension and low-tension windings would be about 570 volts, and that between the low-tension winding and the case about 1,430 volts. It will thus be seen that in extra-high-tension transformers it must be of great importance to provide very good insulation not only between the high-tension windings and the rest of the transformer, but also between the low-tension windings and the rest of the transformer, particularly as the voltages between the different parts of the transformer would be very greatly increased if a breakdown between any two parts were to take place with the consequent setting-up of high-frequency oscillations.

It must not be supposed that the capacities that come into question for the high-frequency currents approach the values given above, as the high-frequency oscillations are not able to penetrate through the whole windings. It is very difficult to determine the values of the capacity and inductance that are concerned with these high-frequency oscillations by the usual method of adding a known capacity or inductance to the oscillating circuit and noting the change of frequency of the oscillations that are set up, because the capacity and inductance of the windings are not able to be considered as being connected in series, owing to the fact that they are distributed throughout the windings. However, in order to obtain an estimate of the magnitudes concerned, the following experiment was made:—

An oscillating circuit was energised by a Poulsen arc, the frequency of the oscillations being kept constant. To this circuit another circuit was loosely coupled containing a thermo-galvanometer, a capacity K and an inductance L. When tuned so as to resonate to the primary circuit, it was found that K = 207 cm. and L = 72,100 cm. The capacity was now removed and replaced by the capacity of the transformer by making connections to the case and to one end of the high-tension winding. It was now found to be necessary to insert a total inductance of 547,000 cm. in the secondary circuit to retune it to the primary.

Assuming that the capacity in the tuning circuit was that of the high-tension winding of the transformer to case, and that the inductance of that circuit was mainly contained in the capacity L, external to the transformer, we find that the high-frequency value of the capacity of the transformer winding is—

$$\frac{72{,}100 \times 207}{547{,}000} = 27{\cdot}3 \text{ cm.}$$

From this experiment we may assume that the capacities that come into question for the high-frequency currents are only of the order of a hundredth part of the values measured by the ballistic galvanometer.

Oscillations of the same frequency but of greater power than those obtained by the connections as shown in fig. 1 were obtained by the connections shown in fig. 2, which shows two transformers similar to the one previously tested connected with their low-tension windings in parallel on the mains and the high-tension windings interconnected at one point, the connection between the high-tension windings being such that the voltage between the free ends of the two high-tension windings was the sum, and not the difference, of the voltages of the two windings. It was then found that sparks of more than a millimetre length could be taken off between the cases of the two transformers.

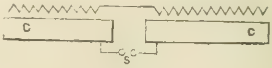

FIG. 2.

Fig. 3 gives a resonance curve for the oscillations set up in the windings of the two transformers, the deflections of the thermo-galvanometer in the tuning circuit being plotted vertically and the natural frequency of the tuning circuit for various adjustments of its capacity being plotted horizontally. Applying the formula of Bjerknes to this curve we obtain for the decrement per whole period of the oscillation in the transformers the value of 0·24, after allowing a value of 0·04 for the decrement of the tuning circuit.

Thus the oscillations set up in the transformer windings are only slightly damped. They are remarkably steady, and on this account very useful for experimental work on high frequency.

Oscillatory discharges of the same frequency as in the above cases were obtained when the connection between the high-tension windings of the transformers was reversed, as shown in fig. 4, and the spark-gap removed to the position

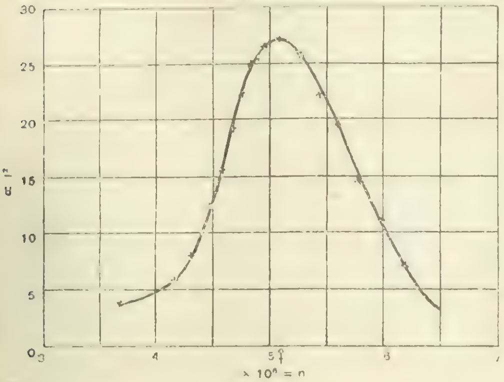

FIG. 3.

as shown, between the cases and the junction point of the high-tension windings.

The oscillations produced in a 40,000-volt oil-immersed transformer of a capacity of 10 K.V.A. were investigated by the methods described above, using the connections of fig. 1, and violent sparks of over 4 centimetres length were observed to pass between the high-tension winding and the case. The frequency of the oscillations was much higher, being 17,500,000 cycles a second, and the logarithmic decrement per whole period was found to be 0·48.

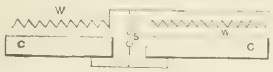

FIG. 4.

The above experiments show that if high-tension transformers are not designed with very good insulation between the windings, and between the windings and the case, brush discharges may easily be set up, which may cause breakdowns to take place in the high-tension or even in the low-tension windings.

DETERIORATION OF STORED COAL.

THAT coal deteriorates very seriously when stored has long been an article of faith, but lately there has been a considerable disbelief in this waste. It is certainly true that Welsh coal put aboard, say, at Port Said, has a very inferior appearance at times. But there are not wanting those who suggest that there is a special reason why a thousand tons of coal "put aboard" at some foreign coaling station gives so poor a performance in ship mileage. Possibly this old bogey of weathering of coal has been raised to account for mileage not run by coal which isn't there.

To add to this growing doubt of deterioration comes now a paper by the U.S.A. Bureau of Mines, on the subject of weathering, and a fuller bulletin is promised. Many industrial undertakings keep in store from 50,000 to 500.000 tons of coal for long periods, and the Bureau of Mines has often been asked for information on deterioration and spontaneous firing of coal in store. Meanwhile this paper comes as an advance guard. Various quotations are cited as to loss of calorific value, notably Groves and Thorpe, on "Chemical Technology of Fuels," 1889 edition: "In some places coal is known to lose 50 per cent. of its heating value in six months." But such exaggerated ideas are not now common.

Of certain coals tested it is stated that though several evolved large volumes of methane, especially soon after mining, the tested coals lost in one year only 0·16 per cent. of their calorific value from volatile gas escape. Reference is made to an English dock superintendent, who has claimed that sea-immersed coal is actually better for 10 years' submergence by 1·8 per cent., and added that a strong dose of salt water 12 hours before using coal would improve its calorific value considerably.

The Bureau chose four kinds of coal for experimentation viz., New River, W. Va., a navy coal; Pocahontas, Va., a steam and coking coal, much used on the Panama Canal works; Pittsburg, a coking and gas coal; and Sheridan, Wyo., a sort of black lignite used in the West.

The New River coal was submerged in wooden boxes in 50-lb. samples crushed to ¼-in. size, at three navy yards under different climatic conditions. Samples of 300 lb. of the same lot were exposed in the open air both indoors and outdoors at the same three navy yards.

The Pocahontas coal was exposed at Panama in a pile of 120 tons, and the Pittsburg coal, as run of mine, in 5-ton bins out of doors at Ann Arbor, Mich., and in 300-lb. barrels in fresh water. The lignite was stored at Sheridan, as both slack and run of mine in 3-ton and 6-ton bins. Except the pile at Panama and the 300-lb. open-air piles at the navy yards, sampling was done by re-handling all the coal in a lot.

At Panama a 10-ton vertical sample was removed each time, and from the 300-lb. piles small portions were taken from numerous points in each pile. No tests were made of increase of friability or of slacking. The salt water samples lost respectively 0·3, 0·4 and 0·0 per cent. The fresh-water sample lost nothing. Period of immersion two years.

Coal of ¼ in. exposed indoors lost 0·39 and 0·80 per cent. Other losses varied from 0·11 to 1·85; the last figure was for outdoor exposure at Key West, Fla., uncovered. Climate clearly has an effect. The big pile at Panama lost only 0·3 per cent. in a year.

The Sheridan coal lost from 3·19 to 5 26 per cent., and bins 15 ft. deep lost half as much again as 5-ft. bins. The period of this loss was 2¼ years.

Thus only the lignite coal suffered over 2 per cent. of loss.

Water submergence, salt or fresh, is evidently a full preservative. The lumps of run of mine coal did not slack. Crushed samples deteriorated more than run of mine. The gas coal lost next to nothing by a year's outdoor exposure, even when sampled from the upper 6 in. of the bins.

It is doubtful if the value of submergence is worth the resulting loss due to wetness, but water storage effectually secures coal from spontaneous firing, a point rather supererogatory, by the way, to mention.

As with experiments we have not long ago referred to, it was found that losses from heating by oxidation were worst at high temperatures. Oxidation is thought to be due to absorption by unsaturated compounds, and coals already high in combined oxygen were the biggest absorbers of that gas.

Small heaps of coal soon dissipated any heat, but heat accumulates in densely-packed large piles.

At 100° C. oxidation proceeds more rapidly than dissipation, and with air supply there is soon a fire. The conclusion is that spontaneous combustion is the result of slow oxidation, with sufficient air to support the action but insufficient to carry off the heat. Oxidation depends on surface, and dust mixed with lump is the worst form for oxidation, for it permits air to gain access to the large surface of the dust. Thus the friability of coal is a factor in spontaneous combustion, for it promotes dust.

High volatile contents does not in itself add to the liability to spontaneous heating, and inquiries showed that the "smokeless" coals were as liable to it as the more bituminous.

Curiously enough, coals with much oxygen in their composition are greedy for more, and show a marked tendency to spontaneous combustion. Neither sulphur nor moisture can be regarded as promoters of self-heating.

Freshly mined coal and fresh surfaces are most prone to oxidise, and after a time surfaces become seasoned, so that if a coal has once heated and it is re-handled and cooled it seldom again develops heat. The application of heat naturally favours combustion, and it is easy to understand that bunkers of iron above hot boilers will fire somewhat readily.

The general conclusions are that coal should not be piled over 12 ft. deep, or so that any part is more than 10 ft. from an air-cooled surface; that if possible only screened lump should be stored; that dust should be kept out and handling minimised; that fine and lumps should be evenly distributed; that the store should be rehandled and screened after two months (presumably only one such move is meant); that external sources of heat be avoided; that coal be seasoned six weeks before storing, and should not be dry and wet alternately, and air should not be able to enter a pile through openings round foreign objects such as timbers or brickwork, or porous bottom or coarse cinders.

Pipes for ventilating a coal pile often do more harm than good.

From all that has been published of late, if coal does seem so very bad after weathering, it is due to slacking, a result of friability, which will, of course, make it more difficult to burn. It is very true, however, that weathered coal has a shockingly bad appearance, but then it is by no means the case that the bright bituminous coals raise more steam than some of the dull coals. Meantime, there appears to be little or nothing from marine engineers, who ought to know how much of fault should be debited to the weathering, and how much to causes only hinted at with trepidation.

Bristol Electric Lighting.—A L.G.B. inquiry was held on September 19th into the application of the T.C. for a loan of £6,646 for electricity purposes, including £3,785 for a motor-converter, and £947 already expended on mains. There was no opposition.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,459. "Apparatus for audibly indicating changes of temperature." F. W. Branson. September 9th.

20,464. "Thermal switches." A. McPherson. September 9th.

20,525. "Metallic-filament electric lamps." H. R. Stevens. September 9th.

20,557. "Method of electrolytically refining tin and like metals." G. Michaud and E. Delasson. September 9th. (Complete.)

20,560. "Machine for preparing the current conducting wires of electric igniters." W. E. Lake. (Fabrik Elektrischer Zunder G.m.b.H. Germany.) September 9th. (Complete.)

20,580. "Protective attachments for telephone mouthpieces and earpieces." S. T. Richardson. September 10th.

20,595. "Pyrometers." (Addition to 6,364/12.) F. Rogers. September 10th.

20 621. "Method of manufacturing electric incandescent lamp filaments." E. M. Bailey and H. F. McDowell. September 10th. (Complete.)

20,659. "Electric lamps for light projections." Compagnie Generale de Phonographes, Cinematographes et Appareils de Precision. (Convention date, October 12th, 1911, France.) September 10th.

20,662. "Electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 10th.

20,663. "Protective devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) Divided Application on 16,708/12th, July 17th. September 10th.

20,671. "Appliance for holding and supporting telephone receivers and combined receivers and transmitters." A. H. Tullett. (Convention date, November 2nd, 1911, Australia.) September 10th. (Complete.)

20,744. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 11th.

20,768. "Starter for induction motors with wound rotors." R. C. Watson. September 12th.

20,770. "Water and damp-proof insulating or non-insulating boot-socks." A. Tolhausen. September 12th. (Complete.)

20,775. "Electrical terminals." H. G. Longford & W. A. Clark, trading as Sphinx Manufacturing Co. September 12th.

20,776. "Cable connectors to electrically-heated laundry and similar irons." G. H. Collins and H. F. Collins. September 12th.

20,800. "Electric lighting lamps." V. Bridgman. September 12th.

20,805. "Flexible metallic clip for attaching and detaching shades, shade-holders, advertisements, decorations, protectors and the like to or from electric, gas, oil or vapour lamps, and other devices that may be used for the purpose of illumination." F. Parks. September 12th.

20,822. "Electrical resistances." E. J. Harman. September 12th.

20,828. "Commutators for electric motors." W. H. Scott. September 12th.

20,835. "Steam controllers." Bergmann-Elektricitats-Werke Akt-Ges. (Convention date, October 26th, 1911.) September 12th.

20,849. "Alternating-current commutator-motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats Ges., Germany.) September 12th.

20,873. "Telephone apparatus." M. C. Conner and A. R. Kahl. September 13th.

20,887. "Alternating-current signalling system for railways." W. H. Dammond. September 13th.

20,913. "Electric lampholder affording an easy method of affixing and removing glass shades and the like." M. G. Roberts and A. W. Gale. September 13th.

20,914. "Device for controlling electric circuits in a determined order." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) September 13th.

20,922. "Electromagnetic clutches." "Vulcan" Maschinenfabriks Akt.-Ges. (Convention date, October 20th, 1911, Austria.) September 13th. (Complete.)

20,932. "Incandescent lamps." H. E. Dolphin. September 13th.

20,943. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparat Fabrik E. Zwietusch & Co. G.m.b. H., Germany.) (Divided application on 21,259/11 September 26th.) September 18th.

20,944. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparat Fabrik E. Zwietusch & Co. G.m.b.H., Germany.) (Divided application on 21,259/11 September 26th.) September 13th.

20,945. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparat Fabrik E. Zwietusch & Co. G.m b.H., Germany.) (Divided application on 21,259/11 September 26th.) September 13th.

20,946. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co., Ltd. (Telephon Apparat Fabrik E. Zwietusch & Co., G.m.b.H., Germany.) (Divided application on 21,259/11 of September 26th.) September 13th.

20,947. "Switching apparatus for interconnecting the lines of an automatic telephone system." Western Electric Co, Ltd. (Telephon Apparat Fabrik E. Zwietusch & Co., G.m.b.H., Germany.) (Divided application on 21,259/11 of September 26th.) September 13th.

20,950. "Apparatus for the electrical treatment of gases and vapours." W. T. Hoofnagle. September 13th. (Complete.)

20,976. "Automatic device for reserving one or more electric motors for operating tanning tubs.". Herrenschmidt & Co. (Convention date, October 18th, 1911, Germany.) September 14th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

Arc Lamps. G. E. Tate and F. O. Monkhouse. 19,912. August 29th.

The Conjunction of Cords or Wires with Electrical Apparatus. G. St. J. Day. 20,342. September 14th.

Electric Shade-Carrier Tongs. J. Ball. 20,718. September 19th.

Electrical Heating or Cooking Apparatus. L. Newitt and F. P. Fletcher. 24,017. October 30th.

Electrically-operated Portable Vacuum Cleaners and the Like W. Schmahl and Magic Appliances, Ltd. 24,668. November 6th.

Holders for Incandescent Electric Lamps. J. Sax & Co. and F. H. Collis. 26,601. November 28th.

Sparking Plugs. G. Nagel. 27,150. December 4th. (December 6th, 1910.)

Series Systems of Incandescent Lamp Lighting. E. Booth and N. R. Booth. 27,862. December 12th.

Electric Fuses. O. L. Peard. 28,872. December 21st.

Sparking Regulator for Internal-Combustion Engines. G. W. Hutchinson. 8,206. April 1st. (September 26th, 1911.)

Trolleys or Collectors for Electricity. L. J. Tetlow. 19,046. August 24th.

Electric Braking Mechanism. K. Brüll. 19,097. August 25th.

Magneto-Electric Machines for Combined Ignition and Illuminating Purposes on Motor Road Vehicles. F. R. Simms and Simms Magneto Co. 19,122. August 25th. (Cognate application, 24,761 of 1911.)

Electric Motors Suitable for Display Advertising and the like. A. C. Harris. 19,268. August 29th.

Apparatus for Electrically Operating and Controlling Planing Machines and the like Reciprocating Tools. Lancashire Dynamo and Motor Co. and A. P. Wood. 19,615. September 4th.

Apparatus for Electrically Controlling Planing Machines and the like Reciprocating Tools. Lancashire Dynamo and Motor Co. and A. P. Wood. 19,616. September 4th.

Magnetic Separation of Ores. J. S. Dalgleish. 19,678. September 4th.

Method of and Means for Voltage Regulation in Stage Transformers. R. Richter. 20,302. September 13th.

Telephone Installations. W. E. Lake. (Firm of Gustav A. Meyer-Henniger.) 20,620. September 18th.

Articles made of Silica Glass and Requiring Leading-in Wires Combined Therewith. H. A. Kent, H. G. Lacell and Silica Syndicate, Ltd. 24,482. November 3rd.

Electric Couplings. J. E. Michler. 24,532. November 4th.

Circuit Connection for Private Telephone Installations Connected to Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 24,807. November 7th.

Process for the Magnetic Preparation or Oiling of Ores or the like, and Apparatus Therefor. Murex Magnetic Co. and A. A. Lockwood. 25,869. November 14th.

1912.

Oil-immersed Electrical Switches and Circuit-breakers. H. R. Schultz. 330. January 4th.

Electric Condensers and Artificial Line. A. Muirhead and Muirhead and Co. 1,626. January 20th.

Means for Heating Liquids by the Aid of Electricity. C. W. Raffety. 2,063. January 25th. (February 16th, 1912.)

Process for Electro-plating Non-conducting Articles. A. Frei. 3,366. February 10th.

Electric Flash Signalling Apparatus for Military, Naval and other Purposes. J. N. Inglis. 3,586. February 13th.

Electrically-heated Clothes or Portions of Clothing. A. Pollak. 4,851. February 27th. (March 17th, 1911.)

Controlling Means for Electric Cooking Apparatus. R. Haddan. (Copeman Electric Stove Co.) 5,987. (Divided application on 2,201 of 1911. October 5th.) March 9th.

Sparking Plugs. I. Koutkine. 6,062. March 11th.

Driver's Brake Valves for Electrically and Pneumatically-controlled Compressed-air Brakes. W. Hildebrand and Knorr-Bremse Akt.-Ges. 6,116. March 11th.

Portable Electric Battery Lamps. B. Pordes. 11,972. May 13th.

Arc Lamps. Korting & Mathieson Akt.-Ges. 15,281. July 1st. (August 12th, 1911.)

Socket Terminal for Electric Conductors. R. Bosch (Firm of). 15,836. July 6th. (April 3rd, 1912.)

Method of Connections for Eliminating the Influence of the Temperature on the Current Strength of a Resistance, the Magnitude of which Increases with the Temperature. Fried. Krupp Akt.-Ges. 3,107. February 7th. (March 4th, 1911.)

Electric Storage Battery Plates. A. Ricks. 4,843. February 27th. (June 13th, 1911.)

Acoustic Tubes Applicable for Use with Telephone Receivers. L. A. L. Struxiano. 6,262. March 13th.

Automatic and Semi-Automatic Telephone Exchange Systems. F. R. McBerty. 8,573. April 11th. (July 27th, 1910.) (Divided application on 17,211 of 1911, July 27th.)

Automatic Brakes for Electric Tramcars and the like. Count F. C. V. di Castelletto. 9,466. April 22nd. (April 22nd, 1911.)

Electrically-Heated Ovens. Veritys, Ltd., and W. G. Pipkin. 10,009. April 27th.

Automatic Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 10,539. May 3rd.

Lightning Protection for Transmission Lines.—A recent report on the general practice in transmission systems, presented at the convention of the Ohio Electric Light Association, stated that the ideal construction for overcoming the dangerous effects of lightning is the placing of the ground wires at the highest point of the poles, and also placing aluminium cell arresters at both ends of the line and in the centre. In discussing this phase of the report, Prof. F. C. Caldwell, of the Ohio State University, made some interesting observations. He attributed the failure of lightning arresters to prevent discharges from the line in their immediate vicinity, to the presence of nodes or points of no vibration in the line. To illustrate this point he drew comparison with the vibration of a string of a musical instrument; the string may vibrate as a whole, the greatest vibration occurring in the middle, or it may vibrate in two parts, in which case there is a point of no vibration at the middle. In this case the string may be held at the middle without affecting the vibration. Similarly, if the lightning arrester is placed at one of the nodes on the transmission line there may be no tendency for a discharge through it, although high potentials and discharges may develop at a comparatively short distance from it. The one difficulty, as pointed out by Prof. Caldwell, is in determining the probable location of these nodes, so that the arresters may be placed accordingly. However, if inductance is inserted in the line by the introduction of a solenoid, and several gaps are tapped along the coil, the probability of all the gaps coming at nodes will be very small, especially as each turn would correspond to a considerable length of line in its effect on the wave of lightning discharge.—*Power.*

THE

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THE LONDON TRAMWAY PROBLEM.

A WEEK has now passed since the conclusion of the West Ham Conference of the Municipal Tramways Association, the delegates to which will doubtless ere this have resumed their accustomed chairs by their own firesides.

Not much of strictly engineering interest was included in the business of this year's Convention, except the important contribution on the subject of corrugation contained in the interim report of the Corrugation Committee, to which we refer elsewhere in this issue, and the visits to the instructive little exhibition of modern tramway appliances and material which is now such an attractive feature of these Conventions. Yet these annual reunions afford a valuable insight into the general state of mind of the municipal tramway fraternity, which, after all, exercises paramount influence on the street traffic problems of Great Britain.

In view of this fact, which cannot, we think, be reasonably disputed, it is surprising and even regrettable that the spectre of the motor-'bus should have so frequently intruded at meetings mainly composed of provincial tramway men, who have really little to fear from such a competitor. For brief reflection will show that the London area and its street traffic problems have no counterpart in provincial centres of population, where, moreover, the Corporations, unlike the London boroughs, are in the happy position of being able, in any event, to control the vehicular traffic in their own streets.

Amidst the mass of contrary opinion to which the situation in London has given rise in the extremist Press of the metropolis, one welcomes the sane and reasonable views of one paper —the *Pall Mall Gazette*—which says, in a recent editorial, that "the tramway has certain merits, which it will take long for any other species of street travel to emulate. Its steady running and its excellent lighting are comforts to which the Londoner who has to make long daily journeys cannot be insusceptible. But the motor-'bus has the advantage of being able to cover territory from which the antiquity of our street planning debars the access of tramlines, and it is hard to think of what the metropolis would do to-day if its ministrations were suddenly brought to an end. In short, we require both facilities, and all outstanding questions of conditions of running and contributions to street maintenance are of a plain business character, which gives no legitimate outlet for passion."

The position could not be more clearly stated; tramways in the principal city and West End thoroughfares are almost unthinkable, while the nearest alternative—shallow tramways under the roads—suffers from objections on the score of cost and inconvenience, as compared with the surface vehicle, which caters for the roadside passenger.

While certain North and South connecting routes through the City may be a technical necessity for the L.C.C. tramways, it must be remembered that this system is already weighed down with unremunerative capital expenditure to an extent probably unequalled the world over, and that notwithstanding this it would probably have been financially prosperous if it had been run on more businesslike and less philanthropic lines.

Had this been the case, it is likely that the advent of the motor-'bus, except as regards its effect on road maintenance, would have been regarded with equanimity.

The question of increased road maintenance is another thorny problem which some people would apparently prefer to treat as being confined to the tramway and omnibus.

It is estimated that the London road authorities already filch the equivalent of some £120,000 per annum from the tramway authorities in respect of road maintenance, the greater part of which should legitimately fall on other shoulders, while the omnibus companies pay something like £40 per annum per vehicle in taxation, none of which apparently finds its way to the maintenance of the roads used by them, and the pros and cons of these two cases are discussed without reference to the general growth of heavy vehicular traffic all round, and the unsuitability of the roads of 10 years ago for the traffic of to-day.

While it is quite evident that the tramways are unfairly taxed for road maintenance in comparison with other forms of traffic, it is equally clear that the problem of road maintenance teems with as many difficulties as the traffic problem with which some people are in the habit of confusing it.

Unity House.

We have frequently had occasion in these columns to inveigh against the methods of the more militant among Trade Unionists. Fundamentally, the be-all and the end-all of their existence appears to be to wage perpetual war against all that is included in the word Capital, and to teach the worker to feel that Capital—represented by the employer—is his hereditary enemy. Another great principle of Trade Unionism appears to be "work for all"—not work and reward according to merit and ability, but work for all. Your Labour leader does not hold with the doctrine, "To each according to his sacrifice"; "To each according to his need" is a much more attractive formula to him whose need is very great and capacity for work very small.

So long as the strike is used as a weapon against the capitalist, and so long as the "picket" is posted to aid in the prosecution of an ordinary strike, both strike and picket are popular amongst the votaries of labour; but it is a little awkward when a Trade Union is the employer. Yet pickets have recently been placed at the door of one of the largest Trade Unions in England, for the purpose of enforcing a demand for Trade Union wages! The story—which has recently been fully told in the columns of the daily papers—is very simple. The Amalgamated Society of Railway Servants engaged 14 men—themselves railway servants—to act as clerks to assist in the labour imposed upon the Society by the Insurance Act. These men were offered 30s. a week. They demanded the Trade Union rate for clerks, namely, 35s. This was refused on the express ground that the men were not worth more than 30s. All the men were members of the Amalgamated Society; two of them were branch secretaries. Incensed at their conduct, the head office demanded their expulsion, whereupon they proceeded to picket Unity House, in order, we suppose (to use the language of the statute), to "communicate information" to persons who might apply for the lucrative office of clerk! The quarrel resulted in the Society advertising for clerks at 35s., making it a condition of employment that they should join the Amalgamated Society as members of an approved society under the Insurance Act. It might be mentioned, in passing, that to make it a condition of employment is contrary to the regulations of the Commissioners, and the Amalgamated Society has itself protested against an attempt at compulsion on the part of a railway company!

If anything were calculated to shake the confidence of the working man in the methods of Trade Unionism, this simple story ought to be sufficient. They now have an opportunity of seeing their own weapons turned against themselves in the capacity of employers. Those who run the Amalgamated Society, with a creditable business instinct, do not see why 35s. should be paid for what ought to be done for 30s. They have sought to disregard the minimum wage fixed by another Union. Can they hereafter be heard to complain if employers make the same reasonable protest against payment of enhanced wages to railway servants?

John Stuart Mill, whom we have quoted with advantage on many recent occasions, stated in his "Principles of Political Economy" (Book V, Chap. XI, par. 3) that "Experience proves that the depositories of power, who are mere delegates of the people, that is of a majority, are quite as ready (where they think they can count on popular support) as any organs of oligarchy, to assume arbitrary power, and encroach unduly on the liberty of private life." The "popular support," upon which the rulers of Unity House thought they could rely was, of course, the support of the members of a Union. "This," they said, "is a matter which touches the pockets of our members. We must study economy in the management of the affairs of the Union, or we shall run grave risks of being superseded." By an accident, their sweating methods have in this instance been dragged into the light of day. It is no very large assumption that similar forms of economy are practised by other Unions who own palatial offices in various parts of the country.

We have always had it in the back of our minds that the working man is ready and willing to drive a good bargain if he has the power to do it.

All the cruel words which have been uttered with regard to the capitalist during the last 10 years may now be applied to those in power at "Unity House." These men who are content to dislocate the entire railway traffic of the country because one mileman on a branch railway is paid less than the Trade Union rate of wages, decline to pay a clerk 35s. a week for the very extraordinary reason that he is not worth more than 30s.

They seem to scatter consistency to the winds; at any rate, the incident bears witness that the Trade Union leaders will not be consistent unless it happens to suit their policy for the moment. Theirs appears to be the consistency of one "Gineral C.," of whom James Russell Lowell wrote:

> Gineral C. is a dreffle smart man;
>   He's ben on all sides that gives place or pelf;
> But consistency still was a part of his plan,
>   He's ben true to *one* party, an' thet is himself.

Notice to Terminate a Contract of Service.

Employers and employed are constantly troubled with the question—What notice must be given in order to terminate a contract of service? Sometimes, of course, the matter is set at rest by the agreement between the parties; but it more frequently happens that such a calamity as a dismissal is not contemplated when the service commences. A case in the City of London Court, of which we published a report last week, shows the uncertainty there is on the subject. A man had been employed in March, 1912, as a traveller in electric supplies. He was to be paid 35s. a week, with 7s. 6d. for daily expenses, and third-class railway fares, and to receive a commission of 1¼ per cent. on business done. He was dismissed on a week's notice in May. He now claimed damages for wrongful dismissal, asserting a right to three months' notice, and saying that there was a custom in the electrical trade to this effect. The jury were unable to agree as to the custom, but expressed the view that the plaintiff should have six weeks' notice. It may be mentioned that if a litigant places reliance on a custom, he must be prepared to show that such a custom is universally known and recognised. For instance, a domestic servant is entitled by custom to a month's notice. We confess, however, that we have never heard of any custom which prescribes that a traveller in fittings is entitled to three months' notice. From the point of view of an employer who might be saddled with a man who was altogether inefficient, such a custom would be irksome in the extreme, and he would, doubtless, take steps to guard against it in his written agreement.

New Zealand Contracts.

In a recent issue of the Electrical Review we referred to certain new conditions which were being formulated by the Australian Government for the regulation of the adjudication of tenders received for Government work and supplies. It will be remembered that the chief effect of these new conditions was to establish as a principle preference to British tenders, as against those of foreign firms. It is with considerable satisfaction that we now note that conditions which will have a similar effect are to be introduced in New Zealand. On another page (see p. 536) we publish a copy of a notice which the Board of Trade have issued in their *Journal*, and which will show exactly what steps it has been possible for their representative in New Zealand to take. It will be seen that the method by which preference to British tenderers is to be given in this case, is different from that adopted in Australia and, if possible, it is more definite. Under the New Zealand tariff higher duties are leviable on foreign goods than those on British if imported for ordinary purposes of trade. But as Government supplies are admitted free of duty, no matter whence they come, the principle of preference to British trade adopted by the Government has not had any effect up to the present on the importation of Government supplies. It has now been found possible to induce the New Zealand Government to prescribe that in all cases of tenders for Government supplies the amount of the difference between the lower duty on British goods and the higher duty on foreign, which would have been operative had any duty at all been levied, shall be added to every foreign tender before comparison is made between the British and foreign tenders for adjudication purposes.

It is perhaps hardly necessary to point out what a tremendous advantage this will prove to British trade, and as, by reason of the vast supplies of water-power available, the electrical development of New Zealand is destined to be very great in the near future, our electrical firms may look for a decided improvement in their position in this Dominion. The Government, as our columns have shown from time to time, are particularly interested in this development, and are making every endeavour to encourage it as much as possible. The Lake Coleridge scheme is an important beginning, and we hope that the greater part of this scheme at least will be carried out by British firms, although we suppose that the new principle of preference now referred to will not operate in this case.

Finally, we find the greatest possible pleasure in congratulating the Board of Trade on its recent successes. The new position in Australia, as we showed at the time, was almost entirely due to the activities of Mr. Hamilton Wickes, then the Board of Trade's representative in the Commonwealth, and now in New Zealand the changed conditions are apparently the result of the representations of Mr. W. C. Wickham, the Board of Trade Commissioner there. The principle of representation of British trade interests in our own Dominions is of comparatively recent origin, and it is gratifying to find that it has been so practically successful.

Patent Revoked.—The Comptroller-General of Patents announces that an order was made on September 28th, under Sec. 26 (3) of the Patents Act of 1907, revoking the letters patent granted to Ettore Bellini for an invention entitled "Improvements in or relating to transmitters and receivers for wireless telegraphic and telephonic apparatus," No. 11,339, of 1911.

NOTES FROM CANADA.

[From our own Correspondent.]

Specialist in meters, instruments, and switchboard apparatus, design and manufacture; good organiser, requires leading position; prepared to take charge of department or works; excellent credentials. [illegible] / [illegible].

So runs an advertisement in a Canadian technical journal the italics being due to the present writer, and not to the advertiser.

There seems to be a popular idea at home that any Englishman will be snapped up at once as a great acquisition in Canada, and it will, perhaps, not be out of place here to state that *as a general rule*, it is taken for granted that men from the Old Country require educating up to Canadian standards before they can be trusted with work of any real importance, and there is certainly some truth in it, as a new man fresh from home has to learn a number of new terms and methods, and generally readjust his ideas about many things, so that there are very few firms over here who will give such a man a really responsible post at once, even if he be over here, and the futility of advertising for such while still in England, is therefore evident. The "specialist in meters, &c.," might very well have kept his money for some other purpose (*e.g.*, let it go towards his fare over here), for the chance of his getting a reply is remote, while that of his getting a "leading position" is still more so.

The truth of the foregoing remarks illustrating the difference between the Englishman's idea of what Canadians think of him, and what they actually do think of him, is well illustrated in the following, quoted from an address given recently by a prominent man, evidently himself a Canadian:—

"I will first take one historical illustration from that old land, spoken of sometimes by the buoyant and boisterous Canadian, without an accent of noticeable respect, as old, moss-covered, stick-in-the-rut England. I do not admire the harshness of some of the adjectives I have heard lusty, self-confident young Canadians use." Again, quoting from the same source: "In some respects, we, in Canada, are a self-satisfied people. Other people praise us so much that, to be agreeable, we join in the chorus and enjoy a reasonable measure of self-laudation. There is quite a different attitude of mind in England and in Germany and in Scotland."

These quotations sum up the situation extremely well.

While dealing with this subject, it may be well to go a little further.

The same reasons which prevent Canadians from placing too much responsibility on the shoulders of newcomers are those which should be taken into account by British firms sending representatives over here, for these representatives have to be given time, first of all, to fall into the ways of the country, and secondly, to get themselves known and get into that intimate touch with local affairs and sources of information which is so necessary to success in this line of work. Canadians can get hints and information from other Canadians which will not be given to the newly arrived Britisher. This fact is a very serious handicap to him, and principals at home should either be prepared to deal leniently with their representatives for 18 months or two years—the latter period is not too long—or they should not launch out in this way at all. Once launched out, they should at all events stick to their policy for at least the period named, when they may expect to reap the fruit of their patience. The market here is bound to increase for a long time more rapidly than the industries of the country, and there is no doubt that British goods are becoming better known and better appreciated. For any firm to send out a man and expect him to do wonders in the first 12 months is folly, and to abandon the policy of having a man here at the end of such a period because profits have not been rolling in is worse, because they will lose a lot of money, whereas by keeping on they would begin to see a steady improvement. Of course, this assumes a good man, goods of proper quality at a suitable price, and, not by any means the least important item, quick and certain delivery.

One prominent British firm which has been represented here now for some three years appears to be well on its feet, though the earlier portion of this period brought admittedly uphill work.

Reference was made in these Notes some time ago to an article in a Canadian technical journal on the breakage of water-wheels, which was said to be due to defective design; the same paper now reports the bursting of a turbine at the Shawinigan Falls Power Co.'s No. 1 Station. The station was flooded to a depth of 10 ft., one man was killed and nine others had narrow escapes.

A somewhat amusing position appears to have arisen between the Hydro-Electric Power Commission, of Ontario, and the owners of the Chats Falls on the Ottawa River. The owners claim $3,000,000, while the Commission, it is stated, will offer $2,000, the original purchase price; reference was made to this matter in the last "Notes." It will be interesting to see how the arbitrators (presumably this will be a case for arbitration) will "split the difference" in this instance.

The city of Calgary, Alberta, is going ahead as regards electric power; £40,000 is to be spent on electric light extensions—400 per month is said to be the rate at which new connections are being made.

Natural gas is now available in the city, and 2,000 H.P. of stand-by steam plant is to be operated by using this gas for firing the boilers. An official is to look into the question of using gas engines for future extensions, as the water-power available is practically all utilised now.

A French-Canadian company has asked the permission of the City Council of Montreal to construct underground electric tramways, and Parliamentary powers will be sought.

NOTES ON THE ECONOMICAL RUNNING OF LOW-PRESSURE TURBINES.

[COMMUNICATED.]

In most cases where low or mixed pressure turbines have been installed to take exhaust steam from existing engines, a very great saving has been effected.

The saving is greater of course when engines have been running non-condensing, but even where the turbine is installed to take steam from engines which were running condensing, a saving of from 25 to 35 per cent. (depending on the efficiency of the engines and the vacuum obtainable in the turbine condenser) is usual.

The writer has found that users (although well pleased with the results obtained) are not always getting the highest possible efficiency from these plants. Low-pressure turbines are usually designed to run with steam at a pressure of 16 lb. absolute. Should the amount of steam delivered from the engines be too great for the load on the turbine, there are two alternative methods of getting rid of the surplus.

1st. By allowing the surplus steam to pass to atmosphere through an automatic valve, and

2nd. By by-passing the surplus steam to the turbine condenser.

When the turbine is supplied with steam from an engine with a steady mechanical load (such as a mill engine), the turbine is designed to keep a pressure of 16 lb. absolute in the engine exhaust pipe, when both turbine and engine are fully loaded.

When the turbine is installed in a generating station, however, both engine and turbine are connected electrically to the same bus-bars (either direct when both are generating A.C., or through a rotary converter when the engines are D.C. and the turbine A.C.).

As the load changes between the engine and the turbine, the pressure in the low-pressure steam pipe will vary in some cases as much as from 16 lb. absolute to 10 lb. absolute.

It is advisable, therefore, that a compound (pressure and vacuum) gauge should be fitted to the low-pressure steam pipe and in view of the switchboard attendant, so that he can regulate the load between the machines to give as nearly as possible 16 lb. pressure in the low-pressure steam range. The automatic valve should be set to open at 17 lb. absolute; if it is set below this, it will be found that steam escapes even when the steam pressure at the turbine is below that of the atmosphere.

This is due to the delivery of steam from the engines being intermittent—each puff lifts the valve. In some cases which have been brought to the writer's notice, the pressure of the exhaust steam is allowed to fall for considerable periods to 10 or 11 lb. absolute. This represents a loss of about 6 per cent. There is, however, a further saving effected by keeping the pressure in the low-pressure steam pipe above atmospheric pressure.

In most cases where turbines are connected to existing engines there is a large amount of leakage at pipe joints, engine low-pressure glands, &c. These leakages were of no great importance when the engines were exhausting to condensers, as a vacuum of 25 or 26 in. would be obtained. With the turbine, however, a high vacuum is indispensable for economical running.

By keeping the pressure in the low-pressure steam pipe and low-pressure cylinders of the engines above atmospheric pressure no air will be able to enter, and a high vacuum will be possible in the turbine condenser.

In one case within the writer's experience, in which four compound engines exhaust to a low-pressure turbine, a 28½ in. vacuum was obtained when the low-pressure range was sealed by keeping the pressure above that of the atmosphere. When the pressure in the range was allowed to fall 4 lb., the vacuum in the turbine condenser fell to 27½ in., representing a loss in efficiency of 10 per cent. There is, of course, a slight decrease in the efficiency of the engines when the back pressure is increased, but this is very slight compared with the saving effected on the turbine.

The writer has found in practice a saving of 9 per cent. on the overall (engines and turbines combined) consumption, by running with a pressure of 16 lb. absolute in the low-pressure range, instead of 13½ lb.

International Electrotechnical Commission.—We have received from the general secretary, Mr. C. le Maistre, a copy of the Third Annual Report of the Electrotechnical Commission, which contains a brief summary of the history of the Commission and of its proceedings to date. It will be remembered that at the Turin meeting held in September, 1911, a certain number of special International Committees were instituted to carry on the work in its preliminary stages and to draw up proposals for submission to the various local committees, of which there is one in each of 20 different countries. Meetings of these small International Committees have been held in Cologne and Paris, and the work accomplished at those meetings is now being considered in the different countries.

A meeting of the small International Committee on Symbols and on the Rating of Electrical Machinery will probably be held at the beginning of December next, when the observations and criticisms upon the present proposals will be taken into consideration.

In this country the proposals of the Special Committee on the Rating of Electrical Machinery are being considered by the Joint Committee of tho Engineering Standards Committee and the British Electrotechnical Committee. On this Joint Committee both users and manufacturers are represented, so that the industry may rest assured that the detailed propositions of the small International Committee will be very carefully scrutinised.

A new development, which also owes its inception to the Turin meeting, has recently taken place in the appointment, by the President of the I.E.C. (Dr. E. Budde) of a Special Committee on Prime Movers in connection with electrical plant. This Special Committee is the outcome of a report presented at Turin by the Italian Committee. Italy, having no coal, has been forced to turn its attention most seriously to the question of water power, and the Italians feel that the time has arrived when the terms used in this connection, which are so intimately connected with the electrical side of the problem, may usefully receive the attention of the I.E.C.

The appointments on this Committee, which will consist of some eight or 10 members, will be made directly after the Summer Vacation: one or two have, however, already been made, the most important of which is that of Mr. H. Zoelly, of Messrs. Escher, Wyss & Co., of Zurich. The Commission is to be congratulated upon securing the collaboration of a man of such wide experience.

It will thus be seen that the four Special International Committees (on Nomenclature, on Symbols, on the Rating of Electrical Machinery, and on Prime Movers in connection with Electrical Plant) are carrying out a most useful, and, indeed, essential *rôle* by covering the ground work in such detail, and thus paving the way to international agreement upon well-defined lines. Their labours will have the important result of lightening the work of the next plenary meeting of the I.E.C., which will be held in Berlin in 1913.

THE MUNICIPAL TRAMWAYS CONFERENCE.

(Concluded from page 504.)

In our last issue we briefly referred to Councillor Neumann's paper on "Tramway Administration by Municipalities: A Retrospect and a Forecast," one of the main objects of which, as stated, was to discuss whether municipal ownership of street transit has proved a blessing to the community and an advantage over private ownership. That he considers municipal ownership is generally admitted to be justified, is only natural, but he is not unreservedly in favour of all municipal methods.

He admits, for instance, the drawbacks of tramway control by a self-selected municipal committee, pointing out that "to make this even moderately successful, it is essential that the best intellect and ability in the country should be pressed into service."

But the business man generally has his hands full, and political or popular candidates who do attain to municipal honours are obviously a very poor substitute. Councillor Neumann, however, says: "In face of the enormous amount of capital invested in, and the large number of people dependent upon, municipal commercial undertakings, is it not absolutely necessary that they should be controlled by those who are best qualified for the work through their business experience and administrative ability? How this ideal can be achieved may well be left to discussion. It would, indeed, be an anomaly if tramway committees were thus improved in their constitution, that the carefully considered decisions of a practical body of men should still be liable to adverse review by a less well-informed, but numerically stronger body in the shape of the Council. It seems to follow, therefore, that tramway committees would have to be invested with a limited power of self-government, and not subject, to the same extent as now, to the caprice of a higher authority. These may be reforms difficult of accomplishment, but they will probably become necessary if municipal trading is to hold its own against shrewd, keen and businesslike competitors." We entirely agree.

Moreover, the squeezable committee, unable to dissociate philanthropy from business (and one might add, unable to resist municipal pioneering in undeveloped districts), is a continual source of danger in tramway administration, and this applies almost as much to the autocrats in charge of local exchequers, who attack surpluses, as Mr. Neumann says, "more often than not without the consent of . . . . or even consulting the manager or committee concerned."

Whether he intended it or not, Councillor Neumann reveals many chinks in the municipal armour, and as his remarks come from within, we trust that his brother Councillors will profit thereby to the ultimate great benefit of municipal tramway administration generally.

Glancing back over the discussion which followed, one is struck by the unnecessary anxiety which London 'bus developments seem to have aroused even in the provinces. Granted that the London tramway has its "little affair," this is due primarily to the peculiar conditions existing in London, which have no counterpart in the provinces.

In the discussion, **Mr. Alfred Baker** (Birmingham) asked for authentic figures for 'bus operation, commenting strongly on the partiality of certain London papers for the motor-'bus, and on their misleading and utterly fallacious statements and deductions.

Ald. Fred. Smith (Liverpool) felt that the 'bus was quite entitled to use the roads, but that the tramways were unfairly burdened in regard to the latter. Figures of costs in regard to the 'bus were wanted, and at Liverpool they would shortly obtain them from their own 'buses. He considered that competition would lead to increased tramway efficiency, and prevent the present tendency to grant undue concessions.

Mr. W. A. Luntley (Wolverhampton) came to the rescue with some particulars as to the cost of running two or three 'buses in his town, which, on the basis of seven months' operation, and allowing 25 per cent. for depreciation, cost $7\frac{1}{4}$d. per car-mile, but he expected that the figure would increase to 8d. for the year.

Mr. Stephen Sellon urged that 'bus competition should be taken seriously; he considered that the 'bus should contribute to the upkeep of the road, whatever might have been argued as to the effect of railless trolley vehicles. The company director left much more to his manager than the councillor did, and that was where municipal administration was at fault.

Alderman Gee (Huddersfield) made a suggestion that tramway committees might be given similar powers to watch committees, which could not be upset by the Council, and **Alderman Brown** (Leeds) wound up the discussion with a contribution which disclosed many weak points in municipal government.

No figures were advanced in regard to the London 'buses, although we have heard that the modern vehicles cost no more than $6\frac{3}{4}$d. per mile to run, inclusive of all charges—a low figure which appears to be explained by the fact that the company builds its own rolling stock on a wholesale scale, and, it is said, at a cost of not more than [illegible] per vehicle.

A paper by **Mr. W. J. McCombe** (Hull) on "Tramway Fares and their Basis," dealt with this very controversial matter in the abstract. He arrives at an early conclusion that no municipal tramway is in practice worked on strictly commercial principles, and that there is no systematised and recognised arrangement of tramway fares by municipalities. In fact the fare schedule, according to Mr. McCombe, is the result of compromise between sections of the committee who view the subject from widely varying standpoints.

He urges that it is futile to take for granted that fares, either general or particular, are a fixed quantity, or of settled quality, without reference to effluxion of time, change of environment or improvement in general conditions. After carefully dissecting the well-known formula that the 1d. fare is the backbone of tramway finance, he comes to the conclusion that there are indications in favour of a lower popular fare, namely, the $\frac{1}{2}$d. fare, for short distances. But, as in the case of most of his arguments, he points out that only favourable local circumstances would justify its adoption. He says it has been proved over and over again that paper speculations are of little value in order that fares may be settled upon an equitable basis, and recommends a practical experiment as the best method of settling the question.

In conclusion, **Mr. McCombe** considers that philanthropic, patriotic and charitable concessions, and special privileges in other directions are a mistake, and quite undesirable in the case of the democratic tramcar. Tables are given showing the average fares charged per mile for the provincial tramways—the accuracy of which, it is almost unnecessary to add, was speedily challenged by several of those concerned.

The following were the principal points in the discussion:—

Mr. F. Schofield (Leyton) twitted the author as to the abstract nature of his remarks; there was nothing definite. He (the speaker) thought that a more equitable method of comparison would be on the basis of percentages of fares values. At Leyton, inclusive of the original purchase price of the old system, the tramways with 9 miles of route cost about £300,000, and it was misleading to compare such a system with one where capital cost was small. He had changed his opinion in regard to the $\frac{1}{2}$d. fare; density of population might justify its adoption. The dominating influence in London was the motor-'bus, and he admitted its superior mobility on the roads, but thought the tramway could compete satisfactorily in his area by a rearrangement of fares.

Mr. J. Dalrymple (Glasgow) said the burden of the paper was the giving of the longest possible ride for the lowest paying fare, also that it was a mistake to consider the 1d. fare as necessarily the mainstay of tramway operation. At one time he would have strongly disagreed with the latter argument, but he confessed that his opinion had been forcibly changed by experience during the last year or two. At Glasgow the $\frac{1}{2}$d. fare distance had recently been extended from a little over $\frac{1}{2}$ mile to over a mile in length, and he had fought against the change, believing that they were carrying all who wanted to ride, but as it turned out the change had resulted in their obtaining an extra million passengers a week. These entailed extra expenditure, but only few extra cars, as a very large proportion travelled during slack hours, when there was plenty of accommodation available. The change resulted in an increase of from $10\frac{1}{2}$ passengers per car-mile, to 13 passengers per car-mile, and as the new traffic was collected in the inner zone, the problem in future was how to cater for this enormous traffic. It resulted in 50 million additional passengers per annum, and required an extra 30 cars; the expenses were not so much greater, and he believed that in time the additional fares would make up for the loss of revenue through increasing the stage length.

Mr. C. J. Spencer (Bradford) urged the members not to apply the results at Glasgow too generally. In his town they had had a universal 1d. fare before 8 a.m., but this was followed by making all 1d. fares into $\frac{1}{2}$d. fares before 9 a.m. He found at first that the receipts fell *pro rata*, then extra travellers appeared, and now they had to run many extra car-miles to accommodate the traffic, and these were all run at a loss before 9 a.m., resulting in a net loss in receipts. The conditions were quite different from those prevailing in Glasgow.

Mr. J. M. McElroy (Manchester) argued that it was dangerous to suggest the possibility of introducing $\frac{1}{2}$d. fares generally, and he noticed that the author had said nothing in his paper as to their effect on his own (Hull) undertaking. In looking into the conditions there, he found that Hull had about the highest population and revenue per track-mile in the country, thus favouring the low fare. They carried the passenger 2¾ miles for a 1d., and before 9 a.m. all 1d. stages were charged for at ½d. In 1908 the Hull undertaking earned 10·22d. per car-mile, but since the introduction of ½d. fares the annual averages had fallen to 9d., 8·9d. and 9·65d., and he considered that the passengers after 9 a.m. were paying for those before that hour. Fares which were good enough for part of the day should be good enough for all day: but if at Hull the ½d fare were available all through the day, it appeared that it would result in the gross profit being entirely wiped out.

Councillor Heather (Leyton) said the real basis of fares was environment, and in London the 'bus competition was the determining factor. Ald. Brodie (Blackpool) enlarged on the excellencies of the Blackpool system, explaining the simple procedure adopted in his town to overcome 'bus competition. There, with the advent of the tramway car, the Watch Committee refused to license the competing omnibus.

Mr. J. B. Hamilton (Leeds) expressed the view that low fares attracted passengers, and providing the ½d. fare proved a source of revenue, as in Leeds, there was no reason why it should not be adopted. In view of the large surpluses earned in some undertakings, it was a question whether the fares should be lowered, and he thought they should. Where the tramway provided adequate facilities the 'bus should not be allowed.

Rail Corrugation.

On Wednesday afternoon, September 25th, a short discussion took place on the interim report of the Special Committee appointed to inquire into the phenomena of corrugation on tramway rails. This report, which is of a very interesting character, and illustrated with numerous explanatory diagrams and half-tones, can be obtained from the Secretary of the M.T.A.

A Committee was originally appointed to deal with the matter in 1908, and in 1909 it was arranged to co-operate with the Tramways and Light Railways Association, certain members of the latter joining the Committee; Mr. C. A. King, of London, was also appointed advisory engineer, and with a Committee of four carried on the investigations. Inquiry was directed to find whether corrugation—

1. Exists initially in the rail itself.
2. Exists initially in the tire.
3. Is produced by the mutual action of wheel and rail, which action must be one of, or a combination of, the following:—

(*a*) By the ordinary rolling motion of the wheels owing to the rail not being hard enough to withstand the local rolling action.

(*b*) By the wheels slipping.

(*c*) By the wheels skidding.

(*d*) By the radial slipping of wheels and axle.

They issued a list of queries to members of the Association and classified some 6,000 replies which are summarised in the report; they also arranged for experimental work which was carried out at Bradford, Dundee, Glasgow, London, Leeds, Manchester and Sheffield, and is also duly recorded in the report.

The replies show that generally systems most free from corrugation are more hilly than the average, and that climatic conditions have no particular effect. Apparently, neither class of paving, make of rail, method of laying nor anchoring, has any direct bearing on the matter; this also applies to the number of cars using the rail before the appearance of corrugation. On 85 per cent. of the systems the wave length of the corrugation is between 2 and 3 in., the extremes are 1½ in. and 7½ in.; and it is quite frequently found where coasting is habitual.

An interesting section deals with the occurrence and characteristics of corrugation, showing that it occurs on both cast and rolled permanent way material, and is produced by both bogie and single-truck cars. It has been found on cable tramway tracks at Handsworth, Streatham and Douglas, and on many railways, but was not known on horse and steam tramways.

An interesting case of the alternate production (by Erith cars), and removal (by Bexley cars) of corrugation on a tramway at Northumberland Heath (Bexley Heath Tramways) is cited, the route being operated by agreement for alternate periods by the two concerns.

It is pointed out that the two types of cars are very similar, and braking arrangements the same, except that the Erith cars have magnetic track brakes, and the Bexley cars have no track brakes.

The Bexley cars, however, ride more easily owing to improved springing and have chilled wheels, while the Erith cars have steel-tired wheels.

An interesting sequel to the foregoing was the statement at the meeting that since the report was prepared, corrugation had appeared on the Bexley tramways.

The Committee made the following general observations:—

There were indications of corrugation in every possible position, viz., on up and down gradients, on straight and curved track, on one or on both rails, or on either rail separately, alternately, and also intermittently.

Periodical records of corrugations at the same places did not indicate any tendency of the ridges to creep along the rail, although the markings appeared to vary in intensity, and to merge from the defined ridge type to the patch type, and *vice versâ*.

The patch type appeared to exist in conjunction with speeds over 12 miles per hour.

Acid tests demonstrate that the corrugation effect is practically superficial, and that the metal in the hollows is less dense than at the crests. Consideration as to the cause of the hollows leads to the conclusion that cold flowing of the rail material does take place, and if this were combined with a certain amount of attrition, the result would probably be in accordance with the actual state of the rail structure as demonstrated by tests.

The information collected by the Committee (by experiments and otherwise) amply showed that slip and skid are continually taking place, and that a pure rolling motion very seldom takes place even for one complete revolution of the wheel.

The general information placed before the Committee coupled with the striated appearance of the corrugated rails, suggests that corrugation might be created by the alternating slip or skid and rolling action of the wheel during its passage along the rail. Slipping or skidding, possibly in conjunction with rotation, would appear to take place in the hollows and pure roll coupled with increased pressure at the crests.

The Committee do not agree with the theory that cold rolling alone is the cause of corrugation, and describe experiments made with saw cuts in rail heads and artificially produced markings in paint, sand, &c., in support of their contention.

As the result of their investigation, the Committee arrive at certain interim findings, based on the foregoing and including the following:—

Corrugation occurs . . . . with electrically self-propelled rolling stock, the construction of which necessitates a relatively low centre of gravity. . . . It is not necessary that the track or the rolling stock or the wheel profiles should be in a worn or defective condition. . . .

Corrugation appears on the rails independently of whether the wheels are being actively driven from the motors or not. [It is suggested that slip and skid take place owing to different wheel diameters due to unequal wear produced by differences in motor speeds.]

Corrugation may be caused and removed by the same set of cars under apparently the same conditions; it does not exist on tramway rails as received from the rolling mills.

As a suggested measure for mitigation of the trouble, it is proposed that a better steel for rails should be obtained, and particulars are given of the physical tests recommended.

Particulars of further experiments, and information required, are mentioned, and an appendix contains a list of previous papers and reports bearing on corrugation matters.

In the discussion Mr. J. M. McElroy (Manchester) said he was satisfied that the report (of which he gave an abstract on the lines of the foregoing) carried the matter a long way towards solution. In places like Glasgow and Manchester, corrugation cost them as much as £10,000 per annum. In his view micro-photography would help largely towards the solution of the problem and the production of a suitable steel for rails.

Mr. C. J. Spencer (Bradford) read a short report from Mr. King, who was unable to be present, and in which he assumed that the origin of corrugation was a condition or set of conditions which exists clearly with electrically-driven rolling stock. Among the features necessary were pronounced inequality of wheel diameters; side thrust of flanges due to low centre of gravity; holding down of wheels on to hard unyielding track, &c. It was curious that there was no corrugation and very little wear on three London tubes, but in this case the track was very elastic, and the rail yielded about

¼ in. vertically to the passage of wheels, and also laterally, thus reducing wear.

Prof. Carus Wilson considered that it would not be possible to get to the root of the matter until they could produce corrugation to order. Corrugation had been produced on purpose, experimentally on several systems, but could not be repeated when wanted. The Erith case was particularly interesting ; it was the hollow of the corrugation that required investigation.

Mr. Stephen Sellon said there ought to be a representative of the rail manufacturers on the committee ; the manufacturer knew that he was not supplying the best rail for present day use, and the rail composition and modern methods of rolling accounted for the presence of corrugation.

Mr. W. J. Hadfield (Sheffield) pointed out that the rolling mill practice was that approved by Mr. Sellon ; and **Mr. Holt** (Leeds) said manufacturers did not know how to supply the class of rail demanded.

Mr. R. C. Bullough (Colchester) thought the rolling mill was the root of the trouble, instancing the fact that one rail only in a batch was sometimes corrugated ; and **Councillor Knowles** (Sheffield) advocated the presence of both rail maker and metallurgist on the committee.

On Thursday, at the conclusion of the discussion on Mr. McCombe's paper, the delegates and visitors were again entertained at luncheon by the West Ham Corporation, and in the afternoon adjourned to the Exhibition at the Plaistow depôt, many of them proceeding later to a Garden Party at West Ham Park, where musical entertainment was provided by the West Ham School Choirs and the Tramways Band.

In the evening, the annual dinner of the Association was held at the Liverpool Street Hotel, when some 400 of the members and their guests were received by the President and Mrs. Blain.

Mr. A. R. Fearnley (vice-president of the M.T.A.), proposed the toast of "The Mayor and Corporation of West Ham," the Mayor (Alderman Hurry) suitably responding ; it fell to Councillor Rodgers (Newcastle-on-Tyne) to propose "The Guests"—who were numerous—while the toast of "The Municipal Tramways Association," suffered nothing at the hands of the Hon. Arthur Stanley, M.P.

The annual business meeting of the Association was held on Friday morning, when Mr. A. R. Fearnley (Sheffield) was elected president for the coming year, and the Mayor of Salford (Alderman Linsley) was appointed vice-president, Mr. C. J. Spencer (Bradford) being re-elected hon. secretary. It was decided to refer the question of action in regard to 'bus competition to the Executive Committee, with power to act ; the Committee was also empowered to express the views of the Association upon the alterations made to the Light Railways Bill.

ELECTRICAL INSTALLATION AT THE WESLEYAN METHODIST HALL.

The new Methodist Church House and Connexional Offices at Westminster, the formal opening of which took place yesterday, have been erected by trustees with Sir Robert W. Perks, Bart., as treasurer, from part of the Twentieth Century Million Guineas Fund. This striking block of buildings stands on part of the site formerly occupied by the Westminster Aquarium and the Imperial Theatre, and is to the designs and plans of Messrs. Lanchester and Rickards, the architects. Our readers will be interested here more particularly in the engineering equipment and the electrical plant and installation, running into a matter of some £5,500. Mr. T. Kerr-Jones, A.M.I.E.E., of Victoria Street, S.W., was instructed by the architects to prepare specifications and plans for the installations for power and lighting, and he was, after the contracts were let, commissioned by the trustees to superintend the work during its execution.

For power work, electric driving has been adopted throughout the buildings, there being 14 motors, with a total of about 120 h.p. The motors are supplied with continuous current at 400 volts from the mains of the Westminster Electric Supply Corporation, Ltd.

The applications of the motors are sufficiently diverse to give a good example—if one be needed—of the adaptability of the electric motor to all classes of work : these comprise the operation of three kinds of pumps, blowers and extractors for the air purifying and heating system, also passenger lifts, organ blowers, sewage ejector plant, and a battery booster.

Commencing with the pumping plants, it may be mentioned that the whole of the water supply for the buildings is drawn from a 450-ft. well, from which it is raised pneumatically to groups of tanks, most of which are placed well above the highest level of the office block. Pumping from the well is carried out by two vertical air compressors, each driven by belt and gearing from a 15-h.p. motor.

In the room which contains these compressors is also installed a fire service pump. This is of the multiple stage centrifugal type, running at 1,870 r.p.m., and direct coupled to a 12-h.p. motor. Its purpose is to keep charged a tank, situated almost at the very apex of the dome and nearly 200 ft. above street level, by means of which the proper head is maintained on the fire hydrants. From this tank a pressure pipe is taken to a diaphragm pressure relay fitted at the base of the dome. This relay has a metal pointer which moves to the left or right according to whether the head in the tank is below or above normal. If water be drawn from the hydrant the pointer makes contact with an adjustable stud, and so closes a circuit causing the pump to start. When full pressure is again restored the pointer moves away from the stud, and, travelling in the opposite direction, reaches another stud upon which a second circuit is closed and the motor stopped. This relay is connected by three wires running to the basement with the automatic solenoid-operated starter which controls the pump motor. It must, of course, be understood that the tank in the dome is only a pressure tank ; the pump will draw from a storage tank of about 5,000 gallons capacity in the basement. The pumps were installed by Messrs. Arnold Goodwin & Son.

For pumping the condensed steam from the radiator heating system, two vacuum pumps have been installed by Messrs. Ashwell & Nesbit, and these are driven by belt from a 5-h.p. variable speed motor, running at from 760 to 1,000 r.p.m.

In connection with the "Plenum" heating and ventilating system, also installed by Messrs. Ashwell & Nesbit, there are two blowers and one extractor fan. Each of these is driven by belt from a 12-h.p. motor, running at from 770 to 1,000 r.p.m.

In the office block are installed two lifts, erected by Messrs. Wm. Wadsworth & Son. These have solenoid-operated starting and reversing control gear operated by a master switch in the cab and by limit switches, top and bottom. Each lift is driven by means of worm gearing from a 12-h.p. motor, running at 950 r.p.m.

The fine organ, by Messrs. Wm. Hill & Son, receives its wind from two blowers, one of which adds its pressure to the wind furnished by the other, so that both high and low pressure can be obtained. These blowers are both of the "Discus" type, driven by belts from a 5½-h.p. motor, running at 840 r.p.m., and controlled by a solenoid-operated starter, worked from an ordinary tumbler switch near the organist's seat, this latter control circuit being at 200 volts. A similar set of apparatus will be installed for the second organ.

As is well known, the sewers in the Westminster area are very near the surface of the streets, and to raise the sewage from the sub-basement into the drain a duplicate set of "Shone" ejector apparatus has been installed by Messrs. Hughes & Lancaster. The electrical portion of this plant comprises two 1½-h.p. air compressor motors, which are controlled automatically. The air reservoir has pipes leading to diapraghm-pressure relays, which start and stop the motors in accordance with low or high pressure, in an analogous manner to the fire service relays mentioned above.

The motor driving the booster is 7 h.p., and runs at a speed of 900 r.p.m., driving it direct through a flexible coupling. The booster set is of Electric Construction Co.'s make.

The lighting of the buildings comprises about 1,600 lamps, and there are five entirely separate lighting installations—viz., the Office Block, the London, City and Midland Bank, the Public Positive, Public Negative and "Police" circuits.

The supply for lighting is at 200 volts throughout, the lamps in the office and public installations being divided approximately equally between the positive and negative sides of the 400-volt three-wire service of the Westminster Electric Supply Corporation, Ltd.

To meet the regulations of the London County Council, it was originally intended to take the supply for the "Police" circuit from the mains of the London Electric Supply Corporation. After the wiring had all been run on this basis, the result of the litigation between the two supply companies was that the Westminster Co. assumed the management of the London Corporation's system in the Westminster area, and that they were not willing to give a supply from the London Co.'s mains. Under these circumstances a battery was installed to meet the demand for an entirely separate source of supply to feed a certain proportion of lamps in all portions of the buildings accessible to the general public; this battery consists of 108 Type L-11 cells of the D.P. Battery Co.'s make, and is charged during the daytime from the Westminster Co.'s 200-volt supply through a booster giving 45 amperes at 0 to 92 volts. It is capable of maintaining the whole of the lamps on the "Police" circuit for six hours on one discharge.

There are two main control rooms, one in the basement and one adjacent to the great hall, and the greater part of the main distribution and distribution boards are grouped in these control rooms, from which about 40 separate circuits radiate. The sub-distribution boards are placed in accessible positions in different parts of the buildings. About 30 miles of cables and wires and 10 miles of conduit have been fixed.

The materials throughout are to a very high standard. All cables and wires, both for lighting and power, are of C.M.A. 2,500-megohm grade and of Connolly's make, whilst all conduit is of heavy-gauge solid-drawn steel, heavily galvanised inside and out. The whole installation is on the draw-through system, and the large number of boxes installed will facilitate inspections and repairs. All distributing boards are in heavy cast-iron cases, a few being fitted with oak frames on cast-iron shells, and where in view the cases are recessed into the walls.

The fittings in the main halls, reception rooms, conference halls and library, are of striking design, and carried out in real bronze with satin-finish glassware. They were specially designed by the architects, and supplied partly by Messrs. J. W. Singer & Sons, and partly by Messrs. Strode & Co.

A great number of the fittings are in the form of two-light and three-light brackets, and these are all fitted with Strode bracket boxes and connecting sockets, so that a bracket may be bodily removed for cleaning without having to unfasten or disconnect the fitting. The main electroliers are provided with iron disconnecting boxes with porcelain connector fittings, and are lowered for cleaning by means of permanent winches.

Messrs. Dove Bros., Ltd., were the main contractors for the whole of the building, and the whole of the wiring for power and lighting was carried out by Messrs. Strode & Co., who also installed the battery and its apparatus, the water level alarm indicators and the intercommunication telephone system.

The clerk of works was Mr. E. C. Howell, and Mr. C. Hale, who was Messrs. Strode & Co.'s foreman during the execution of the contracts, has been appointed electrician-in-charge.

Theatre Installations.—Messrs. S. Gillitt & Co., of Newcastle-upon-Tyne, are at present engaged in carrying out the electrical installations at the following theatres, &c.: Hippodrome, Newcastle; Royal Theatre, Hebburn-on-Tyne; Theatre Royal, Sunderland; Empire Palace, Easington Colliery; Victoria Theatre, Southbank; Prudhoe Picture Palace, Prudhoe-on-Tyne; Palace Theatre, High Shields, and Summerhill Palace Theatre, Birmingham.

Japanese Failure.—According to a Reuter dispatch from Tokio, it is reported from Osaka that, "as a result of the recent forgeries by the cashier of the Nagoya branch of the Mitsui Bussan Kaisha, who fled after putting into circulation bills in the name of the firm for 700,000 yen, the majority of which were held by local banks in Nagoya and Osaka, the Saiga Electrical Co. has failed. The liabilities amount to 7,000,000 yen."

ELECTRICAL TRADE COMPETITION IN AUSTRALIA.

The report of the British Trade Commissioner for Australia for 1911 draws attention to the fact that during the year foreign firms, particularly American, devoted increased consideration to Australia by sending over special representatives to organise their agency arrangements in the various States, and by improving their selling organisation in other ways. This has been noticeable particularly in the trade in petrol and electric motors and lorries, telephone instruments and material, electrical machinery and material, mining drills, &c. The value of the total imports of electrical machinery in 1910 was £321,327, in which the United Kingdom participated to the extent of £176,119, or 54·8 per cent., the United States £93,036, and Germany £32,539. The following table shows the course of foreign competition in 1910—the figures for 1911 are apparently not yet available—in the several items which permit of classification :—

	United Kingdom.	United States.	Germany.	Other countries.	Total imports.
	£	£	£	£	£
1. Dynamo-electric machines over 200 H.P., and parts ...	22,273	2,994	630	14	25,911
2. Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof...	129,440	73,447	22,717	17,064	242,668
3. Regulating, starting and controlling apparatus, including distributing boards and switchboards, except telephone switchboards ...	19,192	16,595	2,512	2,555	40,854
4. Generators for direct coupling to steam turbines	5,214	—	6,680	—	11,894
Total	£176,119	93,036	32,539	19,539	321,327

It appears that when the question of the amendment of certain headings of the tariffs was under consideration in 1911, it was found possible to obtain preferential treatment for British goods under the headings of "Dynamo-electric machines over 200 H.P. and parts" and "Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof." The duties on these goods from the United Kingdom now are 12½ per cent. and 20 per cent. *ad valorem*, as compared with 17½ per cent. and 25 per cent. respectively on foreign goods. The report also enumerates in detail other imports of electrical materials in 1910 of the separate value of £682,217. The particulars are as undernoted, the respective figures for 1911 apparently being also not yet ascertainable :—

	United Kingdom.	Germany.	United States.	Other countries.	Total imports.
	£	£	£	£	£
1. Electroliers, gasoliers, chandeliers, pendants, brackets and zinc tubing	25,796	1,902	714	29	28,621
2. Electric fitting and appliances, namely, switches, fuses and lightning arresters	19,672	6,434	5,878	2,952	34,936
3. Electric heating and cooking appliances	1,589	175	535	48	2,347
4. Electrical and gas appliances (not included elsewhere) ...	79,094	42,545	19,143	12,734	153,516
5. Accumulators, arc lamps and carbons, cable and wire (covered) carbon in blocks of 12 sq. in. and over, vacuum tubes, measuring and recording instruments and prepared insulating tape	277,105	61,447	9,643	9,437	357,632
6. Telephones and telephone switchboards and appliances	45,974	5,137	3,200	1,048	105,165*
Total	£449,410	117,640	39,113	26,248	682,217

* Includes Belgium £9,557, and Sweden £40,249.

The British share of the above formed 65·83 per cent. of the total, whilst Germany participated to the extent of 17·2 per cent., and the United States to the amount of 5·7 per cent. The bulk of the American trade is with New South Wales, and in some articles German trade is chiefly with Western Australia, a fact which is attributed to a strong distributing organisation in that State. Although British goods as a rule are more expensive, the report states that they are better made and more reliable than those from either the Continent of Europe or the United States, both of which rely for the sale of their goods rather on their low price than on their quality. In some lines British firms are ably represented and are fighting hard to hold the trade.

South African Lighting Association, Ltd.—The directors have declared an interim dividend of 3½ per cent., or 7 per cent. per annum, as compared with an interim dividend of 3 per cent. last year.

THE BRITISH ASSOCIATION.—V.

The Hysteresis Loss in Iron due to a Combined Pulsating and Rotating Magnetic Field.

By T. F. Wall, D.Sc., M.Eng., A.M.Inst.C.E.

While data are available relating to the hysteresis loss in iron due to pulsating and rotating magnetic fields acting separately, no experiments have been made to determine the loss due to their simultaneous action. In the case of a plain series single-phase commutator motor, the iron of the cores is subjected to the pulsating field due to a current in the stator winding, while at the same time the rotor core is rotating. Experiments were made by the author to determine whether the total hysteresis loss was the sum of the losses due to each cause acting alone. The hysteresis due to pulsation is similar to that produced in transformers and can be calculated in the same way. The hysteresis due to rotation is similar to that in a direct current armature, giving rise to a definite torque for each value of the flux, the hysteresis torque in the case of the A.C. rotor subjected to a pulsating field being the mean value of the hysteresis torque curve corresponding to the wave form of the pulsating flux.

The method of investigation adopted was to take "running-down" curves with various D.C. values in the stator windings of the machine used for the test, and also with A.C. in the stator windings. In the latter case, the pulsation hysteresis is supplied from the mains, and the rotor is retarded only by the rotation hysteresis. The D.C. tests enable the rotation hysteresis torque curve to be determined, and the A.C. tests show to what extent the rotation hysteresis is modified by the pulsation of the flux.

It was necessary to use special means for accurately measuring the falling speed, and a stroboscopic method was adopted. As the friction of the ball-bearings slightly diminished at low speeds if the bearings were cold, and the measurements had to be very accurate, the machine was run for several hours before taking a curve.

As the result of his experiments the author finds that :—

The rotation hysteresis torque is very considerably reduced by the pulsating action of the flux for those values of the frequency which are usually met with in practice (20-25 cycles per second). The reduction is about 58 per cent. for the range of flux densities used. The rotation hysteresis is, within wide limits of frequency of pulsation, constant, and for all practical values of the frequency may be considered to be the same for any frequency.

As the hysteresis frequency becomes reduced to very low values, the rotation hysteresis approaches in magnitude the value deduced from a curve connecting the rotation hysteresis torque and direct current in the stator winding.

The explanation of the reduction observed appears to be that the molecules of the iron being set in a state of rapid movement by one cause, the additional movement of the molecules corresponding to the other cause takes place much more readily than if either cause were acting alone.

Experiments for Improving the Construction of Practical Standards for Electrical Measurements.

Report of the Committee; Lord Rayleigh (*Chairman*) ; Dr. R. T. Glazebrook (*Secretary*).

(*Section A. Abstract.*)

The Reports from 1861 to 1911 inclusive have now passed through the press, and it is intended that this, the 1912 and final Report of the Committee, shall conclude the reprints, which will be on sale in the autumn of the present year. It seems desirable, however, that the Committee should remain in existence until all questions connected with the republication are determined, and, accordingly, they ask for re-appointment.

With regard to absolute measurements we have, as the direct result of the work of members of the Committee, two pieces of apparatus which should prove equal to any demand for precise measurements in the absolute system for very many years.

A report on the British Association Ayrton-Jones current balance appeared in 1908, and it was stated at that time that the probable error associated with a determination of current in absolute measure was about two parts in 100,000. Since then the balance has been used on several occasions ; it continues to give satisfaction, and there appears to be no reason for doubt that so far as the absolute measurement of current is concerned an accuracy within at least five parts in 100,000 can still be guaranteed. This conclusion is greatly strengthened by the results which were communicated to the Association last year by Dr. Dorsey of the Bureau of Standards, Washington. At that Institution Drs. Rosa and Dorsey have made experiments with a new current balance, the coils of which are arranged in a manner similar to those used by Joule and by Lord Rayleigh. They obtained results for the electromotive force of the Weston normal cell which agree with those obtained at the National Physical Laboratory within four parts in 100,000. Whether this represents a real difference in the results given by the two balances, or is an actual difference in the E.M.F.'s of the reference cells used, has not yet been decided.

With regard to the absolute measurement of current elsewhere, a current weigher has been built at the Laboratoire Central d'Electricité, Paris, and at the Reichsanstalt further measurements are to be made in the near future. It will be seen, therefore, that the absolute measurement is on a very satisfactory basis. At the National Physical Laboratory no efforts will be spared to maintain the Ayrton-Jones balance in good condition, and to obtain results equal in precision to those obtained at the present time.

Turning to the absolute measurement of resistance, for many years no measurements of this quantity have been carried out, but at the present time the Lorenz apparatus at the National Physical Laboratory and other apparatus now being constructed at Berlin and Washington will place measurements of resistance in a position equally satisfactory with those of current. The Lorenz apparatus is now being employed for the measurement of resistance, and it is believed that the probable error will not exceed two parts in 100,000. This satisfactory state of affairs is largely due to the design and size of the apparatus and the ease with which the dimensions of the coils can be measured. Many years ago Lord Rayleigh showed that it was not necessary to measure accurately the diameter of the coils of a Joule balance ; the ratio of the diameters was sufficient, and this ratio could at any time be obtained by measuring the ratio of two currents. In consequence, with a Joule balance an observer is not handicapped in his measurements by the results of linear observations which may have been made many years previously, and which may be incorrect owing to secular change. With the Lorenz apparatus independence of previous linear measurements has been secured by winding the coils with bare copper wire, and leaving them in this condition. This enables linear measurements to be made at any time with ease and with precision.

Referring to material standards, it is most gratifying to record that measurements of resistance, of current, and of electromotive force are now made on the same basis in practically all civilised countries. This satisfactory state has been achieved within the past four years, and is a direct result of the labours of the London Conference of 1908, in which this Committee was so largely interested.

As is well known, the International standard of resistance is that of a specified column of mercury, and that of current depends on measurements with the silver voltameter. The measurement of electromotive force and of current may be conveniently made by means of the Weston normal cell.

During the past two years comparisons of resistance coils and of standard cells, and comparative experiments with the silver voltameter, have been made by representatives of the National Physical Laboratory and the standardising laboratories of America, France and Germany. The results obtained show the remarkable agreement which now exists between the electrical standards of the four countries named.

The Committee feel that the primary objects for which they were appointed have been achieved, and that the present position of electrical standards—as outlined in this report—is very satisfactory. With a view to completing the business arrangements connected with the republication, the Committee recommend that they be reappointed, that Lord Rayleigh be chairman and Dr. R. T. Glazebrook secretary.

The Determination of the Stresses in Springs.

By E. G. Coker, M.A., D.Sc., Professor of Mechanical Engineering in the City and Guilds of London Technical College, Finsbury.

(*Section G. Abstract.*)

The principal difficulties in determining experimentally the stress in a body of complicated form usually arise from the great variation of stress intensity as we pass from any point to a neighbouring one in the body, and hence any alterations of form and configuration produced by stress and capable of measurement, such as the deflection of a spring, afford little or no information of the condition of stress in the body, unless we are able to formulate a theory of the behaviour of the structure in agreement with the measurements obtainable by experimental means.

In some kinds of springs these conditions are fulfilled very nearly, and it is not difficult, for example, to calculate very approximately the stresses in a helical spring due to a given deflection. In other forms, such as plate springs, the conditions are less favourable, since experiments show that, where plates are built up into a matrix, the rubbing friction between the surfaces in contact is often so considerable that the spring taken as a whole cannot be treated as an elastic body, although each of its separate plates may be considered as such. It is suggested that in some cases experiments on models made of transparent materials may prove of use in determining the stresses in springs built up of curved plates, or constructed from a ribbon coiled in a plane, as in a watch-spring. Experimental comparisons of the stresses in steel and some transparent materials show that the effects produced are very similar, and we may therefore obtain a fair approximation to the stress distribution in a steel spring by an optical examination of a transparent model. A general idea of the stress intensity throughout the whole model can often be obtained by a visual examination.

Optical methods must necessarily be confined to models ; but this objection may be entirely removed if advantage is taken of the thermal properties of materials under stress, the fundamental facts of which were discovered and investigated by Thomson and Joule. It is easy to show that a metal, when subjected to stress within the elastic limit, experiences a very small change of temperature—a diminution for tension stress and an increase for compression stress—and this alteration is proportional to the load applied. This change of temperature can be readily shown by a thermopile ; and, as an example, fig. 1 shows some observations obtained for the case of a tension member subjected to a uniformly increasing load, and rising to a maximum of 21,000 lb. per sq. in. The galvanometer deflections, plotted on a time base, show the diminution of temperature experienced; and since the bar is continually tending to return to thermal equilibrium with the surrounding atmosphere, a correction must be applied to the readings. The correcting factor may be readily obtained from the tail of the experimental curve, and the modified readings then follow the curve shown by II; they are now proportional to the time, and therefore to the rate of application of the load. This and other experimental results show that the thermal effect is proportional to the stress for the whole range of elastic deformation in both tension and compression.

Experiment also shows that the thermal effects produced in a beam subjected to bending correspond to the known stresses across the transverse sections. The case of pure shear is of considerable interest, since it may be regarded as the result of compression and tension stresses of equal intensities at right angles, and the sum of the thermal effects is zero. On the other hand, the optical effect of a shear is proportional to the arithmetical sum of the principal stresses at a point. Both methods of experiment may be advantageously employed in many cases, and in some investigations now in progress on springs and plates of various forms, the results obtained optically are being examined independently by thermal tests. For example, the optical effect of two equal-like principal stresses at a point produces a dark field between crossed Nicols similar to that observed in places where there is no stress at all, so that both cases give the same optical effect. Thermal measurements, however, distinguish between these cases and afford a measurement of the stress distribution where an optical test fails.

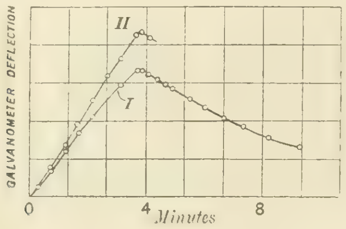

Fig. 1.

The principal difficulty in the application of thermal measurement is in the very small range of temperature—less than 0·05° C. per 1,000 lb. of stress for steel—and the large corrections which are required to allow for the exchanges of heat with surrounding bodies. A third mode of investigation of the stresses in springs and other bodies is offered by the permanent electrical differences between stressed and unstressed metals, a phenomenon discovered by Lord Kelvin. The potential difference available within the elastic limits of a material like steel or wrought-iron is, however, very small, and some experiments made for the purposes of the present paper show that it is less than 0·2 microvolt per 1° C. of difference between hot and cold junctions.

The Water-Power Possibilities of the Highlands.*

"The Economic Aspect of Scottish Water-Power" was the subject of an interesting contribution by **Mr. A. Newlands**, M.Inst.C.E., assistant engineer of the Highland Railway, who said the economic waste represented by the non-utilisation of the water-power possibilities of the Scottish Highlands was at last beginning to receive the somewhat belated attention of industrial life. The north and west of Scotland had the greatest extent of elevated area and the greatest rainfall in the British Isles, with the possible exception of Cumberland, in England. Various estimates of the amount of water-power available in Scotland had been made, and Prof. Forbes, F.R.S., had put the figure at 1,000,000 H.P.

Even if one-half of this amount were accepted, it represented, on a basis of 5 lb. of coal per H.P.-hour, 3½ million tons of coal per annum. This, at 10s. per ton, was worth £1,750,000, which was probably an extremely conservative estimate of the annual value of the Scottish water-power.

The great centres of industry had become too congested and too expensive for the workers. Their housing conditions were unsatisfactory. Rents and taxes were high, and the distractions and expense of large cities were a burden. Employers, on the other hand, were being increasingly hampered by the restrictions imposed on them by combinations of labour, by insurance and liability for workers, and by the restraint of Government supervision, and when to these were added an increased taxation and a rising wages bill, it was easy to account for the growing oncost charges which now represented such a heavy tax on production. The solution lay in the creation of an industrial development in the country districts, and the north of Scotland had exceptional advantages to offer, both by reason of its natural resources and its geographical location. The hydro-electric possibilities of the north were in themselves sufficient to attract and encourage an industrial development, but to these could be added a fine, healthy country population, eager to take up any employment offered to them. Industry in any form could be carried on, as imported raw material could be laid down on the Highland seaboard as easily as in the Midlands of England. The growth of population consequent upon an industrial development such as this would, on a moderate estimate, be not less than five persons per H.P. utilised, so that 45,000 H.P. would create a new population equal to that of the four most northern counties in the mainland. The whole subject was one well worthy the attention of the State, and Mr. Newlands suggested that the policy of State afforestation should be associated with that of water-power development, and that the funds in the hands of the Development Commissioners should be made available for the control and purchase of water rights and development of power as an initiatory step.

Sir Henry Cunynghame, the president, said the importance of the subject was tremendous. The project which Mr. Newlands advocated meant placing at the disposal of the people of Scotland what was equivalent to the produce of a very considerable coalfield—but without the smoke. They might have the whole energy of the water of the Highlands utilised in the service of man without any person seeing anything that would offend his artistic sense. Electricity, unlike steam, could be separated; if they had the industries, they could distribute them all over the place. They need not have the population in cities at all, but could have the people scattered, carrying on such industries as agriculture in summer and other industries, made available by electricity, in winter. He considered that this was one of the most important papers in the whole British Association.

Dr. Scott said that with regard to the Scottish Highlands there were certain difficulties, and one was the cost of transport. With a denser population, however, that would tend to come down.

Mr. W. F. Reid said that unless they worked such a scheme on a very large scale electricity became too costly, and he inquired whether the landowners in the neighbourhood of these sources of power would grant land on reasonable conditions of tenure.

Mr. Newlands, in reply, said as to transport facilities in the North of Scotland there was not a part of the mainland more than 20 miles from the seaboard. He believed that the landlords would sacrifice personal interests if it could be shown that the development of such a scheme would be for the advantage of the Highlands generally, but they would probably resist the attempts of speculators and others who endeavoured to buy up water rights with the view of selling at a profit later on.

The Transmission of Heat.

Mr. C. H. Lander, M.Sc., and **Prof. J. E. Petavel**, F.R.S., described an experimental investigation of the transmission of heat from heated metal cylinders to the surrounding air, which has a direct bearing on the lagging of steam pipes; the temperatures, however, ranged up to 2,000° F., and the pressure in the air enclosure was varied from atmospheric up to 3,000 lb. per sq. in. In the case of steam pipes, the heat loss per hour per sq. ft. per degree F. difference of temperature was measured, with the following results:—

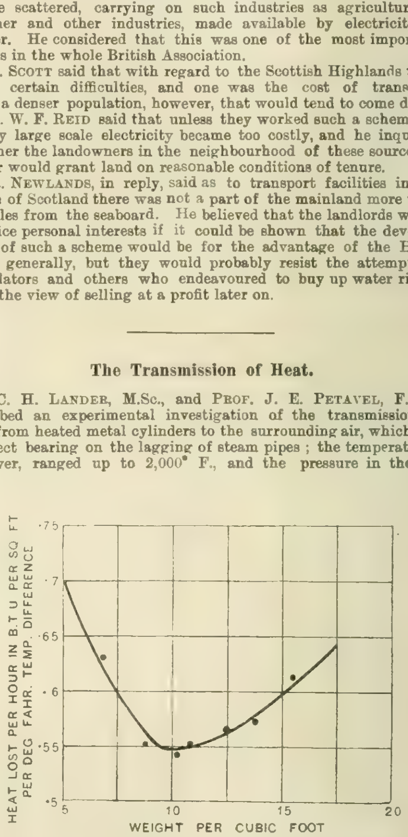

Fig. 1.—Effect of Density of Covering on Heat Loss.

Bare steam pipes containing saturated steam at atmospheric pressure and at 100 lb. per sq. in. gauge pressure, external atmosphere at 60° F.:—

External diameter of radiator, in.	Heat loss per hour in B.TH.U. per sq. ft. per degree F.		Conduction only, taking K = 0·144*.	
	At atmospheric pressure.	At 100 lb. per sq. in.		
0·2	3·94	6·0	0·39	Assuming layer of air to be 4 in. thick round radiator.
1	3·00	4·0	0·13	
2	2·55	2·8	0·089	
3	2·30	2·4	0·074	
5	2.05	2·1	0·060	
12	1·97	—	0·047	

* The constant K is given in B.TH.U. per hour per square foot of surface per degree F. temperature difference for a layer 1 in. thick.

Under the conditions described, the loss of heat is mainly due to convection. In the case of a pipe, for example, 1 in. in diameter, containing steam at atmospheric pressure, the loss by radiation is 0·44 or 15 per cent., and by conduction 0·13 or 4 per cent., so that 81 per cent. is dissipated by convection; at 100 lb. per sq. in. the loss by convection would be about 80 per cent. If the surface of the metal were machined, the loss by radiation would be halved, and if it were polished the loss would be reduced to one quarter.

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* See also Elec. Rev., May 31st, 1912, p. 874.

As all lagging materials are better heat conductors than air, they increase the loss due to conduction; it is necessary, therefore, to arrange them loosely, so as to sub-divide the air space surrounding the pipe as perfectly as possible with the least amount of solid material. The lagging can, however, be too loosely packed, as will be seen in fig. 1, which shows the effect of slag wool under various conditions as regards density of packing. The best result was obtained when the solid material occupied $\frac{1}{17}$ of the total space; the conduction loss was then increased from 0·13 to 0·40, but (assuming radiation to be zero) the convection loss was reduced from 3·2 to 0·14, the total loss being $\frac{1}{6}$ of that observed with the bare pipe.

The loss by radiation per sq. ft. from small pipes diminishes rapidly as the diameter increases, but above 4 in. diameter it becomes nearly constant.

A New Machine for Alternating Load Tests.

By Bernard P. Haigh, B.Sc., Assoc.M.Inst.C.E.

(Section G. Abstract.)

During the discussion that followed Mr. Eden's recent paper on the endurance of metals, references were made to the use of an alternating magnetic flux for producing a pulsating pull in a specimen, and some brief notes were also contributed by the author, describing a machine of this class which had been in use in the James Watt Engineering Laboratories of the University of Glasgow (where it was constructed) for some months.

The present machine is of small size, being intended primarily for testing wire with direct pulls varying up to about 1 cwt.

The construction of the machine is shown in fig. 1, and its principle is illustrated diagrammatically in fig. 2. The lower end of the specimen, W, is attached to the armature A. This is a laminated block of iron, supported on flat springs giving freedom for vertical motion in a small range, directly over the pole P_1 of the magnet. A magnetic flux (indicated by chain lines) is produced by the large coil C, and passes across from the armature to the main pole P_1, thence back to the subsidiary poles P_2 and P_3 by means of the laminated yoke. The total air-gap in the circuit is made small, so that a coil of moderate size is sufficient to produce a very strong flux in the air-gap, developing a strong pull between the pole-face and armature.

When the density of the flux on the pole-face is B lines per sq. cm., the magnetic pull per sq. cm. is given by the expression (Maxwell's law)

$$F = B^2/8\pi \text{ dynes per cm}^2.$$

Taking the area of the pole-face as A sq. cm., the total magnetic flux is (A × B) lines, and the electromotive force induced in each turn of the magnetising coil is—

$$E = 4{\cdot}44\, c\,(A \times B)\, 10^{-8} \text{ volts},$$

where c is the frequency of the alternating current supplied, measured in complete cycles per second. The magnetic pull F is therefore proportional to the square of the ratio of volts to cycles—*i.e.*,

$$F = k\,(E/c)^2.$$

This holds good so long as a constant proportion of the total magnetic flux passes across the gap—*i.e.*, so long as the leakage flux which passes between the sides of the armature and the pole P_1 is a constant proportion of the whole. If this were strictly the case, the pull would depend only on the ratio volts to cycles, and it would be immaterial whether the air-gap varied or not. In practice, however, the leakage flux varies with the gap, and it is therefore important to keep the leakage as small as possible. The leakage flux is proportional to the width of the gap and to the periphery of the vibrator, while the useful flux is proportional to its area; hence it follows that it is important to work with approximately constant gap, and, further, that a large machine (in which the ratio of the periphery to the area is small) is easier to design than a small one, such as that which has been built. Even in this small machine, however, the pulsating pull is fairly constant with respect to variations in the air-gap. The pull increases somewhat as the gap is reduced, and it is sometimes necessary to manipulate the machine skilfully so as to keep the gap constant in spite of slight instability. In a larger machine this would be unnecessary, as the "leakage factor" would be constant.

The small coil C^1 is connected directly to a sensitive voltmeter, and acts like the secondary winding of a transformer. It is introduced so that the voltmeter readings from which the load is deduced may be as far as possible free from leakage errors. The coil is therefore wound with fine wire very close to the edges of the pole-face, so that the greater part of the leakage flux passes outside the coil. In this way the constant k in the equation for the pull becomes almost independent of the size of the gap.

It is not difficult to control the air-gap within the desirable limits when the specimen is not too long. A low-power microscope fitted with a graduated scale in the eye-pieces is handy for the purpose, and allows the range of vibration under any given load to be read off at the same time that any adjustment is being made. When a test of long duration at a given pull is being carried out, it is more convenient to employ an ammeter to measure the magnetising current. As this current is directly proportional to the mean length of the air-gap (for a given flux density), it is a very simple matter to keep the two constant.

If it were possible to avoid eddy currents in the pole-piece P_1 and armature, the strength of the magnetic pull would not depend upon the frequency, but only on the ratio voltage to frequency. In practice, however, the laminations are more or less short-circuited, and eddy-currents are induced which drive the flux to the outside of the pole, increasing the leakage and reducing the pull. As the strength of the eddy-currents is proportional to the frequency, while the pull is proportional to the square of the flux, the pull varies slightly with the frequency, and the machine must be standardised for a number of different frequencies.

It is necessary to use fairly thin stampings, effectively insulated from one another, in order that the flux may be uniformly distributed over the pole face.

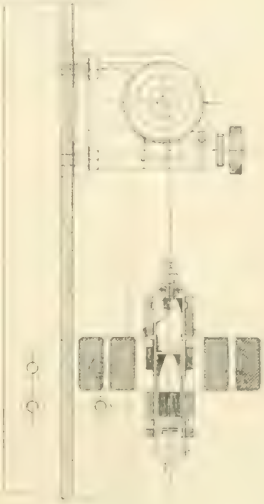

Fig. 1.

The flat springs S_1, S_2 which carry the armature, are primarily arranged so as to guide the armature A between the poles P_2 and P_3, keeping its lower face parallel to that of the pole-piece P_1. By using springs instead of lubricated guides, one ensures the absence of friction, which might easily become a large (and variable) quantity. When working with high frequencies, even the air resistance of the armature and its attachments becomes a measureable quantity, although generally so small as to be negligible.

The lateral stresses are small so long as the air-gaps on the two side poles P_2 and P_3 are equal. Thus the lower spring S_1 is of quite light material, similar to that used in clock springs, and serves only to keep the armature central. It is attached to the armature by the side plates, which pass on either side of the main pole P_1, and is held at the ends by clips D, D attached to the frame holding the yoke.

The upper spring S_2 is made of much heavier material, as it serves the extra purpose of compensating the inertia forces required for accelerating and decelerating the mass of the armature. Although the mass and amplitude are both small, the force required is considerable, as the frequency may be high. The stiffness of the springs may be adjusted to suit the frequency of the test by moving the clamping saddles E, E inwards or outwards on the upper part of the frame.

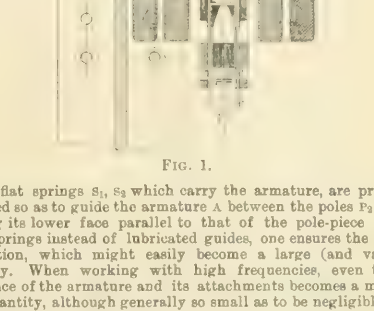

Fig. 2.

It appears desirable to work with a wave of sine shape, as this means that the test is being carried out at one definite frequency, and not with a combination of several frequencies corresponding respectively to those of the fundamental and several harmonics.

The use of a sine wave has the practical advantage that the inertia stresses can be compensated more fully.

To ensure compensation it is sufficient to arrange a spring of the proper strength, so that its rest position, when carrying the weight of the armature, is at the mid-point of the range of vibration required. If the spring is pulled out of this position when vibrating, so that the mid-point of the range no longer corresponds to the rest position, then the specimen will be subjected to a corresponding steady pull, in addition to the pulsating pull of the magnet.

It is easy to provide springs of suitable dimensions to cover a wide range of frequency, provided the armature is kept as light as possible. Lightness is also desirable, in order to minimise the magnitude of the correction.

As shown in the drawing, the spring S_2 (which is, in reality, in two parts) is clipped between nuts on a screwed spindle secured to the top of the armature. By adjusting the two nuts together, the rest position of the armature is moved upwards or downwards as required. The armature may be held in its central position while this adjustment is made, by means of the pin *p* passing through the frames; and in the same way the saddles may be adjusted sideways without any chance of the armature being drawn against either of the lateral poles P_2 or P_3.

It is not necessary in practice to make any calculations when adjusting the span of the springs to suit any particular frequency, for this is more simply and more reliably done by experiment. When the stiffness of the springs is just right for compensating the inertia force at any particular frequency, the natural period of oscillation of the spring and mass together is just equal to this frequency. It may be said that the mechanical system is "in resonance" with the magnetic pull (provided that no specimen is attached, increasing the total stiffness of the system). To determine the frequency corresponding to any particular span of the springs, it is only necessary gradually to raise the speed of the alternator until the armature vibrates with wide amplitude with an almost negligible pull. A range from 120 to 35 extensions per second is obtainable with one set of springs, and other springs might be substituted for other ranges if so desired.

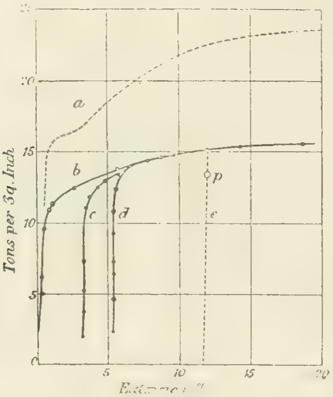

FIG. 3.

Having now dealt with the inertia forces, we may turn to the method of standardising the machine, whereby the constant K may be determined experimentally—

$$P_{max.} = K\,E^2/e^2,$$

where E is the voltage induced in the small measuring coil, and *e* is the frequency—*i.e.*, the number of extensions per second.

This method consists essentially in determining the mean value of the pull of the magnet. When this is known, together with the wave shape of the magnetic flux, the maximum value of the pull is readily deduced. Thus, when the flux follows a sine wave, the pull follows a sine wave of double frequency, and the mean value is exactly one-half of the maximum. The ratio is easily calculated for other waves when the wave form has been determined by the oscillograph.

When standardising the machine, the specimen is replaced by a standard spring, and the inertia of the system is increased by attaching a comparatively heavy mass to the armature. The standard spring is extended until the heavy weight is lifted, and the armature "floats" at its normal level, vibrating in only a very small range, as the extra mass is so great in comparison with the pull of the magnet.

We may now apply a modified form of Newton's law, which states that when a body is vibrating in a constant range with any one, or more, frequencies, the sum of all the constant forces applied must be zero. The pulsating unidirectional pull of the magnet may be regarded as made up of two components; first, a constant pull equal to the mean value: and, secondly, an alternating pull varying in a sine wave. In the case of the armature the four constant forces acting upon its mass, together with the heavy mass attached, are:—

1. The mean value of the magnetic pull.
2. The pull of the standard spring.
3. The force of the control spring (nil).
4. The weight of the armature and the mass attached.

Equating the sum of these four to zero, we deduce that the mean value of the magnetic pull is equal to the pull in the spring less the total weight.

An extra (standard) weight is added, so that the stiffness of the spring may be determined by measurement of the extension necessary to lift the armature back to its normal position. The voltage and frequency are noted, and also the extension of the standard spring necessary to overcome the mean value of the magnetic pull.

The mean value of the pull is thus directly comparable with the standard weight, the values being proportional to the extensions produced. It is, of course, necessary to use a number of standard weights so as to verify the proportionality of the extension of the standard spring to its load within the working range.

The heavy mass for standardising is attached below the armature by means of the extended side plates, which are also used in connection with the guiding spring S_1.

The spring is extended by a small winding drum with worm-gear, which also serves for adjusting the specimen under test. This worm-gear is marked off into divisions which serve as a micrometer, so that the permanent extension of a specimen may be measured by simply noting the angle through which the drum has been turned to maintain the required position of the armature.

Up to the present only a limited number of materials have been tested under pulsating load in the machine, and it may suffice to give some preliminary results obtained from two materials standing at almost opposite extremes of the long range of carbon steels used in the form of wire.

The first of these is a low carbon (0·15 per cent.) annealed wire, breaking under a steady stress of about 24 tons per sq. in., with 20 per cent. extension, while the second is a hard-drawn steel of higher carbon (0·47 per cent.), breaking at about 160 tons per sq. in. with 1·7 per cent. extension.

The results obtained from the ductile material are shown in fig. 3, in which curve *a* represents the autographic stress-strain diagram obtained with a steady load. This test was made with Dr. Barr's wire-testing machine, adjusted so that the duration of loading was 15 minutes. Curve *b* represents the extension of the same material under a pulsating load applied with a frequency of 62 per second. It is clear that extension begins at a much earlier stress, and that the maximum load does not exceed 16 tons per sq. in., which is very close to the yield-point under steady load. It is also remarkable that the percentage extension is very approximately the same for the two curves. Curve *b* represents the greatest extension that has been obtained from a number of specimens. It will be understood that it is not easy to maintain a constant air-gap when extension is so rapid as indicated by the flat curve *b*. The fractures were carefully examined, and do not appear to differ noticeably from those obtained with steady load; in both cases the characteristic local extension of a ductile material was formed. Curves *c* and *d* represent the stress-strain diagrams obtained with pulsating load when the specimen had been previously strained with steady pull and released, leaving respectively 3 per cent. and 5 per cent. permanent extension. The curves rise steeply, and afterwards follow curve *b*; the total extension was again 20 per cent. It is noticeable that curves *c* and *d* are rounded off as they join *b*, and that the rounding appears less with 5 per cent. than with 3 per cent. initial extension. When part of the extension has been carried out with pulsating load, and then subsequently continued, curve *e* is obtained. There is no apparent rounding off at the junction of curves *e* and *b*, but extension recommences sharply when the load reaches its former value. An interval of rest of 24 hours does not appear to alter this result.

When the specimen has been extended by pulsating load, and the load is then somewhat released, say 10 per cent., to the point represented by *p*, it does not appear that any further extension occurs—at any rate after a very short period has elapsed. The reduced load may be reapplied at least 2,000,000 times without further extension, and when fracture occurs it is at the grips, probably due to hammering.

Hard-drawn metals are still more difficult to grip, as the stresses are so high that slipping, on the one hand, and fracture by hammering on the other, are very difficult to avoid. It appears that the strength with a pulsating load is not greatly less than that with a steady load. Thus the better specimens broke with a stress of about 120 tons per sq. in. pulsating, combined with 20 tons per sq. in. steady (applied with the object of minimising vibration) giving a total stress of about 140 tons per sq. in., as compared with about 160 tons per sq. in. obtained in tests with steady load.

Up to the present no clear evidence of fatigue has been found either in ductile or hard-drawn materials. It would appear that ductility is not advantageous in wire subjected to a rapidly pulsating load. On the other hand, the hard-drawn material appears to retain a greater proportion of its strength when tested under a pulsating load.

Gaseous Explosions.

THE fifth report of the Committee appointed for the investigation of gaseous explosions was submitted. It embodied a short review of the present state of knowledge with regard to the flow of heat from the working substance of a gas engine into the cylinder walls. One of the most important questions is the rate at which heat goes into each part of the surface, and the resulting mean distribution of temperature. The greater part of the heat flow occurs in a short time immediately after ignition, and passes therefore into the surface of the combustion chamber and valves and the face of the piston; Dr. Dugald Clerk calculates that the actual rate of flow of heat per sq. ft. per second in the first three-tenths of the stroke is six times that of the whole stroke, in ordinary gas engines at full load, without including radiation before the attainment of maximum temperature. A thin badly-conducting deposit of carbon may materially reduce heat-flow. Radiation is an important, if not the principal, agent in the transfer of heat from the gas to the metal.

An important practical consequence of this is the greatly increased loss of heat which occurs when the mean pressure in an engine is increased by increasing the strength of the mixture. The jacket loss and the metal temperatures are raised in a much greater proportion than the fuel consumption, and the efficiency is diminished. In very large engines this sets a fairly sharp limit to the possible output, which is, as a rule, considerably less than the maximum of which the engine would be capable if it were given all the fuel that it could take. If the load be in excess of this limit the engine overheats rapidly in consequence of the greatly increased heat flow.

The effect of radiation is necessarily to make the heat loss per unit area from a large volume greater than that from a small volume, because the walls receive radiation from the inner layers as well as from the portions nearer to them. The experiments of W. T. David show that the transparency of the products of an explosion while still at a high temperature is very great, and lead to the conclusion that the heat loss per unit area from a mass of glowing gas would go on increasing with the volume of the mass until that volume was comparable with the largest sizes of gas-engine cylinder now made.

One practical aspect of this question is the relation between size and thermal efficiency. In so far as heat flow increases with the volume, the efficiency of large and small engines will become more nearly the same. Of even greater importance practically is the absolute amount of heat flow per square foot, since it is this which determines the internal temperatures, and so sets a limit to the output of the engine. The results cited show broadly that this quantity must be considerably greater in an engine of, say, 3-ft. bore than in one whose cylinder diameter is only one foot, and that the difficulty of designing and working the first is not alone due to the greater thickness of metal, but also to the greater heat flow.

The density of the gas in a gas-engine explosion is from four to seven times that of the atmosphere. In the Diesel engine it is, of course, very much greater. The effect of this factor is greatly to increase the heat flow as compared with an ordinary closed-vessel explosion, where the density is that of the atmosphere.

The most important practical question connected with the relation between density and heat loss is the effect of degree of compression on the working and efficiency of gas engines.

The conclusion gained from practical experience, that there is a point beyond which it will not pay to increase the compression in the gas engine, is in full accord with the results of laboratory experiments on the relation between density and heat flow. Not only is there a point beyond which increasing compression is not followed by an increase in efficiency, but before that point is reached the flow of heat per unit area is increased to an amount at which trouble will begin to arise on account of the difficulty of cooling.

During the suction stroke of a gas engine, or during the period of injection in an engine charged from a separate compressor, the mixture of gas and air which is subsequently to be exploded enters the engine through the valves or ports at a high velocity, so that the gas within the cylinder is in a state of eddying or turbulent motion. This motion gradually dies away after the valves are closed, but will persist for some time during the compression stroke, so that at the moment of explosion there may still be a good deal of turbulence. In consequence of this motion of the gas the convection of heat will go on more rapidly, and what may be called the "effective conductivity" of the gas will be increased.

Clerk found that the result of damping down the turbulence was to retard the rate of inflammation of the gas to a very remarkable extent, so that the character of the diagram was completely altered. If ignition be delayed until the combustible mixture taken into the engine has been compressed and expanded twice and then again compressed, the period of inflammation is about two and a half times that of a normal ignition in which the gases have some turbulent motion. Were it not for this fact, it would hardly be possible to work internal-combustion engines at reasonably high speeds, because the ignition would be too slow. It now appears that this is wholly, or almost wholly, due to the fact that the gas in the engine is in turbulent motion.

Other Papers read at the B.A.

THE following is a list of papers submitted to Sections A and G, of which abstracts have not been published in our pages, but which are of more or less interest to electrical engineers :—

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

"The Heating Effect of Radium Emanation and its Products." By Prof. E. Rutherford, F.R.S., and Mr. H. Robinson.

"The Photo-Electric Properties of Thin Metal Films." By Mr. James Robinson.

"On the Discharge by Ultra-Violet Light of High Speed Electrons." By Prof. R. A. Millikan.

"The Law of the Fall of a Drop through Air at Reduced Pressures, and a Redetermination of *e*." By Prof. R. A. Millikan.

"On a Conductivity imparted to Liquid Air by Alpha Rays." By Prof. J. C. M'Lennan.

"The Origin of the Beta and Gamma Rays from Radio-active Substances." By Prof. E. Rutherford, F.R.S.

"On the Intensity of the Earth's Penetrating Radiation over Land and Large Bodies of Water." By Prof. J. C. M'Lennan.

"Magnetic Disturbances, Sunspots and the Sun's Corona." By Rev. A. L. Cortie, S.J.

"A Machine for Drawing the Curves of Radio-active Changes." By Prof. F. Soddy.

"Photographs of the Arc Spectrum of Nickel under Pressure." By Prof. W. G. Duffield.

"The Current-Potential Curves of the Oscillatory Spark." By Dr. S. R. Milner.

"A Case of Anomalous Conduction in a Solid Dielectric." By Dr. W. F. G. Swann.

"Photographs of a Deposit upon the Poles of an Iron Arc Burning in Air." By Prof. W. G. Duffield and G. E. Collis.

"On the Series Lines in the Arc Spectrum of Mercury and on their Resolution by an Echelon Grating. By Prof. J. C. M'Lennan.

SECTION G. ENGINEERING.

"The Acceleration of a Motor-Car." By Mr. H. E. Wimperis.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Equiluxo" Glassware.

THE GENERAL ELECTRIC CO., LTD., have just brought out a new line of reflectors for use with Osram lamps, under the above title it is designed to give uniform distribution of light without accompanying glare. The material of which this glassware is made is of a milky appearance, having a limpid translucency like that of pure white onyx, and thus allows sufficient light to pass through to illuminate the ceiling. The two principal types in which it is made are illustrated in figs. 1 and 2—the distributing and concentrating types—and these are stocked in a variety of sizes. Bowls, hemispheres and spheres are also made of "Equiluxo" ware.

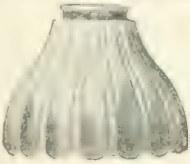

FIG. 1.—DISTRIBUTING TYPE.

FIG. 2.—CONCENTRATING TYPE.

Electric Vacuum Cleaners.

The "Sterdy" vacuum cleaner, which has been put on the English market by MESSRS. SCHOLEY & CO., LTD., of 151, Queen Victoria Street, E.C., possesses some distinctive features, and bears evidence of skill in the design of the motor, which is the most important part of such an appliance. It has been the aim of the inventors to make the apparatus as light as possible, at the same time sacrificing nothing in regard to reliability and efficiency, and hence they have arrived at an appliance which does not exceed 7 lb. in weight.

Unlike similar appliances, the motor is carried in a vertical position, which permits of the design being lighter than when the motor is carried horizontally.

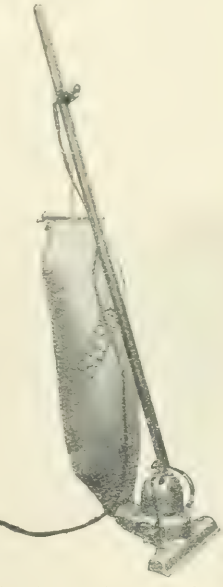

FIG. 3.—THE "STERDY" VACUUM CLEANER.

Unusual care has been given to the manufacture of the motor, which, in spite of its small size, can be used with safety on circuits of 250 volts, without the necessity of putting a lamp or resistance in circuit with it. Moreover, it is made for alternating-current of almost any periodicity, which is a particularly desirable feature, having regard to the extreme variations that exist in this country, both in regard to voltage and periodicity. Provision is made to secure efficient lubrication, and the bearings are specially designed to meet the conditions of a vertical motor. Oiling is not necessary more than once a month.

The makers say that in vacuum cleaners it is a rather desirable feature that there should not be any great air pressure, otherwise it might have a detrimental effect on the carpets if the cleaner were used to any great extent; we understand that the design of the "Sterdy" cleaner allows a low air pressure, but provides for a considerable velocity of the air. The fan is made of aluminium, and runs at 5,000 R.P.M.

An important feature, and one which we understand is patented, is the use of a brush in the mouth of the nozzle, which is claimed to have a renovating effect on the carpet after the sweeper has been used.

Foster Transformers.

The Foster Engineering Co., Ltd., of Wimbledon, S.W., who entered transformer manufacture with their well-known auto-transformer, have extended their operations to embrace large double-wound sets, and have now standardised a series of oil-filled transformers, ranging from 1 to 100 KW., for various voltages up to 3,000 primary and 550 secondary. The cores are of the finest transformer steel laminations, interleaved at every layer and held together by clamps, no holes being pierced through the plates, and great care is taken with the insulation of the windings, which are treated with the firm's heat-dissipating and fire-proofing process. The sub-station transformer, above 40 KW., is housed in a neat corrugated steel case, mounted on rollers. One of them is shown in fig. 4.

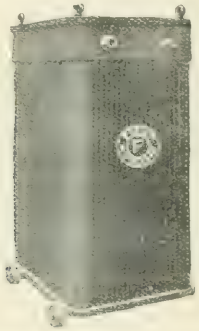

Fig. 4.—Foster Sub-station Transformer.

G.E.C. Three-Phase Distribution Box.

A design of three-phase fuse box has been recently standardised by the General Electric Co., Ltd., in which the difficulty of accommodating the numerous cables in any three-phase distribution box, which is not inconveniently long and narrow, has been neatly overcome by placing the fuses for each phase on separate panels mounted in step fashion. The cables from the lower panels are run below the upper panels, and all are brought out at the top or bottom as required.

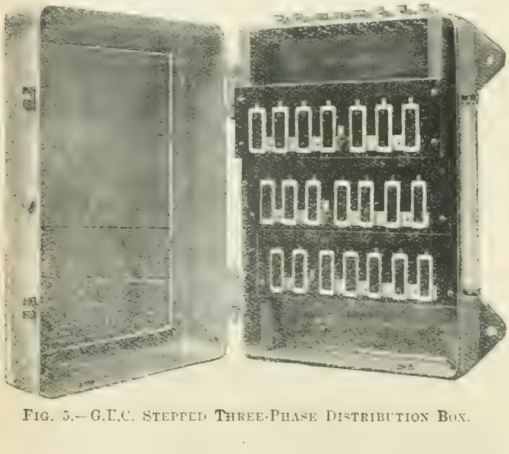

Fig. 5.—G.E.C. Stepped Three-Phase Distribution Box.

A seven-way waterproof cast-iron distribution box of this type, specially designed for industrial service, is illustrated in fig. 5, but the same design has also been applied to glazed boxes for situations in which they are not liable to accidental damage.

Renewable Cartridge Fuse.

Messrs. Ward & Goldstone, of Springfield Lane, Manchester, have recently introduced a renewable type of cartridge fuse, which we illustrate in section in fig. 6.

In appearance, the "T.A.W." fuse is like the usual cartridge, but with rather more substantial finish, metal parts and tongues. It consists of the usual fibre outside tube, into which is fitted loosely a thick asbestos damping tube, and at each end of the cartridge is the metal attachment, which is fitted into the tube and riveted; a vertical slot is cut into this metal portion, through which the fuse wire is threaded. The milled nut clamps up against the projection of the metal pieces fitted in the ends of the fuses, and thus makes connection to the fuse wire. The tongues of the fuse screw into the cartridge ends, and thus complete this article. Should a fuse blow, a new wire can be fitted in a few moments without difficulty, and there is no sand required for refilling; in fact, the fuse wire can be fitted in these cartridge fuses with the same ease as in an ordinary china fuse. The cost of the fuse is rather more than that of the ordinary type, but in use it will be found much more economical, in view of the fact that it can be re-fused innumerable times.

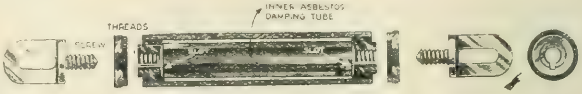

Fig. 6.—The T A.W. Renewable Cartridge Fuse.

Belling Electric Geyser.

The accompanying illustration, fig. 7, shows the complete apparatus employed for rapid water heating in connection with the device which we described in a recent issue: it is controlled entirely by the one hand-wheel shown, which turns on the water first and the current afterwards, and *vice versa*, by means of a mechanical coupling, so that the apparatus cannot be overheated. The equipment as illustrated is entirely self-contained, and the cover, which is nickel-plated, is provided with a lock and key. The water is supplied at any desired temperature up to boiling point directly the handle is turned, and an efficiency of 95 per cent. is claimed for the device. Messrs. Belling & Co., of Lancaster Works, Enfield, are the makers.

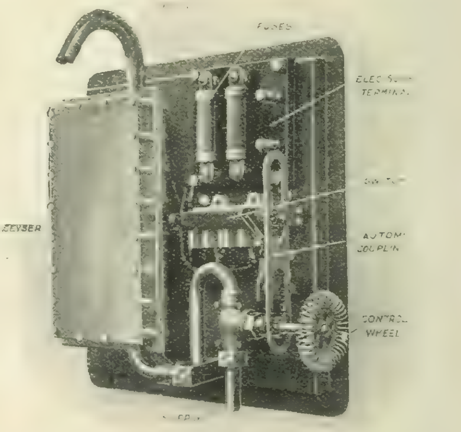

Fig. 7.—"Maze" Pattern, Belling Electric Geyser (Cover Removed).

Publicity Literature.—We have received from the Electric Supply Publicity Committee, of 20a, Tudor Street, London, E.C. (chairman, Mr. A. F. Harrison), a budget of samples of a new issue of publicity literature that is now available for electric supply authorities. Heating and cooking are the main subjects covered, the titles of the leaflets designed expressly to boost these applications being: "Heating by Electricity: Comfort without Labour"; "Electric Cooking: Simple, Hygienic, Cool, Safe and Economical" (with pictures of the Shakespeare Electrical Restaurant at Earl's Court); "Chilly Days" (male and female companion leaflets); "The First Necessity: Electricity in small Households"; "Electricity *versus* Coal and the Servant Problem" (a comparison); "Electric Ironing means Cool Work." Other items include a leaflet on "Artistic Effects with Electric Lighting," and "Electric Power for Lifts," and an application card. The Committee's telephone number is "1109 Holborn."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Is Electric Cooking Proceeding on Sound Lines?

About a month ago I wrote a letter to one of your contempories questioning whether electric cooking was advancing on sound lines. Since then I have seen the interesting papers and discussions that took place at the meeting of the Municipal Electrical Association. Nothing has transpired at this meeting to alter my opinions, but rather to intensify them. There must have been many members present who had doubts on the subject, and it seems a pity they did not face these instead of allowing the cooking enthusiasts to alone give their opinions. In my previous letter I took the averaged hours' use of the maximum demand for cooking as about 2½ hours per day. Mr. Long, in support of his ½d. per unit tariff, was content to take a still lower figure, namely, 400 units per annum per kilowatt of maximum demand, or a daily use of a little over one hour per day.

I entirely disagree with Mr. Long's assumption that it is possible to base the average kilowatt demand for cooking purposes at the low figure of 5 per cent. of the total kilowatts demanded by all cooking consumers. The ½d. tariff falls to the ground utterly if one departs from such ideal figure. One, in the ordinary way, cannot obtain such a figure for power loads which are spread over a nine or 10-hour day. It is inconceivable how such a low diversity factor as 5 per cent. can be obtained where a cooking load at night time would only be spread over a maximum of some three hours. Take a fairly good class district, the majority of people will have dinner or high tea between the hours of six and seven. Most of these cooking operations will entail the demand being used for half an hour to one and a half hours and a diversity factor of 25 per cent. would be a much more likely figure.

The manufacturers of cooking appliances are doing a large business and anticipate big increases in the future. As long as they can prevail upon supply undertakings to supply on low tariffs they are sure of a good business, and it is no concern of theirs if the supply authorities afterwards get into difficulties. I am strongly of the opinion that electric cooking, for the regular every day demand, can never become a sound proposition until the apparatus is designed on heat storage lines or the supply of electricity is given by storage. Where cooking is done on a large scale in private houses or in the case of a restaurant, it would, I believe, be a feasible proposition for the consumer to install a small motor generator and charge a few large capacity accumulators throughout the 24 hours of each day. The heating elements would be on massive lines, and mechanical and electrical breakdowns would be almost non-existent. Makers of electric accumulators would do well to work out cooking on these lines and thus open up a new demand for them. The ½d. a unit enthusiast could then be given full play, and if desirable, he could go further still.

With regard to heat storage, I see no reason why cooking appliances cannot be designed on this principle, so that the average sized private house could get all its heat for cooking purposes with a 24-hour supply at from ·3 to ·4 KW. demand. Tariff of ½d. down to ⅜d. per unit could then be granted with every safety. We are making experiments on these lines with promising results, and I suggest that manufacturers could very much better employ their time in this direction. Current for cooking purposes undoubtedly does, in the majority of cases, superimpose itself on the lighting load, and has in addition a poorer load factor than ordinary private house lighting. To sell such a demand at figures of 1d. down to ½d. per unit will, I contend, in time bring about a dangerous financial position to the undertaking.

A Melbourne firm has brought out a well-designed electric cooker taking from 3 to 3½ KW. demand. There are some 200 of these on order, which will shortly be on the Melbourne mains, and the resultant effect of these is being awaited with considerable interest. The annual sale of units for cooking purposes given by Mr. Cooke, of Luton, is most interesting. When one considers the population of Luton, and that they sold 265,374 units last year, it shows the enormous possibilities of electric cooking. This fact emphasises how very carefully one should approach this subject. Personally, until cooking appliances are designed on different principles to those put forward to-day, I am not prepared to push any of them other than small heating apparatus, such as radiators, irons, toasters, kettles, &c.

P. J. Pringle.

Ballarat, *August 28th*, 1912.

Knife Switches.

I shall be obliged if you will grant me the privilege of saying a few words upon the above subject. After reading the correspondence in the last two issues of the ELECTRICAL REVIEW upon switchboard fires, and more particularly Mr. Chas. C. Garrard's, it made me think that if a few lines appeared in the ELECTRICAL REVIEW upon knife switches they might bring forth some useful correspondence from some of our switchgear experts.

Personally, I have been very closely in touch with switchgear design for the past 12 years, and know pretty well the position of the buyer compared with both the manufacturer and his designer.

Mr. Garrard has brought up a subject which has been a trouble to manufacturers for many years, and nowadays the manufacturer makes both live hinge and insulated hinge knife switches, in order to comply with his customers' wishes.

The purchasers are, of course, mostly consulting engineers and central station engineers; these gentlemen send out their specifications for switchgear, and where knife switches are required they invariably insert a clause somewhat as follows:—"Knife switches must be so constructed that the current does not flow through the hinge."

With all due respect to these gentlemen, my experience is that their knowledge of switchgear is almost nil; I should like to ask the majority of them what experience they have had compared with a switchgear designer who has been at the business for many years.

It is true that they are the buyers; but I say, why do they not ask the opinion of manufacturers of experience?

The principle appears to be for them to work on the old-fashioned method, send out specifications with old-fashioned, and in many cases, most absurd clauses, and absolutely ignore the manufacturer. It is now getting a common practice for switchgear engineers to simply glance through specifications, as they are getting familiar with them.

In the case of some switchgear manufacturers, the weak-minded engineer who is responsible for getting out the drawings and estimates simply works blindly to the specification; the result is that the tender is not accepted, due to the price being too high, caused by an expensively-designed switch or switches.

Switches of the "insulated hinge" type are more expensive than those of the "live hinge" type, on account of the extra part, besides the extra space they take up.

In my opinion, switches of the "live hinge" type are preferable if well made, as the hinge contact has several hundred per cent. more contact effect than the spring clip near the hinge of an "insulated hinge" knife switch.

In connecting "live hinge" knife switches to the cables and bus-bars, &c., at the back of switchboards, I have always taken the precaution to connect the "top" or "break" contact to the incoming supply, so that when the switch is in the "off" position the whole of the blade and the bottom contact are "dead." I am sorry to say that I have known switchboard engineers make the connections the reverse way, namely (and I put it down to their ignorance of electrical connections), they couple the bottom contact to the incoming cable, because it is nearer the bottom of the switchboard, and couple the top contact to the bus-bar, because the bus-bar is immediately above it. Perhaps the above is the reason why customers cry out for "insulated hinge" knife switches.

To conclude, I would like to relate the following incident which occurred at the recent Olympia Exhibition. I did not hear it myself, but I did see the knife switch in question, and, if the story is true, it shows what some manufacturers have to contend with. The knife switch was of the single-pole, single-throw, quick-break, live hinge type, and, I should say, of about 1,200 or 1,500 amperes capacity; it was exhibited by one of our leading switchgear manufacturers.

A visitor during a conversation with the representative on the stand, remarked that it was a large switch to have a live hinge. The representative told him that similar switches were supplied to a certain customer who was very pleased with them. The visitor pointed out to him that the said customer would not have "live hinge" switches, and always inserted the "usual clause" in his specifications to the effect that knife switches must not carry current through the hinges. Imagine the visitor's surprise when he was told that the reason for inserting the usual clause in specifications was simply to prevent other, and mostly smaller, manufacturers from quoting.

Switchgear.

September 30th, 1912.

Switchboard Fires.

I can only assume that Dr. Charles C. Garrard was unable to find time to peruse my previous letter carefully. If he will turn to the letter again, he will find that my remark that switches should be designed so that the current does not pass through the hinge, referred to switches of the ironclad type.

I am aware that there is an open type knife switch on the market carrying current through its hinges, which leaves little, if anything, to be desired, but I think Dr. Garrard will be the first to admit that such a design does not lend itself economically for enclosure in a cast-iron case. Apart altogether from the question of rapid and uncontrollable make and break, it is desirable with enclosed apparatus that the length of arcing surface shall be as great as possible. The best results are obtained when the switch blades are designed to have a double parallel break in series. Fortunately this need not necessarily complicate the construction.

Herbert Berry.
Berry, Skinner & Co.

London, E.C., *October 1st*, 1912.

NEW ZEALAND GOVERNMENT CONTRACTS.

Preference to British Goods.

The following is a copy of a notice issued by the Board of Trade, and referred to in our leaderette on page 523:—

"The attention of the Government of New Zealand has recently been directed to the fact that the right of its Departments to import duty free all goods purchased by them (whether free or dutiable under the Tariff) has, in a number of instances, resulted in the preference accorded by the Tariff law to goods of British origin being nullified in the case of Government purchases. H.M. Trade Commissioner for New Zealand (Mr. W. G. Wickham), who has been in communication with the Government of the Dominion upon the subject, now reports that it has been decided to lay down as a general rule governing all purchases of Government supplies and the acceptance of all Government tenders, that in all such cases there shall be added to the prices quoted for goods not of British origin the excess of duty payable under the tariff on such goods over the amount payable on similar goods of British origin, and unless the price to be paid for the British goods then considerably exceeds the calculated price for foreign goods, the British tender is to be accepted. Where there are special advantages in the quality or character of the foreign goods this rule may be departed from, but only after the submission to the Minister concerned of a report giving detailed reasons for such action."

BUSINESS NOTES.

Electrical Trade in South Africa.—The report for 1911 of the British Trade Commissioner for South Africa states that although the major portion of the imports of electrical goods last year was required in connection with the conversion of steam to electrical driving in the mines of the Witwatersrand, municipal and other industrial, as well as domestic requirements, bulk largely in the total value of the imports. In 1907 the value was £313,838, whereas in 1910 the electrical imports increased to £1,444,869, but in 1911 the imports declined by £394,654. The Commissioner expects a further decline in the present year, although he states that a part of the proceeds of the second debentures of £1,000,000 recently issued by the Victoria Falls Power Co. will go towards keeping up the present scale of imports. The hope is expressed that British firms will participate in the placing of these orders, seeing that the issue is not "tied up" with German financial corporations, as on former occasions. The details of the imports are set forth as follows:—

	1907.	1910.	1911.
Electrical machinery	£156,201	£810,292	£534,141
" fittings (including posts)	76,307	360,392	266,465
" cables and wires ...	74,254	260,834	229,883
Telegraph and telephone material	7,076	13,351	19,726
Total ...	£313,838	£1,444,869	£1,050,215

In addition to the foregoing the imports of stores for the use of the Union Government comprised electrical machinery of the value of £14,203 in 1911 as compared with £21,658 in 1910; electric cables and wires, £62,632, as against £43,681; electric fittings, £15,184, as contrasted with £24,300, and telegraph and telephone materials of the value of £77,061, as compared with £144,808 in 1910. The imports into Rhodesia, which are also cited separately, scarcely reached a total of £7,000 in 1911, as against £4,300 in the previous year.

New Factory at Willesden.—Owing to a large increase of business, the Crypto Electrical Co. have found that the additions which were made to their Bermondsey Street factory at Christmas, 1911, are insufficient to meet the demand for their standard machines. In order to deal with this increase, they have purchased a larger piece of land at Acton Lane, Willesden, on which they have erected an up-to-date factory, which is now equipped with new labour-saving plant for putting standard pattern machines through in large quantities. This factory will act as an auxiliary to those in Bermondsey Street, which will continue without any alteration.

The Crypto Company's New Factory.

For Sale.—The buildings, tools, stores, stocks, goodwill of the business, &c., of the Sunbeam Lamp Co., Ltd. (in liquidation), Gateshead, are offered for sale by private treaty.

The Bray U.D.C. have for sale a 75-kw. alternator, with exciter.

The Chinese Engineering and Mining Co., Brussels, has for disposal one Goerlitz compound steam engine of 1,200 e.h.p., coupled to a Siemens-Schuckert three-phase alternator, with exciter, one rotary converter, one three-phase transformer, switch plant, &c.

Mr. A. Warren will, on October 9th and 10th, sell by auction at 22-28, Mossbury Road, Clapham Junction, S.W., the stock and plant of Mr. G. A. Gunn, electrical engineer.

Messrs. P. Huddleston & Co. will, on October 10th, sell by auction, at 16, Long Millgate, Manchester, a quantity of electrical apparatus, &c. See our advertisement pages in this issue.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet (O.S. 1,596) giving illustrations, prices, and particulars of current consumption, cost of burning, &c., of standard type Osram drawn-wire lamps. Contractors can have quantities of the list overprinted as usual.

Messrs. Fyfe, Wilson & Co., 155a, St. Vincent Street, Glasgow.—Eight-page booklet containing testimonials from users of the Kelvin petrol and paraffin-driven electric generating sets.

Messrs. L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester.—Price leaflet concerning "Capella" carbon-filament and "Wrendal" metal-filament lamps.

From Messrs. Greenwood & Wells, of 25, York Place, Baker Street, London, W., we have received a 20-page pamphlet entitled "Coal—Treated with a Little Consideration," in which the advantages of coal-testing, the purchase of coal on a calorific value basis, and a number of other matters are referred to, a scale of fees for testing being given.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London, E.C.—Pamphlet giving particulars, with prices, of their "London" and "Henley" tapes.

Messrs. H. & T. Danks (Netherton), Ltd., Netherton, Dudley.—Forty-page catalogue well and fully illustrated, containing full descriptive information relating to their various types of steam boilers, namely, Lancashire, Cornish, "Galloway type," dry-back marine, and the Netherton vertical water tube, also steam fittings, "Sisson" superheaters, steel chimneys, water softeners, heaters, and purifiers, steam cylinders, quick-sealing doors, air receivers, &c.

Messrs. British Insulated and Helsby Cables, Ltd., Prescot. Two new catalogues. One of 24 pages contains illustrations of, and a great deal of tabular matter (including dimensions and prices) relating to, their several types of "Prescot" enclosed fuses. The other list (eight pages) describes fully (with excellent illustrations), and gives prices of, Prescot joint-boxes.

The Indestructible Cable Co., 20, High Holborn, London, W.C.—Illustrated price list of wood bell pushes, pear pushes, ceiling roses, adapters, &c., made by Messrs. Beran & Kneller.

Messrs. Hick-Diesel Oil Engines, Ltd., 11, Queen Victoria Street, London, E.C.—New and revised catalogue relating to their Diesel engines, with an explanation and description of a typical installation. Diagrams and half-tone views are given. In addition to their low-speed type the company are now making the high-speed type.

Book Notices.—The *Murray Printing Telegraph Journal*, Vol. I, No. 2, was published on August 30th; the first number appeared two years ago, but the editor, Mr. Donald Murray, states that he hopes to publish future numbers at least once a year. In the present issue an account is given of his recent visit to America, where he inspected the various printing telegraph systems, and disposed of the United States rights for the Murray multiplex system to the Western Union Co. The apparatus will be manufactured by the Western Electric Co., which is allied with the Western Union. Mr. Murray was impressed with the merits of the Morkrum Co.'s system, and arranged to represent that company in Europe and other countries outside North America. He remarks that the Baudot alphabet is now generally admitted to be the best for machine telegraphy. Some interesting comments are made on the typewriter position in America. Other notes relate to the extending use of silver as a substitute for platinum contacts, electromagnets instead of permanent magnets in polarised relays, the use of small letters (lower case) without capitals for printing telegraphs, and the rapid progress of the Edison nickel-iron accumulator.

"Der Elektrizitatszahler." By R. Ziegenberg. 1912. Berlin: H. Meusser. Price M 10.

"Magnetic Properties of Alloys." Reprinted from the *Transactions* of the Faraday Society. London: The Faraday Society. Price 7s. 6d.

"*Proceedings* of the Physical Society of London." Vol. XXIV, Part V. August 15th, 1912. London: *Electrician* Printing and Publishing Co. Price 4s.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 6. June, 1912. New York: The Society. Price 75 cents.

Trade Announcements.—Messrs. Isaria, Ltd., 208, Tower Bridge Road, London, S.E., inform us that according to the new Post Office system their registered telegraphic address should read "Isarialim Berm. London." The indicator word Berm. can be left out for foreign telegrams or cablegrams.

Acting on medical advice, Mr. J. A. Brockett, electrician, &c., of Station Square, Whitby, has relinquished his business and sold it to Mr. T. H. Beecroft, and it will in future be conducted by this gentleman.

The *Financial News* Amsterdam correspondent says that Messrs. Philips & Co., of Eindhoven, Holland, who are a considerable factor in the international export trade, have turned their business into a limited liability company. "The issue of 2,200,000 fl. 6 per cent. profit-sharing preference shares was 24 times over-subscribed, and the shares have risen within a few days from 104 to 110 per cent."

The New Garter Foundry Co., Ltd., are removing to more convenient premises at Groveland Foundry, Dudley Port, Staffs.

Messrs. Safety Light, Ltd., have opened showrooms at their new address announced last week (118, Queen Victoria Street, E.C.).

The Indestructible Cable Co., 20, High Holborn, W.C., have recently taken over the agency here for Messrs. Beran & Kneller G.m.b.H., of Potschappel, Germany, manufacturers of electrical bell pushes and all classes of wood turnings for the electrical trade.

Bankruptcy Proceedings.—Albert Edward Martin (trading as the Midland Electrical Supply Co.), electrical engineer, 39, Great Charles Street, Birmingham, Warwick.—The first meeting of creditors herein was held last week at the offices of the Official Receiver, 191, Corporation Street, Birmingham. The statement of affairs showed gross liabilities amounting to £1,262, of which £793 was expected to rank for dividend, and the assets totalled £64, leaving a deficiency of £729. The failure was attributed to want of capital, having to pay interest and insurance premiums in respect of borrowed capital, loss on contracts, and heavy law costs of suing creditors. It appeared that the receiving order was made on the petition of creditors, the act of bankruptcy being that the debtor executed a deed of assignment to a trustee for the benefit of his creditors. It was stated that the debtor was formerly a partner in a business which supplied electrical accessories, from which he drew about £3 10s. weekly. In June, 1908, the partnership was dissolved, the debtor leaving the firm and receiving, as his share of the business, £120. He started business with this amount at Moseley Road, under the style of the Midland Electrical Supply Co. He removed to 69, Great Charles Street in August, 1910, and three months later to 39, Great Charles Street where he continued to trade until August last, when notice was given to his creditors that he had suspended payment. The books of account have been fairly well kept, but he has not prepared a balance-sheet or profit and loss account since June, 1910. The balance-sheet at that time showed a deficiency of £249. According to a trading account from June, 1910, to the date of the receiving order, a net profit was made of £248 odd, while the household expenses were estimated at £557. The debtor admitted that he became aware of his position in June, 1909, when a friend investigated his affairs. The matter was left in the hands of the Official Receiver.

Osram Week, 1912.—The General Electric Co., Ltd., of Queen Victoria Street, E.C., encouraged by the success of "Osram Week," 1911, have decided to repeat the campaign during the current month. It is hoped that the 1912 "Better Lighting" Campaign, which commences on Monday, October 14th, will be even more successful than that of last year. Our readers will find a fairly full reference to the matter in an advertisement appearing in this issue, and it will be observed that a strong, fully-organised effort will be made during the days named to impress the Osram claims upon the minds of millions of householders, shopkeepers and others, by the medium of a gigantic Press-advertising scheme, by the display of posters on hoardings, by circular letters advising hosts of electricity users, actual and prospective, to consult electrical contractors in their particular district, and so on. We have before us at the time of writing a good deal of explanatory literature, specimen newspaper advertisements, &c., relating to the scheme, upon which an enormous amount of ingenuity and work have been expended. It is not necessary to enter here into all the detailed conditions and advantages affecting electrical contractors and factors who are willing to co-operate with the company in this mutually profitable "sales-making" effort, but we are asked to bring the matter to the notice of all who may be interested, so that they will lose no time in applying for the full particulars, wherein are explained the manner in which their own local businesses may receive a suitable advertisement in the newspaper Press, and the manner in which they can make their own effective Osram electrical exhibition for the week. A special design for a window show will be circulated. Special portfolios and order forms, without names and addresses, have been prepared, and copies of these will be sent to parties prepared to co-operate. If desired, these can be printed with the local firms' names and addresses, but, as will be observed, the time is short.

Dissolutions and Liquidations.—Zedecco Batteries, Ltd.—At a meeting held on August 26th, at 64, Broad Street Avenue, E.C., it was resolved to wind up voluntarily, with Mr. H. A. Kidd as liquidator.

Berry Construction Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. J. C. Wrist, the liquidator, at the office of the British Electric Transformer Co., Ltd., at Hayes, by November 29th.

Economic Electric Co., Ltd.—A meeting is to be held at 51, North John Street, Liverpool, on November 1st, to hear an account of the winding up from the liquidator, Mr. F. T. P. Deyes.

Sunbeam Lamp Co., Ltd. (in liquidation).—A notice is published in the *London Gazette* for October 1st notifying that by an order of the Court, dated September 13th, Mr. G. E. Corfield, of Balfour House, Finsbury Pavement, E.C., has been appointed an additional liquidator to act jointly with Mr. Thomas Wallace.

Stockall-Brook Time Recorders, Ltd.—A meeting is to be held on October 30th, at Huddersfield, to hear an account of the winding up from the liquidator, Mr. O. Avison.

M. A. Ritter & Co., dealers in rubber, gutta-percha, balata, &c.—Messrs. O., M. A., & O. H. Ritter have dissolved partnership. The business will be continued by Mr. O. Ritter.

LIGHTING and POWER NOTES.

Argentina.—The German Oversea Electric Co., in Buenos Ayres, which supplies yearly upwards of 200,000,000 kw.-hours, and whose works have a capacity of 90,000 kw., is threatened with competition from two quarters. An Italian-Argentine company is seeking a concession from the T.C., and the Compania de Tranvias Lacroze, which is concerned mainly with tramways, but has not yet attempted the construction of the, some time since officially sanctioned, underground railway, is applying for Government confirmation of its right, also to supply light and power in the city. Respecting the application of the former company, the German company has addressed a protest to the T.C., and declared its intention to so cut rates for consumers, when its competition station is ready to begin working, as to destroy the latter's commercial *raison d'être*. The power of the tramway company, with its other schemes in hand, to offer a serious competition with the wealthy German company, is regarded as small.—*Elektrotechnische Zeitschrift*.

Mr. C. F. Moujan, on behalf of a syndicate of Belgian, English, French and North American capitalists, has applied to the Buenos Ayres Municipality for a concession to erect electric power houses for the supply of current for public and private services, the concession to be to December 31st, 1957, when all would revert to the Corporation.—*Review of the River Plate.*

Australia.—According to the *Financier*, it is officially stated that at Altona, eight miles from Melbourne, an extensive area of brown coal has been mined for some time by a local company. This company has now been bought out by a body of English and American capitalists, who have been responsible for the erection of large electrical undertakings in Canada and South America. A power house is to be constructed, and it is stated that up to £3,000,000 for development will be provided, if the industrial development warrants it. The purchasers financed a similar undertaking at Rio Janeiro, the largest individual power scheme in the world. The primary aim of the purchasers is the supply of current for power and lighting to Melbourne and suburbs.

Bainbridge.—The Aysgarth R.D.C. has given Mr. J. Cockburn permission to erect overhead wires at Bainbridge for an electric light installation.

Ballybay (County Monaghan).—A scheme is on hand for the electric lighting of Ballybay. The town has been surveyed and plans and specifications made out.

Bexhill.—As a result of the Council's appeal, the net assessment of the electric light undertaking has been reduced from £1.600 to £1,300.

It has been decided to lay cables to provide for the lighting of the new road to Sidley, St. George's Road and St. David's Avenue, at a cost of £343, and to establish a sub-station to meet the requirements of the rapidly developing district at Little Common.

With regard to certain suggestions for using electric light surpluses for the relief of the rates, the town clerk has drawn the attention of the Council to a section of the order, which states that, after paying interest on the money borrowed, &c., a reserve fund must be formed from the profits of the undertaking, and until it reaches a figure of 10 per cent. on the capital borrowed, no money is to be paid in relief of rates. According to this, the Council should have a reserve fund of £7,400, whereas it only amounts to £1,224, and it would, therefore, be a very long time before any money could be paid in relief of rates.

Birmingham.—It is proposed to erect a new boiler house at Summer Lane electricity generating station at an estimated cost of £12,894.

Blackburn.—Reporting further to the Electricity Committee on the necessity for a new power station, Mr. Wheelwright, the electrical engineer, states that the sacrifice involved will not be great. The total capital raised up to March 25th was £293,199, of which £286,055 has been actually expended, leaving a balance of £7,144. A sum of £99,673 (practically one-third) of the capital raised had been paid off, leaving an outstanding debt of £193,526. This figure represented, in addition to the balance of £7,144, an expenditure, firstly, on the mains and distributing system, &c., of £97.765, which would not be affected by the proposals: and, secondly, a capital of £88,617 actually represented by the Jubilee Street works. In its final condition as a transforming station this would have a substantial capital value of about 50 per cent. of this figure, which reduction he confidently anticipated would be more than balanced by the larger margin between cost and revenue on sales of energy from the new works. A suitable position for the new generating station should be obtained adjoining the railway and canal on the outskirts, and as near as possible to a good power district. After careful investigation he suggested that a portion of the Greenbank estate, owned by the Corporation Gas Committee, would satisfy the main points, and the close proximity of the gas works might possibly bring about the use of gas for boiler firing. "I have no hesitation," adds the engineer, "in stating that the necessary capital to build and equip a generating station of equal capacity will be very much less than one built 10 or 15 years ago. In view of the demand for power now in sight, additional provision will be required for the winter of 1914 to 1915, and as it will take from 12 to 18 months to carry out the scheme, the obtaining of the sanction of the L.G.B., and the erection and equipping of the station, the question should be considered at once."

Bolton.—The Electricity Committee has decided to ask the Finance Committee to direct application to be made for sanction to borrow £120,000 for the purposes of the proposed generating station at Back-o'-th'-Bank. It was also resolved that the structural work at the new station be carried out in ferro-concrete and brick.

Bristol.—The B. of G. has decided to have the electric light installed at Stapleton Workhouse, at present lit by gas, at an estimated cost of £1,016.

Canada.—The Ontario Hydro-Electric Commission has expropriated the Chats Falls, near Ottawa, from the owners. The offer made by the Commission is $2,000. The owners ask $3,000,000, quite a margin between the offering price and the price asked. The falls are very valuable, and according to our correspondent, probably worth the price asked, as it is possible to develop 150,000 H.P., and they are only 28 miles from Ottawa, which expects to obtain what power it requires from that source.

The Winnipeg ratepayers have endorsed a by-law giving the Council power to spend $750,000 on an electric distribution system.

At Sandy Falls, eight miles north-west of the Hollinger gold mine, Porcupine, Ont., the Porcupine Power Co. has installed an electric power plant for the purpose of supplying power to the district. The installation consists of two generators of 1,500 H.P. each, and a third unit can be added. This company is now supplying light and power to the towns of Porcupine and South Porcupine, and to the Hollinger, McEnaney, Plenaurum and Dome Mines. The mines are now in the fortunate position of having power developed for them almost before they can utilise it.

The Ontario Hydro-Electric Commission has prepared a book of "Regulations and Rules for Inside Work." These have been framed with the object of ensuring that the design, materials, construction, equipment, workmanship and maintenance of electrical work and installations throughout Ontario, as well as repairs, alterations or extensions thereto, shall be in accordance with the best commercial practice, and that the interests of the public, workmen and others, shall be duly guarded, both with regard to safety, to life, limb and property, and convenience. These regulations are being sent out to the different companies and individuals who are interested.

Our correspondent adds: "There is a great deal of poor wiring in this country. A short time back the chairman of the Board of Underwriters, Montreal, wrote the City of Ottawa to at once appoint an electrical inspector, permanently, and have all wiring into buildings inspected, as they were led to believe, and rightly, that there was much very poor wiring in the buildings of the city."

The Quebec Light, Heat, Power and Railway Co. showed earnings for the year ending June 30th, 1912, equal to 2·11 per cent. on the common stock, after all charges, save dividends, had been provided for. This meant that had no dividends been paid, the surplus for the year would have been $211,200. The fixed charges of the past year were $204,000 more than in the previous year, while the amount written off to organising expenses was $7,000 less this year than last. A French representative was present, and asked certain questions with respect to expenditures on the Quebec and Saquenoy railway, which were not answered. Light was expected to be thrown upon the situation as respects the relationship between the Quebec Railway and the Quebec and Saquenoy, but none was forthcoming, though Sir Rodolphe Forget was present. This retinence on the part of the company has caused some suspicion, which is not to the ultimate interest of the company, nor to that of the Quebec financier, Sir Rodolphe Forget.

The Ottawa municipal electrical undertaking will show bigger profits this year than last, notwithstanding the fact that the management cut their rates for lighting almost in half a year ago. Much more light is being used this year than last, and nearly double the number of lamps are used by consumers. Ottawa uses more lamps than any city in America, it is said, averaging out at four lamps *per capita*.

Cheltenham.—The B. of G. has accepted the offer of the borough electrical engineer, Mr. Bache, to draw up a specification and approximate estimate of the cost of installing the E.L. at the Workhouse premises. A return of the gas and fuel consumed in the Workhouse is to be prepared.

Consett.—The Durham County Council has accepted the offer of the Durham County Electric Power Co. to extend the mains so as to supply current to the Consett secondary school, the Council to pay £39, £25 of which is to be repaid when the extended main is utilised for public lighting next year.

Continental Notes.—FRANCE.—The Energie Electrique du Littoral Méditerranéen has placed an order with the Thomson-Houston Co. for the supply and installation of the plant at the transformer station to be built at Pennes, in connection with the supply of current to the city of Marseilles. The plant will first consist of a single group of four transformers, one a reserve; but ultimately the equipment will comprise nine 4,000-KW. single-phase transformers. The present order includes accessory material, comprising a 40-KW. transformer for the auxiliary service, a battery of accumulators, and a motor-generator group for lighting service, with distribution switchboard, instruments and connections, both for 45,000 volts and 13,000 volts, the former being the pressure of the supply from the stations at Brillanne and Ventavon, and the latter that of the distribution in Marseilles. The Thomson-Houston Co. has also been entrusted with the equipment of the Eguilles transformer station destined to serve sectionally the high-pressure lines from the Brillanne station, transmitting current to Arles, Pennes and Allauch, and also for feeding sundry lines at 18,500 volts pressure, serving the district distribution.—*La Lumière Electrique.*

L'Industrie Africaine is the style of company just floated in Paris with a capital of 900,000 fr., with the object of building a generating station at Grand Bassam on the Ivory Coast, West Africa.

Dewsbury.—Application is to be made to the L.G.B. by the Corporation for sanction to borrow £14,500 to allow of an increase in plant at the works in Bradford Road. Turbine equipment will absorb a great amount of the money asked for.

Dundee.—Extensions estimated to cost £49,000 are proposed for the Corporation electricity department. The Scottish Office has granted the full borrowing powers applied for, namely, £68,000, and the Corporation has, therefore, resolved to obtain estimates for the electrical plant required.

East Ham.—The abstract of accounts of the electricity undertaking for the year ended March 31st last, shows a gross profit of £11,933, as against £11,258 in the previous year. After providing for interest on and repayment of loans and income-tax on profits, there remains a net profit of £1,907, as against £2,127 in 1911.

Edinburgh.—Two cooling towers have just been erected in connection with the Corporation electric lighting station; in their construction new features are shown differing from towers at central stations in other parts of the country and also abroad. Hitherto these structures have been of wood, and very little attention has been paid to the architectural side. The new towers at Edinburgh are each 40 ft. square at the base and 139 ft high. Although the site is surrounded by high buildings the towers are conspicuous objects. A railway tunnel is near at hand, and, owing to that and the nature of the subsoil, attention had to be paid to the foundations. Standard sections of rolled steel joists and channels, in combination with cast-iron plates, are used for the construction of the base, and for the upper part of the towers stamped steel plates are used in conjunction with cast-iron gratings. It is estimated that the whole scheme, including turbine machinery and condensing plant, will cost about £45,000. This extra plant will be capable of producing about 3½ million units a year, and the saving in coal will represent over £10,000 a year. Opposition was at first made to the erection of the towers on the score of amenity, but the design followed out imparts to the structures rather an ornamental effect, stone being adopted to add to the substantial appearance of the lofty buildings.

By appropriating the electric lighting surplus of £2,000, the Corporation has been able to "scrape through" without increasing the municipal rates. At the monthly meeting of the T.C. there was some plain speaking on the subject, one member describing the proposal to apply the surplus to the relief of the rates as "cowardly finance." In moving that the surplus be put to the reduction of the capital debt on the undertaking, Mr. Stevenson gave it as his opinion that the principle of charging the users of a commodity, of which they had a monopoly, more than they ought to be charged, in order to relieve the general ratepayer, was unjust and inequitable. It practically meant that they were charging the users of electric light their rates twice over. Mr. Bruce Lindsay, in supporting the motion, characterised the proposal as bad business and bad finance. It was a piece of opportunism and simply scraping through, and grabbing here and there for anything that would give the Council or the treasurer the credit of not increasing the city rates. Mr. Harrison moved that the surplus be applied to the relief of the rates. The Lord Provost said not only had the T.C reduced the period from 30 to 25 years for the clearing off of the debt, but it had cleared off during the last year something like £4,000, which might very well have been put to capital expenditure. If every undertaking in the city was in the same condition as the electric lighting undertaking, there would be a very different story to tell. By 27 votes to 16 it was agreed to appropriate the surplus for the rates.

Gillingham (Kent).—The T.C. proposes to extend the plant at the electricity works by installing a second Diesel engine of a larger type. The total outlay is expected to be about £6,000.

Glasgow.—The city electrical engineer has been instructed to prepare plans for the erection of a generating station on ground acquired some time ago by the electricity department in the east end of the city.

Great Harwood.—With reference to the electricity scheme for the district, a deputation of councillors visited Bispham on Thursday last week to see the actual working of a system suggested by Mr. J. Speight, the electrical engineer, who is at present advising the Great Harwood U.D.C.

Halifax.—The E.L. Committee has instructed the town clerk to endeavour to obtain the sanction of the L.G.B. to the Corporation borrowing £4,200 for transformers and £2,600 for switchgear, which, it is expected, will be required at the electricity works during a period of two years.

Hendon.—At the last meeting of the R.D.C., a letter was received from the North Metropolitan Electric Supply Co., stating that, in addition to lighting the Edgware Road through Edgware by electricity, it was supplying other consumers with current, and had therefore decided that it would be better to obtain the sanction of the Council to supply power in the district. A discussion ensued upon the matter, in which strong objection was raised to giving the company a monopoly over Pinner. In the result, the matter was adjourned for inquiry.

Itchen.—The U.D.C. has decided to apply to the B. of T. for a prov. order for electric lighting. The estimated cost of a scheme is £14,500.

Kendal.—In connection with the electricity undertaking, application is to be made to the L.G.B. for sanction to borrow £1,000—£800 for new cables, £100 for new services, and £100 for new meters.

Leeds.—The reasons which actuated the Tramways and Electricity Committee in suggesting the inauguration of a hiring department for electric motors were explained to the Leeds Chamber of Trade at its meeting on Monday by Mr. Robert Armitage, M.P. He said the cost of energy was being reduced, and would represent a loss to the Corporation of about £8,000 per annum, but it would be able to recoup itself through the great increase in the use of motors. The authorities thought the establishment of a motor-hiring department would tend to increase the use of motors still further. A resolution was passed opposing any extension of municipal trading in the direction indicated.

Leicester.—By a majority of one the Corporation has adopted a recommendation of the Tramways and Electricity Committee to apply for powers to supply electric motors, arc lamps, cooking, heating and other utensils and fittings, so as to be able to let them out or sell them if need be. Councillors Baker, Thurley and Carver strongly opposed the recommendation, urging that the Corporation in asking for these powers would not be acting fairly and honestly to a very large section of the ratepayers, many of whom had laid themselves out specially to supply electric light fittings.

Leyton.—The Electric Lighting Committee has reconsidered and amended the figures of its estimate for the half-year ending March 31st next, with the result that the estimated deficiency for the half-year has been decreased from £732 to £320.

London.—SHOREDITCH.—The borough electrical engineer has lodged formal notice of objection to the proposed fees which have been adopted by the L.C.C. as payable by undertakers in respect of duties performed by the County Council's inspectors in inspecting testing stations, viz., for the first three testing stations, or less, in the same area of supply £10 per year; for each additional station in the same area £2 per year.

POPLAR.—It has been decided to seal an agreement with the L.C.C. for the supply of electricity for lighting Blackwall Tunnel and working the pumps. The agreement provides for not less than 100,000 units per annum, and up to 50 KW., the normal being 25 KW., at a price of ·96d. per unit, and is to cover a period of five years, subject to reduction of the charges to correspond with any reduction made by the Borough Council to other consumers. An agreement with the Port of London Authority is also to be sealed, varying former agreements for a supply to the docks and the rental of wayleaves. The charge for energy is put at ·6d. per unit, with a minimum consumption of 750,000 units additional for general purposes, and an approximate consumption of 100,000 units for working the Millwall dry-dock pumps. The minimum consumption is to be increased by 5,000 units for every kilowatt demanded in any year in excess of the maximum of 150 KW. for general purposes during the Council's peaks. In connection with the conference convened by the L.C.C., on the subject of electricity supply in London, the Council has decided to inform the L.C.C. that no good purpose would be served by such conferences, but that, as there is in existence a conference of East London municipal electricity undertakings, the Executive Committee of that conference should be invited to meet the L.C.C. Committee as a body.

WOOLWICH.—The B.C. has circularised the other metropolitan authorities, expressing the opinion that the proposals of the L.C.C. to reduce the maximum periods for repayment of future loans for electric lighting purposes—viz., buildings 30 years, instead of 42 years; mains 25 years, instead of 30 years; and plant and machinery 15 years, instead of 20—are prejudicial to the development of electricity undertakings, and asking the various Councils concerned if they are prepared to join in representations to be made to the Finance Committee of the L.C.C. to reconsider the matter.

MARYLEBONE.—The present 70 and 110-watt lamps in 17 roads are to be increased to 160 watts. The extra candle-power will amount to 17,735. The general manager of the undertaking reports that the Council's scheme of eight selected contractors is working smoothly. Even odd jobs are not carried out by the department, an arrangement having been arrived at with two or three of the eight contractors to supply men for these jobs at a percentage on the labour cost, and it is therefore a fact that cannot possibly be questioned that the Council is carrying out no wiring work except through contractors.

STEPNEY.—Application is to be made to the L.C.C. for sanction to the borrowing of £10,250 for defraying the cost of mains in connection with the undertaking.

HAMMERSMITH.—Application is to be made to the L.C.C. for sanction to borrow £3,000 for the purposes of the electricity undertaking.

Morley.—The Corporation electricity accounts show that there has been an increase in the expenditure, compared with the previous year, the amounts being £3,858 and £3,702; the increase is mainly accounted for by the advance in the price of coal and the cost of distribution. The receipts amounted to £3,075, and showed a deficit for the year of £783, as compared with the receipts, amounting to £3,172, and a deficit of £530, in the previous year.

Ottery St. Mary.—On Monday evening the first public supply of electric light for the town of Ottery St. Mary, East Devon, was switched on by Lord Coleridge at the factory, in the presence of members of the Urban Council and a large number of townspeople. The power which drives the dynamo, supplying a large battery of accumulators, is water taken from the River Otter. The turbine drives all the machinery at the factory in addition to the dynamo. The company responsible for the introduction of the new illuminant into the town is the Ottery St. Mary Electric Light and Power Co., and Mr. E. R. F. Coleberd is the proprietor.

Rotherham.—The Electricity Committee, on the advice of the electrical engineer (Mr. Cross), has recommended the T.C. to install an additional 1,000-KW. turbo-alternator.

Salford.—The Electricity Committee of the T.C. has accepted the offer of Mr. T. Roland Wollaston, M.I.M.E., Manchester, to provide detail designs and specifications of additional filtration plant for the bore-hole water at the electricity works, to obtain competitive tenders and to superintend the construction, at a fee of 20 guineas, with a further payment of 60 guineas, six months after starting the plant, provided that the added apparatus consistently removes from the softened water 95 per cent. of the present suspended matter.

Application is to be made to the L.G.B. for sanction to borrow the sum of £25,000 to defray the anticipated expenditure on the installation of mains and service cables during the next few years.

Shipston-on-Stour.—The P.C. has requested the Worcestershire C.C. forthwith to grant permission for Messrs Brown & Parsons, Ltd., of Leamington, contractors for the E.L.

scheme, to erect poles and overhead wires in the town for public lighting. Delay has arisen owing to a petition sent to the C.C. by 40 ratepayers asking that permission to erect the poles be refused "as there was an efficient gas works in the town, and the E.L. was not necessary."

Shotton.—The question of a supply of electricity for lighting was raised at the meeting of the Hawarden R.D.C. on Friday last, and it was decided to call a public meeting in order to ascertain the local feeling. Mr. Monsdale pointed out that the subject had been under consideration for 12 months, and it was time something was decided. If the people of Shotton objected to electric lighting they would then proceed with a scheme for Queensferry and Sandycroft, because the people felt that they wanted electricity there.

South Africa.—At a recent special meeting of the Ladybrand T.C., an electric lighting scheme was discussed. The scheme proposed to light the town would cost something like £5,000, and the annual cost would be about £1,100, whilst the revenue was set down at the latter figure. The matter was adjourned for further inquiries into public and private lighting.

Stoke-on-Trent.—The T.C. has applied to the L.G.B. for a loan of £16,969, in respect of sums spent on the electricity undertakings and not sanctioned by the board.

Southborough.—The U.D.C. on September 20th decided to obtain from Mr. W. C. C. Hawtayne a report as to the supply of electricity to the town, with a view to considering the advisability of obtaining a prov. order. Mr. T. W. Horne said they should approach the Tunbridge Wells T.C., the Tonbridge U.D.C., and the Kent Electrical Power Co. to see on what terms they would supply current in bulk, as he considered a £3,000 scheme too large for the town. He added that he understood that Tunbridge Wells T.C. could give a bulk supply, and that the cost of cables would be about £1,000. His proposal that this should be done was rejected by nine votes to four.

Swansea.—The Council's existing agreement with the Anglo-French Nickel Co. regarding rates for the supply of current is to be terminated, and the company is now to be charged the following rates as from April 1st last:—2d. per unit for the first hour per diem, and 1d. per unit afterwards, such number of units so charged being determined by the maximum demand at any time during any quarter, and that 2½ per cent. discount be allowed for prompt payment.

Tyldesley (Lancs.). The Finance and General Purposes Committee of the U.D.C. has had an interview with Mr. Taite, the engineer and manager of the Lancashire Electric Power Co., who outlined the steps taken by his company for providing electric light for the district. Arrangements had been made with the South Lancashire Tramways Co. whereby electricity would be supplied in bulk for distribution in the township. This supply would be available within a short time after securing a site on which to erect a transforming station. In reply to the Chairman, Mr. Taite said his company was not prepared, on the terms suggested by the Council, to entertain the proposal to re-transfer, and would only do so upon certain stipulations (to be arranged) as to the company supplying large consumers. Subsequently the Committee decided to postpone further consideration of the matter in order that the clerk might prepare and submit a report upon the terms of the agreement under which the order was transferred to the power company.

Uckfield (Sussex).—The R.D.C. on Monday referred to a Committee the question of applying for a prov. order for E.L. in respect to the parish of Crowborough. The local gas company has given notice of its intention to apply for an order, and the object of the Council is to protect its rights.

Walthamstow. The lighting superintendent has been directed to submit a report upon installing a system of automatic lighting and extinguishing for the public street lamps. A report is also to be prepared by the electrical engineer upon the question of converting of the whole of the public street lamps to electricity. Negotiations are to be carried out with the Woodford Council with respect to the supply of electricity in bulk to that Council. Owing to the metal-filament lamps placed in certain cars proving very satisfactory, the tramways manager has been instructed to similarly equip the remainder of the Council's cars.

West Bromwich.—The Corporation has decided to apply for sanction to borrow £6,500 for additional plant for the supply of electricity, to meet the increased demands for power purposes, particularly those of Messrs. Braithwaite & Kirk, which firm has agreed to take a supply of at least 80,000 units per annum for the next five years.

Wimbledon.—The Fixed Price Light Co., Ltd., has been authorised to wire for electric lighting purposes, certain buildings belonging to the Council in Durnsford Road. In consequence of a recent breakdown at the electricity works of a 1,000-KW. turbo-alternator, a Sub-Committee has been appointed to consider the desirability, or otherwise, of providing additional generating plant.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Aberdeen Suburban Tramways Co. has under consideration a proposal to introduce the railless traction system between Bieldside and Culter, and between Stoneywood and Dyce. In connection with this matter representatives of the company recently paid a visit to Dundee to see the system in operation there.

Australia.—During the current financial year, 130 new electric cars have been put into service on the New South Wales Government lines, 10 more than are in service in the whole of Victoria, and the orders for the next financial year exceed this year's by 50 per cent. The electrical equipment, axles and tires are imported from England, but the complete cars, underframes and trucks, are constructed and equipped in the State. The Ultimo plant has been increased to over 30,000 KW., and an order has been given for the first instalment of machinery for a new power house now being constructed at White Bay, with provision for 7,000-KW. units. Provision is being made at this new station for the use of more than 1,000 tons of coal daily. The station is designed for construction and operation in complete separate units, so that pace may the more easily be kept with engineering progress.

Bolton.—The Sunday service of cars has for many years commenced at noon, and an effort has been made by some of the townspeople to secure the running of occasional cars on certain routes earlier in the day. The Committee has now decided not to entertain the question of running cars on Sunday mornings.

Colne.—At a recent meeting of the T.C., Alderman Hewitt gave notice of his intention to move at the next monthly meeting of the Council that the latter agree to accept an offer recently made by the Colne and Trawden Light Railway Co. to sell its undertaking to the Corporation, the amount of the purchase to be fixed by arbitration.

Continental Notes.—Belgium.—The Ghent Tramways Co. has just secured the concession for two new lines of electric tramway in the town of Ghent.

Russia.—For the construction of an electric railway from Moscow to Podolsk, with a branch to Obiratowka, of an aggregate extent of 55·5 versts, there has been formed at Moscow a company, with a capital of 2,500,000 roubles in shares, and 7,500,000 roubles in bonds.—*Elek. Zeitschrift.*

Croydon.—The Sub-Committee appointed by the County Council to report as to suggested extensions of the tramway has inspected various routes, and finds that certain districts are sufficiently populated to render the extensions justifiable, but, having in view the decision of the Council to seek powers to run motor-omnibuses, and bearing in mind that it would take some time to obtain powers for tramway extensions and for works to be carried out, it has decided to take no action in the matter at present. Application is to be made to the B. of T. for an order permitting the Corporation to give a supply of electricity to the works at Beddington of Lacy-Hulbert & Co., Ltd. The cost of extending mains is put at £900.

Doncaster.—The Council's apparent laxity in providing tramway facilities for the suburban residents at Warmsworth and Conisboro' is providing a good deal of discussion locally, and it is hoped that ere long the Corporation will see its way to extend the present system to the two places mentioned, and so put the last links to the chain of tramways which would then extend without a break from Sheffield right up the Don valley to Doncaster.

East Ham.—The tramways accounts show a gross profit of £16,339, as against £7,424 in the preceding year, and after providing for interest on and repayment of loans, the net profit for the year amounts to £3,854, as against a loss of £4,647 last year.

East Kent.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order authorising the construction by the East Kent Light Railway Co., for light railways from Wingham to Stodmarsh, and from Great Mongeham to Ripple, places in the new colliery area.

Edinburgh.—The report by Mr. Campbell, the burgh engineer, on new systems of tramway traction and their application to proposed extensions in Edinburgh has been discussed by the special sub-Committee of the Corporation Tramways Committee, but no definite decision has been arrived at. The report suggests three routes for consideration as suitable for extension purposes—the northern route, extending from Blackhall on the west and ending at Pilrig on the east; the central route, beginning at Ardmillan Terrace on the west and extending to the Tron Church in High Street; and a southern route. The railless trolley system is suggested as suitable for the northern and central routes. Dealing with the advantages and disadvantages of the railless trolley system, the burgh engineer says it is useful as a "feeder" to an existing tramway system, and for testing the demand for a new traffic route, and as the first instalment of an eventual tramway. The disadvantages as applied to Edinburgh is that the system requires overhead equipment, it is rather severe upon macadan road surface, particularly upon the descent of a hill; it is not quite so economical in working as the self-propelled tramcar, and dust is created by its passage. There is no doubt, however, that the railless electric trolley car presents particular advantages as applicable to the existing needs and conditions of the city.

Glasgow.—Some difficulty has been experienced in Glasgow, as well as in other cities where the local T.C. has to contend with heavy vehicular traffic. Here there are differences of opinion as to the class of material with which streets traversed by tramway rails should be laid. Recently the Tramway Committee met representatives of the Sub-Committee on Streets and Footpaths Repair, &c., who expressed the opinion that nidged setts ought to be put down in streets in which tramways are laid, and instructions were given to the general manager to report on the matter.

Halifax.—The Tramways and Electricity Committee of the T.C. proposes to purchase from the Commercial Car Hirers, Ltd., of London, a motor-omnibus for the sum of £830, and also to ask that it may be empowered to give an order for two additional 'buses at the same price. A 'bus from the London company has already been on trial, and with a load of 40 passengers (about 5½ tons) took the incline up Mount Tabor with comparative ease. The two additional cars are to be specially designed to cope with the steep gradients on the routes upon which they will run.

Leeds.—The Tramways and Electricity Committee has decided to recommend the City Council to apply for the necessary powers for carrying out various extensions of the tramway system, including the continuation of the railless traction system from Guiseley to Otley and Ilkley, and from Farnley to Drighlington.

A sub-committee was appointed to consider the question of the revision of tramway fares and the possibility of utilising more spare cars on Saturdays and at holiday times. At present there are a number of cars always in the depôts, and they cannot be run owing to the shortage of men to run them. If some of the spare men at the depôts could be utilised as conductors and some of the conductors who are qualified drivers were given their opportunity of taking the better position, it was felt that the difficulty experienced at present might be got over, as the public would benefit by the augmented service.

Leicester.—The Tramways and Electricity Committee recommends the T.C. to extend the electric tramways in six areas of the town, viz., Loughborough Road, Overton Road, Evington Road, Welford Road, Knighton Fields Road East, Cavendish Road, and King Richard's Road, the scheme involving an expenditure of about £100,000. The Council is also asked to seek powers to run petrol motor vehicles, instead of the proposed railless electric cars, to Thurmaston.

Liverpool.—The Mersey Docks and Harbour Board, as a result of complaints from steamship companies as to inconvenience owing to the steepness of the structure, has decided to convert the floor of No. 6 Bridge of the Prince's Landing Stage, Liverpool, into two moving electric platforms, travelling in reverse directions, to facilitate the passing of passengers' luggage, &c., from the Prince's Parade to the landing stage, and *vice versa*. The estimated cost of the alteration is £3,000.

Rotherham.—The railless traction system to Maltby is to be opened for traffic during this week. Three cars are to be used in connection with the route, and the full fare is 6d., with lesser amounts for shorter distances. The cars are rubber-tired vehicles accommodating 28 passengers, and equipped with 40-H.P. motors.

Soyland.—The U.D.C. has passed a resolution in favour of the electric tramways being extended from Halifax to Ripponden on terms to be arranged. Halifax T.C. requires a guarantee of £100 a year against loss, and this is looked upon as an exceedingly fair offer, as £300 a year was originally asked for.

Stainland.—The Council has agreed to accept the offer of the Halifax Corporation to run motor-'buses from the tramway terminus at West Vale to the Vicarage, Stainland, provided the necessary Parliamentary powers are obtained; the District Council will contribute a sum not exceeding £134 per annum for five years towards the loss in any one financial year.

Swansea.—The borough electrical engineer has been directed to proceed with the preparation of the necessary plans, specifications, estimates, &c., in connection with the overhead equipment of the various sections of the tramways proposed to be constructed under the Swansea Corporation Act, 1912, and tenders are to be invited for the various works in connection therewith. Plans, specifications, &c., are also to be prepared by the surveyor for the laying of the permanent way of the above-mentioned tramways. The General Purposes Committee has decided to instruct Mr. Stephen Sellon and Mr. Philip Dawson to advise the Corporation, independently of each other, at a fee of 25 guineas and travelling expenses each, as regards the suggested tramways at Townhill.

Walthamstow.—The Light Railways Committee has decided to purchase four double-deck roof-covered cars, and to carry out extensions to the car-shed to provide accommodation for these cars; also to double the tramway track at Kite's Corner, Billett Lane and Forest Road.

Warrington.—The Whitley and Stretton P.C.'s having petitioned the Tramways Committee for a car service between Stockton Heath and Stretton, the Corporation tramway manager has been instructed to report upon the cost of a petrol-electric motor-'bus.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Argentine Marconi Co. has entered into arrangements with the Argentine Government for the erection of a high-power station to communicate with Europe, North America, China, Japan, and the Australasian Archipelago.

Cheap Telephones.—Telephone call boxes are to be provided in the streets of several German cities, at which the charge per call will be a halfpenny.

High-Frequency Generators.—It is reported that the rivalry between the two types of high-frequency generators which have been introduced in Germany during the past 12 months threatens to lead to legal proceedings as to the validity of the patent rights of one of the machines. On the one hand, there is the Goldschmidt generator, which was first announced to the public, and for the international working of which outside of Germany there has been formed, as previously mentioned in this journal, the Compagnie Universelle de Télégraphie et Téléphonie Sans Fil, of Paris. On the other, there is the Telefunken Co., which controls the high-frequency generator devised by Count Arco, and which is closely associated with the A.E.G. and the Siemens-Schuckert works. The intimation of the formation of the Compagnie Universelle has induced the Telefunken Co. to announce that the further trials made with the Arco machine have been successful, and the construction of six large generators is proceeding rapidly at the A.E.G. works. The Telefunken Co. adds that a claim has been lodged with the German Patent Office alleging that the Goldschmidt patent is invalid, on the ground of old and prior publication in France. Four large and four small Goldschmidt machines, it is understood, are being made by the Bergmann Electricity Works Co.

High-Speed Wireless Transmission.—On Monday last Marconi's Wireless Telegraph Co., Ltd., gave a demonstration of high-speed automatic transmission and reception at their works, Chelmsford, to representatives of the British Post Office, Admiralty, War Office, Colonial Office, and Crown Agents. The high-speed signals transmitted from Poldhu, Cornwall, where other representatives of the Government were present, were received and recorded at Chelmsford, both by means of a recorder on the principle of a gramophone, and printed on tape.—*Financial News*.

Imperial Wireless.—On the reassembling of Parliament next week, the debate on the agreement between the Post Office and the Marconi Co. will take place; charges have been levelled against the Government to the effect that the agreement creates a monopoly, and that, on the other hand, the Government refrains from legislation requiring all passenger ships to be provided with wireless equipment in view of the protest put forward by the Advisory Committee of the Board of Trade, which alleged that shipowners would be compelled to install Marconi apparatus at great cost.

Long-Distance Telephony.—It is expected that the direct telephone line between Germany and Italy, *via* Switzerland, will be opened for service in the near future. Owing to the great distance, the size of wire chosen is 4½ mm., but the charges for use are comparatively low. The transit line from frontier to frontier in Switzerland has been carried out by the Swiss Telegraph Authorities at their own expense, and Switzerland will levy a charge of 2 fr. for each conversation of three minutes. On the other hand, Germany and Italy will each make a charge of from 1 fr. to 2 fr., according to the zone in which the town is situated whence it is desired to speak. During the night the charges will be reduced to three-fifths of those stated, and monthly subscriptions at half rates will be accepted.

New Wireless Company.—According to the daily Press, a new British company called the Universal Radio Syndicate, Ltd., has been formed to acquire the rights of the Poulsen-Pedersen system of wireless telegraphy, and to establish communication between England and Canada, receiving a subsidy of £15,000 per annum from the Canadian Government.

Sparkless Wireless.—The daily Press states that a French engineer, M. Bethenod, has patented a system which enables several neighbouring telegraph stations to communicate without interfering with each other, ten times more quickly than with submarine cables, and at a tenth of the cost. The invention substitutes sparkless for spark telegraphy, and it is declared that communication can be made by it at a speed of up to 200 words a minute. Moreover, it makes wireless telephony immediately practicable.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—October 15th. Balancer and switchgear for the U.D.C. See "Official Notices" to-day.

Australia.—South Australia.—October 22nd. Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" September 13th.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" September 13th.

December 17th. Three sections of common battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" September 13th.

October 22nd.—(*a*) 37,000 carbon filament lamps, and (*b*) insulated lead-covered copper cables, for the Melbourne City Council. See "Official Notices" to-day.

November 12th.—Deputy P.M.G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 19th.—One mercury vapour converter, for the P.M.G.'s Department. See "Official Notices" to-day. Also two batteries, and a 4-K.V.A. single-phase transformer. High Commissioner in London

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—October 24th. The Austrian State Railway authorities in Vienna are inviting tenders for an installation of electric lighting in the railway workshops and material stores at Gmurden.

Crete.—Candia.—October 10th. The date for forwarding tenders for the electric lighting of the City of Candia has been postponed to October 10th.

France.—Dole.—October 26th. Supply and installation of a transformer and an electric motor. Particulars from the Sous-Intendance Militaire, Quartier Bernard, Dole (Jura).

Bourges.—October 10th.—Supply of electric material in four lots—Glow and metal-filament lamps ; bronze and copper wire and cable ; brushes, bells, reflectors, &c. Particulars from the Ecole de Pyrotechnie, Bourges.

Germany. — Bremen. — October 7th. Tenders are required for the supply, erection and setting in working at the power station at Bremen-Woltersdorf, of a 3,200-KW. steam turbine and a 3-7,000-KW. dynamo set, including condensers. Particulars, 8 marks, from the Abteilung Allgemeine Verwaltung.

Gillingham.—October 22nd. One 500-H.P. Diesel engine and alternator, for the Corporation. See "Official Notices" to-day.

Great Western Railway.—October 14th. Stores for a year. See "Official Notices" September 27th.

Isle of Thanet.—General stores for a year, for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 20th.

Leeds.—October 7th. The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. Mr. J. B. Hamilton, general manager.

London.—October 15th.—6,000 steel tires for driving wheels and 5,000 steel tires for pony wheels for electric tramcars for the L.C.C. for a period of 12 months. Chief Officer, L.C.C Tramways, 62, Finsbury Pavement, E.C.

L.C.C.—October 15th. Installation of electric lighting, bells and telephones at the Highgate Secondary School, St. Pancras, N.W. See "Official Notices" to-day.

Maidstone.—October 17th. Coal for a year for the Corporation electricity works. Borough Electrical Engineer, Fair Meadow.

Mansfield.—October 9th. Electric lighting for the Workhouse, Stockwell Gate, Mansfield, for the Guardians. Specification, one guinea, returnable, from Messrs. Vallance & Westwick, architects, Mansfield.

Mexborough. — October 5th. Turbo-generator, condenser and switchgear, for the U.D.C. See "Official Notices" September 13th.

Rotherham.—October 16th. One 1,000-KW. steam turbo-alternator, condensing plant, piping, H.T. switchgear, &c., for the Corporation. See "Official Notices" to-day.

Spain.—October 18th. The municipal authorities of Morales de Toro (province of Zamora) are inviting tenders for the concession for the electric lighting of the town during a period of eight years. Particulars can be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Morales de Toro (Zamora).

October 14th.—Tenders are being invited by the municipal authorities of Cassadela Sera (province of Gerona) for the concession for the electric lighting of the town during a period of five years.

Tenders are at present being invited by the municipal authorities of Vich, for the concession for the electric lighting of the town during a period of ten years from April 16th, 1913.

November 9th. The Spanish Ministerio de Fomento, in Madrid, are inviting tenders for the concession for the construction and working of electric tramways between Vigo and Lavadores, and between Vigo and Arratales. It may be added that a project has, in each case, been submitted by a would-be concessionaire, the concession being only put up for tender in accordance with the practice in Spain.

Watford.—October 15th. One 500-KW. steam alternator and a switchboard machine panel for the U.D.C. See "Official Notices" September 27th.

CLOSED.

Australia.—According to the *Australian Mining Standard*, the following contracts have been placed : P.M.G.'s department, Brisbane :—

Galvanometers, rheostats, condensers, cords, and 60 miles cotton-covered wire (at £3 4s. 6d. per mile).—B.I. & Helsby Cables, Ltd.
Protectors, bells, 443 telephones, &c.—Jas. Paton & Co.
Ebonite cases, heat coils, fuses, &c.—Western Electric Co. (Australia), Ltd.
60 miles wire, at £16 17s. 6d. per mile, and 20 miles, at £8.—Noyes Bros., Ltd.
Galvanometers.—J. Bartram & Son, Ppy., Ltd.
Conductor cords, diaphragms, ear-pieces, &c.—Lawrence & Hanson Electrical Co., Ltd.
Ear-pieces and mouth-pieces.—W. G. Watson & Co., Ltd.
100 tons cast-iron pipes, at £10 2s. per ton.—C. Monteith & Sons.

P.M.G.'s department, Sydney :—

10 miles tinned copper wire, at £10 19s. 9d. per mile, 25 miles ditto, at £8 14s. 3d.—W. T. Henley's Telegraph Works Co., Ltd.
45 miles tinned copper wire, at £8 12s. 6d. Standard Cable Manufacturing Co., Ltd.
100 Ericsson magneto wall telephones, £122 10s.—Ringdahl & Co.

Victorian Railways :—

Eight electric car bodies, £568 15s. each.—A. Pengelley & Co., Adelaide.

Public Works Department :—

Installation of a Lister-Bruston lighting set at the farm workers' block, Lunatic Asylum, Mont Park, £263.—Messrs. Sutherland & Ashman.

Hopetoun (V.) Electric Supply Installation :—

Suction gas engine, £455.—Noyes Bros., Ltd.
Gas producer, £198.—Cambridge Gas Producer Co.
200-KW. generator, booster and spares, £149 ; Tudor battery, £438.—McLean and Co.
Equipment, £54.—India-Rubber, Gutta-Percha and Telegraph Works Co.
Equipment, £36.—Noyes Bros., Ltd.
Consumers' meters, £60.—Watson & Co.
Aluminium cable, £98 ; erection of cable, £221.—McLean & Co.

Beulah (V.) Electric Light Installation :—

Suction gas engine, £455.—Kynochs, Ltd.
Gas producer, £198.—Cambridge Gas Producer Co.
200-KW. generator, booster and spares, £149 ; Tudor battery, £533.—McLean and Co.
Equipment, £67.—India-Rubber, Gutta-Percha and Telegraph Works Co.
Equipment, £51.—Noyes Bros., Ltd.
Consumers' meters, £60.—Watson & Co.
Aluminium cable, £85.—British Insulated and Helsby Cables, Ltd.
Erection of aluminium cable, £228.—McLean & Co.

The *Australian Mining and Engineering Review* reports that the following tenders have been accepted :—For the Prahran and Malvern Tramways Trust (Vic.) :—

Construction of permanent way and erection of poles (contract No. 34), £68,898.—Albion Quarrying Co., Ppy., Ltd.

For the Launceston Tramways :—

233 tons of 90-lb. rails, £1,980 . 36 tons of 90-lb. rails, £268. H. Jones and Co., Hobart.
100 standard 6-lb. irons, and three combination electric cookers, £142.—Pacific Heating Co.

Messrs. John Sharp & Sons (Melbourne) have accepted tenders for supply of electrical plant, to be installed in their timber mills, as follows :—

Overhead electric travelling cranes, one 6-ton, at £611, one 10-ton, £677.—Babcock & Wilcox, Ltd.
Motors, comprising two 3-H.P., two 10-H.P., and one 15-H.P., and equipment, £197 16s.—Pfaff, Pinschof & Co., Ppy., Ltd.

Austria.—The Vienna branch of Messrs. Brown, Boverie and Co., have secured a contract for the establishment of a large central electricity generating station at Kasparberg, Bohemia.

Bolton.—On September 26th the Electricity Committee accepted the tender of Mr. J. B. Scholes for 25,000 tons of coal.

Brighton.—The tender of Mr. H. J. Galliers has been accepted by the Brighton Guardians, at £42, for the supply of electrical fittings.

Derby.—The Electric Lighting Committee of the T.C. has accepted the tender of Messrs. J. A. Aiton & Co., for steam piping, at £187 ; and that of the Chain Belt Engineering Co., Ltd., for a chute for the coal bunkers, at £46.

Finchley.—The following tenders have been received for a supply of flame arc lamps :—

Jandus Arc Lamp Co.	£296
Union Electric Co.	360
General Electric Co.	372
Engineering and Arc Lamps, Ltd.	314
Crompton & Co.	304

France.—Contracts have been placed by the Société Electrique de l'Eau d'Olle with the firm of Thomson-Houston and Co. for four three-phase 3,750-KW. alternators, 8,000 volts ; and for three 5,000-KW. three-phase transformers, 8,000/6,000 volts.

The following orders have also been received by Messrs. Thomson-Houston, Paris :—From the Société Anonyme des Hautes Fourneaux, Forges et Acieries de Denain et Anzin, a complete equipment of steelworks travelling cranes and large plate rolling machines, comprising 21 motors of 21 up to 160-H.P. capacity ; from the Hauts Fourneaux de la Chiers, a motor-driven blooming equipment ; from the Société Métallurgique de Senelle, an order for a 750-H.P 480-volt motor ; and lastly, from the Société des Hauts Fourneaux et Forges d'Allevard, a 300-H.P. 3,000-volt motor for their iron and steel works.

G.P.O.—Messrs. Scholey & Co., Ltd., London, have received a contract for the supply of "Britannia" metallic-filament lamps.

Halifax.—The Tramways Committee has accepted the tender of the Commercial Car Hirers, Ltd., London, at £830, for the supply of a motor-'bus.

The Tramways and Electricity Committee has accepted the tender of Messrs. Siemens Bros., Ltd., for the supply of nine pairs of 40-H.P. motors, for £1,548.

Houghton-le-Spring.—For installing electric light at the hospital, the R.D.C. has accepted the tender of Messrs. S. Stobart and Co., at £32.

Leeds.—The Isaria, Ltd., are now supplying A.C. single-phase meters of their E.V. type to the Corporation electricity works.

London.—Kensington.—The estimate of Messrs. R. Waygood & Co., Ltd., at £49 10s. has been accepted by the Guardians, for repairing the lifts at the Infirmary.

Marylebone.—The B.C. has accepted the following tenders for supplies of coal to the electricity undertaking:—

A. Blackmore & Co. 3,500 tons, at 13s. 6d. per ton, and 3,500 tons, at 14s. 6d.
Myers, Rose & Co. 2,500 tons, at 13s. 6d. per ton, 2,500 tons, at 14s. 8d.
Wm. Cory & Sons.—10,000 tons, at 14s. 3½d. per ton.

Rawtenstall.—The T.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for a high-tension switchboard panel.

River Wear Commission.—A contract has been placed with Messrs. Cowans, Sheldon & Co., Ltd., for four 3-ton portable electric cranes for South Dock, Sunderland.

Rotherham.—The T.C. has accepted the tender of Messrs. Heenan & Froude, for extensions to the refuse destructor, at £5,375.

The Corporation has also placed a contract for meters with Messrs. Chamberlain & Hookham, Ltd., Birmingham.

Rugby.—The U.D.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for three transformers.

Salford.—The T.C. has accepted the tender of the Earl of Ellesmere for an annual supply of 6,000 tons of No. 2 best washed slack, delivered at the electricity works, at 11s. 10d. per ton in barges, and 12s. 4d. per ton in carts. The tender of Adam Bromley & Son has also been accepted for a similar supply of 2,000 tons of pea nuts to the electricity department, at 13s. per ton.

FORTHCOMING EVENTS.

Iron and Steel Institute. Friday, October 4th. At Leeds. Last day of Autumn Meeting.

Society of Engineers.—Monday, October 7th. At 7.30 p.m. At the I.E.E., Victoria Embankment, W.C. Paper on "Town Planning from an Engineering Aspect," by Mr. E. R. Matthews.

International Engineering Exhibition.—October 4th to 26th inclusive. At Olympia.

Association of Engineer's-in-Charge.—Wednesday, October 9th. At 8 p.m. At the St. Bride's Institute, London, E.C. Presidential Address by Dr. H. S. Hele Shaw.

NOTES.

Legal Query.—A letter was received a few days ago from a correspondent who put to us a legal query relating to a cinematograph theatre, but this has been mislaid, and we have no record of the name or address of the writer. Perhaps when he sees this note he will be so good as to send us a copy of his letter.

Power in Textile Mills.—We are informed that an error occurred in the table of the principal turbine installations in British textile mills, given on page 455 of our issue of September 20th. The alternator installed at Messrs. Ashton Harrison & Co.'s mill is there ascribed to Messrs. Siemens Bros., but was manufactured and supplied by Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, to the specification of Mr. Robt. Blackmore, of Stalybridge.

Inquiries.—A correspondent asks for the name of a maker of a guillotine suitable for armature winders. Makers of tinned steel wire as used in motor manufacture are also asked for.

Electricity in the Schoolroom.—It is reported that experiments made in Stockholm on school children have demonstrated that, by maintaining high-frequency electric oscillations in the room in which they work, their physical and mental development can be materially accelerated, and their work is done with less fatigue. A similar experiment is to be initiated in New York.

The "Standard" Discovers Electrolysis.—A series of sensational articles, under the headlines "What Invention Next?" and "Inventions and Discoveries," has been running in the *Standard* for some weeks; while it may do some good by directing the attention of the general reader to the work that has been and is being accomplished by engineers and scientists, it has not been free from those defects which, somehow, almost invariably creep into the treatment of technical matters in the daily Press. Fanciful speculations as to what may—or may not—conceivably come to pass in the remote future are deftly converted into "intelligent anticipations" of what may quite possibly be realised at an early date; and as the layman has no means of distinguishing between the probable and the fantastic, he may be led to form wholly erroneous ideas regarding such questions as, for instance, the wireless control of airships or the future of tramways and railways. We cannot afford space to comment at any length upon the articles, but may draw attention to one or two flagrant examples of glib nonsense.

Thus, one article was devoted to the marvels of electrochemistry. We were informed that water was a simple chemical compound of hydrogen and oxygen gases, and the writer had the audacity to state that "the great problem before scientists to-day is the discovery of some means whereby water can be decomposed into these constituent gases in an economical manner." "Conviction is rapidly growing that electrochemistry will provide some new and economical method of effecting this decomposition." The object of this imaginary research is to enable ships to travel at high speeds without the aid of coal, oil or wind, *drawing their power from the water on which they move.* Well may they say "What next

"An expert engineer intimately associated with the latest uses of applied electrochemistry" is credited with the forecast that at no remote date motor-cars will be driven by electrolysed water, and he sees "no reason at all why, by the use of gas cells, cars should not run between 500 and 600 miles with one charge." This "engineer," we imagine, employed his hat as a telephone for the communication of this information. The same expert, dilating on the advantages of magnetic oxide of iron as a protection against corrosion, declared that a bridge like the Forth Bridge would in future be permanently protected from corrosion *after erection* by a single treatment on electrochemical lines. "Prodigious!"

Objection to Municipal Motor Hiring at Leeds.—At a meeting of the Council of the Leeds Chamber of Commerce, held on Tuesday evening, under the presidency of Mr. F. J. Kitson, discussion took place on the proposal of the Leeds Corporation to borrow £10,000 for the purpose of hiring out motors to users of electric current.

Mr. Wardle drew attention to the project, which he held was a most improper one for a Corporation to undertake, and he said the proposal went altogether beyond the right province of the Corporation.

The chairman said he also thought it did.

Mr. Wardle said it interfered with traders in a most unfair way; not only so, all that municipal employment meant an addition to the number of Corporation officials. It was a very great evil, and he saw no reason why they should do it. If people wanted a motor, they could go and purchase or hire one from a private firm.

Mr. Lupton thought the idea was that the Corporation had surplus power and that they could utilise it in that way.

The chairman said he would like to put in a protest. The Corporation were going beyond what they ought to do.

Mr. Wicksteed said that, seeing the Corporation had taken over the supply of electricity, he supposed they ought to supply motors suitable for the current.

Mr. Wardle did not think so. He expressed the view that, under municipal management they paid about 40 per cent. too much for gas. The same quantity of gas was made in Sheffield under a company for nearly £100,000 less than was paid in Leeds. The tramways would be very much better managed if they were leased to a company. He contended that municipal trading was nearly always bad, for they got such a large number of employés who did not earn their wages for the most part. It was absolutely a scandal; in many municipal undertakings men were pitchforked into jobs because they were voters, and they did not earn their wages. The managers of the Corporation did not treat them as a private employer would.

Conversation ensued as to the number of makers of motors in Leeds, and it was said there were four.

In reply to Mr. Wicksteed, who asked if he suggested that a municipal official would not buy as efficiently as a private user, Mr. Wardle said that as a rule business was badly done by an official, although he did not say that would be the case in this instance.

Ultimately, Mr. Wardle agreed to a suggestion that he should give formal notice of a motion to protest against the proposal of the Corporation.

Newcastle Exhibition.—Mr. W. R. Potter, of Messrs. Potter, Thomas & Co., Newcastle-on-Tyne, writes as follows (too late for our "Correspondence" columns):—"As a reader of your valuable paper, I was greatly interested in reading the report of the Electrical Exhibition recently held in Newcastle, more especially your remarks with reference to the exhibit of the working electrical laundry, by the Provincial Laundries, Ltd., Newcastle; to those who had not the pleasure of inspecting these machines, your remarks imply that the entire running and the *heating* of the various machines was carried out solely by means of electricity. It may interest you to know that these machines were driven by means of overhead shafting, which in turn was driven by a motor, and the heating of the various polishing and collar-shaping machines was entirely carried out by means of gas, which was most ingeniously laid on, and I think great credit is due to our friends in the gas industry when they can produce such machines heated in this manner. . . . I am only afraid that the thousands who saw this exhibit went away with the idea that the whole process of ironing and heating of the machines was carried out by means of electricity, no doubt owing to the fact that a large display of electrical ironing took place next to the barrier.

A Solar Heat Engine in Egypt.—The Shuman solar heat engine, in a much improved form, is being experimented with at a place near Cairo; the installation is expected to develop about 100 H.P. from the sun's radiant heat.

Locating Icebergs.—Dr. M. Coplans, of Leeds University, has gone to America in order to carry out experiments with a new system for locating icebergs. He will proceed to the ice-zone in a United States cruiser. His system depends upon variations in the electrical conductivity of sea water, on the ground that the presence of icebergs sensibly influences this conductivity over a wide area.

Alleged Long-Firm Frauds.—According to the *Standard*, the following men were charged at Old Street Police Court last week, with fraudulently obtaining large quantities of goods from persons in different parts of the country:—James Winslow, otherwise Darton, aged 39, of Lockinge House, Stafford Street, Swindon, Wiltshire; Frederick Carrier (otherwise Darton), 37, of Broad Street, Swindon; and Frank Horace Hepden, or Hampton, of Hill Side, Dencombe Hill, Forest Hill. "Mr. Sefton Cohen (for the Public Prosecutor) said that it had been deemed necessary to enter against the prisoners further charges of conspiracy to obtain, and of obtaining, by false pretences goods from various firms in London and the provinces. The prisoners Winslow and Carrier had, it seemed, started offices in premises at 3, City Road, at a rental of £60 per annum. They traded in the name of Darton & Co., as shippers and agents, and it was an element of the case that the name of Darton & Co. was assumed because there was a well-known firm of that name for whom they might be mistaken. The offices were kept open until the June quarter, when a distress for rent was put in, and they then left. During the period of their occupancy goods of a most varied character were obtained on credit, by means which, the prosecution suggested, were those known as long-firm proceedings, *i.e.*, the giving of references between themselves, and from one to another as different firms. Thus the name 'Anderson & Co.,' Aldersgate Street, was Darton under another name; and 'Rey & Co.,' of Town Hall Chambers, Old Street, was another; 'F. Hampton & Co.,' of Lower Thames Street, a third, and so on. Goods had been supplied to Darton & Co. and F. Hampton by their using one another as references. The Hoffman Manufacturing Co., of Chelmsford, had been, it was alleged, defrauded of ball-bearings to the value of £30, counsel proceeded. Messrs. Ward & Goldstone, electrical engineers, of Salford, had on four occasions supplied goods to 'F. Hampton' to the amount of £19 odd. The same firm had also supplied goods to Darton & Co., on a reference to Hampton, and in the autumn of last year had been victimised by a firm calling itself Coates & Co., of Chiswell Street, with which the prisoner Hepden would be identified, and the latter, as Hampton, would be shown to have obtained insect powder from Messrs. Keating, of the Borough, to the value of £10, and there the name of a fresh firm, called Beck & Cahill, of Eltham, Kent, was used as a reference. When County Court proceedings were resorted to by Messrs. Keating, and judgment was obtained, a bill of sale was notified as barring all execution on any goods of Hampton & Co. The prisoners were then further remanded, bail being allowed."

North-Eastern Counties Electrical Exhibition.—The second North-Eastern Counties Electrical Exhibition at Newcastle-on-Tyne was brought to a finish on Saturday night, September 28th, after a most successful run. From every point of view, the exhibition has proved a complete success, and, from start to finish, has been most popular, as is proved by the fact that no fewer than 150,000 persons visited it in the three weeks it was open. Financially, too, it has realised more than the highest expectations. On Saturday evening a pleasing presentation was made to Mr. L. E. Buckell, the lighting engineer of the Newcastle Electric Supply Co., who was on the advisory board, and Mr. W. Peacock, the organising manager and secretary. The presentation had been arranged by the exhibitors, in recognition of their indebtedness to these two gentlemen, and subscriptions were speedily forthcoming. Mr. Alan G. Robson, of the Simplex Conduits, Ltd., handed over to Mr. Buckell a gold chronometer, and Mr. Robert Robson, of the Electrical Contractors' Association, handed to Mr. Peacock a silver cigarette case, cream jug and sugar basin. In view of the success that has attended the exhibition, it is proposed to hold an "Ideal Home" exhibition next Easter.

The 25 Club.—We learn from Mr. J. G. Lorrain, the hon. secretary, that the next dinner of the above club will be held at the Waldorf Hotel, Aldwych, on Wednesday, October 30th, at 7.15 for 7.30 o'clock.

Appointments Vacant.—Chief assistant electrical engineer, for the Barking U.D.C. (£130); shift engineer, for the City of Dublin Electricity Supply Committee (£130); assistant electrical engineer, for the Shipley U.D.C.; clerk, for the Swindon Corporation Electricity and Tramway Departments (£80). See our advertisement pages to-day.

Educational.—South-Western Polytechnic Institute, Chelsea.—The day courses in electrical engineering commenced on September 30th; particulars are given in the prospectus for the session 1912-13. Mr. A. J. Makower, M.A., is head of the department, and preparation is given for the degree in Engineering of the University of London. The Institute has its own electricity supply plant, and a large equipment of electrical machines and apparatus for experimental work. Evening courses are also conducted in connection with the department.

The Polytechnic.—The session for 1912-13 commenced on September 30th; courses are provided in electricity and electrical engineering, Mr. W. Hibbert being the head of the department. Lectures are given in telegraphy and telephony by members of the engineering staff of the G.P.O., and a special course on illuminating engineering will be begun on October 25th.

Edinburgh University.—Under the new scheme for engineering degrees the full resources of the University and the Heriot-Watt College are now to be utilised, to enable students to specialise in the departments of civil, mechanical and electrical engineering.

University College, London.—A course of post-graduate lectures will be delivered by Prof. J. A. Fleming, F.R.S., on "Electromagnetic Waves and the Theory of Electrons," commencing on November 6th. The course will comprise six or seven lectures, and is preliminary to a course on "Radiotelegraphy" in the following term. Particulars can be obtained from the secretary.

Fatality.—An inquest was held at Westminster on Monday into the death of Robert Revell, aged 47, who was found lying at the foot of a step-ladder which, it appeared, he had been using for the purpose of changing the carbons of an arc lamp at a Bloomsbury garage. The medical evidence showed that there was no sign of an electric shock, but according to the *Times* the jury found that death was due to a fall from a ladder, but they were unable to say whether an electric shock or drink was the cause.

Institution and Lecture Notes.—Mr. Alfred Hands, M.I.E.E., F.R.Met.S., has entered into arrangements for the delivery of lectures on "Thunder and Lightning," illustrated by lantern slides and experiments, during the first half of the 1912-13 season, before literary and philosophical societies, and in public halls in different parts of the kingdom, including towns in Scotland, Lancashire, Yorkshire, the Midlands, north, south and west London, and so on. We have before us a copy of the synopsis of the lectures, from which we gather that the lecturer, as the result of his long specialised study of the subject, should be able to impart to his audiences a great store of educative and interesting information.

East of Scotland A.M.E.E.—At a meeting of the branch at Dunfermline on Friday last, the President (Mr. C. A. Carlow, Leven) congratulated the members on the large accession to the membership, and announced his intention of awarding a handsome prize for the best paper received during the session. The following dates were provisionally fixed for the session's meetings: Edinburgh, October 26th (open meeting); Dunfermline, November 22nd; Kirkcaldy, December 20th; Dunfermline, January 24th, 1913; Edinburgh, February 22nd; Dunfermline, March 28th; Kirkcaldy, April 25th; and Dunfermline, May 16th.

Mr. Carlow followed with a presidential address, in which he outlined reasons for the increased price of coal since 1896. The three most important reasons he adduced were: (1) More complete organisation of labour; (2) the carrying-on of mining operations at greater depths and in less advantageous circumstances, and (3) the effect of recent legislation. Under the third heading, the speaker observed that in May, 1911, the amended special rules came into force, putting further restrictions on the use of electricity in mines. This means of transmitting power was one of the best friends of the coal industry, and anyone familiar with the subject knew the extra cost due to the establishment of these rules.

The Association of Mining Electrical Engineers held the annual meeting at Sheffield last week.

The Newcastle Conversazione Abandoned.—We regret to learn from our Newcastle correspondent that the Conversazione of Scientific Societies, to which we referred in our last issue, had to be abandoned "owing to local societies of civil, mining, mechanical and electrical engineers not replying in time to permit of arrangements being made." With so excellent a programme as that which we printed in our last issue, there seemed to be every prospect of a most successful gathering.

Electricity for Stoutness.—The *Standard* reports that a London specialist has introduced to the notice of the medical profession a new electrical treatment for stoutness. The main point in the new treatment is the exercising of most of the large muscles of the body under the influence of electricity to an extent that cannot be obtained by ordinary physical methods, such as walking. When certain applications of an electrical current are made to the trunk or limbs, local contractions of muscles frequently occur. Patients being treated for stoutness by this system have to sit in reclining chairs whilst electricity is applied through a number of metal plates which are brought into contact with the skin at various points. The results are said to be both successful and rapid.

Business Announcement.—With regard to our notices regarding the affairs of Mr. A. Martin, trading as the Midland Electrical Supply Co., of Birmingham, the Midland Electric Manufacturing Co., Ltd., of Stafford Works, Rea Street South, Birmingham, write pointing out that their company is in no way connected with the concern referred to, and has never been in any way associated with the same.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also their friends and relatives and others, to keep readers of the ELECTRICAL REVIEW *posted as to* [illegible].

Central Station Officials.—The staff of the York Corporation electricity department have presented a clock to MR. HERBERT FOSTER, who is leaving to take up an appointment with the Electrical Co., Ltd., of London.

MR. W. M. MILNES, assistant electrical engineer to the Burnley Corporation, having obtained another appointment at Coventry, MR. T. TAYLOR has been appointed assistant engineer, and MR. H. LEAVER, of Middlesbrough, has been selected to fill the position of senior assistant engineer.

MR. E. B. THORNHILL has been appointed borough electrical engineer at Limerick, in succession to Mr. Grainger, who resigned that appointment.

MR. W. W. PARKINSON, the works manager of Blackpool Corporation electricity department, was married to Miss Gertrude Robson, eldest daughter of the late Mr. Fredk. Robson, of St. James's Road, South Shore, at the Wesleyan Church, at Ansdell, on Friday last.

MR. F. C. HODGE, of Stretford, has been appointed to the position of installation foreman recently advertised by the Salford Corporation electricity department.

MR. ALBERT SPENCER-WELLS, of the Wellingborough Electric Supply Co., Ltd., and formerly of Stratford-on-Avon and Cheltenham, has joined Messrs. Callender's staff at Bombay.

Tramway Officials.—A large gathering of the officials and employés of the Hull Corporation tramway electrical engineer's department took place at the tramway power station on Saturday evening, to bid farewell to MR. W. T. ROBSON, who is leaving to take up the position of general manager of the South Shields Corporation tramways. Mr. J. Wilkinson, the tramway electrical engineer, referred briefly to the 12 years which Mr. Robson had spent as an official in the department, and said that Mr. Robson had gained the esteem of all with whom he had come in contact, and especially of the men over whom he had had control. He wished him on behalf of all present every good fortune in his new undertaking. On behalf of the staff and employés, Mr. Wilkinson asked Mr. Robson to accept with the best wishes of all those present, a gold lever watch. Mr. Robson responded in suitable terms.

MR. L. E. HARVEY, tramways manager at South Shields, who is leaving to take up a similar appointment at Ilford, has been presented by the staff and employés with a hall clock and photograph of the subscribers, and by the shed men and office staff with a leather suit case.

MR. EDMED, permanent way engineer on the Maidstone Corporation tramways, who is leaving to take up a similar position at Dartford, has been presented by the tramway employés with a case of pipes and a silver-mounted walking stick.

MR. FRANK BUCKLEY, the newly-appointed manager of the Wigan Corporation tramways, has been presented by the Salford Tramway staff with a silver flower stand as a farewell gift.

General.—MR. E. H. OWEN, who is shortly severing his connection with the Diesel Engine Co., intends to devote his extensive knowledge and experience of high-compression engines to a new development in Diesel type motors.

The *Times* announces that the Postmaster-General has appointed MR. L. A. MARSHALL, I.S.O., to be Assistant Secretary to the Post Office.

At the annual meeting of the Govan Unionist Association, satisfaction was expressed over the fact that MR. GEORGE BALFOUR would again contest the constituency. In the course of the proceedings a letter was read from Sir Geo. Younger, the Scottish Unionist Whip, congratulating the Unionists of Govan on having again secured Mr. Geo. Balfour as candidate.

MR. M. I. WILLIAMS-ELLIS left England last week for South Africa, in connection with electrical work on the Rand.

Obituary.—MR. DUNCAN MCNAUGHT.—We regret to announce the death of Mr. Duncan McNaught, resident engineer to the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., who passed away on Monday, September 23rd, at the age of 56, after a brief illness resulting from internal complications. Mr. McNaught entered the company's service some 25 years ago, and in spite of his strenuous work in connection with his important position, was at all times of a congenial disposition and interested himself considerably in various local events, especially athletics. He was likewise a keen yachtsman. This pastime always had a fascination for him, and he enjoyed it at every favourable opportunity. He was a son of the late William McNaught, of Glasgow, and Manchester, the inventor of the McNaught compound beam engine, and his grandfather was the inventor of the well-known McNaught indicator. The interment took place at East Ham Parish Churchyard on Saturday last. The *cortège* was attended by the following mourners:—Mr. Robert McNaught (brother), Mr. Stuart A. Russell (works manager), Capt. Benest (submarine cable department), Mr. W. Best (electric light department), Dr. Brews, J.P. (his medical attendant), Messrs. W. D. Blair, H. B. Robinson, T. H. Ivey, F. T. Laws and H. E. Westhorp (engineering department), R. Stables and A. Cheetham (india-rubber department), G. Stoat (ebonite department), E. Wolfe (electrical cables department) Geo. K. Willsher (general offices), also Messrs. T. W. Dickson, T Ginman, C. Brown, J. Gemmell, C. Rush, H. Nelson, W. Cosh, H. Wolfe H. Towlson, F. Pattinson, M. Williams, E. Barnard, W. Robinson D. Anderson, J. W. Pearson, A. Collier, Williams and Gamblin Amongst the numerous company assembled in the church and at the graveside was Mr. [illegible] H. Gray [illegible] the company's

THE LATE MR. DUNCAN MCNAUGHT.

directors). The floral tributes, which were very numerous, included those sent by the engineering department staff, workmen of the engineering department, the india-rubber and tire-making staff, Charlton Conservative Club, Mr. Stuart A. Russell, india-rubber works athletic club, proofing department, Mr. C. H. Gray, Mr. M. H. Gray, "Graysilver Band," and a beautiful artificial wreath from the members of the works fire brigade, of which Mr. McNaught was captain.

CITY NOTES.

Quebec Railway Light, Heat and Power Co., Ltd.

THE directors' report for the year ended June 30th, 1912, which was submitted at the annual meeting held at Montreal on September 10th, showed that the gross earnings from operation for the year were $1,415,825, as compared with $1,280,127 in 1911, an increase of $135,698. The operating expenses were $734,925, as compared with $661,907, an increase of $73,018. The net earnings were $680,900, an increase of $62,680 over 1911, equal to 10·13 per cent. After adding miscellaneous income of $194,584, and deducting fixed charges of $660,364, dividends paid October 15th, 1911, and January 15th, 1912, amounting to $199,990, and organisation expenses of $3,920, there remains a net surplus of $11,211, which added to the surplus account leaves a balance of $73,539 to the credit of this account. Reserve accounts have also been created. The work of the consolidation under the direction of Mr. R. S. Kelsch, consulting engineer, of the various power supplies at the Queen Street sub-station has been completed and is a great advantage both to the customers of the company and the company itself, guaranteeing as it does a service free from interruptions or breakdowns, the company being able to utilise power from any one or all of its hydraulic stations, and its steam plant for its various lighting or power requirements. Special attention has been paid during the year to the distribution system, and a large sum has been expended in repairs and replacements. Several important power contracts are in view for the coming year and the outlook is bright. The increase in gross earnings from operation of $135,698 demonstrates not only the increased growth of the company's business, but also of the city and district served by the company, and it is the opinion of the directors that this increased growth will continue. A feature of the financial report is that while a large sum has been spent by the company upon the upkeep and improvement of its various plants, the percentage of operating expenses to gross earnings remains at the low figure of 51·91 per cent. The completion of the company's new office building at the corner of Crown and St. Joseph Streets was unfortunately delayed until May 1st this year. The completion of the building enables the consolidation of the company's executive offices in the one building, and has facilitated the transaction of the company's business.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months ended September 30th.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. for the quarter to September 30th on the ordinary shares.

Helsby Wireless Telegraph Co., Ltd.

Lieut.-Col. J. Bernard (chairman) presided at a meeting of the shareholders of the above company at Lennox House, Norfolk Street, W.C., on Wednesday. The proceedings were purely formal, and on the motion of the chairman the report, from which we make the following extracts, was adopted :—

"Since December 5th last, the date of the last report, the award in the arbitration then referred to has been given, and its terms, although onerous, allow us to continue the development of our wireless telegraph business which we are now actively pursuing. The arbitration was tiresomely prolonged, and the award was not forthcoming until June 11th last. The expenses were considerable, but Messrs. Siemens Bros. & Co., Ltd., very generously supported us not only financially, but by placing their experienced advice and technical experts at our disposal, and, probably, without their assistance we should not have been able to maintain our application against the long-drawn-out opposition to which we were subjected."

"We are advised that the Lodge patent is a master one, and therefore it was impossible to quote prices or seek business until the above award was given, but in the meantime a great deal of preparatory work has been done and the apparatus standardised, and your directors are glad to report that the numerous inquiries reaching them are now being energetically dealt with. Moreover, they are advised that the system, altered and improved, now adopted is quite free from any likelihood of contention as regards patent infringement, &c. The report recently issued by the Merchant Shipping Advisory Committee respecting life-saving appliances and other means of ensuring safety of life at sea refers, *inter alia*, to the evidence given before it by your chairman and by your engineer, and to the work already done by your company. The Committee draw attention to the fact that it is desirable to first establish the conditions of a free market in wireless telegraphy before recommending compulsory usage, so as to obviate the possibility of ship owners being delivered into the hands of a monopoly which could impose such terms as it pleased without stay or hindrance. Your directors believe that this recommendation is greatly in favour of your company's prospects, since, subject to a free market being established, the Committee are of opinion that the installation of wireless telegraphy is a necessity on all foreign-going vessels having on board 50 persons or more, including passengers and crew, and that it is desirable with regard to vessels not carrying passengers that an adequate number of them should be so equipped. This weighty dictum appears to open up a vast field for the operations of your company, which your directors are now ready to take advantage of.

"In the last report the question of tranferring the company's entire commercial management to the British Insulated and Helsby Cables, Ltd., or an associated company, was referred to. Your directors having gone further into the details of the matter, have come to the conclusion that it is preferable to retain the commercial control of the business in the hands of your company, and they have now arrived at an alternative arrangement with the British Insulated and Helsby Cables, Ltd., and the Automatic Telephone Manufacturing Co., Ltd., which they recommend being carried through under an agreement, as being the best possible arrangement for your company, under all the circumstances, and this agreement they are now ready to complete. These altered conditions will, with the vendor shareholders' assent, not prevent the scheme for the reduction of capital from £20,498 to £10,000 being carried through in accordance with the special resolution passed in December last, and confirmed in January. An application to this effect to the Court will be made as early as possible."

"Referring to the accounts . . . . for the reasons already stated . . . . practically no business has been transacted during the year. A considerable reduction has been made in the general charges, and it has been deemed advisable to write down the value of the stock to the lowest possible figure, the depreciation having chiefly arisen through our having to remodel our apparatus, in consequence of the judgment given last year by Mr. Justice Parker, and to conform with the Lodge (Master) Patent under which we are obliged to work. Regarding the large amounts appearing as an asset under the two headings, "Purchase Account" and "Preliminary Expenses," your directors propose to write down the aggregate of these amounts by the amount (£10,498) of the reduced capital following the surrender of the equivalent value of the vendor shares, as soon as that reduction has been effected."

Owing to ill health, Captain Gonne has been obliged to resign his seat on the board. The directors have obtained an acquisition to the board in Mr. Arthur Brooker, a gentleman widely known in the telegraph world, who has been appointed to fill the vacancy.

Prospectus.—*The General Electric Co. (U.S.A.).*—Applications have just been invited for $4,000,000 forty-year 5 per cent. gold debentures in denominations of $500 and $1,000 each to bearer at the price of 99¾ per cent. and accrued interest, which at exchange $4·86 is equivalent to £103 10s. per $500. A simultaneous offer of debentures has been made in the U.S.A. The proceeds are to provide for the rapidly-expanding business of the company, orders received for the current year being at a rate in excess of $90,000,000 per annum against about $70,000,000 in 1911.

Costa Rica Electric Light and Power Co., Ltd.—The annual meeting of this company was held on Wednesday at the offices, Dashwood House, Old Broad Street. A representative of the Electrical Review was informed that the proceedings were private, and a request for a copy of the report was refused.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved :—

Cape Town-Cairo Railway and Telegraph Combination Syndicate, Ltd.
Chorley and District Tramways, Ltd.
De Martis Electric Storage Syndicate, Ltd.
Dual Ignition Co., Ltd.
E.B. Liquid Fuel Burners and Furnaces, Ltd.
Electrical Trolley Head Co., Ltd.
Electric Entertainments Syndicate, Ltd.
Electro-Metallurgical Syndicate, Ltd.
Electric Ordnance Co., Ltd.
Electro Scrip Sign Co., Ltd.
Gravity Flame Arc Lamps, Ltd.
Hart-Durtnall Syndicate, Ltd.
Holmquist Electric Co., Ltd.
Integral Steam Generator Syndicate, Ltd.
Ljungstrom Engine Boiler and Condenser Co., Ltd.
Mersea Motor and Electric Co., Ltd.
Mountain & Gibson & Thornewill, Ltd.
National Radium Trust, Ltd.
Palmer & Co. (Electricians), Ltd.
Perth Traction and Development Co., Ltd.
Pollak-Virag Rapid Telegraph Co., Ltd.
Premier Electric Institute, Ltd.
Technical Press Bureau, Ltd.
Wireless Syndicate, Ltd.

United Electric Tramways Co. of Caracas, Ltd.—The report (as appearing in the *Financier*) states that the profits of the local company (the whole capital of which is owned by this company) for the past year have shown a gratifying increase. The net result is that had the profits of the local company been distributed they would have been sufficient to pay a dividend of over 5 per cent. on this company's capital, in addition to debenture interest and sinking fund, and the usual provision for renewals and reserve. The directors consider this very satisfactory. The operations of the local company (La Compania de Tranvias Electricos de Caracas) are shown as under :—Gross receipts, 1911-12, Bs1,247,405 ; increase, Bs158,424 ; operating expenses, 1911-12, Bs688,610 ; increase, Bs51,572 ; net receipts, 1911-12, Bs558,795 ; increase, Bs96,851 (at an average exchange for the year (25·96) equal to £21,523 ; increase, £3,799). After adding Bs171,030, the balance of profit carried forward from the previous years, providing for the mortgage interest payable to this company—viz., £10,200 (equal to Bs257,550), setting aside Bs50,000 to reserve and renewal funds, and paying a dividend of 5 per cent. on the share capital of Bs636,000, which absorbed Bs31,800, the local company are enabled to carry forward Bs390,476. Notwithstanding an increase in operating expenses, due to the increased traffic, the ratio to gross receipts is less by 2·38 per cent. compared with the previous year. Three new cars which the increasing traffic necessitated have been provided, and are now being put into service, and two new short extensions of the line have been authorised. In compliance with the terms of the trust deed £979 has been placed to the sinking fund for the redemption of mortgage debenture stock, and £1,100 first mortgage debenture stock has been purchased this year in the market and cancelled.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—The report shows (according to the *Times*) that the net earnings for the year ended June 30th amounted to $2,822,399 After deducting fixed charges and dividends paid and payable, and placing $455,526 to reserve for renewals, amortisation, &c., there remains a net surplus of $204,855. The gross income, as compared with the previous year, shows an increase of $597,510, or 12·3 per cent., and the net earnings an increase of $410,063, or 17 per cent. The business of both the gas division and the electric division has continued to expand, the gas output showing an increase of 8 per cent. and the electric output an increase of 43·6 per cent., as compared with the previous year. In order to meet the increasing use of gas and electricity and to anticipate future requirements, expenditures during the year for extensions, improvements and betterments completed and in course of completion amounted to $1,364,703.

Dundee, Broughty Ferry and District Tramway Co., Ltd.—Ex-Provost Brownlee, the chairman, moving the adoption of the directors' report, which recommended payment of a dividend of 2½ per cent. on the ordinary shares, at the annual meeting last week, pointed out that there was an increase in revenue of £735, and an increase in expenditure of £470. The increased receipts were due to the coal strike and the consequent withdrawal of many of the trains. Everything in connection with the company was going quite satisfactorily and the revenue had been fairly good. Mr. George Balfour seconded, and the report was adopted. Messrs. George Balfour and D. W. Wybrants were re-elected directors. Mr. Balfour, in acknowledging, said that recently a scare had got up with regard to motor-'bus competition with tramways, but after a pretty wide experience of tramways and a moderate knowledge of motor-'buses, he thought that no one holding tramway stock in interurban systems need fear motor-'bus competition, even with the most up-to-date 'buses or with future improvement of the 'bus system.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 8 per cent. per annum for the six months ended June 30th last. The dividend will be payable on October 15th next.

Madras Electric Tramways (1904), Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the June half-year.

Babcock & Wilcox, Ltd.—The directors announce an interim dividend of 7 per cent. (actual) on the ordinary shares.

Cleveland and Durham Electric Power Co., Ltd.

The sixth ordinary general meeting was held at Newcastle-on-Tyne on September 26th, Mr. James Falconer, M.P., in the chair. There was a large attendance of shareholders.

The Chairman, in moving the adoption of the report (see Electrical Review, page 509), said that the gross profit for the year was £25,783 as against a gross profit of £20,973 last year. In considering the bearing of that on the result of the year, it was necessary to keep in view that during the year covered by the accounts they had a railway and a coal strike. The coal strike cost them £8,000 as a direct loss, and when they took that into account, with the fact that they had still increased their profit by £4,810, he thought the shareholders would agree that there had been a substantial advance in their business. During that strike they had been able to supply their consumers every unit of energy they required. The net profit for the year was £6,720, and with the carry forward there was £15,000 to dispose of. They proposed to write off the discounts on the second debentures (£2,800), and to lay the foundation of a depreciation and renewal fund (£2,000), and to pay 2 per cent. on the preference shares which came to £6,674; that left £3,589 to carry forward to the next account. With regard to the position of the company's business, he would like to say a few words. As the shareholders knew, that company—the Cleveland Limited Co.—was formed to acquire shares in the Cleveland Parliamentary Co., which owned statutory powers over a wide area, and to develop it. In that company were held the whole of the shares. They also owned the controlling interest in another company, called the Northern Counties Co., which supplied the power for certain other areas. Now, the best method of testing the advance of the company's business was to take the results of the Limited Co. and of the Parliamentary Co. and of the Northern Counties Co. together. Taking the gross profit for the year of the three companies, these amounted to £34,153, an increase over last year of £8,932. In the preceding three years, they were in 1909-10 £20,000, in 1910-11 £26,000, and as they had just heard in 1911-12, £34,153. It had also to be borne in mind that their capital charges had been increasing, because they had been spending more money and had had to pay more money for these three years. The charges for interest were as follow:—In 1909, £17,629; 1910-11, £19,598; and 1911-12, £25,571; and the balances in these three respective years were £2,500, £6,423 and £8,500. If they took another test, that of the amount of horse-power connected, which was a real indication of the business which they had secured, the figures for the year which they had now reached was 48,429 H.P. connected, as against 40,460 H.P. on June 30th, 1911, an increase of substantially 20 per cent. As regarded the immediate future, they had at the present time contracts arranged to the extent of 11,000 H.P., so that the volume of business which the company might look forward to doing showed a steady substantial increase. He thought they would agree that there had been a real substantial progress in the development of the business of the company. He added that it was the board's opinion and his own, that there was good reason for the shareholders having confidence in the company. That opinion was based on these considerations. They had an exceptionally fine field for the supply of power, and they had the best system of generation of any company, owing to the fact that they had in their area of supply a very large volume of waste heat which they had been able to utilise for manufacturing electricity. From the point of reliability and economy their company would compare favourably with any company of which he was aware. They had laid down a very comprehensive system of distribution, so that they were able to deal with a very large increase in the volume of their business without any great expenditure on their system of distribution. So far as the directors were concerned, they had confidence in the undertaking. As to the time in which success would be fully attained, that was a question which very much depended on the consumers, fluctuations might occur that were beyond their control, yet, if their progress was maintained, as there was every reason to believe it would be maintained, they were approaching a time when there would be a return for the capital in the undertaking. The chairman then went on to refer to a circular that had been sent out by Mr. Gemmell. The questions raised in that circular, he said, were old questions, but at the same time shareholders who did not know the facts might think there was something in the charges which were made apparently against the board. The first point Mr. Gemmell raised was as to the arrangement between that company and the Waste Heat Co. So far as the interests of their company were concerned, he did not know that there was anything that was more satisfactory than that arrangement. They had been able to get a supply of power on much more favourable terms than any other company was able to manufacture it. On what grounds Mr. Gemmell could suggest that this waste heat agreement was against the interests of their company he could not possibly understand. It was suggested that it was not within the powers of the company. It was not only within the powers of the company, but it was the absolute duty of the board to provide the cheapest current they could, and this they had done in making this agreement. The next point Mr. Gemmell dealt with was the question with regard to what he called "fictitious profits" as between the Limited Co. and the Parliamentary Co. In this regard Mr. Gemmell was under a delusion. There was nothing of the kind in the accounts. The chairman went further into Mr. Gemmell's statements at considerable length.

Mr. Gemmell said he did not doubt that the directors had done their best, but they could not shut their eyes to the fact that they had produced very poor results in the last six years. He regretted that he was unable to accept the chairman's statement as a proper interpretation of the position of affairs. It was not a satisfactory explanation of past irregularities, and it was not an adequate reply to the charges made against the directors. The shareholders were not getting fair play. They were not getting out of this business what they as shareholders were entitled to. There ought to have been a dividend for both preference and ordinary shareholders. They were not getting half the profits that were estimated in the prospectus without waste heat. After further remarks, Mr. Gemmell moved an amendment postponing the adoption of the report, and appointing a committee of investigation.

Mrs. Gemmell seconded the amendment, and on the Chairman putting it, he declared that the mover and seconder alone voted for it.

The report was then adopted by a large majority.

The election of Mr. C. P. F. Pierret as a director was confirmed, and Mr. Philip E. Noble was re-elected.

Mr. William Swan, the retiring auditor, was then re-elected, an amendment moved by Mr. Gemmell that Messrs. Strachan & Co. and Messrs. Peat & Co. be appointed being defeated, only Mr. and Mrs. Gemmell supporting it.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Madras Electric Tramways [illegible] Ltd.—[illegible] per cent. cumulative preference shares of £[illegible] each, fully paid, Nos. [illegible].

The Committee have appointed special settling days as under:—

Wednesday, October 16th.—General Electric Co., Ltd., further issue of 15,000 6 per cent. cumulative preference shares of £10 each, £6 paid (Nos. 25,001 to 40,000) (provisional certificates).

Thursday, October 17th.—Buenos Ayres Lacroze Tramways Co., scrip, fully and partly paid, for £500,000 5 per cent. consolidated mortgage debentures.

And ordered the undermentioned securities to be quoted in the Official List:—

Buenos Ayres Lacroze Tramways Co.—Scrip, partly paid, for £500,000 5 per cent. consolidated mortgage debentures.

General Electric Co., Ltd.—Further issue of 15,000 6 per cent. cumulative preference shares of £10 each, £6 paid (Nos. 25,001 to 40,000) (provisional certificates).

Ruston, Proctor & Co., Ltd.—Further issue of 150,000 ordinary shares of £1 each, fully paid (Nos. 350,001 to 500,000).

Sunderland District Electric Tramways, Ltd. According to the *Financier*, the report states that the accounts for the year to October 31st, 1911, after providing for interest on prior lien bonds and debentures, show a loss of £688, increasing the debit balance of revenue account to £16,890. The meeting was called for yesterday.

Lisbon Electric Tramways Co., Ltd. The directors have announced an interim dividend of 3 per cent., free of tax, payable on November 1st.

Metropolitan Electric Tramways, Ltd.—The directors have declared an interim dividend of 2½ per cent. (6d. per share), less income-tax, on the ordinary shares.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1¼ per cent.

STOCKS AND SHARES.

Tuesday Evening.

Foreign politics have overhung Stock Exchange markets very darkly this week. Once more it is the Balkans which is the centre of the disturbances, and with the newspapers' contents bills full of gloomy—not to say sensational—suggestions, it is not surprising that neither investor nor speculator cares to venture far into fresh avenues of financial enterprise. So far as price movements in our lists are concerned, the most marked are those in Sao Paulo Trams and Rio Trams. There is also considerable business going on still in the Underground Railway group.

City and South London Ordinary stock, after touching 46, subsided to 42 on the delay in the expected announcement that the line was going to be taken over by the Midland Railway on the basis of a 2½ per cent. guaranteed dividend. On the face of it, the rumour did not look probable, but it served its purpose; and perhaps, on the theory that where there is smoke there is fire, there may be something in the idea that one of the bigger companies is angling for control of the oldest tube in London. The company's four Preference stocks have all moved up to the extent of a point each. Central London Ordinary, after rising 3 to 81, eased off to 79, and here also the rumour-mongers are very busy with the suggestion that the Great Western, this time, is seeking to obtain the Central London for its own by the promise of a guaranteed dividend variously estimated between 4 and 4½ per cent. It has of late become so fashionable to connect one tube railway with sometimes several of the bigger lines that any statement is eagerly snapped up, and prices are advanced without much regard to the inherent likelihood of the rumours proving correct. Metropolitan Consolidated fell back 2½ in Tuesday's slump, and Districts shed a point. There is no change in Great Northern and City Preferred, and East Londons keep steady at 9⅝.

London United Tramways Preference are 25s. up to 5⅞, and the Debenture stock at 74 is a point higher, on whispers that important negotiations are afoot with a view to bringing this company more closely into the tube and 'bus combine. There is never much market in either class of the London United Company's issues, so it takes little to move the prices quite sharply. Moreover, the progressive results achieved by the Metropolitan Electric Tramways had their sympathetic effect, while the tramway shares themselves spurted ⅛, the Deferred rising 1/32 on the good figures printed in the report. British Electric Tractions are a little better. Isle of Thanet 4 per cent. Debenture rose 2. While the railway market is influenced largely by the depression brought about by the Balkans affair, the Tramways section is able to pursue a line of its own, and no particular notice is taken of the happenings abroad.

English Electricity Supply shares continue to show decided strength. In the London division the feature is the strength of Brompton Ordinary and Preference, the former rising 10s., and the latter 1s. 8d. Cities are the turn easier at 18 middle. Metropolitans, however, are ⅛ down. Oxfords recovered part of the dividend deducted, and show a rise of 5s.; while the other movements are mainly the result of *ex*-dividend markings, some of the deductions being partially recovered by now.

It has already been mentioned that Sao Paulo Trams are particularly strong, and the net result is a rise in the shares to 285, being about 17 points higher on the week. There is, of course, a comparatively narrow market in the shares, and statements are in the air amalgamating this company with one or two others; although, at the same time, it is declared that the rise in the price is justified on the earnings of the company, which certainly show remarkable expansion, and point to a possible increase in the dividend before long. Rio trams are 5½ higher, following upon their rise of 4 last week. Shawinigan Water stock has eased off 2 points nominally, but this is due to the fact of the stock being quoted *ex* rights. British Columbia Electric Railway Deferred shows a rise of 2, and the whole of the Latin-Canadian market displays strength. There has been a recovery in various Mexican issues, the news from the country being read as rather less disquieting than it was a week ago. Calcutta Trams are good, putting on ⅛, and Cordoba Light and Power Ordinary hardened to 18s. 9d. middle.

In the Telegraph market, the firmness of the Anglo-American group is again noticeable, though there are no quotable changes in the prices of Anglo-American stocks. American Telephone and Telegraphs lost their 2 points rise of last week. The recovery in West India and Panama Ordinary and First Preference was hailed as an indication that the buyers from over the water are taking an interest again in the shares, but perhaps it would be well not to build too much upon this assertion at the moment, for the Americans are very busy engineering their autumn boom in Rails, in the teeth of the excitement and unsettlement produced by the forthcoming presidential election. Moreover, the anti-trustites are on the war-path again, and money is dear in New York.

Globe Telegraph Trust Ordinary and Preference both recovered the dividends taken off the prices last Friday. Oriental Telephones are 1/16 higher, and so are United River Plate Telephones. Reuters, on the declaration of a substantial increase in the dividend, moved up 17s. 6d. to 11⅜ middle. The Marconi market has been flat. Added to the plain hint of possible competition, there is the unfortunate accident to the renowned inventor which has involved the question of his eyesight; and although everybody is thankful to hear the physicians say they hope that Mr. Marconi's eyesight will not be impaired, the mere apprehension of such a thing served to depress the market materially. A recovery has ensued from the lowest prices touched, but various parts of the group—American, Canadian and Spanish—participated in the dulness shown by the shares of the parent company.

Manufacturing issues are, on the whole, very firm. Babcocks at 3 5/16 are 1/16 better, though Dick, Kerrs have given way slightly. Several of the Debenture stocks are in demand, and in some cases there is not sufficient supply to meet it. In the Rubber market the prices of shares have followed that of the raw material, which has been sagging. Conflicting views are expressed by people who ought to know as to what the future of the raw rubber market is likely to hold, and those who contend that there will be a shortage of the product before Christmas stick to their guns in spite of the apparent apathy shown by large users of raw rubber.

The additions made to our dividend columns, to which we drew attention last week, have already proved useful, if we may judge from several remarks which have reached us. At the risk of wearying by reiteration, may we repeat that, in most cases, it is essential to work out the yields on the basis of the last dividends paid; but where this would be obviously misleading, we have left the space blank in the final column. For example: General Electric Preference shares, of course, now carry a 6 per cent. dividend, but this distribution will not start until the new year. There are a few instances of somewhat similar sort which have to be treated in this way; and, as we observed last week, it will be regarded as a kindness if readers will take the trouble to point out what mistakes and omissions may have eluded the endeavour to get the lists exactly correct.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the five weeks ended August 30th, 1912, amounted to 1,403,438, compared with 1,228,805 units in the corresponding five weeks in 1911.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for interest on the 4½ per cent. first mortgage debenture stock, for the six months ended 1st inst., were posted some days ago.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Sept. 25	3,215	+ 127	17	27,768	— 48	14·4	..
Ayr	„ 28	970	+ 21	19	8,628	+ 142	8	..
Bath	..	..	..	..	..	..	..	..
Birkenhead.. ..	..	..	..	..	..	..	..	..
Birmingham Corp.	„ 21	21,453	+3,340	25	264,483	+59,861	57·17	..
Blackburn	„ 25	2,507	+ 155	26½	31,953	+ 205	14·62	..
Blackpool Corp. ..	„ 26	4,908	+ 595	..	..	..	11·87	..
Blackpool-Fleetw'd	„ 28	2,364	+ 244	12	20,830	— 777	8	..
Bournemouth ..	„ 25	4,327	+ 315	25½	52,402	+ 1,425	21·95	..
Bradford	„ 21	11,183	+ 269	25	141,105	— 2,098	56	..
Brighton	„ 29	2,136	— 45	26	29,860	— 1,120	9·5	..
Bristol	„ 27	15,029	+2,088	..	271,198	+20,819	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 20	648	+ 177	38	11,304	+ 3,018	3·65	..
Barnsley	„ 20	392	+ 6	„	6,745	— 270	..	..
Barrow	„ 20	806	+ 68	„	14,748	+ 2,943	5·37	..
Devonport ..	„ 20	1,156	+ 73	„	20,573	+ 1,561	8·85	..
Gateshead ..	„ 20	2,197	+ 65	„	39,348	— 100	11·25	..
Gravesend ..	„ 20	460	— 12	„	7,973	— 227	6·5	..
Greenock.. ..	„ 20	1,733	+ 150	„	30,968	+ 3,191	7·25	..
Kidderminster ..	„ 20	252	— 5	„	4,6 7	+ 21	..	..
‡Leamington ..	„ 20	431	8	„	7,316	+ 333	..	..
Merthyr	„ 20	446	- 3	„	7,613	— 403	2·9	..
Metropolitan ..	„ 20	17,602	—1,026	„	335,619	— 500	22	..
Middleton ..	„ 20	675	— 19	„	12,829	— 429	8·5	..
Mid. Joint Com'tee	„ 20	6,902	+ 392	„	124,046	+ 5,718	..	..
Oldham—Ashton	„ 20	1,261	+ 84	„	23,254	+ 1,388	9·18	..
Peterborough ..	„ 20	274	— 1	„	5,254	+ 311	5·81	..
Potteries	„ 20	4,178	+ 111	„	71,804	— 1,266	27	..
Rothesay	„ 20	596	+ 45	„	9,693	— 83	2·75	..
Southport ..	„ 20	683	+ 22	„	11,733	— 307	8·17	..
S. Metropolitan..	„ 20	1,737	— 88	„	32,613	— 1,015	..	..
Swansea	„ 20	2,417	+ 12	„	43,916	+ 65	12·5	..
Tynemouth ..	„ 20	586	— 18	„	9,901	— 993	3·75	..
Weston-s-Mare ..	„ 20	500	— 90	„	6,264	— 1,308	8	..
‡Worcester ..	„ 20	648	— 65	„	11,888	— 141	5·75	..
Wrexham ..	„ 20	251	+ 22	„	4,386	+ 506	..	..
Yorks. Wool. Dist.	„ 20	2,269	+ 85	„	41,153	+ 933	17	..
Miscellaneous ..	„ 20	..		„			..	..
Burnley	„ 28	3,185	+ 476	..	..	.	12·44	..
Burton-on-Trent ..	„ 29	529	— 25	26	7,172	— 433	6·6	..
Bury	„ 22	2,745	+ 215	25	33,258	+ 685	22·5	..
Cardiff	„ 21	5,085	+ 224	25	61,889	— 2,665	17·35	..
Chatham and Dist.	„ 26	1,806	+ 3	39	33,476	— 368	14·98	..
Cork	„ 26	992	— 6	39	18,938	— 907	9·89	..
Croydon	„ 20	3,551	— 60	24	46,308	— 1,257	11·6	..
Darlington	„ 28	435	— 12	26	5,875	+ 30	4·87	..
Darwen	„ 27	547	+ 24	26	7,346	+ 155	4·36	..
Dover	„ 21	512	— 87	25	6,735	— 556	4·75	..
Dublin	„ 27	11,450	+ 440	..	77,940	— 9,417	54·25	..
East Ham .. .	„ 28	2,115	— 66	26	27,921	479	7·87	..
Exeter .. .	.	.	..	.	..		.	..
Glasgow	„ 28	39,540	—1,750	..	319,896	6,276	98	..
Hastings	„ 30	2,528	43	..	..	— 2,4 8	19·3	..
Hull	„ 28	5,835	+ 203	26	75,524	+ 730	13·5	—1
†Ilkeston	„ 25	122	8	26	2,867	— 675	..	..
†Ipswich	„ 21	482	— 4	25	12,070	233	10·5	..
†Kilmarnock ..	„ 21	169	+ 8	18	3,112	— 219	4·25	..
Lancashire United	„ 25	2,954	+ 209	39	52,488	— 315	39	..
Leeds	„ 28	16,097	+ 913	25	204,612	+ 6,199	112·7	..
Leicester	„ 28	5,814	+ 262	39	99,216	+ 2,934	20	..
Leith	„ 28	1,884	+ 88	19½	13,971	+ 157	8·72	..
Liverpool	„ 21	23,870	+ 604	37½	453,834	+20,058	117	1
‡L.C.C.	„ 18	80,158	—6,855	..	1,042,349	—55,849	141·1	—·5
London United ..	„ 28	12,679	— 632	..	248,318	—13,625	..	..
†Lowestoft	„ 28	209	— 20	52	10,728	— 947	8·5	..
Manchester ..	„ 28	84,194	+1,757	26	488,952	+14,804	105	..
Newcastle	„ 28	8,825	+ 434	..	113,849	+ 1,147	31·8	..
Newport	„ 21	1,423	+ 56	25	17,801	— 695	7·25	..
Oldham	„ 29	4,116	+ 256	27	56,016	+ 2,992	23	..
Pontypridd	„ 28	855	+ 40	26	10,185	— 705	5·5	..
Portsmouth.. ..		..	..	..	..	..	15·75	..
Preston	„ 25	1,602	— 39	26	21,953	+ 958	10	..
Rotherham	„ 25	1,545	+ 184	25½	18,726	+ 1,170	12	..
Salford	„ 30	10,033	+ 193	26	132,990	+ 2,925	41	..
Sheffield	Oct. 1	13,609	+ 792	..	178,611	+ 6,215	40	..
Southampton ..	Sept. 25	2,591	— 38	25	33,487	— 155	11	..
Southend-on-Sea ..	„ 25	1,818	+ 124	26	28,681	+ 2,247	7	..
†South Shields ..	„ 21	684	+ 93	25	16,252	— 139	10·25	..
Tyneside	„ 25	1,075	+ 126	13	6,452	— 763	11	..
Wallasey	„ 28	2,196	+ 19	25½	30,859	— 466	8·72	..
Walthamstow ..	„ 28	1,481	— 13	26	20,223	— 849	9	..
West Ham.. ..	„ 19	5,111	— 332	24¾	65,912	— 2,647	16·45	1·2
Wolverhampton ..	„ 25	2,025	+ 88	26	26,463	+ 337	13·75	..
Cen. London Rly...	„ 28	9,687	+ 163	13	57,489	+ 597	6·78	·5
City & S. Lon. Rly.	„ 29	5,671	— 663	13	36,956	— 2,976	7·26	..
Dublin-Lucan Rly.	„ 27	334	+ 2	13	2,124	— 137	7	..
G.N. and City Rly.	„ 28	2,687	— 88	13	17,817	— 40	3·5	..
L'pool Overh'd Rly.	„ 29	3,252	+ 166	13	21,934	+ 1,801	6·6	..
Llandudno-Col. Bay	„ 27	817	+ 12	43·5	14,556	+ 620	6·5	..
Lond. Elec. Ry. Co.	„ 28	25,575	+ 180	13	157,675	+ 4,785	21·25	..
Mersey Railway ..	„ 28	4,488	+ 345	13	26,877	+ 3,066	4·5	..
Metropolitan Rly...	„ 29	85,851	+ 443	13	216,688	+ 5,457	25·75	..
Met. District Rly...	„ 28	24,707	+1,950	13	154,475	+13,528	26	..
†Anglo-Argentine ..	„ 23	58,280	+5,556	39	1,934,933	+72,811	.	..
§Auckland	Aug. 30	18,602	+2,334	2	40,460	+ 8,506	24·1	..
Bombay (B.E.T.) ..	Sept. 9	5,996	+ 849	35	107,047	+ 5,117	..	..
§Brisbane	Aug.	27,680	+8,030	8	158,894	— 5,126	..	..
Brit. Columbia Rly.	..	..	..	..	..		..	..
Calcutta	Sept. 28	8,805	+ 818	..	..	+11,336	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Aug.	3,387	..	..	25,537	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 15	1,785	+1,638	..	28,355	+ 8,165	14·7	2
§Montevideo ..	Aug.	26,249	+2,284	10	290,107	+89,834	..	..
Perth (W.A.) ..	Sept. 27	8,644	+ 589	..	72,816	+10,298	22	..

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* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9¾—10¾	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8¾—9¾	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10¼—10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98—100	..	4 10 0
Brompton & Kensington, Ord...	5	10	9†	8¾—9¼	+ ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼—8¾	+ ⅛	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97—100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞—5⅛	..	4 13 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅜—4⅞	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾—4¼	..	5 6 0
Do. Do. 4 % Deb... ..	100	4	4	94—96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½—5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98—101	..	4 9 1
City of London, Ord.	10	8	6†	17—19	— ½	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12½—14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118—122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99—102	..	4 8 3
County of London, Ord... ..	10	6	4†	11½—12	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅞—12⅜	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106—108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100—103	..	4 8 3
Edmundson's, Ord.	5	Nil		⅞—1⅛	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3—3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84—87	..	5 3 6
Folkestone	5	6	6	4⅞—5⅛ xd	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅞—5⅛ xd	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92—95	..	4 14 9
Hove	5	9		7½—8	..	5 12 6

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*	1911.	1912.			£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½—8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90—93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78—82	..	5 9 9
London Electric, Ord.	3	2½		1⅝—2⅛		3 10 8
Do. 6 % Pref.	5	6	6	5¼—5½	..	5 11 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90—93	..	4 6 0
Metropolitan	5	4	4†	3⅞—4⅛	⅛	4 17 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4½—4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99—102	..	4 8 9
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86—88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½—99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4⅝—4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101—104	..	4 16
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10—11	..	5 9 1
Oxford	5	7½	6†	6—6½	+ ¼	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	8½—9½	..	5 5 3
Do. 7 % Pref.	5	7	7	6¾—7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85—88	..	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅝—1⅞	..	..
South London, Ord.	4	5	..	3—3½	..	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98—101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛—1¼	..	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96—99 xd	+ 1½	4 11 0
Urban, Ord...	£3	Nil		¼—¾	..	..
Do. 5 % Cum. Pref.	5	2		2½—3	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½—88½ xd	..	5 1 8
Westminster, Ord.	5	10	9†	8¾—9¼	..	5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	5—5⅜	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼—5¾	..	5 4 4
Calcutta, Ord.	5	8½	..	7½—8	..	5 6 3
Do. 5 % Pref.	5	5	5	4¹⁵⁄₁₆—5³⁄₁₆	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95—97	..	5 3 1
Canadian Gen. El. Com. ..	$100	7	7	113—118 xd	..	5 18 8
Do. 7 % Pref.	$100	7	7	118—122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	⅞—1	+ ¹⁄₁₆	3 0 0
Do. 5 % Deb.	100	5	5	94—97 xd	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92—94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81—84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½—97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	¹⁄₁₆—³⁄₁₆	..	Nil
Do. 6 % Pref.	1	6	6	¹¹⁄₁₆—¹³⁄₁₆	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104—106	..	4 14 4
Madras, Ord.	5	Nil	..	1½—2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102—105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87—89	..	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	94—97	..	4 2 6
Do. 7 % Cum. Pref.	$100	7	7	108—111	—1	6 6 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½—96½	..	5 3 8

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	86½—88½	..	5 13 0
Montreal, Lt., H. and Power ..	$100	8	9†	240—250	..	3 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	39—42	..	..
River Plate, Ord.	Stock	10		240—250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109—114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102—104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99—101	..	4 9 1
Shawinigan Water, Capital ..	$100	5	5	152—156 +rts	— 2	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108—110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104—106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	94—97	..	5 3 1
Victoria Falls Power, Pref. ..	1	11⅞d.	17½d.	³¹⁄₃₂—1¹⁄₃₂	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103—105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7¼—7¾	..	5 8 3
Do. 5 % Deb. Red.	Stock	5	5	96—98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	147—149	2	5 7 5
Do. Collat. Trust	$1000	4	4	93½—95½	..	4 3 9
Anglo-American Telegraph ..	Stock	3	3	68—70	..	5 7 2
Do. 6 % Pref.	Do.	6	6	113½—114½	..	5 4 10
Do. Def...	Do.	30/-	..	26⅝—26⅞	..	5 11 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102—104	..	4 16 2
Chili Telephone	5	7	8	7⅝—7⅞	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½—84½ xd	..	4 14 8
Cuba Telegraph	10	6	..	9½—10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½—17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼—3¾ xd	+ ⅛	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	6¾—7 xd	..	7 2 10
Direct United States Cable ..	10	5	4	7½—8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98—100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130—133	..	5 5 3
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	78—80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	..	3 18 10
Eastern Extension	10	7	7†	13⅛—13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	99—101	+ ½	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98—101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11—11½ xd	+ ⅛	5 4 4
Do. 6 % Pref.	10	6	6	12¾—13¼ xd	+ ⅛	4 10 7
Great Northern Telegraph ..	10	18	18	28¾—29¾	..	6 1 0
Indo-European Telegraph ..	25	13	..	57—59	..	5 8 5
Mackay Companies Common ..	$100	5	5†	87—91	..	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	68—71	..	5 12 8
Marconi's Wireless Telegraph	1	20	..	5¹³⁄₁₆—5¹⁵⁄₁₆	..	4 1 1
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅛—4⅜	— ⅜	3 17 8

Monte Video Telephone, Ord...	1	6	..	1³⁄₃₂—1⁵⁄₃₂	..	5 6 8
Do. 5 % Pref.	1	5	5	¹³⁄₁₆—¹⁵⁄₁₆	..	5 6 8
National Telephone Def. ..	Stock	6	..	154½—156½	— ½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	101—102	+ ½	4 8 8
Oriental Telep. and Elec. ..	1	8	..	1¾—1⅞	+ ¹⁄₁₆	4 5 4
Do. 6 % Cum. Pref.	1	6	6	1³⁄₃₂—1⁷⁄₃₂	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88—90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98—100	..	4 0 0
Reuter's	10	10	10†	11½—11⅞	+ ⅞	8 12 0
Submarine Cables Trust ..	Cert.	6	6	129—132	+1	4 11 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7⁹⁄₁₆—7¹¹⁄₁₆	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅜—5⅝	..	4 8 11
West Coast of America	2½	2½	..	1¹¹⁄₃₂—1¹⁹⁄₃₂	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96—99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3⁵⁄₁₆—3⁹⁄₁₆	+ ¹⁄₁₆	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅝—10⅞	+ ⅛	5 10 4
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾—10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101—103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13¼—13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	96—98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100—103	..	4 7 5

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	$\frac{3}{16}$— $\frac{5}{16}$	..	Nil
Do. 5 % Pref.	1	6	5	$\frac{11}{16}$— $\frac{13}{16}$	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81 xd	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	+1	..
Do. 5 % Perp. Deb. ..	100	5	6	95½— 98½ xd	..	5 1 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	[illegible]	8†	78 — 80	+1	3 15 0
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	[illegible]	..	77 — 79	..	2 10 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1⅝	1¼†	41½— 42½	+2	3 3 6
Do. 5 % Pref., 1891	100	5	5	107 —109	+1	4 11 9
Do. Do. 1896	100	5	5	105 —107	+1	4 13 6
Do. Do. 1901	100	5	5	104 —106	+1	4 14 4
Do. Do. 1903	100	5	5	103 —105	+1	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞— 2⅛	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	..	½— ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	69 — 74 xd	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	+2	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5¾— 6¼	+1½	..
Do. 4 % Deb.	100	4	4	72 — 76	+1	5 5 3

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	60½— 61	—2½	2 13 3
Do. Surplus Lands	100	2⅞	2¼†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	40¾— 41¼	—1	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1$\frac{3}{32}$— 1$\frac{9}{32}$	+ ⅛	4 13 9
Do. Def.	1	Nil	..	¼— $\frac{5}{16}$	+ $\frac{1}{32}$	Nil
Do. 5 % Pref.	1	5	5	$\frac{13}{16}$— $\frac{15}{16}$	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	97½—100½ xd	..	4 19 6
Potteries, Ord.	1	8½	..	$\frac{5}{16}$— $\frac{7}{16}$	..	..
Do. 5 % Pref.	1	5	5	$\frac{17}{32}$— $\frac{23}{32}$	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	$\frac{11}{16}$— $\frac{13}{16}$	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅛— 4¼	— ⅛	Nil
Do. "A"	1/-	..	..	$\frac{21}{32}$— $\frac{23}{32}$	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	90 — 92	— 1	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼— ¾	..	Nil
Do. 6 % Pref.	5	3	..	2⅞— 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	5½— 5¾	..	5 2 4
Do. 2nd Pref.	5	5½	5½	4$\frac{13}{16}$— 5$\frac{1}{16}$	..	5 3 6
Do. 4 % Deb.	100	4	4	93½— 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb. ..	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾— 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	..	7¼— 7¾	+ ⅛	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	147 —152	+2	5 5 8
Do. Pref. Ord.	100	6	6	120 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108 —111	+1	4 10 1
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —106	+ ½	4 5 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	101½—103½	..	4 7 0
Calcutta Trams, Ord.	5	7	..	6¼— 6¾	+ ⅛	5 3 8
Do. 5 % Pref.	5	5	5	4$\frac{15}{16}$— 5$\frac{3}{16}$	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	⅝— ¾	..	..
City Buenos Aires Trams (1904)	5	5	5†	5½— 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	$\frac{1}{32}$— $\frac{5}{32}$	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜— ⅝	..	..
Do. Pref.	1	6	..	$\frac{29}{32}$— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	..	1$\frac{1}{16}$— 1$\frac{5}{16}$	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 95	+1	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	126 —130	..	5 7 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	102 —104	..	5 15 5
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7½ — 7⅞	..	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛— 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼— 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	160 —165	+5½	3 0 7
Do. 1st Mort. 5 % Bonds ..	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	101½—102½	..	4 17 7
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	280 —290	+17	3 9 0
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 14 0
Singapore Trams, 5 % Deb. ..	100	5	5	83 — 86 xd	+ 1½	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅞— 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½—103½	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	[illegible]	..	⅝— ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	$\frac{11}{16}$— $\frac{13}{16}$	..	7 7 8
Babcock & Wilcox	1	28	..	3$\frac{3}{16}$— 3$\frac{7}{16}$	+ $\frac{1}{16}$	4 1 5
Do. Pref.	1	[illegible]	[illegible]	1$\frac{7}{16}$— 1$\frac{9}{16}$	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	⅜— ½	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝— ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 18 8
B.I. & Helsby Cables	5	10	8†	7⅜— 7⅞ xd	..	6 7 0
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	$\frac{9}{16}$— $\frac{13}{16}$	..	Nil
Do. Deb...	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10¼— 11	..	6 16 4
Do. Pref.	5	5	5	4¾— 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	15†	3$\frac{13}{16}$— 3$\frac{15}{16}$	..	5 1 7
Do. Deb...	100	4½	4½	103 —106	+1	4 5 0

Crompton & Co.	8	Nil	..	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	..	¾— ⅞	..	5 14 3
Do. Pref.	1	6	6	$\frac{15}{16}$— 1$\frac{1}{16}$	+ $\frac{1}{16}$	5 13 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	$\frac{9}{16}$— $\frac{13}{16}$	..	Nil
Do. fully paid	5	Nil	..	1⅝— 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	72 — 75 xd	..	6 13 4
Electric Construction	2	2½	3¾	¾— 1	..	7 10 0
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95 xd	..	4 4 3
Henley's, Ord.	5	17	5†	12¼— 13	..	5 15 5
Do. Pref.	5	4½	4½	4¾— 5	..	4 10 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11½— 12½	..	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	34 — 36	..	6 13 4
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13

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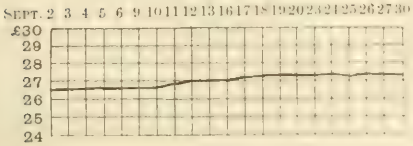
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

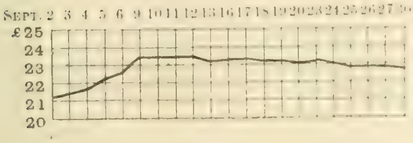
METAL MARKET.

Fluctuations in September.

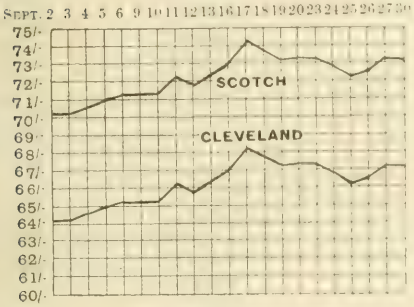
SPELTER (G.O.B's.).



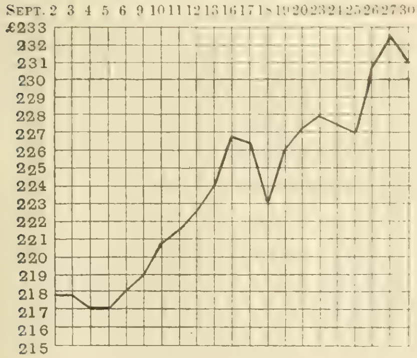
LEAD (ENGLISH).



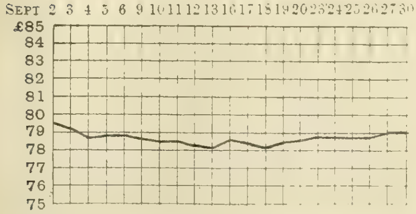
IRON.



TIN.



COPPER (G.M.B's.).



Battery Connectors. — The Crown Woven Wire Brush Co., of Salem, Mass., desires to receive from firms and others manufacturing battery connectors, samples and prices of their products.

A NEW TYPE OF INSULATOR.

Telephone and telegraph engineers are painfully aware of the troubles which arise in the use of the ordinary porcelain insulators, and it is therefore useful to draw attention to a new type of insulator which has been developed by the Minerallac Electric Co., of Chicago. This insulator is a non-breakable combination of insulator and pin in one piece, being turned out of a solid piece of wood which is then specially treated. This construction, by eliminating the joint between the insulator and the supporting section, renders the natural toughness of the specially selected wood available to resist the mechanical line stresses. Moreover, the absence of the joint prevents any moisture from creeping between the pin and the insulator. In the ordinary types, such creeping frequently results in swelling of the untreated wood of the pin and cracking of the glass or porcelain of the insulator. The strength of the wood is increased by the process of impregnation which is used, the compound used serving as a cement.

Insulators made of materal similar to that now used in this design have been in steady service for eight years on high-tension work, and it is claimed that they stand applied voltages of 33,000 without showing any deterioration in insulating qualities. The insulation resistance is stated at approximately 1,300,000,000 megohms per inch cube, and the dielectric strength as 1,000 volts per mil at 20 mils thickness. Another advantage which is claimed is that inasmuch as wood is a poor conductor of heat, moisture will not condense upon the surface of the insulator as it does upon glass or porcelain. The coldness of glass or porcelain causes a very rapid collection of moisture in a fog or mist. Moreover, the oily surface which is always found with this impregnated form of wood insulator prevents the collection of water or moisture in a continuous film during rains, while the glass or porcelain insulator will often have a thin film of water over the entire surface, causing rapid leakage or breakdown.

Instead of carrying insulators up the pole and screwing them on by hand as in the case of glass or porcelain, it is possible to put the complete installation on the cross-arm before distribution along the line. The weight of the wooden pin is about one-third that of a glass insulation pin, while wooden insulators can be installed with a hammer and do not break even if they are dropped to the ground from the height of the cross-arm.

From the point of view of maintenance, the cost of insulators and replacement of broken ones is insignificant compared with the expensive time and transportation of the lineman making the repairs. Insulator repairs at the present time constitute the greatest item of expense in overhead line work. With glass or porcelain insulators, the contracting of the tie wire is sometimes sufficient to break off the top of the insulator, while the presence of water causes swelling of the untreated pin. Another cause for lineman's service is one short pole between two taller poles; a change of temperature will cause the tightening of the line, the insulators being pulled from their pins and suspended in the air. A slight wind will then cause a short-circuit, which may require hours to overcome.

With the new insulator here described, any strain caused by contraction of the tie-wire, or upward pull caused by poles setting and the line tightening, can be withstood, while the compound with which the insulator is impregnated is, in addition to being a good insulator, an excellent preservative as well. It renders the wood waterproof, and, under ordinary conditions of use, it is claimed that such insulators should have a life of approximately 30 years. It, therefore, appears that the only person who will view the advent of this new insulator with regret, is the small boy who at present utilises the glass or porcelain insulator as a convenient target for stone throwing.

Electrolytic Copper in Norway.—H.M. Consul at Christiania (Mr. E. F. Gray) reports a Press announcement to the effect that the past 12 months has witnessed the erection, at Aamdal, of the first copper works to produce pure copper on the spot where the ore is mined, by M. Hybinette's process of extraction, during which the copper is elutriated from the ore by weak sulphuric acid and precipitated from the solution to pure copper by the help of electricity. The works will probably increase their production in the coming year to 3 tons of metallic copper per diem. The satisfactory results at Aamdal, and experiments with the so-called "kisafbrand," or pyrites burnings, from the Orkla Mine—one of the largest Norwegian copper and sulphuric mines—have brought into prominence the possibilities of a new Norwegian industry. Owing to the want of suitable Norwegian copper works, the Orkla and Sulitjelma Mines, in both of which foreign capital is largely interested, have hitherto exported their copper sulphur pyrites to Germany and Helsingborg, respectively, to have the copper extracted there. It now, however, appears likely that the Hybinette companies will receive the necessary support from Norwegian cellulose and other manufacturers interested in the consumption of sulphur, to enable them to take over this industry.—*Board of Trade Journal.*

Australian Tariffs. — The Australian Commonwealth Customs authorities have lately given a decision to the effect that "electrical appliances, &c., battery cells imported with, and for, telephonic wall or table sets," are to be classified under No. 178 (D) of the tariff, the duty being 17½ per cent. *ad valorem* on foreign goods and 10 per cent. on British productions.

AGRICULTURAL APPLICATIONS OF ELECTRICITY.

By Wm. MANKTELOW.

Apart from electroculture—or the direct application of electric currents or discharges to growing crops—a science which is not yet out of its experimental stages, electricity is now employed to replace manual labour in the preparation of cattle food, thrashing cereals, and in irrigation and general pumping work. Very little reliable data is available concerning the energy requirements and the average annual energy consumption of agricultural machinery, hence special interest attaches to a paper recently presented by M. P. Lecler to the Comité Technique du Syndicat Professionel des Usines d'Electricité. The author has collected useful figures from a number of farms in which electric driving is actually employed; thence he derives factors of interest to central station engineers, and considers means whereby agricultural loads can be increased in extent and made as favourable as possible to the supply authority.

TABLE I.—Capacity and Energy Consumption of Agricultural Machinery.

Apparatus.	Kg. of material handled per hour.	Watt-hours per hour.	Watt-hours per 100 kg. treated.
Grinding fattening food ...	2,000-2,500	2,600	125
„ fresh bones ...	13	150	2,000
„ oil cake	550	750	150
Crushing oats	16	200	1,000
„ maize	50	200	400
Flatting oats	400	110	275
Mill type crusher (oats) ...	50	300	600
„ (barley)	250	1,800	750
Beetroot cutter (with cleaner)	1,800	450-500	25
Chaff cutter	400	1,000	300-400
Dairy (per 100 quarts of milk)	—	—	285-570
Agricultural mill	70	1,600-1,800	2,500
Sorter	120	—	20
Winnower	600	—	50

In many cases agricultural machinery, designed for hand operation, is converted to electrical driving by the mere attachment of an electric motor and the necessary gearing. The performance of such a machine is generally much less satisfactory than that of a machine primarily designed for electric driving. An apparent exception is to be found in thrashing machines. Old-fashioned thrashers converted to electric driving by the installation of a 2 or 3 H.P.-motor require from 0·15 to 0·25 unit per cwt. of grain, whereas a thrasher specially designed for electric driving, and fitted with a 10-H.P. motor, requires 0·25 to 0·5 unit per cwt. It is only fair to note, however, that the latter apparatus has a much more complete arrangement for cleaning the grain. Apart from the humidity and general quality of the grain (both of which factors greatly influence the energy consumption during thrashing), the degree of attention in handling the machine greatly affects its performance. The light load demand of a thrasher is generally over 80 per cent. of the full load demand, and any inattention in feeding at once increases the average consumption per cwt. of delivery.

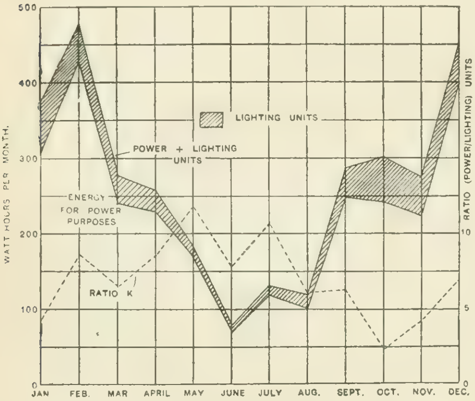


Fig. 1.

To cite only one further instance of the uncertainty attached to the power requirements of agricultural machinery, it may be pointed out that the demand of cylindrical grinders and crushers may rise to five times the normal or higher if the gap between the cylinders is set slightly too small.

Under these limitations as to accuracy, Table I shows the average energy consumption, including transmission and other losses, of various classes and sizes of agricultural machines. Better results could probably be obtained in specially designed apparatus, and it must be noted that the figures here and hereafter are based on a comparatively small number of cases.

Table II refers to a number of small farms, and shows the total motor horse-power installed and the average annual consumption for power and lighting, the machinery driven in the various cases being shown in column 1. Fig. 1 refers to a 620-acre farm, and represents monthly variations in power, lighting and total demand.

From the limited data available, it appears that small farms using such electrically-driven machines as are at present in fairly common use, consume an average of about 8 KW.-hours per acre per annum. In large farms the corresponding figure appears to be 5 KW.-hours per acre per annum. These figures are, according to the author, less than half those generally adopted in Germany.

The ratio of the energy consumption to the KW. capacity of the installation (taken over daily, monthly or annual periods), may be regarded as a "factor of utilisation" U. The ratio of the energy consumption for power to that for lighting purposes may be denoted by K, and enables an approximate estimate of the power load which may be expected in agricultural areas where electric lighting is already in vogue. Further, the factor K provides a basis on which to design a sliding tariff scale.

TABLE II.—H.P. Installed and Amount and Distribution of Annual Power Consumption on Small Farms.

—	Total H.P. motors installed. (P)	Annual KW.-hrs. for			Coefficients of comparison.	
		Power.	Light.	Total.	K= (F/L)	U= (F/P)
Grain sorter	1	48·3	75·2	123·5	0·64	48
Separator and churn ...	0·5	34·0	52·3	86·3	0·65	68
Ditto ...	0·5	75·7	95·7	171·4	0·79	151
Separator and lye washer	1	122·7	106·3	229·0	1·15	123
Ditto ...	1·5	248·3	135·3	383·6	1·84	165
Chaff and root cutters ...	1	41·1	131·1	172·2	0·32	41
Ditto ...	1	37·8	99·3	137·1	0·38	38
Kneading trough and root cutter	0·5	99·3	113·5	202·8	0·81	199
Grain crusher	4	223·0	53·6	276·6	4·17	56
Thrasher	3·5	253·5	92·8	346·3	2·74	72
Trasher and lye washer.	4	333·2	97·0	430·2	3·45	82
Thrasher	4	350·2	99·2	449·4	3·53	86
Thrasher, chaff cutter and root cutter ...	4·5	506·6	139·8	646·4	3·61	112

The energy consumption of agricultural machinery varies greatly with the season; as a rule, it is low during the summer and high during the winter months. As shown by Table II the coefficient of utilisation is very variable but always low; its values in the cases dealt with, range from 38 to 200 KW.-hours per KW. The season at which demands have to be supplied is also very variable, so that of two loads, even having the same coefficient U, one may be favourable and the other unfavourable from the supply station standpoint. This is well shown by figs. 2 and 3, from which it appears that U for dairies is fairly uniform throughout the year, except in very large dairies where the summer increase in the volume of milk dealt with and the necessity for refrigerators, &c., involve an appreciable summer peak.

Machinery for the preparation of cattle food is chiefly required during the winter months; grain crushers are chiefly worked from August to January, and root and chaff-cutters from January to April. The value of a thrashing machine load to the central station varies with the policy adopted by farmers in the district. If thrashing is performed immediately after the harvest a high steady day load is obtained in August. If, however, a small thrashing machine is used in the farm buildings at odd times during the winter, it is generally used in bad weather and during winter evenings; it will then offer a most unfavourable load curve. Fig. 3, the average for four farms, shows the average result of both styles of working. Dairy demand is invariably a day load; root, grain and chaff machines are not tempting to the central station.

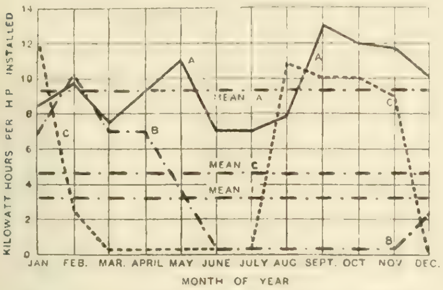


Fig. 2.—A, Dairies; B, Chaff and Root Cutters; C, Crushers.

Cheap supply is essential if electricity is to be freely employed on farms, but the tariff adopted should certainly encourage day working during summer months in order to counteract as far as possible the natural tendency to perform indoor power work during the winter and in bad weather and after dusk. Owing to the fact that outdoor work is practically at a standstill during November, December and February, it is a moot point whether a tariff can be designed which will have the desired effect.

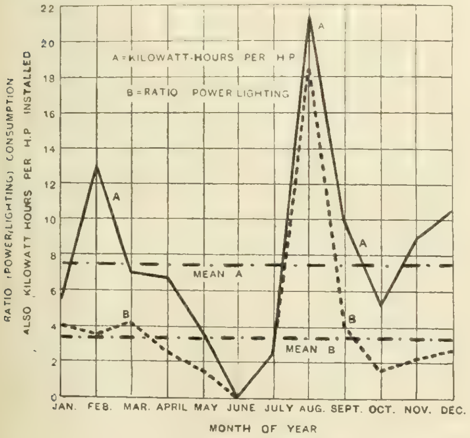


Fig. 3.—Threshing Machines.

The ratio of the power to the lighting consumption varies with the size of the farm, being less than one for small concerns and from five to six for large farms.

Typical values are shown in Table II and figs. 1, 3. The numerical value of K is roughly equal to H.P. of motors installed up to 5 H.P. The power consumption naturally becomes relatively greater the larger the farm, in fact, it may be taken as roughly proportional to the area of the farm, whereas the lighting consumption is made up of an approximately constant quantity (for the lighting of the farm house and outbuildings), and an additional quantity varying with the size of the farm and covering such lighting requirements as vary with the latter.

It is obvious that in the near future the power demand on farms employing electric driving will be quite preponderant; for instance, an electric plough requires 10·5 — 12·5 watt-hours per cb. yard of soil worked so that this demand alone, where present, would quite swamp the lighting load.

The present subject is of vital importance to agriculturists (as offering a solution to the present shortage of farm labour); to central stations (as offering a valuable increase in day load); and to electrical and agricultural manufacturers. It is highly desirable that a systematic collection of practical data should be commenced in as many districts as possible in order to provide reliable information as to design of apparatus, tariffs and as a guide to the policy of all parties concerned.

BUYING DEPARTMENTS.

By A. Traveller.

A little consideration will prove that a few notes on the above subject may be valuable. As much profit can be made and business extended by good buying as by smart selling. Yet, as a rule, how little attention is given to the former as compared with the latter!

We will commence with the office or works entrance. All too prevalent is the small counter across a narrow passage or the still smaller window marked "Inquiries." Where such an approach is permitted, it is safe to hazard that the individual who will attend to you is a diminutive office boy, who, in a shrill voice, asks you what you want, or throws in front of you a slip of paper, on which you are to write your business. If you are personally unknown to the buyer, the betting is ten to one against an interview.

As this procedure is equally applicable to any visitor—customer or otherwise—it is almost unbelievable that it should be allowed to continue in a single instance. It is unbusinesslike, irritating, and leads to much delay.

Almost as bad as the youthful guardian of the portals is the commissionaire or lady typist. Although invariably these good people are polite and eager to assist you, yet, for one, my heart drops when I observe that my business has to filter through the brain of either of these worthies.

The remedy is simple, and the slight additional cost would be soon recouped by the time saved and the better conduct of business. Appoint a man of discretion, with a good experience of the particular office, whose duty it would be to interview visitors and to inform travellers either who to see, or that there was no prospect of business being done in their line.

Whilst in many firms the selling side of the business is elaborately organised and conducted by high-salaried officials, yet the buying is greatly neglected and proceeds on the most casual lines; the actual placing of the orders being frequently left to a junior with other work to do. The result is that there is no system or economy shown, and the young buyer is open to the influence of an affable or, may be, generous traveller.

Due to the excellent management, and the very keen competition, the business organisation of the large West End shops is the most highly developed of any. In these establishments the buyer is one of the highest paid of the staff. Certain hours are purposely set aside to interview travellers, who are therefore sure of at least an interested hearing.

Many firms may consider themselves more than sufficiently looked after by travellers, perhaps unduly bothered by them. If this is so it is to a great extent their own fault. It is a common occurrence for a representative in a special line—say, lamps or cables—to call on a firm, only to be put off being seen by some excuse. He naturally calls again and again, with the same result each time. One day he happens to see the buyer and learns that the firm has a contract for these goods. If the traveller were informed of this at first, he would not be fool enough to waste his time by calling again.

Gas companies are putting up a good fight for continuation, which, with the internal competition in the electrical trade, will compel an overhaul to be made of the selling and buying organisation and systems. When that has been done, travellers will be courteously and intelligently received, ordering will be done on sound lines, and the pokey entrance and office boy attendant will be swept away.

It is the wisest people who anticipate, and who do not wait to be compelled to adopt beneficial innovations.

REVIEWS.

Growing Crops and Plants by Electricity. By E. C. Dudgeon. 1912. London: S. Rentell & Co. Price 1s. net.

The avowed purpose of this book is to interest the general reader, and to give the farmer, the market gardener and the amateur horticulturist a clear idea of what has been done, and is being done, in the application of electricity to growing plants. The first aim is realised tolerably well; but we doubt whether the farmer and market gardener will gain much satisfaction from the work. A summary is presented of the results obtained by various experimenters since the pioneer investigation of Prof. Lemström.

Chapter III summarises the results of the author's experiments at Lincluden (chiefly on potato crops), and Chapter VII deals with her investigations as to the effect of the mercury arc light in a 20 × 10 ft. greenhouse. In studying the data of the various trials, we are impressed by the very high percentage of cases in which, owing to natural causes, breakdown of plant, disease or insect, &c., the results obtained were "irregular" or "not satisfactory," "not favourable to the discharge," and so on. The total amount of practical data relating to electro-culture is, after all, very limited, and we agree with the author that there is a fruitful field of enterprise open to anyone with capital and energy to investigate the subject thoroughly. Until more data, of more definite nature, are available, the average farmer or market gardener cannot be expected to risk capital in the matter. Experiments on a small scale are of very limited value: it is the results and cost of wholesale electroculture which must determine its practical value. This at once leads us to a most serious omission in the present book. Nowhere, except in a passing mention of a new system, yet untried, is any information given as to the cost of installing and operating the equipment required for electroculture. Neither are details given as to the actual arrangement of apparatus and conditions of working in the more important trials mentioned. So far as the practical agriculturist is concerned, these omissions are fatal.

The matter of the treatise is chiefly a statement of experimental results, and affords in a compact form a *résumé* of the most important work which has been done in this field. The writer's style is difficult to follow in places, and the English is not always above criticism. One sentence, in Chapter VIII, contains 142 words, and, perhaps naturally, does not make its point at all clearly. Throughout the book a careful revision of the proofs would easily have remedied a number of defects in composition. Tabular matter is set out regardless of space occupied. A handsome appearance is thus secured, but, by arranging the data in a few large tables (using a smaller type), much space would have been saved, comparison of results would have been facilitated, and additional text might have been included. Pages 6 and 7 are each devoted to one half-tone illustration (8·5 × 6 cm.), which have not even the merit of being specially interesting.

We are not convinced either as to the possibilities of improved stock rearing in an electrified atmosphere or as to the relevancy of this branch of electroculture to the subject in hand. Surely there is enough pertinent material available to avoid the devotion of over half a page to electrically-*heated incubators* in a work claiming to deal with *growing crops and plants* by electricity!

Chapter VIII suggests that the beneficial effect of electroculture depends on the nitrification of the soil by silent discharge from overhead wires; on facilitated assimilation of plants and assisted capillary attraction of moisture; and on augmented flow of sap and increased formation of starch and sugar. These are, however, no more than probable explanations. While we should have preferred a modified arrangement of the data presented and the inclusion of some definite estimates as to the present possibilities of electro-culture, the work should certainly interest the general reader and should encourage the practical agriculturist to pursue the study of this subject and its immense potentialities.

La Costruzione delle Linee Elettriche Aeree. By Dott. Ing. Italo Brunelli. Rome: Stabilimento Cromo. Tip. di Carlo Colombo. Lire 7.50.

This book is a comprehensive study of overhead electrical conductors, their uses, construction, erection and maintenance. The author rightly points out that as a special branch of engineering, and a very important one, the subject of overhead lines has not had the complete treatment that has been accorded to subterranean cables. This is perhaps natural considering the smaller financial interests concerned, but a work of this kind is none the less welcome as a book of reference to be used by designers and constructors of overhead lines for telephone, telegraph, lighting and power use. In most other treatises on overhead work, the part especially relating to tramway work, an important branch, is confined to very general remarks about the suspension of the wire, and devoted more to the details of the poles and ornamental fittings. There are no unnecessary or useless theories in this book, but the whole subject is treated, from the principles involved to the practical carrying out of them. The book confines itself almost entirely to single overhead wires, dealing only slightly with overhead cables.

Part I is concerned with the materials used in constructing overhead lines, taking in their order conductors, insulators and supports. The author gives comparisons between the uses of aluminium, bronze, iron, and mixed steel and copper wires. He shows that for the same conductance, an iron wire weighs six times as much, and has 2½ times the diameter of a bronze one with a conductivity of 88 per cent., and costs 1½ times as much. These disadvantages become less with the smaller diameters, also when a low resistance is not specially required.

There is nothing of special interest in the genera electrical and mechanical tests described for the material of the wire. A detailed comparison is given of various types of line insulators and their supports, *i.e.*, the stems, brackets and poles, with special reference to the respective advantages of wood, iron and armoured concrete poles. The subject of insulators might have been dealt with more fully, as they form such an important part of the construction of high-pressure lines. The action and effect of sparks over high-pressure insulators are not even mentioned, and only one type of the Hewlett interlink suspension insulator is shown.

In the chapter on poles, it is shown that, for most ordinary transmission lines, wooden poles are the most economical. In this connection, it may be mentioned that the Société Electrotechnique de Dresden has lately published a very interesting account of methods of impregnating wooden poles with preservative fluids, as described in a paper by Messrs. Hattenburg and Berdenick, with an account of the electrolytic replacement of the natural sap by saline solutions.

Part II of the present work commences with the study of the effects on the material of a conductor of suspending it from supports some distance apart, showing the special conditions of stress it is subjected to. There is a useful rule given that for iron wires the normal tension to be used will be equal to the weight per kilometre of the wire. This applies also to phosphor-bronze wire, but for bronze wires for telephone use, and for aluminium wires, the normal tension should be one and a half times the kilometric weight.

The general formula of catenary curves is worked out, as being the basis of all calculations for stresses on overhead lines, and an approximation in view of the flatness of the curve in ordinary lines is arrived at which brings the equation for the curve to that of a parabola. An example is given to show that the approximation is one that does not lead to serious error. The rule is also quoted that the tension at the point of support is equal to the tension at the vertex of the curve plus the weight of a length of the wire equal to the dip of the line. The minimum tension at the supporting points occurs when the dip is equal to one-third of the distance between the supports. Catenaries with points of support at different levels are considered here; also special cases such as the breaking of one of the supports, and the resulting alteration of the tension on the points at either side. A careful study is made of the influence of temperature on line wires, and of the influences of snow, ice and wind. Methods of damping vibrations of overhead wires are described.

This part concludes with the calculation of the flexibility of various kinds of pole supports, and also deals briefly with the catenary support used for high-speed railway and cross-country lines.

Part III is concerned with the fittings, the lay out, and the erection of overhead lines, dealing first with the important question of the proper spacing of the poles. The cost of erection is dealt with in some detail. Jointing, fixing and erecting the wires themselves are gone into fully in this part, which concludes with the special conditions affecting lines for electric traction.

There follows an appendix on the subject of the construction and laying of cables for underground and submarine use. Although treated very briefly, the general principles of cable laying are put in an interesting and accurate way. This part of the book would not be of great practical value to the engineer engaged in submarine cable work, the matter being treated too briefly, but the very complete and clear way in which the main chapters of the book, dealing with overhead lines, is written makes the book a valuable one. In either the preliminary stage or the constructional stage of an overhead line scheme for telegraphy, telephony or power transmission, it would be an advantage to have such a book at hand.

Telephony. By McMeen and Millar. 1912. London: Crosby Lockwood & Co. Price 17s. net.

For some years past it has been sometimes a pleasure, sometimes not altogether a pleasure, to the writer to express his opinion upon sundry books dealing with the application of electrical science to the practice of telephony and the allied arts. Very rarely has it been possible to express other than qualified praise; many otherwise excellent books have appeared from time to time, spoiled because of the authors' or publishers' lack of appreciation of what properly constitutes a text-book. Of works there are many containing a wealth of useful information, well written in most cases, with carefully-prepared and well-drawn illustrations, but designed solely to serve as aids to the passing of the many examinations with which an earnest student is confronted nowadays as a result of an unfortunate craze which exists at the present time. This is, of course, not the place to indulge in a dissertation upon the ethics of true scientific education and the examination system which has of recent years grown up; neither has the writer any quarrel with the authors and publishers who, recognising the need for their works, cater for the potential examinee. Such is a matter of pure business. But the writer's objection is to the classifying and calling of such works text-books, for it is obvious that clothing the information to be conveyed in language adopted for ready assimilation and reproduction, where reasonable clarity of argument is often sacrificed to extreme conciseness, is not the best method for the production of a book whose aim should be to make clear all about, and everything in connection with, the subject therein treated. One such book came before the writer some time ago, an admirable production, embodying the infinitude of detail and description usually associated with books having their origin on the other side of the Atlantic, but, unfortunately, it made use of language somewhat akin to that associated with the alleged humour of pictures depicting the troubles of telephone employés engaged in negotiating wayleaves with the assistance, or otherwise, of an irate bull.

Now the book before the writer at the moment is a text-book. It describes in detail everything telephonic; it is written in language of which an Oxford man need not be ashamed—that is, assuming that after his three years at the University, he spent some nine or ten in the States—in other words, the book does not require to be translated into English idiom, or, perhaps, one should rather say *out* of American idiom. There is no padding of the earlier chapters with descriptions of historical attempts to achieve a telephone service—and, above all, there is no list of questions at the end, supposed to be, but rarely in fact, worked out and answered by the reader.

The opening chapters contain a very brief and most sensible reference to historical progress in telephony, a splendid chapter on acoustics, with special reference to the electrical reproduction of speech, electrical signals, and telephone lines with their peculiarities, only now beginning to be understood generally. There are separate chapters on the elemental instruments used in telephony, transmitters, receivers, switches, batteries, &c., which, in the scheme of the book, go to form a basis upon which are built up the later chapters dealing with switching systems, from the most elementary magneto board to the most up-to-date common battery switchboard and automatic switchboard. In the space available one cannot possibly enumerate all the contents of this book, but readers may understand that there is nothing in any way connected with the use of a telephone which is not adequately and clearly described. Both illustrations and diagrams are of a very high order of merit, and in connection with the latter there is one feature worthy of special comment. That is the use of conventional symbols which are fully explained in such a way that one has no difficulty in reading the diagrams, even where they are seemingly most involved.

Of course, as regards outdoor line construction, American practice, which differs much from that obtaining in this country, is described, but this in no way discounts the value of the book. There is one particular chapter to which reference may be made, and that is the one dealing with the control of railway traffic by telephone. The method, suitably modified to meet the conditions, is believed to be in use on at least one of our railways. It might possibly repay the others to study the matter, and if so the present book would prove of no little assistance.

The price of this book may seem high (17s. net.) to those who are—may one say—out to obtain diplomas, but to those who want to *know*, the price is by no means exorbitant. To such it may be confidently recommended.—R.M.H.

THE PRESENT POSITION OF ELECTRICITY SUPPLY UNDERTAKINGS IN VICTORIA, AUSTRALIA.

An interesting report has recently been presented to the Parliament of the State of Victoria, Australia, showing the present position of electricity supply undertakings in the State. Under the State Electric Light and Power Act of 1896 all such undertakings have to obtain a separate Order in Council, and to supply annually particulars of their technical position.

It appears that since the passing of the Act 66 orders have been passed; in 4 cases the preliminaries have not been completed, leaving 62 actually granted. Of these 8 have been cancelled, 1 has ceased operation and 1 was not proceeded with, leaving 52 in operation, 8 of which have been transferred from their original holders. Two existing orders were granted in 1898, one in 1899, two in 1900, two in 1901, one in 1903, two in 1904, two in 1905, one in 1906, four in 1907, six in 1908, five in 1909, eight in 1910, and 16 in 1911.

These figures show that although for the most part the new undertakings are small, there is a considerable increase in the public interest in electricity supply.

The following particulars of the principal undertakings indicate the progress which has been made in popularising the use of electrical energy:—

(*a*) *Melbourne City Council* supplying city area.—4,393 consumers; 1,003 public arc lamps; 1,481 private arc lamps; 1,878 motors connected; 6,808 total H.P. of motors; 7,006 KW. total capacity of generating station.

(*b*) *Melbourne Electric Supply Co., Ltd.*, supplying outlying districts.—6,407 consumers; 162 public arc lamps; 1,425 private arc lamps; 1,266 motors connected; 6,609 total H.P. of motors; 5,775 KW. total capacity of generating station.

(*c*) *Electric Supply Co., of Victoria, Ltd.*, supplying the town of Ballarat.—886 consumers; .35 public arc lamps; 247 private do.; 1,000 KW. total capacity of generating station.

This station supplies energy to the local tramways having 20 cars, 12½ miles of track, and carrying 2½ million passengers per annum.

(*d*) *Electric Supply Co., of Victoria, Ltd.*, supplying the town of Bendigo.—798 consumers; 128 public arc lamps; 142 private do.; 1,300 KW. total capacity of generating station.

This station supplies energy to the local tramways having 16 cars, 9¼ miles of track, and carrying 2½ million passengers per annum.

(*e*) *The North Melbourne Electric Tramways and Lighting Co.*, supplying the Essendon, Flemington and Kennington districts of Melbourne.—497 consumers; 750 KW. total capacity of generating station.

This station supplies energy to a tramway system have 15 cars, 10 trailers, 7 miles of track, and carrying 2⅛ million passengers per annum.

(*f*) *The Melbourne Electric Supply Co., Ltd.*, supplying the town of Geelong.—1,000 consumers; 293 private arc lamps; 212 motors connected; 1,263 total H.P. of motors; 800 KW. total capacity of generating station.

(*g*) *The Nhill Electric Light Co. Propy., Ltd.*, supplying the town of Nhill.—81 consumers; 10 H.P. of motors in use; 863 private incandescent lamps; 75 KW. total capacity of generating station.

The station plant includes one suction gas producer and gas engine, one direct-current dynamo, accumulator battery and one steam stand-by set.

(*h*) *The Borough Council of Inglewood* supplying the town of Inglewood.—73 consumers; 706 incandescent lamps; 24 KW. total capacity of generating station.

(*i*) *The Hamilton Electric Supply Co., Ltd.*, supplying the town of Hamilton.— 120 consumers; 5 public arc lamps; 16 private arc lamps; 14 motors connected; 48 total H.P. of motors; 104 KW. total capacity of generating station.

The plant consists of two producer gas generator sets, 50 and 100 B.H.P., and one oil engine set of 26 B.H.P., with an accumulator battery.

(*j*) *The Kerang Council* supplying the town of Kerang.—180 consumers; 8 public arc lamps; 1 private arc lamp; 1 motor of 5 H.P.; 80 KW. total capacity of generating station.

(*k*) *The Donald Electric Supply Co., Ltd.*, supplying the town of Donald.—125 consumers; 6 motors; 23 H.P. total of motors; 32 KW. total capacity of generating station.

The plant consists of suction gas producer set and an accumulator battery.

(*l*) *The Kilmore Electric Supply Co., Ltd.*, supplying the town of Kilmore.—60 consumers; 5 public arc lamps; 2 private arc lamps; 17 KW. capacity of generating station.

(*m*) *The Rochester Town Council* supplying the town of Rochester.—127 consumers; 5 public arc lamps; 4 motors; 13 H.P. total of motors; 50 KW. capacity of generating station.

(*n*) *The Hampden Shire Council* supplying the town of Camperdown.—178 consumers; 11 motors; 18 H.P. total of motors; 80 KW. capacity of generating station.

(*o*) *The Hampden Shire Council* supplying the town of Terang.—167 consumers; 11 motors; 19 H.P. total of motors; 70 KW. capacity of generating station.

(*p*) *The Bulla Shire Council* supplying the town of Sunbury.—30 consumers; 2 motors; 14 H.P. total of motors; 100 KW. capacity of generating station.

(*q*) *The Mildura Shire Council* supplying the town of Mildura.—198 consumers; 65 H.P. total of motors; 105 KW. capacity of generating station.

(*r*) *The Leongatha Butter and Cheese Factory Co., Ltd.*, supplying the town of Leongatha.—82 consumers; 7 motors; 15 H.P. total of motors; 22 KW. capacity of generating station.

(*s*) *The Casterton Freezing Works Co. Propy., Ltd.*, supplying the town of Casterton.—125 consumers; 1 motor of 2 B.H.P.; 48 KW. capacity of generating station.

(*t*) *The Poowong and Jeetho Shire Council* supplying the town of Korumburra.—130 consumers; 5 motors; 18½ H.P. total of motors; 42½ KW. capacity of generating station.

(*u*) *The Drouin Co-operative Butter Factory Co., Ltd.*, supplying the town of Drouin.—42 consumers; 2 motors; 18½ KW. capacity of generating station.

(*v*) *The South Gippsland Creamery and Butter Factory Co., Ltd.*, supplying the town of Yarram.—52 consumers; 3 motors; 16 H.P. total of motors; 24 KW. capacity of generating station.

(*w*) *The Tatura Butter Factory and Farmers' Produce Co., Ltd.*, supplying the town of Tatura.—80 consumers; 25 KW. capacity of generating station.

(*x*) *The Charlton Electric Light and Power Co., Ltd.*, supplying the town of Charlton.—110 consumers; 45 KW. capacity of generating station.

(*y*) *The Footscray City Council* supplying the city of Footscray.—46 consumers; 1 motor of 22 H.P. Supplied in bulk from Melbourne City Council. Capacity of sub-station, 150 KW.

(*z*) *The Yarrawonga Shire Council*, supplying the town of Yarrawonga.—85 consumers; 1 motor of 3 H.P.; 45 KW. capacity of generating station.

(*aa*) *The Birchip Electric Supply Co., Ltd.*, supplying the town of Birchip.—120 consumers; 3 motors; 12 H.P. total of motors; 29 KW. capacity of generating station.

(*bb*) *The Euroa Shire Council*, supplying the town of Euroa.—76 consumers; 74 KW. capacity of generating station.

(*cc*) *The Rainbow Electric Light Co.*, supplying the town of Rainbow.—19 consumers; 15 KW. capacity of generating station.

Although the capacity of many of these stations is at present small, they form the nucleus of progressive undertakings, and there is no doubt that in the near future many of them will show rapid progress.

A NEW METAL-VAPOUR LAMP WITH A WHITE LIGHT.

The chief disadvantage of the mercury-vapour lamp at present is the peculiar colour of its light, and the many attempts hitherto made to improve this have not been very successful. Dr. M. Wolfke,[*] after experimenting with a large number of easily fusible metals and alloys in place of mercury, has now apparently solved the problem by the use of an alloy of cadmium with a small percentage of mercury. Cadmium is eminently suitable for the purpose, because (1) its temperature of vaporisation in *vacuo* is low (450° C.); (2) it does not attack quartz glass in any way; and (3) its spectrum, especially at the higher temperatures, contains a bright red line at a wave length of ·644 μ.

If pure cadmium alone is used in the lamp, a decidedly red light is obtained, but the addition of a small percentage of mercury (from 3 per cent. to 10 per cent., depending on the shape and size of lamp) converts this red light into a satisfactory white light, which does not distort the natural colours of objects any more than an ordinary open arc lamp does. This is due to the fact that the spectrum of the new lamp contains bright lines distributed amongst all the colours. Thus, the mercury introduces violet lines at ·405 μ and ·409 μ, a blue line at ·436 μ, green lines at ·492 μ and ·546 μ, and yellow lines at ·577 μ and ·579 μ, whilst the cadmium supplies blue lines at ·468 μ and ·48 μ, a green line at ·508 μ and a red line at ·644 μ. Owing to the fact that mercury vaporises at a lower temperature than cadmium, it is a simple matter to extract any excess of mercury present whilst the lamp is still connected to the air pump and so obtain the best percentage of mercury experimentally.

Two forms of lamp have been developed—one having a graphite annode and a cathode of cadmium and mercury, whilst the other has both electrodes of cadmium and mercury. The former is, however, far less economical, especially at low ratings, as can be seen from fig. 1, where Curve I refers to the graphite anode lamp and Curve II to the other form. With graphite the consumption does not fall below one watt per Hefner candle-power until a total consumption of about 800 watts is reached, whilst the other form of lamp reaches this economy even at a total consumption of only 100 watts.

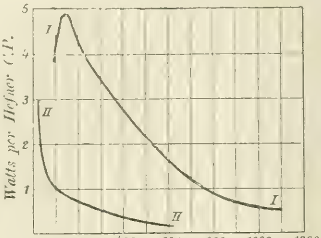


Fig. 1.

Careful experiment has further shown that the efficiency of the new lamp (with both electrodes of the alloy) is quite equal to that of the pure mercury vapour lamp, as is shown by the following Table :—

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[*] *E.T.Z.*, September 5th, 1912.

Total consumption in watts.	Cadmium-mercury lamp.		Mercury vapour lamp.	
	c.p.	Watts per c.p.	Watts per c.p. from one test.	Watts per c.p. from another test.
150	150	1·0	·87	—
220	310	·71	·68	·89
300	590	·51	·47	·64
380	960	·4	·34	·45
540	2,370	·23	·23	·29
620	3,800	·16	·21	·25

The figures for the pure mercury lamp here given are those published by R. Kuch and T. Retschinsky in the "Annalen der Physik." 1906. Page 563.

The characteristic curves (or curves connecting terminal volts and amperes) of the various lamps are shown in fig. 2. Here Curve I refers to the lamp with anode of graphite and cathode of cadmium and mercury, Curve II to the lamp with both electrodes of cadmium and mercury and Curves *a* and *b* to the pure mercury lamps of Küch and of Cooper-Hewitt respectively. It will be seen that, for a given current, the mercury-cadmium lamp takes a lower voltage than the others ; but this disadvantage can be got over by employing specially small electrode chambers. In this way voltages as high as 100 have been used with small currents like 3 amperes. The cadmium-mercury lamp, like the pure mercury vapour lamp, requires a certain time to elapse after switching on, to arrive at its steady state. During this interval the voltage, the total watts and the candle-power increase gradually, whilst the current and the watts per candle-power fall.

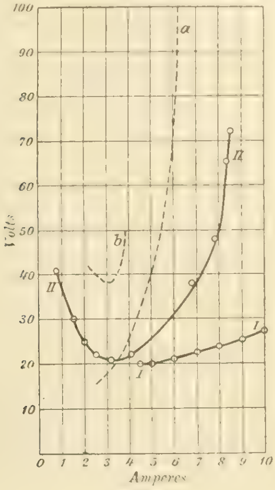

Fig. 2.

The active material of the cadmium-mercury lamp being a solid at ordinary temperatures, it becomes deposited on the inside walls of the lamp when it gets cold after being extinguished. This causes no trouble in practice, however, because as soon as the lamp is switched on again the deposit is vaporised and the quartz glass walls become quite clear again. To ensure the absence of permanent deposit it is, however, essential to employ absolutely pure cadmium, free from all oxides, and this can only be attained by filling the lamp in vacuo.

For the purpose of striking the arc in these lamps the tipping arrangement generally used in the case of the mercury lamps is useless, because no liquid electrode material is present initially. Amongst the methods tried by the inventors are (1) the use of a small induction coil ($\frac{3}{8}$-in. spark length about) to give a spark between an auxiliary anode and the cathode ; (2) the use of the oxides of calcium, barium, strontium, &c., in the cathode so that when raised to a glowing temperature a large supply of electrons may be liberated and conduct the current across ; (3) the use of a flexibly supported auxiliary anode which, by shaking the lamp, can be made to bridge the circuit momentarily ; (4) the use of an auxiliary graphite anode moved electromagnetically.

These methods are more or less applicable, but none of them are so convenient as two fresh methods devised specially for the new lamp. The first of these is applicable when a graphite anode is used. This anode *d* (fig. 3) is connected to the + terminal by a short iron chain *e*. By tipping the lamp the graphite slides down and touches the cathode alloy *b*, and so closes the main circuit. The current thus started then automatically tips the lamp back and strikes the arc, the iron chain curling itself up again in the anode chamber.

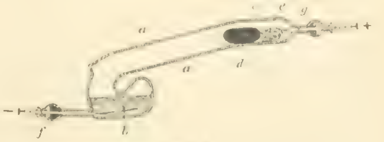

Fig. 3.

A better arrangement, and one suitable for lamps in which both electrodes are of the alloy, is that indicated in fig. 4. The action of this depends on the fact that the inside of the lamp near the electrodes becomes covered when cold with a dense conducting metallic coating. Near the cathode *b*, against the wall of the tube, a contact ring *d* is fitted. This ring is connected to the anode *c* by means of a high-resistance conductor *n*, which may lie either inside or outside the lamp tube. In the cold state the portion of tube between *d* and *b* is thickly coated, and at the instant of switching on a current passes through this coating, and vaporises it. The arc then immediately jumps across from the cathode to the anode *c*. The arrangement is very simple and practical, and forms probably the best method for lighting these lamps with solid electrode material.

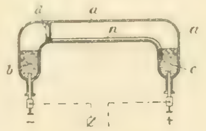

Fig. 4.

ABANDONMENT OF A CONTRACT.

[By our Legal Contributor.]

It not infrequently happens that the builder or contractor is compelled to ask himself the question—Can I carry on the work with any chance of making a profit? If he sees no profit in the future, it will be necessary for him to consider whether immediate stoppage will not help him to cut his loss. That loss may be serious enough ; for he not only becomes exposed to an action for breach of contract, but will forfeit the value of all materials brought upon the site, and the value of work already done.

The mere fact that great difficulties are experienced does not justify abandonment. In Macdonald *v.* Mayor of Workington (1892), H.B.C. 222, a builder contracted with a corporation to execute certain sewerage work according to plan, specification, and working drawings. In the course of the work it was found that certain tunnelling specified was impracticable, owing to the quantity of water in the soil ; and the builder suggested certain modifications of the scheme. These proposals were rejected, whereupon he threw up the contract. In an action to recover the balance due to him on the contract, so far as it had been performed, Baron Pollock found for the defendants, and held that the builder could not throw up the contract because the nature of the soil makes performance according to plans and specification difficult or impossible.

Similarly, the fact that difficulties are experienced with local authorities does not entitle a contractor to abandon. In one case a contractor agreed with the defendants to execute certain works according to plans and specifications, under the superintendence of the defendants' engineer, within a period of 18 months. During the progress of the works the plans were deviated from, and difficulties arose with certain landowners affected, in consequence of which the builder stopped work and sued to recover for work and labour done and money paid to the use of the defendants. It was held that a contractor to execute certain sewerage works for a sanitary authority under the Public Health Acts is not entitled to abandon the contract because of difficulties created by the landowners affected. (Dickinson *v.* Richmond Sewerage Board) (1893) H.B.C. (199).

Abandonment of a contract may also take place from the other side, as where, for instance, a building owner refuses to allow the work to proceed. In that case the builder or contractor is entitled to recover, as damages, all the expenses to which he has been put, and the profit which he would have made.

The mere fact, however, that the employer refuses to pay anything before work is handed over to him in a completed state is no evidence that he has abandoned his contract. In Rees *v.* Lines, 1837, 8 C. & P. 126, the plaintiff contracted to build a house for the defendant, according to a certain plan, for an agreed sum. After proceeding with the work and making a payment of £15 on account of the contract, the defendant, it was alleged, had abandoned the contract. In an action by the builder to recover the balance of the contract it was held that the fact that the defendant when asked for money, had stated that he would not pay a farthing, was not proof that he had abandoned the contract, for he was not then liable to pay anything as the work was not completed.

NATIONAL INSURANCE ACT, 1911.

Further Decisions of the Umpire under Unemployment Section of Act.

By JOS. J. H. STANSFIELD, F.C.I.S.

In the Electrical Review of August 16th last the decisions up to August 1st of the Umpire appointed under the provisions of the National Insurance Act, 1911, were set forth in an article by the writer. The present article contains the principal decisions affecting the electrical industry which have been passed since August 1st up to September 30th.

In many cases difficulties may have been found in deciding whether a workman was or was not included under the unemployment part of the Act, from the fact that at times many workmen are engaged on work that is clearly insurable and at other times on work which is exempt, and from the further fact that the Umpire in many of his decisions has used the words "wholly or mainly employed."

The difficulty arising in consequence of the use of the words "wholly or mainly" has, on several occasions, been brought to the notice of the Umpire, and he takes the view that these words should be applied to each payment of wages with reference to the period of service for which wages are paid.

If the workman has been employed on insured work for more than half the period for which wages are being paid, the Unemployment Book should be stamped. Thus, if a workman who is paid by the week has, during the week, been mainly employed on insurable work, his book should be stamped for that week; on the other hand, it should not be stamped if he has been mainly employed on uninsurable work. Similarly in the case of workmen paid at intervals shorter or longer than a week, the main employment during the period for which wages are paid decides whether the Unemployment Book has to be stamped or not.

This interpretation of the Umpire is only provisional, and must not be taken to exclude the possibility of a contrary interpretation in special cases should application be made to the Umpire.

In the meantime, however, the Labour Exchanges have been notified of the interpretation placed upon the words where there has been no special application, and as the Exchanges have the inspection of Unemployment Books placed in their hands, it will no doubt be considered advisable by those whom it may concern to act in accordance with the interpretation.

In the previous article it was stated that the Board of Trade proposed to make a general order exempting drivers and attendants of any vehicle and stablemen and other workmen employed in tending horses or to clean any vehicle. This order has now been made.

In many of the decisions it will have been noted that the Umpire has tried to distinguish between mechanical and electrical engineering and trades allied therewith, the former only being one of the scheduled trades. An interesting example of this is that the man who saws, planes or makes accumulator cell boxes is exempt, whilst engineers' fitters who machine moulds and make tools in connection with electrical storage batteries are liable to pay contributions.

The numbers in the various sections follow on from the article of August last.

Mechanical Engineering.—Contributions are payable in respect of the following:—

13. Testers of water meters and hydraulic fittings employed by way of manual labour (A. 731).

14. Electro-welding repairs to steam boilers, steel castings and other iron and steel structures, being mainly repairs to boilers of steam vessels (A. 744).

15. All classes of labourers employed in factories and workshops or in yards or stores immediately connected therewith, in a mechanical engineering establishment (A. 749).

16. (1) Making and repairing leather driving belts and leather hose pipes; (2) repairing and testing chains, all being for use in a mechanical engineering establishment (A. 803).

17. Manufacture of mechanical driving chains and chain gearing (A. 808).

18. (1) Driving cranes at works for unloading and loading material; (2) driving machinery and otherwise working in the mechanical engineering establishment of river conservators (A 812).

19. Boilermakers and labourers engaged wholly or mainly in repairs of boilers in connection with steel works or other businesses (A. 870).

20. Bricklayers and labourers engaged wholly or mainly in repair of boiler settings in connection with steel works and other businesses (A. 871).

21. Case-hardening parts of the products of a mechanical engineering establishment and in respect of sweaters employed in such an establishment soldering together metal parts with use of blow pipes (908).

22. Cranemen (hand or power), engineers and firemen (stationary engines) and boilermen (A. 933).

23. Fitting finished millstones to the hursting or grinding mill of a mechanical engineering establishment (A 950).

24. Manufacture of buffalo-hide pickers (A. 1,043).

25. Wholly or mainly making power-driven fans (A 1,054).

26. Engineers' fitters wholly or mainly filing up dies from patterns and making gauges and patterns from drawings in use in the manufacture of steam turbine blades (A. 1,063).

Electrical Engineering.—Contributions are payable in respect of:—

11. (1) In the manufacture of transformers, excluding coil-winding; (2) as toolsmiths and toolmakers (A. 728).

12. Building upon the site constructional work, such as . . . . switchboard galleries for electric stations, &c., and the preparation of the material for such on site, or in a constructional yard or shop (A. 740).

13. Armature disk notchers and stampers, core builders (A. 765).

14. Employés of an electric light and traction company engaged in the work of repairs to boiler, dismantling same

for inspection, and in repairs to engines in a power station (A. 786).

15. Electricians and assistants engaged wholly or mainly in the installation, upkeep, and repair of electrical machinery (including conductors), electrical wiring for power, light, or bells, in factories, workshops, and other buildings (A. 854).

16. Guillotine cutting punch press, stamping and twining of brass work for electric motor brushes for dynamos (A. 881).

17. Electric switch and contact makers engaged in the manufacture of automatic weighing machines for flour, sugar and cocoa (A. 888).

18. Manufacture and repair of vacuum cleaning machines (hand or power) including the woodwork but excluding the manufacture of hose pipes (A. 943).

19. Electric wirers in the roofing department of constructional engineers (A. 948).

20. Electricians and their labourers employed by tin mine owners in the upkeep and repair of electrical machinery and conductors (A. 953).

21. Manufacturing, assembling, erecting, or repairing of electrical switches, cut-outs, circuit-breakers and switchgear generally, including main and sub-station switchboards, motor control panels and starters and accumulator boards (A. 984).

22. Tool-makers making dies and tools used in the manufacture of lamps and gas and electric light fittings (A. 1,001).

23. Wholly or mainly making or repairing tools in connection with the manufacture of magnetos (A. 1,044).

24. Engineers' fitters machining moulds and making tools in connection with the manufacture of electrical store batteries (A. 1,068).

Contributions are *not payable* in respect of the following :—

24. Persons employed in the manufacture of electric fittings for billiard tables, but not including the installation of electric light in billiard rooms (B. 719).

25 Making or repairing electrical manufactures for torsion meters and other light instrument work (B. 726).

26. Making movable electrical cooking and heating apparatus (B. 727).

27. A scientific instrument maker engaged in assembling electrical measuring, testing and recording instruments (B. 730).

28. Making electrically-welded chain by machinery mainly for pulley blocks (B. 760).

29. Screwing, turning, boring, enamelling and boxing conduit fittings for electrical wiring (B. 794).

30. Ebonite and vulcanised fibre workers making insulating parts for the electrical trade (B. 805).

31. Making magneto-electric cycle lamps (B. 832).

32. Manufacture of electrical signs (B. 845).

33. Making or fixing electric letter signs, stall plates, &c. (B. 899).

34 (1) Art metal workers producing artistic wrought-metal, such as electric fittings, stove fronts and repoussé, silver, copper and brass work ; (2) packers of artistic wrought metal (B. 907).

35. Making moulds for shaping micanite for use in the manufacture of insulators (B. 932).

36. Fixing on the site, or preparation, including dressing, enamelling or polishing of slate or marble to finished dimensions for electrical appliances (A. 952).

37. Employed on lathe and vice in the manufacture of arc lamps for cinematographs (B. 940).

38. (1) Wood turners and polishers, turning and french polishing wood parts for electrical fittings ; (2) wood machinists on drilling and turning machines, making electrical work, such as adaptors, wall plug covers, pillars for lamps, bobbins for electrical wire and conduit bushes ; (3) putting together and fitting with terminals electric fittings, such as wall plugs and adaptors ; (4) breaking down timber and cutting blanks for (2) above (B. 965).

39. (1) Fixing or mounting fuse-wire or strip on china, porcelain or other insulators ; (2) fitting and fixing fuses in protecting cases (B. 983).

40. Manufacture, assembling, erecting or repair of small switches, cut-outs, circuit-breakers, distribution boxes and other fittings commonly used for ordinary domestic services (A. 984).

41. Making carbons for arc lamps (B. 1,005).

42. Wholly or mainly sawing, planing and making accumulator cell boxes (B. 1,046).

Cables, Overhead Lines and Street Lighting. Contributions are *not payable* for the following :—

15. Workmen employed by a Town Council wholly or mainly painting lamp columns (see also B. 547) (B. 734).

16. Painting street lanterns (B. 774).

17. Joiners and other workmen making wooden drums for electric light cables (B. 1,003).

Generation and Supply of Electrical Energy.—Contributions are not payable in the following cases :—

12. Theatre or music hall stage electricians and their assistants not engaged in wiring buildings or other work of a permanent character (B. 843).

13. Switchboard attendants or other workmen engaged wholly or mainly in minding, testing or driving electrical machinery, and not engaged wholly or mainly in the upkeep and repair of electrical machinery and conductors (B. 855).

14. Charging electrical accumulators (B. 1,005).

Tramways.—Contributions are payable in respect of the following :—

3. Brass-founders and other brassworkers engaged wholly or mainly in casting and machining of brass trolley-wheels for tramcars (A. 746).

4. Repairing controllers on tramcars (A. 789).

5. Wheelwrights, carpenters, smiths, fitters or other workmen, including unskilled labourers engaged wholly or mainly in the construction, decoration or repair of vehicles (A. 853).

6. Wholly or mainly in welding the track joints of tramway rails in the construction of new tramway lines, and in the reconstruction and alteration (but not the repair and relaying) of existing ones (A. 939).

7. Reconstruction of an existing railway, converting same from steam to electric (A. 980).

8. Fixing controllers on tramcars (A. 1,014).

Contributions are *not payable* for persons employed in :—

2. Tramway department of a County Council, inspecting material for tramway service (B. 785).

Works of Construction.—Contributions are *not payable* in respect of :—

1. Laying asphalt or tarred macadam in the yards of and the paths leading to buildings (B. 738).

THE SLAGGING TYPE OF GAS PRODUCER.

This gas producer receives attention in Technical Paper No. 20 of the U.S. Bureau of Mines, which is conducting tests upon it to show its value for fuels high in ash. With coke fuel and limestone flux for both intermittent and continuous runs up to 100 hours, the results point to success. Low grade fuels with high ash of 50 to 60 per cent. have succeeded in Europe, and in the U.S. with fuels up to 30 and 44 per cent. of ash have been tested in high grade fuel producers only.

Laboratory tests show that for high percentages of carbon monoxide, the fuel bed of a producer must have a temperature of 2,300° F. or more. Such a temperature fuses the ash and makes clinker difficulties. Now, if a producer is used of the blast-furnace type, the use of a suitable flux will remove this ash as slag. Bischof is said to have proposed a slagging producer in 1839. In 1840 one was built at the Audincourt Ironworks, in France, by Ebelmen, using charcoal, iron furnace slag and clay, which ran out as a fusible slag. One was built by Taylor, and worked at Chester, N.J., for four weeks with small anthracite and 30 to 40 per cent. of blast furnace slag as flux. The fuels used must have enough fixed carbon in their composition to develop the heat necessary to fuse the ash and do the other work of the producer. A battery of producers was installed at Gironcourt in 1907, using fuel of 20 to 25 per cent. ash, and giving a gas with 28 to 30 per cent. of CO and 9 to 10 per cent. of H and CH_4.

The Bureau of Mines uses a producer with a steel shell and brick lining and slag notch. There are six air tuyeres near the base, and four others at higher points for steam admission, fuel being charged at the top, where also the gas passes off very much as in the blast furnace. A cooling device is necessary in the combustion zone, a coil of pipe in the lining for water circulation, with 4½ in. of magnesite brick between coil and fire. The producer top also is water-cooled. The scrubber contains only water-sprays. The gas passes the fine water-sprays and is dry scrubbed by a layer of wood wool; the air blast comes from a positive blower at 5 or 6 to 16 in. water-gauge, the blast being passed through a heater. Coke was first used as a simple fuel. Limestone will increase the fluidity of the slag, and with the first trials ½-in. crushed limestone was used. Analysis was of little use for fixing proportions, for so much of both fuel and lime was blown over by the blast.

Tests have been made with 4 to 28 lb. of stone per 100 of coke. Burning 30 lb. of coke per ft. of fuel bed per hour, and using 6 of stone to 100 of coke, the slag was semi-fluid, black and glassy when cold. The gas showed 31 per cent. of CO and less than 2 of CO_2. To get a low fusion slag 4 lb. of stone per 100 of coke was tried, but the slag would hardly flow and clinker accumulated 6 or 8 in. deep, though the gas was excellent.

Next, tests with 12, 20 and 28 lb. of stone were made under no steam as before, and the air blast at ordinary room temperature with a 6-ft. fuel bed. The slag ran freely with 12 lb. At 28 lb. the fluidity point was passed, and the slag would hardly flow. With 20 lb. of stone the results were satisfactory, the slag less viscous, and freely flowing and spreading readily when run. When the blast was preheated it was found possible to run with an intermittent period of four days. With a 76-hours' run the gas was regular and excellent at 31 per cent. of CO, and 1½ of CO_2 tapping the slag hourly. Limestone 15 lb., coke 20 lb. per ft. of bed. Air at 440°. Other good runs of 100 hours were made with 15 lb. of stone, and the use of 0·75 lb. of steam had no effect in reducing slag fluidity.

It may be remembered that Thwaite had a slagging producer on test at Leeds, and that blast furnace or slagging producers formed a feature in the gas power electrical scheme put forward in 1906 by Thwaite and Booth in their coalfields power scheme.

The success of a slagging producer must depend upon the cost of lime necessary to effect the fluxing and upon the possibility of making use of the slag by way of a raw material for cement manufacture. As a rule, a slag is deficient in lime if a cement is to be made, and lime must be added and ground up with the slag and the whole re-burned and ground. Some slags also serve well, when crushed, to form the basis of artificial stone. It is clear that the whole of the lime for a cement cannot be put through the producer, for this must be worked so as to give a liquid slag, an end not attained with either an excess or a deficiency of lime. The report before us is hopeful that the slagging producer will be a means of utilising low grade fuels.

For large gas producers it is certain that a really successful slag producer would be very helpful, for it would economise labour. A producer can be handled entirely by mechanical means, as regards its fuel and other charges, exactly like the blast furnace, of which it is but a modified example. With a slagging process the riddance of the ash or waste could be also dealt with on mechanical lines. It may be considered that so far no gas producer outside the blast furnace has been made of really large size. But, if a producer could be made really large enough to admit of mechanical ash removal apart from slagging, there is no apparent objection to be raised against the employment of a conveyor or chain scraper gear, which should remove the burned-out ash and clinker from the pit bottom of a water seal producer, so saving the wages cost of the present system of raking out, though this is more easy and quick to carry out than the raking which is necessary with the ordinary grate bottom apparatus.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,076. "Telephone systems." C. A. Whipple. September 16th.

21,102. "Electrical switches." B. D. Horton. (Convention date, October 23rd, 1911, United States.) September 16th. (Complete.)

21,115. "Electric pendulum and switch for controlling electric clocks." W. J. Parker. September 17th.

21,120. "Interlocking electric starting switchgear." A. H. Railing and C. C. Garrard. September 17th.

21,157. "Regulator for train lighting systems and the like." P. Kennedy. (Convention date, July 6th, 1912, United States.) September 17th. (Complete.)

21,179. "Electric indicating apparatus." Tyler Apparatus Co., Ltd., and E. H. Bishop. September 17th.

21,194. "Method of, and apparatus for, producing mezzotint, stipple, and other printing plates, and autographic, facsimile, and other telegraphic records." A. S. Bridgwater. September 17th.

21,212. "Electric cooking apparatus." T. Birkett and Simplex Conduits, Ltd. September 18th.

21,215. "Detachable sleeve for the inspection of wires in cables." J. A. Williams. September 18th.

21,244. "Telegraphy." E. D. Cather. September 18th.

21,263. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 18th.

21,281. "Electric furnaces." E. Stassano. (Addition to 8,901 of 1911.) September 18th. (Complete.)

21,290. "Electric furnaces." J. M. (known as Johannes) Bocuze. (Convention date, October 14th, 1911, France.) September 18th. (Complete.)

21,310. "Secondary cells, charging the same and utilising current therefrom." M. R. Hutchison. (Convention date, September 28th, 1911, United States.) September 19th. (Complete.)

21,331. "Printing telegraph instruments." E. J. Kessels. (Addition to 17,322 of 1910.) September 19th. (Complete.)

21,342. "Bedroom electric reading lamp and watch suspender." C. F. Clark. September 19th.

21,349. "Mountings or fittings for tubular incandescent electric lamps." D. Assersohn. (Addition to 17,855/07). September 19th.

21,351. "Telephone apparatus." R. Lagus. September 19th. (Complete.)

21,365. "Portable electric lamp for signalling and other purposes." J. Ormandy and G. W. Colmer. September 19th.

21,370. "Instruments for measuring electric resistances." E. I. Everett. September 19th.

21,410. "Electric water heaters or geysers." L. M. Waterhouse and Simplex Conduits, Ltd. September 20th.

21,411. "Electric arc lamps." A. H. Railing and A. E. Angold. September 20th.

21,415. "Direct current dynamos and motors." E. R. Freeman. September 20th. (Complete.)

21,433. "Brush-rocking apparatus for dynamo-electric machines." Pintsch's Electric Mfg. Co., Ltd., and C. H. Vidal. September 20th.

21,445. "Production of sheet mica and the like from mica waste and other materials." F. Bolling. September 20th. (Complete.)

21,446. "Calculating apparatus particularly adapted for reckoning out charges for the use of electricity, gas, water and so forth." H. Bruckmann. September 20th. (Complete.)

21,471. "Polyphase alternating electric current commutator motors." Siemens Schuckertwerke G.m.b.H. (Convention date, September 22nd, 1911, Germany.) September 20th. (Complete.)

21,472. "Cooling dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., and W. Marden. September 20th. (Complete.)

21,478. "Electric furnaces for producing gas reactions." H. Pauling. (Convention date, October 24th, 1911, United States.) September 20th. (Complete.)

21,504. "Electric motor-regulating resistances." A. H. Railing and C. C. Garrard. September 21st.

21,533. "Electric-controlling devices for automatic photographic devices." S. Grossi. September 21st. (Complete.)

21,540. "Automatic thermic cut-out for electric lighting and power transmission circuits." A. Tasso. September 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

Dynamos. A. A. Price. 19,581. September 2nd.

Telegraphic Relays. S. G. Brown. 19,779. September 5th.

Quadruplex Hughes' Printing Telegraphs. G. Banzati. 19,815. September 6th.

Electric Safety Fuse. J. Muller. 19,856. September 6th.

Method of and Apparatus for Electrically Treating Plants, Seeds and the like. F. Muller and Veifa-Werke Vereinigte Electrotechnische Institute Frankfurt-Aschaffenburg. 19,962. September 7th. (June 20th, 1911.)

Electric Furnaces. A. E. Bourcoud. 20,038. September 8th.

Collectors for Electric Traction. R. C. Sayer. 20,100. September 11th.

Electric Switches. A. F. Berry. 20,171. September 11th.

Series Electrical Lighting. B. C. Atherton. 20,794. September 20th.

Electromagnetic Relays, Electromagnets and the like. Western Electric Co. (Western Electric Co.) 20,860. September 21st.

Automatic Electrically-Governed Engine Stop-Gear. H. D. Hinckley and W. D. Halliday. 23,359. October 23rd.

Electric Lamps for Motor Vehicles. H. Aron. 24,380. November 2nd.

Magnetic Clutches. A. T. Collier. 24,776. November 7th.

Means for use in Automatically Regulating the Timing in Magneto-Ignition Apparatus. H. Diehl. 25,161. November 11th. (November 23rd, 1910.)

Telegraphic Systems. P. Faiells. 27,510. December 7th. (December 9th, 1910. Addition to 4,920 of 1911.)

Manufacture of Metallic-Filament Incandescent Lamps. Siemens Bros. and Co. (Siemens & Halske Akt.-Ges.) 29,098. December 27th. (Convention date not granted. Addition to 19,077 of 1910.)

1912.

Apparatus for Producing Electric Oscillations Adapted for Wireless Communication and other Purposes. W. Dubilier. 11,091. May 9th.

Telephones and other Apparatus Embodying Exposed Diaphragms. E. A. Graham. 13,768. June 12th.

Makers of Connections to Commutator Segments of Dynamo-Electric Machinery. Siemens Schuckertwerke Ges. 15,662. July 4th. (July 4th, 1911.)

Magneto-Electric Machines for Ignition. W. Hayer. 1,895. January 17th.

Construction of Burglar Alarm. J. H. Lang. 3,232. February 8th.

Electric Incandescent Lamps. R. H. Henderson. 7,148. March 23rd. (March 23rd, 1911.)

Electric Signalling Circuit for Train Despatching and Like Systems. J. C. Field. 7,435. March 27th. (March 30th, 1911.)

Device for Locking Together an Incandescent Electric Lamp of the Bayonet-Capped Type and Lampholder. G. E. Meek. 12,228. May 23rd.

Devices for Ensuring Electrical Continuity in Metallic Conduits for Electric Cables. L. M. Waterhouse and Simplex Conduits, Ltd. 13,079. June 4th.

Automatic Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,563. June 21st. (Addition to 7,093 of 1910.)

Canada. The *Times* correspondent at Toronto reports that at the recent annual banquet of the Manufacturers' Association, at Ottawa, Mr. R. S. Gourlay, the new president, said:—"We were asked by British manufacturers if we would favour an increase in British preference." His answer was:—"We would not: and their best course is to cast in their lot with us, and establish branch factories in Canada."

Fire.—An outbreak of fire occurred on Wednesday last week at the fitting shop of the British Insulated and Helsby Co.'s works at Prescot. The roof and a quantity of stores were totally destroyed.

THE

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STATESMANSHIP FOR MANUFACTURERS.

STUDY the prospective markets and nurse them! Organise a foreign trade campaign! Co-operate in reason with your British rivals in order effectively to meet foreign competition! Advertise to the whole world your ability as an up-to-date manufacturer!

To readers of the ELECTRICAL REVIEW such advice as the foregoing is not unfamiliar. Indeed, it is very much like a selection of texts from a series of our own. On this occasion, however, we quote the suggestions from a statesman of experience, Lord Selborne, who uttered them last week at the opening of the Olympia Machinery and Engineering Exhibition. Writers in the trade Press may say such things as the outcome of special study, and as the result of urgent warnings received from qualified observers; trade commissioners and consuls also may offer similar counsel in very definite terms; but we are afraid that too often such suggestions have come to be regarded as a matter of course when passed through such channels, and we have noticed occasionally a disposition to treat them as more or less idle talk. We would remark at once, however, that we believe that disposition to be breathing its last, though ultra-conservation still occasionally betrays itself. In the electrical and engineering trades especially have we noted with feelings of deep satisfaction the new spirit that has in recent years entered into British investigation of foreign trade possibilities, while there is also a slight movement toward more efficient organisation, a more sympathetic attitude toward the principle of co-operation to gain common ends has been engendered, and save in a few exceptional cases, the desire to hide one's light under a bushel no longer occupies the breast of our manufacturers.

So far, then, the spirit, the attitude, the desire, have undergone a healthy change. The recognition that a certain course of procedure is wrong is not enough. If the pace has been too slow, it must be speeded up; if the method of doing business be obsolete, it must be scrapped in favour of the more efficient though more exacting system which altered conditions have necessitated; if orders from new markets be desired, we have got to do something more than wish for them. Sentiments are of little avail, a mere assent to the editorial proposition that these days demand more active effort in a foreign field is of little use, from our national and individual manufacturing point of view, unless we take some very definite course to extend our trade—unless we become thoroughly aggressive. These, we know, will be termed platitudes; they are—we admit it.

Can we say, though, with such reflections prominently in mind, that our manufacturers and traders are doing their best to maintain and develop the British position abroad, seeing that a strong policy is essential for productive activity and prosperity to be continued at home in the years that are to come? If we understand the views of Lord Selborne, as reported in the Press, he, at any rate, is not satisfied with the position of affairs. Speaking as the result of his experience in an office of high authority in South Africa, and assisted also by the suggestions of students having other coigns of vantage from which to view the battle, he appeals to the British manufacturer to pay heed to the alertness of foreign competitors in getting their feet early into new trade territory, and he suggests, as a study well worthy of the statesmanship of our manufacturers, "the nursing of prospective markets." Of course we are in the most complete agreement with his lordship, for again and again have we urged our firms to take a large view of export matters, not being content with a mere inquiry' and order-book business producing an immediate profit, but establishing a connection in, and a hold upon, new markets where an immediate satisfactory return was out of the question. In recent years we have emphasised the forward movement or awakening that was taking place among the people in such markets as China, Turkey, Russia and South America, all of which must inevitably soon bring a huge demand for modern facilities; also the hopefulness that should exist with regard to trade in Canada, Australia, India and South Africa. It used to be said in some quarters that our electrical firms could not afford to stand the financial drain involved. We have seen in a number of cases that that objection has been falsified by practical experience, even when trade was not good, and profits were smaller.

But to-day—What of the position in 1913? Reports from every hand show that electrical engineering works are full of business, extensions to works are being carried out, order books are in a healthy state, deliveries cannot be promised as quickly as desired. A discordant note is struck by the report issued by one manufacturer this week, but the position described has arisen through exceptional losses, and one can only hope that it is but a temporary fall from ordinary dividend grace. Taking the outlook generally, we appear to be in the midst of a bigger boom than ever before. The weekly reports in the engineering Press have formed for some months past quite entertaining reading, showing the rush of business and the fulness of employment for labour. But booms do not last. We must profit by past experience, and remember the drop in the trade curve which comes as inevitably after the boom as the night follows the day. In times of depression we discuss things that are wrong, and mean to put them right when trade improves; as activity increases and the boom comes on, we are busy or we forget those good intentions. Now the best way, surely, is in time of boom when we can better afford it, to adopt this policy of nursing prospective markets, so that slackness when it comes will be less serious. We hope that the appeal of Lord Selborne for the matter to be dealt with in a statesmanlike, instead of a parochial, manner by British manufacturers will receive a sympathetic attention from those to whom it was addressed, and from all who are interested in strengthening the foundations of the citadel of British engineering.

Co-operative Exhibiting.

The suggestion for co-operation and advertisement touched upon briefly in the preceding article is a very timely one. It should not be passed over lightly, but deserves the most profound deliberation from all of us. There is an international exhibition to be held at Ghent, Belgium, next year. How can we secure that British electrical engineering shall have a really true representation in evidence? We can hear in a hundred offices at once the remark that "it is ridiculous to suggest that such a firm as ours could stand such a burden." We recognise the heaviness of the burden, but why not share it with your brother manufacturers? Surely that would be better than to see the foreigner go in and win. Mr. J. M. Robertson, M.P., the Parliamentary Secretary to the Board of Trade, who followed Lord Selborne, showed that he appreciated how great was the growing burden of individual displays at international exhibitions, but like many more of us, he also sees how imperatively necessary international advertisement of the manufacturing products of this country has become. We observe that even in Germany criticism is being offered that international exhibitions are following too closely on the heels of one another. It is feared that excess will lead firms to get into the way of holding aloof. It is understood, however, that the firms who, under the auspices of the Board of Trade Exhibitions Branch, entered into a co-operative arrangement at Brussels and Turin, found the efforts well worth while. Our foreign competitors have shown their satisfaction with exhibitions of this kind by increasing the space at succeeding shows, and it is certain that if we are not wide awake in respect of Ghent, we shall be eclipsed in a country which can afford us one of the best trade opportunities so far as the Continent is concerned. There will be no other great exhibition in Belgium for a decade, and the British Government proposes to make a special feature of engineering and machinery in the British exhibit. The fact that on the Continent there are to be met our keenest electrical rivals with their network of connections spread out in all directions must not be allowed to dictate a policy of apathy. British electrical apparatus must be advertised if it is to be known; it is likely to be known more effectively if it is *seen*. The quality of our production is high, why not let it speak for itself in a co-operative electrical advertising effort at Ghent? How far are rival competitors in the British electrical industry willing to join hands in a splendid effort to boost their products in the presence of Continental buyers and of those who will come from other foreign markets to visit the exhibition? Each may reduce the cost to the other and both stand to gain something. In our next issue we shall give some further details of the arrangements, and we venture to hope that some way will be found for ensuring that British electrical industry not only shall not suffer, but shall greatly gain, from the holding of this exhibition and from the facilities that the Board of Trade are placing at our disposal.

The Fees of Expert Witnesses.

It is interesting to notice that the President of the Incorporated Law Society has been attempting to blame the expert witness for the abnormal expense of modern litigation. If it be true that your expert demands and receives large fees, we see no reason why he should not do so. Anyone who has had experience of the law from the point of view of the man who is summoned to assist the Court by giving evidence will appreciate that the fee charged may very properly be out of proportion to the time spent in the witness-box. A busy engineer may have to make a preliminary report, travel to a remote part of the country to view the *locus in quo*, attend numerous conferences, make plans, models, and drawings, and conduct experiments. Surely he is entitled to charge a reasonable sum for all these services which make a very serious demand upon his time? His fee is but the reward of talent and experience. May we suggest to Mr. Samson that the lawyer's bill of costs might often be materially reduced if the client were advised to consult a technical expert at the earliest possible moment? Suppose, for instance, the question at issue is whether a generating plant is capable of doing the specified work. The lawyer may advise as to the construction of the contract; the lawyer's client who supplied and erected the plant may be satisfied in his own mind that it complies with the contract, and may have sufficient force of character to impress his legal advisers with the same view. But an independent expert will look at the whole matter from a more or less impartial standpoint, and may well be in a position to switch off a very expensive current of litigation.

DOMESTIC WATER-HEATING BY ELECTRICITY.

Herr A. Ritterhaussen, in a paper read before the Verband Deutscher Elektrotechniker recently, discusses the importance both to the consumer and to the supply engineer of electric water-heating for domestic use.

He points out that about three-fifths of the heat required for domestic purposes (exclusive of that for room warming) is used for heating water, and if this is to be supplied electrically so as to compete favourably with gas or coal, the charge for electricity must be a lower one than is usually possible under ordinary circumstances.

The difficulty can be overcome, however, if some form of heat storage is employed for the water-heating, so that the required energy can be supplied to the apparatus not necessarily when the hot water is required by the consumer, but at times of light station load, such as the early morning or the daylight hours. Such a load, completely under the control of the supply station, can, of course, be economically supplied at a very low figure, and may, eventually, prove a valuable means of levelling the load curve.

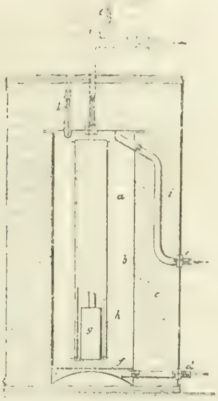


Fig. 1.

To meet this requirement, Herr Ritterhaussen, after long experiment, has developed an interesting form of heat accumulator which he claims competes favourably as regards first cost, working cost and simplicity with the gas-heated "geyser" and similar rivals.

The arrangement of this is shown in the section, fig. 1. The heat accumulation takes place in the water itself, the heat being given off by the heating body *g* at the bottom of the circulating tube *h*, and conveyed by convection to the top of the main chamber *a* in the neighbourhood of the outflow pipe *i*. As hot water is withdrawn by the consumer, fresh cold water from the mains enters by the pipe *d* at the bottom, and the perforated plate *f* serves to prevent all eddying and mixing of this cold inflow with the existing hot water.

The cold water thus remains at the bottom, and passes gradually into the circulating tube *h*, and, after heating, to the top of the chamber. The well-known fact, that in a vertical chamber, such as this apparatus forms, heat travels downwards only very slowly, makes it possible for the cold and hot waters to remain in this way in the same chamber for an extraordinarily long time without mixing. Thus, at any moment the full amount of hot water corresponding to the energy supplied is immediately available.

Heat dissipation is reduced to a minimum by surrounding the water chamber by an 8-in. thick coating of very loosely packed silica. No metallic connections between the water and the outer casing occur, except the inflow and outflow pipes. The inlet pipe is only in contact with cold water, since no appreciable heating occurs below the bottom of the circulating tube, and, therefore, no loss occurs through it. Loss through the outlet pipe is practically prevented by the simple device of carrying the pipe in a downward direction for some distance (about 18 in.) in the non-conducting coating as shown. With this arrangement all convection currents in the pipe are prevented, and so extremely little heat escapes through the pipe, whilst with a pipe directed upwards, or even horizontally, and however well lagged, a prohibitive amount of waste was found to occur.

The accumulator is provided with a simple automatic cut-out which disconnects the supply as soon as the desired temperature is reached, and reconnects it after water has been drawn off. This consists of a contact thermometer *k*, and an electromagnetic mercury switch *l*. This device only consumes about half a watt, and since the temperature changes in the accumulator take place extremely slowly, the mercury switch only has to operate very occasionally, and has a very long life.

The apparatus is thus wholly automatic, and is also in no way disturbed, if, at certain times of the day, the supply is entirely cut off, either by a time switch or by hand.

E.T.Z., August 22nd, 1912.

NOTES FROM INDIA.

[By our special correspondent.

Dacca.—Under the old scheme of things when this very ancient and highly interesting city was the capital of the new province of Eastern Bengal and Assam, a concession for electric lighting and tramways was, after considerable delays and expense, granted to Messrs. Octavius Steele & Co., of Calcutta. In due course a company was formed, the necessary capital was subscribed, some locally, some in England, orders were given for the plant at home, and everything progressed satisfactorily. The old three-wire 440-volt central station, which was a free gift of the old Nawab of Dacca to the citizens, was to have been absorbed in the new power scheme and the existing overhead bare copper mains utilised to some extent.

Suddenly, and without warning, came the news of the Delhi Durbar booms, one of which, in response to a fierce agitation among Bengalis, was to nullify the partition of Bengal, and by a stroke of the pen the province of Eastern Bengal was wiped out and the proud city of Dacca reduced to its former decaying position. Interest in the new electric lighting scheme ceased for the time, orders not executed were cancelled, and the promoters of the scheme were naturally very disappointed and dissatisfied. Now, however, after a lapse of several months the newly-appointed Governor of Bengal has signified his intention of making Dacca his headquarters for at least two or three months a year, and active work on the new lighting scheme has again commenced. By March, 1913, it is hoped that the machinery will be in operation, and current from the new power house in the mains. The Bengal Government, it is said, has guaranteed a certain minimum consumption per annum, sufficient, at any rate, to pay yearly establishment charges and maintenance; and it is anticipated that street lighting and private consumers will yield a sufficiently large revenue to go towards paying a dividend.

Agra.—Tenders are being called for a lighting scheme for this ancient and beautiful Moghul city and cantonments. It is not generally known as yet whether the Government are allotting the necessary funds; or whether it is in the initiative of a private syndicate who have obtained a lighting concession. A new electrical inspector has recently been appointed in the United Provinces, and contractors are not yet familiar with his methods.

Wire.—Government engineers are frequently specifying metal-covered wires in India in these days, the popular favourites being "Stannos," imported by Messrs. Siemens, and Henley's system. As these metallic-covered wiring systems are cheaper and neater than, and probably as durable as, either wood casing or conduit work, neither of which in India is very lasting, wire manufacturers who have not yet put a "system" on the Indian market should wake up and meet a want, instead of, as some wire manufacturers' agents do, wasting time and misplacing energy in decrying the "systems" which are growing in popularity.

The wiring method which has stood the test of time is undoubtedly teakwood casing work spaced away from walls on small porcelain button insulators; but a new fashion has come in—whether to stay or not is a debatable point—and it must be catered for even temporarily.

Electric Drive for Mills.—A new flour mill driven electrically has been opened recently by Messrs. Andrew Yule, of Calcutta. The motors are by the Lahmeyer Co., running direct off the Supply Co.'s H.T. 6,000-volt mains. The consulting work was in the hands of Mr. Speyer, who explained the economy of motor drive to an interested audience of commercial men.

COMPENSATING VOLTMETERS.

By F. T. HOMAN, A.M.I.E.E.

It is frequently of advantage to be able to measure at the generating station the voltage at the feeding point of a feeder without resorting to the use of pilot wires. For this purpose compensating voltmeters may conveniently be used; their main advantages are:—

1. The low cost of installation and upkeep.
2. The elimination of frequently troublesome pilot wires.

Fig. 1 shows a diagram of connections for a voltmeter applied to a single feeder.

B is a high series resistance provided with three terminals, and is connected across the bus-bars.

A is a low-resistance shunt inserted at the bus-bar end of the feeder.

It will be noted that the effect of the shunt A is to oppose the drop across the few turns of high resistance to which the voltmeter is connected, and, consequently, when there is any load on the feeder, the voltmeter reading is correspondingly reduced to allow for the voltage drop on the whole length of the feeder.

The shunt may conveniently be dispensed with altogether by using instead a short length of the feeder cable itself, such that the resistance corresponds with the calculated resistance of the shunt. This will not usually mean tapping more than about 20 ft. of feeder.

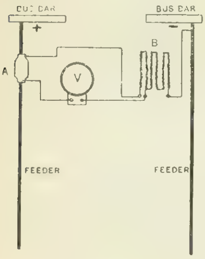


Fig. 1.

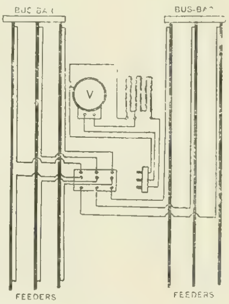


Fig. 2.

By the adoption of a suitable plug or switch arrangement a single instrument may be used on several feeders.

Fig. 2 shows the connections for three feeders, using a three-pin plug and sockets, and employing a length of feeder in place of the shunt in each case.

The "moving-coil" and "hot-wire" types of instruments are suitable for use as compensating voltmeters; the electrostatic type is, of course, unsuitable.

The above remarks apply to direct-current working. For alternating-current systems a similar arrangement is possible; the high resistance will be non-inductive, and a reactance will be used in place of the shunt. Instruments of the "induction" or "hot-wire" types may be used.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Use of Mica in the Insulation of Electrical Apparatus.

If you will permit us, we should like to make a few criticisms and add a few notes to the very able article on the above subject by Messrs. Fleming and Johnson, in the recent issues of the ELECTRICAL REVIEW.

We agree with the writers that there is a lack of knowledge amongst electrical engineers as to the limitations of this insulator in some directions, and also as to its use and advantages in other cases.

We also agree with the writers that the mottling on some of the muscovites does not greatly affect its insulating value for practical purposes. This mottled appearance is often caused by inclusions of magnetite and decomposed felspar (or china clay). Prof. E. Wilson some time ago carried out a series of experiments to ascertain the dielectric strength of various commercial micas; the results have been published, and we shall be pleased to forward a copy to any electrical engineer who cares to apply to us. The dielectric strength of the best clear ruby mica compared to spotted Bengal mica was as follows, the test pieces being 4 mils thick:—

Bengal ruby clear ...	5,250 volts per mil.
Bengal spotted	2,750 volts per mil.

We forward a direct contact photograph to show the form of the magnetite inclusions in the spotted mica of the same quality as the tested piece. The figures for the spotted mica are high enough for all ordinary purposes; the ruby clear is used largely for special high-tension work, condensers and so on.

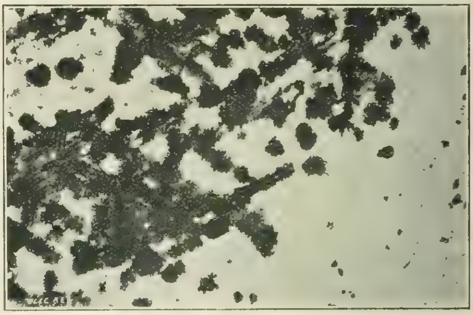


Fig. 1.—Direct Print from "Bengal Spotted Mica," showing Magnetite Inclusions.

We cannot agree that "amber" mica (phlogopite) is much more expensive to split than muscovite. By reason of its softness it requires a little more care, perhaps, than muscovite, but an expert, or properly trained splitter, using the *proper* form of knife would not consider it much more difficult to deal with if the edges of the slab had been trimmed as they should be for this purpose; that is, the mica should be trimmed round with a knife held on the slant, what is known in the trade as sickle trimmed, because the natives in India use a sickle for this purpose. If this is done before splitting, much time and waste will be saved in dealing with any kind of mica. The actual process of splitting correctly and economically is difficult to explain on paper, and can only be acquired by practice and training, a point that, we fear, is not generally realised.

We do not agree either that the cost of amber mica is three to four times that of soft green; about 25 per cent. to 50 per cent. extra would be nearer the mark.

We agree with the writers that the so-called "softness" of many micas is due entirely to the presence of moisture between the laminæ, and that all attempts to soften mica artificially by "annealing," or any other way that alters its structure, only result in partially or wholly destroying its most valuable characteristics, particularly its insulating value, by the partial disintegration which these processes involve.

We certainly must protest most strongly against the statement that pure mica has only a restricted application on account of the limited area of the sheets. Mica can be obtained and is regularly sold in sizes up to 24 in. × 12 in., which is large enough for most purposes; nor, when one considers the way in which all large mica that comes on the market is absorbed at once, is it true to say that mica over 12 in. long "is not a commercial proposition." We forward a photo herewith of part of an order we have just executed for some mica over 12 in. long (fig. 2). The rule shown in the print is a foot-rule, and this is typical of orders we also have in hand.

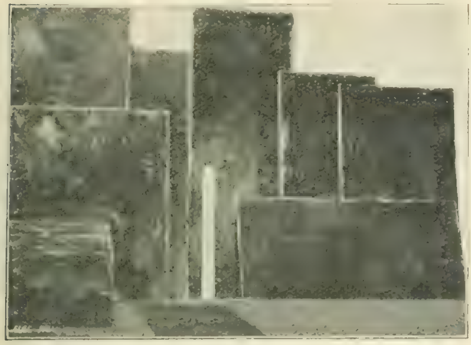


Fig. 2.—Large Mica Plates for Electrical Insulation.

Referring to the use of pure mica in commutators, we cannot help thinking that there is a lot of nonsense talked about the relative hardness and softness of mica used for this work; whilst, on the one hand, we hear of engineers who are troubled with the uneven wear of mica and micanite in their commutators, there are plenty of firms who use the so-called hard micas and who never seem to have any trouble at all in this direction, which suggests that the cause of this trouble should be sought for elsewhere, a view which is shared by one of the leading insurance engineers, who naturally has exceptional opportunities for studying this question.

With reference to the respective merits of mica and micanite for commutator insulation, we sell large quantities of both insulators, and consequently we have a fairly good knowledge of the experience of the users, not only of material we sell ourselves, but also that from other sources, and there is no doubt that micanite gives far more trouble in use than pure mica, a view which we are sure is shared by the vast majority of electrical engineers; in fact, we have always made a point of asking every electrical engineer we meet, which he would prefer to use, apart from the question of cost, and in no instance can we recall a single answer in favour of micanite, whilst from the number of times we are asked to replace burnt-out micanite segments with mica, we think that this dissatisfaction is pretty general. The enclosed photo. showing one of these burnt-out segments—just received—shows well the usual trouble; the insulation is completely burnt away (fig. 3). As long ago as 1906, Mr. Michael Longridge, chief engineer of the British Engine, Boiler and Electrical Insurance Co., Ltd., stated in his annual report that he "deemed micanite unsatisfactory for use between commutator segments, and that *pure mica* should be used."

Micanite has very many uses, and although a long way behind mica, is nevertheless a very useful insulator, only it is unfortunate, in the interests of both buyers and manufacturers, that enthusiasts should rush in and claim for it virtues that it does not possess; even more than mica in some directions, it has its limitations, and one of these appears to be its unsuitability for commutator work. The reader has only to turn up the "Correspondence" columns of back numbers of the Electrical Review to see this, and it is unnecessary to go into the matter here.

When micanite was first put on the market, some years ago, it was then made very carefully and with large splittings; they were called No. 5 grade, but would to-day be classed as No. 4; so much have the gradings fallen in area since then. Makers then claimed for it a dielectric strength of 1,000 volts per mil, and undoubtedly it would and did stand this test. But to-day, although, with all these years of experience and practice behind them, one would expect manufacturers to produce a much better article than the early micanite, this is not so; its dielectric strength has fallen to about half of what it used to be, and the breakdown strain of most commercial micanite now seems to be about 500 to 600 volts per mil. This may possibly be a partial explanation of the dissatisfaction that exists amongst so many electrical engineers with this material. For this result the buyers are mostly to blame; they have constantly demanded a cheaper and cheaper article, and the manufacturers have nobly done their best to meet this demand, in spite of the always-increasing cost of raw material, &c. The whole value of micanite as an insulator depends upon the area of the splittings from which it is made, and no amount of careful workmanship, heating and pressing will compensate for No. 6 splittings being used instead of No. 5 or No. 4. If buyers are prepared to pay a good price for a good article, we are confident that manufacturers can produce a micanite far superior to anything at present on the market.

However, even at its best micanite must necessarily be far inferior to mica as an insulator. The binding cement, no matter how small a quantity is used, is always a source of weakness; it is liable to carbonise under the action of heat and to deteriorate under the action of ozone. The researches of the writers themselves demonstrate this in their valuable paper on "Chemical Action in the Windings of High-Voltage Machines," read before the I.E.E. at Manchester, February 14th, 1911, from which we beg to quote: "As regards the micanite samples, the mica itself was unaffected, but some action was observable on the varnishes used for cementing the laminæ together;" again, in summing up the results of their investigations, Messrs. Fleming and Johnson state that "Mica is itself unaffected, but the cements used in building it up are liable to attack on exposed surfaces." Mr. E. H. Rayner, M.A., of the National Physical Laboratory, in his paper on "High-Voltage Tests on Insulating Materials," read before the I.E.E. on February 8th, 1912, makes the following remarks with reference to micanite and mica. Where micanite was under test at high voltages ". . . . the material becomes rapidly hot and softens around the electrodes, swells by internal vapour pressure, and is finally pierced;" and later on, "Generally speaking, thin qualities up to about 1 mm. will withstand a stress of 20,000 volts per millimetre in air for 10 minutes," (equal to 500 volts per mil, which bears out our contention stated earlier in this letter). "Above this thickness, up to 2·5 mm. there is more difficulty in making material which will withstand this stress." Speaking of pure mica, he said: "Mica may be run very near the breakdown point for a long time, and is unaffected by ordinary temperatures met with in machines." A test piece 0·04 mm. thick was subjected to 7,000 volts for two hours, and was not punctured, "although the steel ball electrodes were too hot to hold and the brush discharge stained the mica with a ring of iron oxide"; this strain is equal to 4,375 volts per mil of thickness.

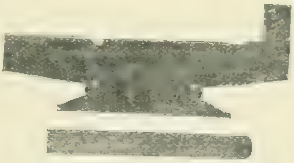


Fig. 3.—Micanite Commutator Section, showing Failure of the Insulation.

There is no doubt that mica should be used as far as possible without any cement whatever, and this can be done to a far greater extent than is realised if only a little care is used. To mention one use, pure mica tubes can be obtained consisting entirely of rolled mica and containing no cement whatever up to 12 in. or 18 in. long, and the increased cost is not so great as would appear at first sight, because these tubes can be used so much thinner, as they will stand a much greater breakdown strain than micanite tubes; to show that these are a "commercial proposition," we might mention that we have supplied thousands of such tubes to various electrical firms. If electrical engineers could only spend a few hours with a splitting knife and a few sheets of mica now and again, they would be astonished at what can be done with it; by splitting a large sheet up into plates about 1 mil thick, it can be bent round sharp corners or into slots as easily as micanite if precautions are taken to hold it in place, and there is always the advantage that much thinner insulation can be used with no fear of any changes taking place due to chemical action.

F. Wiggins & Sons.

London, E.C., *October 1st*, 1912.

Re Contracts in India.

In your issue of August 23rd, 1912, under "Correspondence," you published two letters signed respectively "One Interested" and N. M. Marshall, on the subject of contracts in India. On reading these letters, and taking into consideration the fact that they both appear under the same date, it seems to us that they were both inspired by one and the same mind, except that "One Interested" is accusing N. M. Marshall of being given preferential treatment by the Government, by being favoured with the contract for the Coronation lighting, and N. M. Marshall in turn accuses some firm, whose name he does not state, of being favoured in the same way that "One Interested" states that N. M. Marshall was favoured. Now, this correspondence certainly seems to indicate that either "One Interested" or N. M. Marshall is very much at sea in the statements made, and under the circumstances we think that a statement of fact may be of interest to your readers.

For a number of years past we have been estimating for Government work, and in some cases we have been favoured with orders, but in other cases the orders have gone to some other local firm here, and we feel sure that some of the orders which have passed us have not passed us on account of our prices being high.

Our own idea of this subject is that the Government does not always place orders with the lowest tenderer, because some firms here have a practice of cutting their prices to an absurd limit, and if orders were always placed with the lowest tenderer one firm would be favoured with practically the whole of the Government's orders, and other firms would become tired of tendering, so that the cheapest firm would eventually obtain a monopoly of Government contracts, and so stifle all competition.

We believe that the Government method here is to spread the work round as much as possible, so as to keep a number of firms available for their work, instead of giving the whole of the contracts to one firm, and the Government, when working on these lines, does not always appear to place orders purely on the question of price, but considers the nature of the work to be done, the class of material offered, and the abilities of the various firms to make a decent job of any orders placed with them.

The statement that the contract, amounting to Rs. 1,20,000 (£8,000), for the illumination of Bombay in honour of His Majesty the King's visit, was placed with one firm without other firms being asked to tender, is an absolute out-and-out misstatement of fact, and in support of our statement we enclose herewith a copy of our estimate dated June 1st, 1911, for the Coronation illuminations amounting to Rs. 1,25,000.

From this you will see that we were asked to tender, and that our price was only Rs. 5,000 higher than that tendered by the Parsee gentleman trading under the name of "N. M. Marshall," and sometimes as "Marshall & Co.," and it was Messrs. Marshall & Co. who booked this order.

We also know that other firms were asked to tender, but we do not know what their prices were, as the Government does not make a practice of issuing a return showing the various sums estimated for different installations.

You are at perfect liberty to publish any portion of this letter or of our estimate, and we think it a great pity that Government officials are not allowed by Government rules to defend themselves against such attacks as were made in your issue of August 23rd, 1912.

It seems to us that the only possible result of the letters written by "One Interested" and N. M. Marshall will be that the Government will decide to do the whole of its electrical work departmentally, and this will result in all orders for material being placed at home, and Bombay electrical firms will have a very bad time to look forward to. As it is, the Government is now doing a large amount of electrical work departmentally.

Pro **Greaves, Cotton & Co.**
J. Elliott.

Bombay, *September 20th*, 1912.

Knife Switches.

As a designer and manufacturer for many years, I would point out that, in approaching the above subject, consideration should be given to strong simple mechanical design, giving ample area of contact, sufficient cross-section, and pressure of contact between surfaces.

In designing switchboards, a maximum density of 1,000 amperes per sq. in. cross-sectional area for bus-bars and bare connections; 750 amperes per sq. in. for purely current-carrying parts of switchgear; and 250 amperes per sq. in. for contact surfaces, give excellent results in freedom from heating at all movable and fixed mechanical joints, and at the same time ensure strong mechanical design.

The designing and choice of materials so as to obtain and maintain sufficient pressure between contacts is all-important in determining the useful life of a switch.

Now, in designing switchgear on the above lines, the question of "live hinge" or not is of no moment whatever, the only consideration is the question of heating, and I submit that a consulting engineer has no business whatever (if honestly considering the interests of his clients) to specify in what manner, or of what type, the switch shall be constructed. He is not a switch designer or manufacturer, and probably his only actual experience has been with paper switches of the single stroke pen type. It is quite possible to safeguard everybody's interest by specifying switches to be of strong mechanical design (and see that they are so when delivered), and to be free from abnormal heating when loaded as per specified conditions.

In conclusion, I would state without fear of contradiction from any responsible switchboard designer, that the finest switch ever designed is that originally introduced (I believe) by the British Thomson-Houston Co., and manufactured by the General Electric Co., of New York, and used on most of their traction boards. This switch has a "live hinge."

Knife.

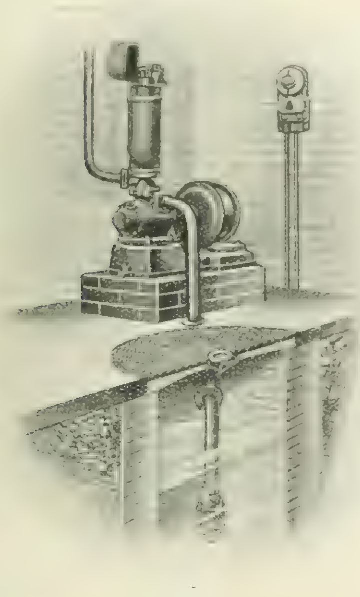
[To prevent misconception, we think it well to state that the writer of this letter is a well-known municipal engineer. —Eds. E.R.]

Factory Electrification.—The days are gone by when it was necessary to convert factory-owners and manufacturers to the advantages of electrical driving. It is practically generally recognised now that the electric motor offers advantages which no other form of driving can offer, and many steam and gas-driven factories are now being changed over to the electric drive, and very few new factories are put down on the old lines. Among the factories which are being at present equipped to the specifications of Mr. Frank Broadbent, who has specialised in the electrification of factories and workshops, are the following:—The Home and Colonial Stores tea and cocoa warehouses, which will take a supply for about 50 motors of various sizes, in addition to electric light, from the mains of the Shoreditch Vestry; W. P. Griffiths and Sons, Ltd., about 30 motors and lighting from the South London Electric Supply Co.; R. & R. Clark, Ltd., of Edinburgh, about 60 motors from the mains of the Corporation supply; and the *Nottingham Guardian*, lighting and power, from the Corporation supply.

ELECTRICITY AND SMALL WATER SUPPLIES.

A field of application of electrical energy which can be extended considerably, at any rate in this country, is the utilisation of electric power for supply of water to small isolated installations, such as country houses, &c. A good deal has, of course, been done by means of the ordinary plunger pump driven electrically, but a modern improvement which appears to be worthy of attention has recently been installed at the Seapatrick Mills, this being, we understand, the first installation of its kind in this country. It consists of a pump of the type shown in the illustration below, fitted with a small air chamber and automatic switch, and direct-coupled to an electric motor, the pump and motor being mounted on the same self-contained bed-plate. The system is known as the Pitro, and this was installed by the Pittler Universal Rotary Machine Syndicate, Ltd., of London.

In this system, the air is compressed in the top of the air chamber to a predetermined pressure, when it actuates a small diaphragm. This throws out the automatic switch, and therefore cuts out the motor. When the pressure falls in the air chamber, due to water being drawn from the system, the reverse action occurs, the diaphragm being actuated by a spring. Hence the system is entirely automatic, and the motor only drives the pump when water is being drawn from the system.



Automatic Electric Pumping Set.

The advantage of electric power in this connection is that an instant response is given to the demand for water, and therefore the necessity for a storage system such as a cistern is done away with. The advantage of this is obvious when it is remembered that such cisterns accumulate dirt, and harbour bacilli, thus tending to propagate illness and disease. The action of the motor-driven pump ensures a steady flow of water without any pulsation in the system. The pump itself is entirely enclosed, and runs practically noiselessly, without the vibration which is an unfortunate feature of a good many reciprocating pumps. Its steadiness in running, combined with the compactness of the arrangement, allows of a comparatively light foundation being adopted, and hence the cost of installation is comparatively low.

From the operating point of view, the action of the pump combines the good features of the piston pump, allowing the use of high pressures and a suction lift of up to 25 ft., with that of a centrifugal pump, in that it can be driven at a relatively high speed, and can, therefore, be directly coupled to an electric motor.

The moving parts of the pump itself are few in number and simple in construction, and as there are no valves the wear and tear and upkeep are extremely small. Pumps of this design have been in continuous operation for over two years, and have shown so little wear that they maintain their high overall efficiency. Owing to the special features of the design of this pump no stuffing boxes are required, as the internal pressure keeps it perfectly tight, and it is arranged in such a way that the water itself acts as a lubricant. Hence, attendance charges are cut down to the minimum. These sets are being built in a range of sizes capable of dealing with 325, 650, 1,100, 1,650, 2,200 and 3,000 gallons of water per hour, working against a pressure of 60 lb. per sq. in. or 130 ft. The power required for driving the pump under full-load working conditions ranges from ½ to 4 B.H.P., according to the size of the set, and the cost of running, taking the price of electrical energy at 1d. per unit, will be of the order of 1d. per 1,000 gallons pumped. It is, therefore, seen that the apparatus described constitutes a very real advance on some of the previously existing types of electrically-driven pumps, and is worth the consideration of electrical engineers who are interested in country house installations and similar work.

AN AUTOMATICALLY-OPERATED MINING LOCOMOTIVE.[*]

An accumulator locomotive which requires no driver, and which starts itself, stops itself and sets its own points automatically, has been in use for the past year and a half in a coal mine at Heydt, with very satisfactory results from the points of view of safety, economy and simplicity of operation.

Starting and stopping are effected by means of a wooden lever which projects well in front of the locomotive, through a slot. As soon as the locomotive meets any obstruction this lever is pushed in as far as the buffers, and so cuts off the electric supply, and, at the same time, connects the motor up as a dynamo and short-circuits it so as to act as a brake.

At the low speed adopted (viz., about 1 m. per second, or 2¼ miles per hour), this brake is able to pull up the locomotive and its train of trucks in a distance of about a yard. As soon as the obstruction is removed, the lever is forced out again slowly by a spring, and the locomotive starts again. The lever is so sensitive that even a person standing in front of the locomotive will serve to stop it. When the locomotive is required to run in the reverse direction the complete lever mechanism has simply to be swivelled round till the lever projects at the other end of the locomotive.

The locomotive is provided with a single 2-H.P. (continuous rating) totally enclosed shunt motor, geared to the wheels through double-reduction spur gear. Shunt winding was adopted in preference to series winding, to avoid the risk of the motor running away on down grades.

Thirty accumulator cells are carried, with a capacity of 72 ampere-hours, which is sufficient for a 6 or 7-mile journey. Charging takes place on sidings at the loading place of the trucks from a 220-volt D.C. supply, requiring 30 amperes for about three hours. A single attendant is able to change the batteries in from two to three minutes.

The weight of the complete locomotive is 2½ tons, its overall length, excluding the lever, is 7 ft. 8 in., breadth 2 ft. 10 in., and height 4 ft. In an 8-hour shift one locomotive can deal with about 40 useful ton-miles, the consumption being about ·27 KW.-hour per ton-mile.

The following figures show the average monthly results (averaged from the records for the months April to July, and excluding interest and sinking fund allowance):—Working days, 23; total useful ton-miles, 1,680; wages, £2 19s.; materials, 7s. 6d.; cost of current, 12s. 4d.; total cost, £3 18s. 10d.; cost for one ton-mile, ·57d.; average output for each locomotive in eight hours, 37 useful ton-miles.

Since the locomotive runs on a line with various points and crossings, these have to be automatically operated in any one of various predetermined ways by the locomotive itself. For this purpose several hooks are provided at each end of the loco.-frame, and into these hooks rings can be inserted which catch in lever arms projecting from the truck, and which actuate the points. The hooks are so arranged that each is directly over one particular point lever, so that by inserting rings only in certain hooks, the particular track to be followed by the train is predetermined.

Whilst a train is passing a crossing or points, a barrier is automatically raised a short distance away, which serves to prevent a second train approaching by operating its lever. As soon as the first train is through the crossing, the barrier drops, and the second train automatically starts itself again. Successive trains can follow one another as closely as desired, because there is no danger from collision since the trains stop as soon as any obstacle is reached and start again as soon as it is removed.

Diesel Engines.—According to reports appearing in several newspapers, Messrs. Harland & Wolff, Ltd., have sold to the Burmeister and Wain (Diesel System) Oil Engine Co., Ltd., London, the engineering and boiler-making shops at Glasgow, which previously belonged to the London and Glasgow Engineering and Iron Shipbuilding Co., and were acquired by Messrs. Harland & Wolff in February last. In future the works will be used solely for the manufacture of Diesel engines.

Hungary.—It is reported that new works for the manufacture of cables are about to be started in Buda-Pest by Messrs. Siemens & Halske.

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[*] *E.T.Z.*, August 22nd 1912.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—VIII.

The long drawn-out dispute between the principal tramway authorities in Australia and their employés has advanced a further stage. Some of the companies have held conferences with the workers' Union, and, as a result, settlements satisfactory to both sides have been arrived at and approved by the Court. On the other hand, some of the companies have refused to meet the Union and are using every means in their power to fight the case. In order to obtain further evidence, and at the same time to allow negotiations as to the purchase of the Perth lines by the Western Australian Government to be completed, the Court has now adjourned *sine die*, and in the future will meet at Sydney, not at Melbourne as hitherto.

Acting on the advice of the Judge given at the sitting referred to in the last article, the Melbourne Tramway Co., employing some 1,500 persons, met the officials of the men's Union, and came to a definite agreement. The terms were very far from those claimed by them, but in many cases they were an advance on existing rates and, it was stated, would involve the company in an additional outlay of £75,000 a year. At a men's meeting called to consider the settlement, one of the speakers said it represented an increase of 14 per cent., while during recent years the cost of living had increased by at least 33 per cent. It is this salient fact which is responsible for the greater part of the industrial unrest in Australia at the present time.

Under the settlement, some of the principal new rates are:—Gripmen and conductors, first year 8s. 6d., second year 9s., afterwards 9s. 6d. per day; extras when training students; casual hands, 42s. per week guaranteed; tunnel cleaners, 9s. per day; shunters, 8s. 4d. per day; car workers, 8s. 4d. per day; engine drivers, first-class £4, second-class £3 15s. per week; shed men (day, middle and night shifts), 10s. 6d. per day; assistants (day, middle and night shifts), 8s. 6d. per day; signalmen in charge of levers, 10s. per day; track gangers in charge of road, 10s. 6d. per day; track gangers in charge of men, 10s. per day; track repairers, 9s. per day; 'bus drivers, 9s. per day; boiler cleaners, 8s. per day, and 6d. per hour extra when cleaning inside boilers; labourers over 21, lavatory men, office porters and orderlies, 8s. per day.

Other conditions are these:—The week to consist of 48 hours, and overtime after eight hours' work to be paid for at time and a quarter, and afterwards time and a half. When a man does different classes of work during one shift, the highest rate of pay to be paid. All employés reporting themselves for Sunday duty to be given a full day's work at time and a quarter rate. Gripmen and conductors to be paid from time of signing on to signing off.

Pay at time and a quarter to be given for the following eight public holidays: Christmas Day, Boxing Day, New Year's Day, Good Friday, Easter Monday, Eight Hours' Day, King's Birthday and Foundation Day. Also ten days' annual holiday on full pay.

As regards disputes, a board of reference, consisting of one representative of the company, one of the men's union, with the Industrial Registrar as umpire, was appointed to deal with all disputes. In the case of offences charged against the men, they could be represented by an officer of their union.

Employés were to be allowed to wear their association badge on duty, and to post their notices on the company's notice boards.

These terms were granted by the company and accepted by the men, and while several points, such as the question of preference to unionists, were referred to the decision of the Judge, they appear to form a fair compromise on the matters in dispute.

This settlement practically disposed of the case against the Melbourne Co., which was accordingly indefinitely adjourned to permit of final signatures to the settlement being obtained. The North Melbourne Co. had a number of conferences, but they have not yet finally settled matters. They state that being a smaller company they cannot afford the same terms as the Melbourne Co. The men rely on a clause in the North Melbourne Co.'s working agreement with the municipal authorities, whereby they were bound by any arrangement made by the Melbourne Co. with its employés. It was pointed out that this clause did not contemplate the present position, and it was asked if the Judge, by a judicial settlement instead of a mutual agreement, could alter it. The Judge promised consideration of the point, but urged the parties to come to an agreement.

The negotiations in the cases of the Prahran and Malvern Tramway Trust and the Ballarat, Bendigo, Hobart and Fremantle systems were reported to the Judge as proceeding, but progress was very slow.

In the case of Adelaide, a rupture between the parties had taken place, but efforts were being made to renew negotiations. The Judge pointed out his anxiety to do all in his power to aid in a friendly settlement, and adjourned the cases indefinitely to enable the various points to be discussed between the parties.

The two cases left were Perth and Brisbane. As regards Perth, negotiations are proceeding between the company and the Western Australian Government as to possible purchase of the undertaking by the Council. The Judge adjourned this case to await developments, as in the event of the deal being concluded, there would be no need for further action on his part.

The Brisbane Tramways Co. refused to meet the men's Union, and submitted that there was no case against them on 15 grounds. The principal of these were that there was no dispute between their employés and themselves, and that if there were, the dispute did not extend beyond the State of Queensland, and consequently the Court had no jurisdiction. The company did not employ any of the members of the men's union, which was not an organisation within the Act, and as a tramway company was not an industry in respect of which an industrial dispute, extending beyond the limits of a State, could arise, therefore no organisation could be registered, and no proper parties were before the Court. Finally, the company submitted that as regarded the claim for preference to unionists, the Court had no power to make an award of preference.

The Judge reserved his decision on these points, and proceeded to listen to the evidence produced by the company. This largely consisted of the testimony of present employés of the company that they were satisfied with the existing conditions of service, and did not press the claims in the log presented by the men's Union. Mr. Myers, a conductor, once a member of the men's Union, explained his reasons for resignation, and the difficulty he experienced in getting the resignation accepted. Mr. Stevens, the traffic manager, gave detailed evidence as to the history of the company's dispute with the men's Union, the formation of the local Union, with the goodwill of the company, and the conditions of employment of the various grades. He opposed the men's claims for a minimum wage for casuals, to display their notices on the company's premises, and for the granting of preference to unionists.

At this point the company handed in a petition signed by 710 of their employés, stating they did not belong to the men's Union, and did not want to do so. The fight then centred on the manner in which these signatures were obtained, and by whom the petition was promoted. The company admitted that they had prepared the petition on the advice of their legal advisers, and also that all signatures were obtained in a magistrate's office, in the presence of a sergeant of police. Mr. Warton, on behalf of the men's Union, challenged a number of the signatures, and urged that many of the men signed under fear of the consequences of refusing.

The Judge ultimately decided to appoint his associate on the bench, a Commissioner, to proceed to Brisbane to take evidence from a number of the employés as to the conditions under which they were led to sign the petition, and also to find out why the 60 men were resigning from the men's Union. As the taking of this evidence would take some time, he would proceed with the case at some future time in Sydney. This adjournment would enable the proceedings to be brought in another Court to be argued before a full bench of Judges. He would also, if asked, state a case for the Superior Courts as to the wearing of the badge, including, if desired, the other defendants.

The whole matter is therefore, for a time, in abeyance.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Interlocked Controller.

We illustrate herewith an interlocked control panel recently made by the General Electric Co., Ltd., for the control of variable-speed shunt-wound motors. The controller, which is of the drum type, is mounted on a cast-iron case, containing the shunt regulating resistance, the contacts for the latter being on a faceplate inside the controller case.

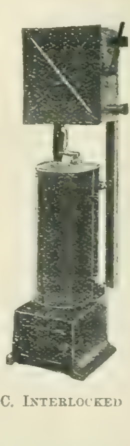


Fig. 1.—G.E.C. Interlocked Controller.

A "Salford" circuit-breaker, in a separate cast-iron case mounted above the controller, is electrically interlocked with the drum contacts so that it can only be closed when the controller handle is in the "off" position. Also, if the breaker trips, the controller handle must be brought to the "off" position before the circuit-breaker can be closed again.

The "K.K." Detector.

In our issue of July 5th, describing tests of the Railophone, we referred to the resonant relay invented by Mr. H. von Kramer and Dr. Kapp, upon which the working of the system depends. We are now enabled to illustrate the device, which is capable of responding to electromagnetic impulses producing by induction currents of the order of ⅛ milliampere with an E.M.F. of about 20 millivolts, at 100 cycles per second, while remaining undisturbed by the mechanical vibrations met with on railway trains. The detector consists essentially of a steel reed tuned to a natural frequency corresponding to that of the transmitting apparatus, and polarised by a steel permanent magnet, the free end of the reed resting normally midway between the poles of a laminated electromagnet energised by the receiving circuit (fig. 4). Thus, when a minute alternating current circulates through the windings of the magnet, the end of the reed is set in vibration, the amplitude increasing by virtue of resonance if the current is maintained. The vibrating reed is not directly utilised as a contact maker; it is mounted between two light reeds, which carry platinum contacts through which a local circuit is completed (fig. 3), and when the amplitude of vibration becomes great enough for the reed to strike and separate these supplementary reeds, this circuit is interrupted, allowing an electromagnet to drop its armature and close a local circuit. An ivory stop between the contact reeds prevents the latter from following one another when struck by the vibrating reed. The instrument responds to a power of only four-millionths of a watt the frequency to which it answers can readily be adjusted. The device can be adapted to a great variety of applications quite apart from its special use in the Railophone system, and is, it will be seen, a very clever invention.

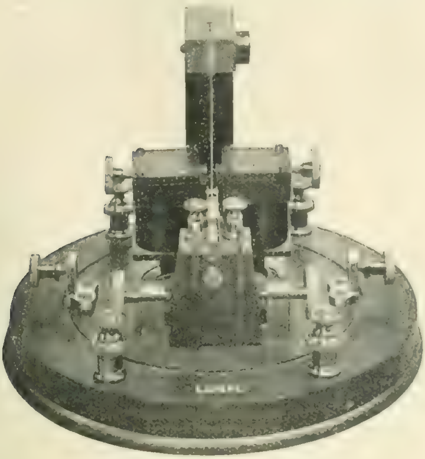
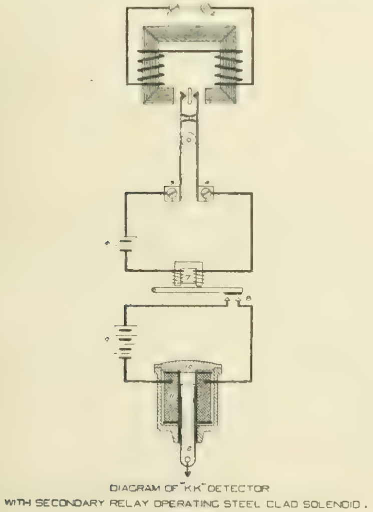


Fig. 2.—The "K.K." Detector.



1, 2, terminals of receiving circuit; 3, 4, terminals carrying the contact reeds; 6, battery in secondary circuit, giving 0·1 ampere; 7, electromagnet; 8, switch in operating circuit; 9, battery energising 11, operating solenoid, with steel yoke 10 and core 12.

Fig. 3.—Diagram of Connections of Detector and Operating Circuit.

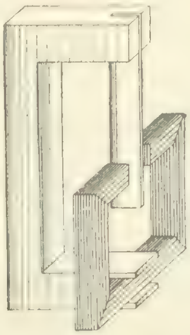


Fig. 4.—Magnet System of "K.K." Detector.

The G.E.C. Breakfast Cooker.

The General Electric Co., Ltd., have introduced a specially designed breakfast cooker, which embodies several distinct uses. As a toaster, it quickly produces a crisp, golden-brown toast. As a hot plate it can be used for making coffee or tea, boiling eggs, &c. The pan or tray can be used for frying bacon, or, if the pan be inverted over the hot-plate, it can be employed as a girdle for baking scones, &c. The little overhead rack will keep the plates, toast and other things warm till required.

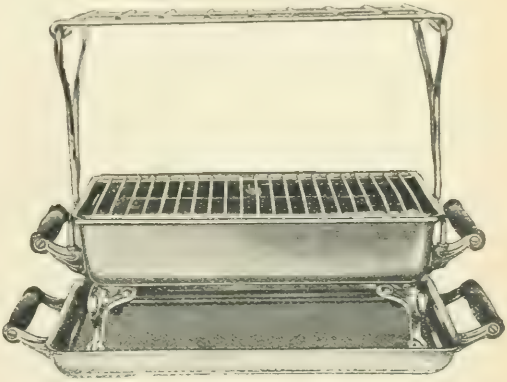


Fig. 5.—G.E.C. Breakfast Cooker.

The heating wires, though amply protected by a substantial guard, can be seen when they are glowing with heat. This adds greatly to the effective appearance of the stove, which is artistically designed, making it ornamental as well as useful.

The Siemens "Lumograd."

Messrs. Siemens Bros. Dynamo Works, Ltd., of Caxton House, S.W., are now placing upon the market a neat and compact portable instrument for the measurement of illumination, which reads directly in candle-feet. It is known as the Siemens "Lumograd," and is completely self-contained, there being no accessories except, where required, a tripod stand for the measurement of candle-feet at various angles. The standard lamp is run from a dry cell, thus eliminating trouble caused by accumulators. Each Siemens "Lumograd" is supplied with three glasses of different densities, by means of which readings may be made, covering a range from ·0625 to 8 candle-feet. The actual measurement of illumination is made by comparing the illuminations on both sides of a light-proof screen, one side being illuminated by the external source of light, and the other side by the standard lamp contained in the instrument. The latter is so arranged that it may be moved away from or closer to the screen, thus decreasing or increasing the illumination on the

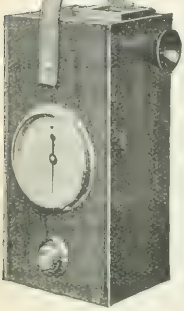


Fig. 6.—The Siemens "Lumograd."

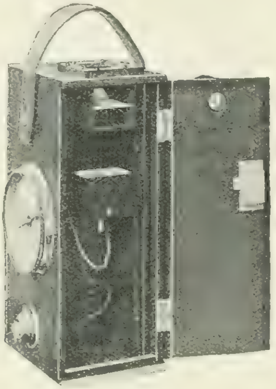


Fig. 7.—Interior of the "Lumograd."

lower side of the screen, until both sides are equally illuminated. This operation is accomplished by means of a thumb-screw attached to a toothed wheel and rack, whilst the pointer is fixed to the same shaft, and indicates on the dial the illumination value in candle-feet. The readings may be checked at intervals by setting up a lamp of known candle-power (preferably 1 or 2 c.p.), and placing the instrument so that the glass in the head of it is 1 ft. from the source of light. The reading can then be checked, and should it be found to be incorrect, a simple adjusting screw is provided, by means of which the correction can readily be made.

BUSINESS NOTES.

Bankruptcy Notices.—On Monday at Blackburn County Court a bankruptcy motion was heard arising out of the estate of John Wm. Garsden, electrical engineer, of 5, Hope Terrace, Blackburn. On behalf of Mrs. Anne Simpson, Birkenhead, one of the creditors, Mr. Gamon, of Liverpool, asked for an order that the decision of the trustee rejecting her claim against the estate should be reversed, and that the said claim should be admitted to rank for dividend for the full amount thereof. Mr. Gamon said that Garsden formerly carried on business as an electrical engineer in partnership with Samuel Lord and Wesley Sutton. That partnership continued until September, 1909. Prior to that date applicant had lent a considerable sum of money to the partnership. The partnership was dissolved, and the partnership assets, with the exception of the book debts, were transferred to a limited company, called the Howe Electrical Engineering Co. In June this year applicant recovered judgment against Garsden, and the two other partners. Then Garsden became bankrupt, and Mrs. Simpson put in proof in the ordinary formal way. The trustee rejected the proof on the ground that there were joint partners. He agreed that he could not prove in competition with the separate creditors of the Garsden estate unless he showed that there was no joint estate, and were no solvent partners. He claimed he could prove without receiving dividend until the separate creditors had been satisfied. Without proof he would be cut out of Court altogether. He had the right to prove, even if his rights were postponed. The trustee should have raised this question when dividend was being actually paid, and not have rejected the proof. Mr. Gamon's second point was that there were, in fact, no solvent partners, and no joint estate. Mr. Gamon produced the deed dissolving the partnership between Garsden, Sutton and Lord, which, he said, showed that there was no joint estate. The hearing was adjourned until December 2nd for the purpose of Mr. Gamon considering the position of the other two partners.

Thomas Topping, electrical and mechanical engineer, Southport. —October 13th is the last day for the receipt of proofs for dividend; Mr. E. D. Symond, receiver, 11, Dale Street, Liverpool.

Private Arrangements.—Charles Howard Egan (trading as C. H. Egan & Co.), electrical engineer, 21, Lincoln Place, Dublin.—A meeting of the creditors in the above matter was held recently, when a statement of affairs was submitted, showing liabilities totalling £3,288, all of which was due to unsecured creditors. There was one fully-secured creditor—viz., the Royal Bank of Ireland, Dublin, for £99 in respect of overdraft on current account. The assets were estimated to produce £1,302 net, and consisted of sundry debtors (£654), estimated to produce £565 uncompleted contracts, costs of materials and wages, £639; cash in hand, 11s. 7d.; stock in trade at cost, £96; two motor-cars and a motor-boat, £160; and tools and appliances, £34 12s., making a total of £1,496, from which had to be deducted £194 for claims of preference creditors and costs of arrangement. There were three policies of insurance on the life of the debtor, but these were held by the bankers against their claim. Mr. Egan is stated to have commenced trading in College Street in 1894, and from 1898 up till 1909 the firm was known as Egan & Tatlow. In 1909, however, a dissolution of the partnership took place, and on matters being gone into between the partners, it was found that Mr. Egan was indebted to the firm to the extent of £405, for which amount Mr. Tatlow is now scheduled as a creditor. Mrs. C. H. Egan is down as a creditor for £186, and it appears that the debtor lost about £500 in a Stock Exchange transaction and his wife realised some shares which she held, and reduced the balance to £230; her claim of £186 is in respect of the proceeds of the shares which she realised. With the exception of the claim by Mrs. L. G. Egan, the debtor's mother, the remainder of the liabilities are all for goods supplied. In regard to the assets and the item "uncompleted contracts," it is stated that there will be a certain amount of profit on the contracts when they are finished, but at the meeting the solicitor, appearing on behalf of the debtor, explained that a number of his contracts had resulted in a loss, and it was not possible to say exactly what profit would be made beyond the amount stated. The household furniture (£300) and office furniture (£50) were not set out in the statement as assets. The debtor made an offer of a composition of 6s. in the £, payable by instalments spread over 12 months, the last two to be secured; but the creditors would not accept this, and, after some discussion, the debtor proposed to pay a composition of 6s. 8d. in the £, and several of the creditors present expressed their willingness to accept this offer, the composition to be paid by instalments at three, six, nine and 12 months, the last two to be satisfactorily secured. The following are creditors:—

Tatlow, William	£405	Kenny & Co.	£43
Tudor Accumulator Co.	348	Curtis, W., & Sons	42
Solomons, E. M.	230	Littauer, J.	40
Egan, Mrs. C. H.	186	Birch, J.	24
Egan, Mrs. L. J.	176	Best & Lloyd, Ltd.	21
General Electric Co.	146	Waller & Co.	25
Hornsby, R., & Sons	139	Grevener, J. & H.	20
Brit. Ins. Cables, Ltd.	123	Murphy, H. W. G.	20
Veritys, Ltd.	110	Alliance Gas Co.	19
Booth Bros.	108	Miller & Beatty, Ltd.	17
Edison & Swan E.L. Co.	108	McCormick, W. O.	17
Newtons, Ltd.	100	Brooks, Thomas & Co., Ltd.	16
Crossley Bros., Ltd.	93	MacFarlane & Sons	16
Jandus Arc Lamp	80	London Electric Firm	17
L'Estrange & Hay	77	Brit. Thomson-Houston Co.	14
McDougall, J., Ltd.	75	Battersby & Co., Ltd.	16
Osler, F. & C., Ltd.	61	Proprietors, *Irish Field*	14
Prickard, Ltd.	44		

And sundry creditors for smaller amounts.

Hydro-Electric Work Abroad.—Amongst the orders received by Messrs. Boving & Co., Ltd., during the last two months are the under-mentioned:—

Water turbines, for the City of Kyoto, Japan.

Fujimi plant, three units of 1,100 h.p. under a head of 14·2 metres, and one exciter of 75 h.p.

Ebisugawa plant, one unit of 500 h.p. under a head of 3·1 metres.

For Cataguazes, Brazil, two units of 750 h.p. under 26 metres head, and two exciters of 66 h.p.

Six turbines of from 6 to 100 h.p. for Scotland, Japan and Brazil.

Orders for Victoria turbo-pumps include one 2,400-g.p.m. pump for the Kuala Lumpur Engineering Co.; one 350-g.p.m. pump for Wellington, N.Z.; four 1,000-g.p.m. pumps for Messrs. S. Pearson & Sons, Ltd.; and one for the Parkside Mining Co. (through the A.E.G. Electric Co., Newcastle-on-Tyne), to deliver 600-g.p.m. against a head of 900 ft.

Pipe-line orders include two welded pipe lines of 42-in. diameter, and each of a length of 2,778 ft., for the Kumamoto Hydro-Electric Co., Japan.

Dissolutions and Liquidations. — Institute of Wireless Telegraphy, Ltd.—This company is winding up voluntarily, with Mr. G. P. Taylor, 36, Spring Gardens, Manchester, as liquidator. A meeting of creditors is called for October 10th.

Pearson Fire Alarm, Ltd.—A meeting will be held at 67, Watling Street, E.C., on November 12th, to hear an account of the winding up from the liquidator, Mr. H. Wingfield.

Sparks & Williams, consulting engineers, 52, Queen Victoria Street, London, E.C.—Messrs. J. N. Sparks & A. E. Williams have dissolved partnership. Mr. Williams will attend to debts.

Messrs. H. Jaggar & Co., electrical engineers, Batley and Dewsbury.—Messrs. H. Jaggar and A. Brook have dissolved partnership. The stock, plant and other properties have been taken over by Mr. Brook, who is to continue trading as "A. Brook & Co."

Meldrum Bros., Ltd., Timperley, Manchester.—A first dividend of 2s. 6d. in the £ is payable at 3, York Street, Manchester.

Catalogues and Lists.—The Western Electric Co., Ltd., North Woolwich.—Eight-page booklet (No. 109), giving brief particulars with prices and illustrations of complete private telephone equipments for commercial and residential use; also a circular giving prices, &c., of Blake insulated staples.

The Attracta Electrical Co., 75, Fetter Lane, London, W.C.—Price leaflets of "Auto" mercury break flashers and "Attracta" arc lamps.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—A fine catalogue (No. 535) of over 80 pages, containing well-executed illustrations, descriptive information, prices and so forth, of a great variety of telephone apparatus, the material listed being restricted to articles in general use. The sections are: telephones and accessories, telephone switchboards, protective devices, condensers and these are followed by a telegraph code and index

MESSRS. FALK, STADELMANN & CO., LTD., 83-85, Farringdon Road, London, E.C.—36-page list (No. 348), in which they show and state prices of a variety of designs of their "Aureola" luminous electric radiators, convectors and Bastian heaters.

MESSRS. VERITYS, LTD., 31, King Street Covent Garden London, W.C.—A batch of new publicity literature has been received. The largest item consists of a supplementary catalogue of electric supplies for shipbuilders. As a prefatory list shows, the firm have done a great deal of electrical apparatus business with H.M. Navy, and in this catalogue of 140 odd pages, which is excellently produced and most profusely illustrated, there are given particulars and prices of Aston steam dynamos, oil engine sets, motors, drills, hoists pumps fans, distribution boards, motor starters, searchlights, electric cooking and heating apparatus, electric light fittings and a host of other things intended for ship service. The other literature before us includes the following: No. 689—the "Aston" electric oven and other cooking apparatus; No. 691—"Three good points" concerning "Aston" electric radiators; No. 692—a folder showing numerous radiator designs; No. 702 (24 pages) dealing with "Aston" switchgear complying with the Factory Act Regulations; and a number of interesting little enclosure cards. While referring thus briefly to the company's present activities in regard to publications, we may add that they are now making at the above address an interesting display of their "Aston" radiators designed to harmonise with the various favourite periods of English decoration. The designs have been prepared with a thorough knowledge of each particular decade, and this is helped by the workmanship. Many of the details employed in the enrichment of these radiators have been taken from the actual work of Sheraton, Chippendale, &c. While ordinary electric radiators may be quite suitable for offices or more or less nondescript rooms, something different is required for the homes of the well-to-do, where harmony in decoration is desired. The firm invite an inspection of their display.

MESSRS. NEVILLE & CO., Midland Electrical Works, Bracebridge Street, Birmingham.—Lists showing a series of new patterns of luminous electric radiators. They vary from a simple design of two-light (almost featherweight) "Handy" radiator to very artistic forms. The "Corinthian" design, in polished brass, with fluted copper reflector, is exceptionally fine, and a four-lamp design, "The Belgrave," fitted with screens of crimson silk, strikes us as a novelty.

THE FOSTER ENGINEERING CO., LTD., Wimbledon, S.W.—Four-page list containing illustrations, brief particulars, and prices of a new series of electric advertising signs. The "Zenith" arc lamp signs are supplied with either single or double screens or with screen and diffuser. In the last-named of these, the two side panels are opaque, only the centre panel transmitting the light of the lamp. The sign is pendant from two metal straps, allowing it to be used in conjunction with any arc or metal filament lamp or gas fixture. Another sign shown is the "Aero," which, like the "Zenith," can have its sign plates changed as often as required. It is suited for shop-window and other similar service. The sign frame slips over the lampholder and is held in place by the shade ring. The "Aero" signs are supplied with either oxidised metal finish or in black enamel. It is claimed that these signs do not rob the lamp of its direct light, being illuminated by reflection. Other Foster signs are the "H 1" model, which shows the legend on the front plate in various colours, and the "J 1," which is a colour-changing sign, the variations in the tints being due entirely to the change in the view-point on the part of the onlooker.

MR. C. CAMPART, 49, Newgate Street, London, E.C. (London office of the Anglo-Swiss H. Cuénod Construction Co.).—56-page catalogue containing a very fully illustrated description of the Thury regulator, its principle, working, speed of regulation, sensitiveness and advantages, and its principal applications. Regulation of D.C. generating units, A.C. regulators, automatic regulation of several generators running in parallel, automatic regulation for a three-wire system, regulation of feeders, automatic regulation of accumulator batteries, controlling mechanism, regulation of electric furnaces, and distant control—these are some of the sections in the book. A number of inquiry forms are given at the end of the book showing the particulars required. A separate 8-page list contains descriptive particulars of a high-speed automatic regulator. Among the chief advantages claimed for the regulator is its very high speed of operation, the time needed for the lever arm to pass from one extreme position to the other being from one to two seconds, or even less if required. This regulator has been developed for certain special cases where a very high speed of regulation is required, principally for voltage regulation of generators where the load variations are sudden and excessive. A test of this regulator is particularised, the results being shown by oscillograph curves.

THE SYNCHRONOME CO., LTD., 32 and 34, Clerkenwell Road, London, E.C.—Descriptive pamphlet and price list of 16 pages, relating to the company's electric clocks. The history of the system since it was introduced by Mr. F. Hope-Jones in 1895, is briefly mentioned, and the contact controlling pendulum time transmitter, and the dial movement, are shown. Tabulated prices appear of standard electrical impulse dials in wood and metal frames, also of turret clocks, and particulars of automatic time switches, astronomical regulator clocks, installations for ocean liners and for hotels.

MESSRS. DAVIS & TIMMINS, LTD., York Road, King's Cross, London, N.—70-page catalogue containing illustrations and tabulated sizes and prices of a large variety of Standard B.A. screws, and Standard Whitworth screws, with counter-sunk, cheese and other heads, with many different sizes of slots and pitches and diameters of threads. Prices are given per gross for brass and steel respectively. Some tables showing standard dimensions for screw heads and different threads, also decimal and millimetre equivalents are given.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, London, E.C.—16-page art paper booklet entitled "A New Method for Electrical Installation," and describing the "Henley" wiring system and its possibilities. The letterpress is free from technical phrases, and is written to be of interest to the layman as well as to the electrical engineer. It fully describes the system, and is illustrated with interior and exterior photographs of a few of the installations recently carried out in buildings from large country mansions to small cottages. This system is now well established; it has been taken up by many of the largest contractors in the country, and is accepted by the leading fire offices. A number of copies of the booklet will be furnished to contractors for distribution on application.

THE INTERLOCK METAL HOSE CO., River Park Road, Wood Green, London, N.—Ten-page pamphlet containing illustrated particulars and prices of their asbestos packed flexible metallic tubing for extra high-pressure steam, gland connections, &c. The "Dalmer" boiler tube sweeping apparatus is also shown.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—No. 6 Bulletin of 24 pages, containing a detailed and illustrated account of the "Angold" magazine flame arc lamps, particulars of tests of same, a list of spare parts, and night views of a number of public thoroughfares in different cities where these lamps are in service.

MR. A. L. PIERCE, Wallingford, Conn.—Illustrated leaflet relating to the Pierce tree insulator.

THE VATOR CO., LTD., Aston Cross, Birmingham.—Folder relating to their "Fyrout" fire extinguisher.

THE INVENTION AND NOVELTY EXCHANGE, 121, St. Stephen's Green, Dublin.—Illustrated leaflets describing the Imperial electric vacuum cleaner, the "Cadillac" suction cleaner, the "Paragon" lamp bracket and Williams's test clamps.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—The company have sent us a reproduction of their new showcard design. They have an extensive advertising campaign on foot for this season in the form of advertising, the issue of booklets, folders, price lists, and last, but not least, the showcard referred to above. In this, as in their last year's showcard, the company lay great emphasis on the strength and durability of the Mazda drawn-wire lamp. This quality is symbolised by the rock of Gibraltar, and a battleship in the foreground; while Mazda brilliance is indicated by the fact that the illumination on the side of the rock nearest the lamp is far more intense than that given by the sun on the other side. The "Sun's Only Rival" design has been retained in the new showcard, and is merged in the dominating "strength" conception, thus linking the new and the old designs, and maintaining a continuity of advertising policy. It is executed very effectively in nine colours. In addition to being employed in the form of showcards, postcards, and flashing signs, the Gibraltar design is also being used on the cover of the new Mazda lamp list, of which we have received a copy.

THE PARAGON WIRE MILLS, 10-12, Norman's Buildings, St. Luke's, London, E.C.—Price leaflet of silk and cotton-covered copper wires, also a card of specimens and prices of bell flexibles and wires and braided wires.

Advance in Prices.—THE ADAMS MANUFACTURING CO., LTD., of Bedford, announce an increase of 10 per cent. (before deducting the usual discounts) in all catalogue prices for Adams Igranic switchgear. The alteration takes effect from October 15th, and is due to continued rise in the price of raw material.

Austria.—The Schwechater Kabelfabrik of Messrs. Heinrich Eger & Co., of Schwechat, Lower Austria, has just been converted into a company with a capital of £20,000. It is proposed to extend the works and to put down a new plant for the manufacture of lead-covered cables.

Poland.—New electrical engineering works have just been started in Warsaw by the Polnische Elektrotechnischewerke "Siemens" Gesellschaft.

Book Notices.—*Engineering and Metallurgical Books, 1907-11.* By R. A. Peddie. London: Grafton & Co. Price 7s. 6d. net.—In these days of complexity, when multiplicity and diversity are the marks of every phase of civilisation, one hails with pleasure the advent of any means by which some degree of order may be attained and one's labours lightened. Amongst such aids to comfort, reference books deserve a very high place, particularly in a newspaper office; and the work before us, though admittedly incomplete, aims to fill up a wide gap in their ranks. We are continually being asked by our readers to recommend books on all kinds of electrical subjects, often on small sections of a subject that could by no means justify the publication of a book, and the bibliography now provided will be of great assistance in reminding us of the books available. So far, every book that we have looked up in it as a test has been found duly recorded; the titles are arranged under subject headings in alphabetical order, and there is also an index to authors' names and a table of subject headings. The compiler will be glad to receive particulars of books not included, to be published in the supplement for 1912, which, we are pleased to note, is already in preparation. The size, date, publisher and price of each book are given.

In the October number of *Scribner's Magazine* there are two excellently illustrated and interesting articles relating to the subject of railway terminal stations and their construction, lighting, motive power, &c. The terminal chiefly considered is the great new station in New York City of the Pennsylvania Railroad. Mr. W. Symes Richardson is the writer of "The Terminal—The Gate of the City," and Mr. Samuel O. Dunn, the editor of the

Railway Age Gazette, is responsible for "The Problem of the Modern Railway Terminal." These two contributions occupy a very large proportion of the number.

The *Motor Manual.* London: Temple Press. Price 1s. 6d. net.—Now in its fifteenth edition and 230th thousand, the *Motor Manual* is an established institution, whose popularity cannot be questioned. It is chock full of practical hints for motor-car drivers and owners, and we cannot imagine any garage completely equipped without a copy of this book.

How to Take Out Patents. By A. E. Edwards. Second Edition. London: Wyman & Sons. Price 2s.—This book is intended to fill the gap between purely technical works on patent law and popular treatises which afford little real assistance to the inventor; it covers both British and foreign patents, and besides defining a "patent," describes how it can be obtained, what can be patented, and what constitutes novelty. The constructiou of a sound specification is explained, and—most difficult problem of all—the methods of dealing profitably with patents are discussed. A large section is devoted to foreign and colonial patent law and procedure. The author's treatment of his subject is terse and lucid, and the book appears to be admirably adapted for the purpose for which it was written.

"*Journal* of the South African Institution of Engineers." Vol. XI, Nos. 1 and 2. August and September, 1912. Johannesburg: The Institution. Price 2s. each.

"Atti della Associazione Elettrotecnica Italiana." September 30th, 1912. Milan: Stucchi, Ceretti & C.

"Die Telephonie ohne Draht." By Dr. K. Markau. 1912. Brunswick: Vieweg & Sohn. Price M. 4.50.

"*Proceedings* of the Sydney University Engineering Society." 1911. Vol. XVI. Sydney: The Society.

"Calculs Techniques et Economiques des Lignes de Transport et de Distribution d'Energie Electrique." By C. Le Roy. Paris: Hermann et fils. Price 6 fr.

"*Boletin* de la Sociedad de Fomento Fabril." August. 1912. Santiago de Chile: The Society.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII. No. 7. September, 1912. New York: The Society.

"Quarterly Trade Journal of the British Chamber of Commerce of Turkey." September, 1912. Constantinople: The Chamber. Price 2s. 6d.

The British Fire Prevention Committee has issued a further report (Red Book No. 171) on its series of glazing tests, this time in respect of three windows glazed with "Chadrac" electroglazing, and submitted for review by Messrs Chater & Sons, London. Whilst up to the present the limit of fire-resisting glazing has been on a panel measuring 2 ft. × 2 ft., the panels here reported on are double the size—*i.e.*, 4 ft. × 2 ft.—and this is certainly a remarkable achievement for glazing under fire tests for one hour at temperatures ranging up to 1,600° F., followed by the application of water from a steam fire engine at short range, tests which were passed with complete success.

Trade Announcements. — The Westinghouse-Cooper-Hewitt Co., Ltd., whose London offices and works were formerly situate at 151-2, Great Saffron Hill, London, E.C., have, consequent upon the growth and development of business, now removed to 80, York Road, King's Cross, London, N., to which address all communications should be forwarded. Their telephone number remains the same—"1647 City"—whilst under the recent postal concessions the telegraphic address now reads—"Hewittic, Kincross, London."

The Midland Electric Manufacturing Co., Ltd., have appointed Mr. H. J. Stanley, of 90, Deansgate, Manchester, to be their sole representative in Lancashire and Yorkshire from October 1st.

Messrs. Shalders & Davis, electricians, of Southampton, are, owing to the approaching demolition of the buildings, vacating their premises at 17, High Street.

The sole agency in Scotland for the sale of the prize-winning "Ceag" miners' electric lamp has been obtained by Messrs. Archibald Baird & Son, Ltd., Hamilton.

The "E.N.S." Electric Co. are equipping premises at Adderley Road, Saltley, Birmingham, for the manufacture of switches, fuse-boards and other electrical accessories, and hope shortly to be in a position to execute orders.

LIGHTING and POWER NOTES.

Accrington.—In connection with the proposed overhead lighting scheme, the work of installation is to be proceeded with forthwith, the electrical engineer being authorised to arrange for the wiring for 200-c.p. lamps, and Alderman Higham and the Mayor being empowered to obtain and decide the tenders for all the materials required. Provisional arrangements have been made for the taking of a site in Clayton-le-Moors for a transforming station.

Argentina.—The President of the French Bank of the River Plate requested the Buenos Ayres City Council to defer consideration of a petition at present before it for an electric light concession. He stated that he was acting on behalf of a Paris syndicate, which was interested in acquiring a similar concession, and the plans and full particulars were expected shortly.

Bangor (Co. Down).—The gas manager has been instructed to submit a report showing the cost of a small electric lighting plant, it being proposed to light the street electrically.

Barking.—The Council has informed Mr. W. Ivey, who desired to know whether an offer for the sale or leasing of the undertaking would be considered, that if an offer is submitted, it will receive attention.

In consequence of an anticipated loss on the undertaking, the charges for current for lighting have been increased from 4d. to 4½d. per unit, and for power by ⅛d. per unit on the scale charges.

Bath.—The Surveying Committee of the T.C. on Monday decided to convert 48 gas lamps in various streets to electricity. The cost of lighting will be the same as paid for gas, £2 10s. per lamp per annum.

Bedlington.—The Council has installed a comprehensive electric lighting scheme for the main highways from the station to West Sleekburn, Startford and Bornarsund. The current is supplied by the Bedlington Coal Co. from its power station at Bornarsund.

Blackburn.—The T.C. has confirmed a resolution of the Electricity Committee instructing the engineer to prepare a scheme for new electricity works, together with estimates, for submission to the Committee.

Bootle.—The agreement between the T.C. and Messrs. Harland & Wolff for the supply by the Corporation of electricity to the ship-repairing yard at North Docks for a period of five years from December 1st, 1912, was signed at a meeting of the T.C. on October 3rd. The terms of the agreement were not made public, but under the scheme the plant for distribution will be housed in a sub-station on Messrs. Harland & Wolff's premises, instead of at the Raleigh Street pumping station. The installation will include a 250-kw. rotary set, with transformer, switchgear and other apparatus, at an estimated cost of £1,500 (inclusive of £250 for a second transformer to existing rotary), and an alternative h.t.-feeder will be laid to the new works, at an estimated cost of £3,200 for a 500-kw. cable. The cable will be purchased out of the existing loan sanctioned for mains, but the £1,500 for new plant will be provided for out of a further loan to be sanctioned by the L.G.B. The original installation will comprise over 1,500 h.p., applied to motors for the most part operating tools on the individual-drive system, while the lighting will be carried out by flame arc lamps connected in groups on 220-volt circuits.

The T.C. has received the sanction of the L.G.B. to a loan of £41,919 for the erection of the new generating station at Marsh Lane to replace the existing power station at Pine Grove. The amounts of the loan are made up as follows:—£6,717 for purchase of land (60 years' period of repayment); £10,054 for erection of buildings and supply and fixing of weighbridge and steam piping (30 years); £19,735 for machinery (10 years); £1,263 for h.t. mains (25 years); and £4,150 for l.t. mains (20 years). Further works proposed to complete the undertaking amount to £6,694, and the L.G.B. has informed the Council that it will be prepared to entertain an application for sanction to a loan on the precise sum being ascertained.

Bradford.—On Wednesday last a third vertical Curtis turbine unit, of 4,500 kw. capacity, was started up at the Valley Road electricity works of the Corporation, by Alderman Hayhurst, in the presence of a large company, which included the chairman, Alderman Robinson, and members of the Electricity Committee. A luncheon was afterwards held at the Town Hall, when many of the local power-users were present. Including the previous Curtis turbine plant and four 1,000-kw. Corliss engine units, this station will now have a capacity of 14,500 kw. The station is provided with a Worthington base condenser and twin circulating pumps driven by a small Curtis turbine.

Burton-on-Trent.—An overhead h.t. three-phase main is to be erected from the electricity works to the pumping station, at a cost of £474, exclusive of distributing mains. In case the electrical engineer obtains another consumer about 1,000 yards further on, he has been authorised to erect this line at an estimated cost of £142. The public library and reading room is to be lighted with single-light fittings, instead of the present three-light ones, with 100-watt lamps and special "Holophane" reflectors, at a total cost of £18.

Canada.—The municipal telephone exchange at Fort William has been equipped throughout with electric radiators, totalling 73 kw., in sizes between 2½ kw. and 8 kw. No other form of heating is employed; the room temperatures required were 65° F. to 70° F., with a temperature of 40° below zero outside. It is recorded that no trouble has been experienced in keeping more than the required temperature during the 24 hours per day in which the building is in use, and as it uses current all day except for two hours of peak load, terms sufficiently favourable to enable it to compete with other forms of heating were obtained. The capacity of the plant is 1¾ watts per cb. ft.

The following powers have been conferred on the Ontario Hydro-Electric Commission by a Bill in the Ontario House to amend the Power Transmission Act:—

To take over existing power transmission lines and to improve water powers, by assisting municipalities and others in the storage of water, making of sluices, &c.

To expropriate a local distribution plant where a municipality has voted to enter into a contract with the Commission for a supply of power.

To regulate the installation of electrical equipment and installation of wires in all buildings, including private houses.

To require the appointment by municipalities of inspectors to see that such regulations are carried out.

To order the removal and alteration of any works that are a menace to the public safety or endanger life

To control absolutely light and power rates charged by municipalities, whether they take power from the Commission or not.

To control the rates of any company or individual taking power from the Commission.

To prescribe a uniform system of book keeping on the part of power municipalities.

To direct the disposal of surpluses earned by municipal power plants supplied by the Commission.

To order all wires under its jurisdiction underground in cities and towns.

With the co-operation of the Dominion Railway Commission to order underground all wires strung on streets where the municipalities construct tunnels or conduits to carry such wires.

To impose a penalty of $100 a day for any disobedience of any such order.

The above regulations are now law, and several cities are at present putting some of them into force.

Hamilton is endeavouring to have all the electric, telephone and telegraph wires in the city placed underground, and the companies affected are making a strenuous fight. Ottawa has also taken action to have all the wires on the principal streets placed underground.

Some of these regulations, however, impose a big expense on the various companies, and it may be difficult to carry, at least some of them, out.

Continental Notes.—AUSTRIA.—During the month of July last no fewer than 21 applications to utilise water-power for electrical purposes in various parts of Austria were received by the Hydrographische Central Bureau in Vienna.

BOHEMIA.—An electric power plant is being installed in the weaving mills of Messrs. Georg Löw, at Koniginhof.

SWEDEN.—The Uddeholm Co., of Uddeholm, who are adapting their plant at their Hagfors and Mykroppa works to the production of iron and steel by electricity, are putting down a large installation to utilise the Maltforsen Falls, on the River Ufar, about three miles from Hagfors, in the generation of the necessary electrical energy. It is stated that the capacity of the plant to be put down will be about 5,000 H.P.

GERMANY.—The Brandenburger Electricitätswerk Gesellschaft is the name of a new company which has just been formed in Brandenburg, with a capital of £50,000, to take over and carry on the municipal central electric lighting station in that town. The A.E.G. is interested in the new undertaking.

NORWAY.—A new power house has been completed at Flekkefjord, and will supply energy in part for systematic experiments in domestic electric heating by means of surplus energy in Swedish tile or fayence stoves, the same system being under test at Gottenburg, where stoves are heated up over-night, and used for heating purposes during the following 10 or 12 hours. Surplus electricity is used at Flekkefjord on a large scale for cooking during the day.

Cwmamman.—A representative meeting of ratepayers has decided by an overwhelming majority to recommend the Council to undertake an electric lighting scheme, at a cost of about £6,000. The Ammanford Gas Co. has extended its mains to the district, and has had trial gas lamps in use for about 12 months; it submitted two offers to the Council for the street lighting, 200 lamps being required, and the lower offer being equivalent to a 7¾d. rate. It is understood that the Council will install a suction gas plant and overhead mains, and that for street lighting alone the cost will not exceed the figure mentioned.

Cwmcarn.—At the new colliery here, as in the case of other collieries in the district, everything is driven electrically, there being no boiler on the ground. Energy is brought to the pit by overhead wires from the generating station at Abercarn.

Dalkey.—At the monthly meeting of the Urban Council, last week, a letter was received from Mr. W. A. Evans with reference to a company he was about to promote for the purpose of supplying electric light in Kingstown, Dalkey and Blackrock, stating that plans had been prepared setting out a scheme. He asked for the expression of the Council's opinion. The company would seek permission to open the roads in order to lay cables. The most economical scheme would be to get electric light from the tramway company, and if the three townships were to co-operate with the tramway company, the Dublin Corporation and the gas company could not prevent the tramway company from getting their Act of Parliament amended so as to enable them to supply electric light in Kingstown, Dalkey and Blackrock. It was pointed out that Kingstown had every facility for putting up a station at Dunleary, and could deliver spare energy, as Pembroke had proposed to do for Blackrock, at 2½d. per unit, leaving it to Dalkey to distribute it throughout the township. After some further discussion, it was decided to appoint a Committee and to ask Kingstown not to come to a decision as to the company's offer until an opportunity was afforded of discussing the matter with the Dalkey representatives, whose interests were so vitally affected.

Derby.—A L.G.B. inquiry was held on October 2nd into the application of the T.C. for a loan of £10,750 for electricity purposes. There was no opposition.

Dromore (Co. Down).—The Urban Council has decided to proceed with the scheme for the electric lighting of this town.

Dover.—The *Dover Express* contains a very lengthy report of a meeting of the Electricity Committee when a report on the estimated saving of £1,130 due to turning out the street lamps at midnight, was discussed. Apparently, the mayor and the chairman did all the talking, and eventually the report was approved. The local paper considers that the T.C. has utterly befogged itself over the lighting question, and it is somewhat difficult for the outsider to follow the various proposals made in view of the £3,254 net profit stated to have been made last year.

Dublin.—The Electricity Supply Committee of the Corporation last week issued its annual report and statement of accounts of the electricity undertaking for the year ending March 31st, 1912. The report states that after discharging all expenditure on the working of the undertaking for the 12 months, amounting to £49,034, and all capital charges amounting to £37,364, there remains a net profit on the year's working of £11,670. The income from private consumers for the 12 months amounted to £68,180, being an increase of £11,812 on the figure of the previous year, and the net surplus, after payment of the increased working expenses and the additional capital charges, shows an increase profit of £5,211 as compared with the previous year. The units sold for power purposes amounted to 6,724,000, and the cost of generation and distribution per unit, viz., 1·14d., shows a slight reduction of ·05d., and the capital charges of 1·13d. show a reduction of ·14d. per unit. The Council has already approved of the proposal of the Committee that out of the net profits of this year it should wipe out the last of the old debit balances of the undertaking. This will leave a credit balance of £4,672, which the Committee would have desired to bring forward to this year as a reserve. The Municipal Council, when considering the estimates on March 29th last, however, decided that out of the estimated profits of the current year a sum of £5,000 should be transferred to the relief of the rates, and as any charge of this kind must be met out of the actual cash balance, the decision of the Council wipes out the entire balance to the credit of the undertaking. In conclusion, the report stated that the Committee earnestly trusted that in dealing with the annual estimates of the Corporation in future, full consideration would be given to the really urgent necessity of a substantial reserve fund being built up in order that the undertaking might be developed in the manner in which the members of the Council themselves desired.

Dudley.—At the monthly meeting of the T.C. last week, the sale of the Corporation's electricity undertaking was again considered, on a resolution submitted by Councillor Adshead, to the following effect: "That the resolution passed last meeting authorising the sale be rescinded." The question was again fully discussed in all its bearings, and eventually the resolution was rejected by 22 votes to 4, so that the number of members of the Council in favour of the sale has greatly increased. Subsequently, at an open meeting of the Chamber of Commerce, a resolution was carried to the effect that the B. of T. and the L.G.B. be asked to withhold their sanction to the sale of the works until a public inquiry has been held.

Edinburgh.—The Public Parks Committee of the Corporation have considered the question of the lighting of the Calton Hill, and the electrical engineer has been asked to report on the matter.

Egypt.—Mr. Murdoch Macdonald, Under-Secretary for Public Works in Egypt, is investigating some of the artificial nitrate factories of Sweden in connection with the proposal to install a hydro-electric power station at Assouan.—*African Engineering.*

Ewell.—The Epsom U.D.C. has decided to proceed at once with the extension of the E.L. mains to Ewell, and to canvass the district for consumers.

Flaxton.—The R.D.C. has consented to the application of the York T.C. for permission to lay an E.L. cable at Heworth, which is outside the city.

Formosa.—An electricity generating station has recently been completed by the Japanese Government at Korisho, on the Island of Formosa. The water-power of the River Daian is utilised, the water being led along a canal until a fall of 130 ft. is obtained. Two turbines and dynamos, each of 500 H.P., have been installed, although only one is at present employed in supplying current for lighting and power purposes at Shoka and Taichu, the latter being the chief city in the centre of the island.

Gerrard's Cross.—The Uxbridge and District Electric Supply Co., in order to cope with the increased demand for current, is about to lay a trunk feeder at a pressure of 6,000 volts from Uxbridge to Gerrard's Cross and Beaconsfield. A new district will be tapped between the two places.

Gillingham (Kent).—The T.C. has applied to the L.G.B. for a loan of £6,615 for the installation of another Diesel engine at the E.L. works, as intimated in last week's ELECTRICAL REVIEW.

The cables are to be extended to the works of Messrs. H. G. and W. Croneen, brick makers, who are installing a large motor.

Hazel Grove and Bramall (Cheshire).—The U.D.C. is considering the advisability of adopting electricity for street lighting purposes. Negotiations have been opened with the Stockport T.C. for a supply of current.

Hinckley.—The Leicestershire and Warwickshire Electric Power Co., Ltd., has applied to the B. of T. for permission to erect overhead lines for the transmission of energy at a pressure of 6,600 volts in the district outside Hinckley.

Hove.—As notice for the purchase of the undertaking of the E.L. company must be given not later than December next, the General Purposes Sub-Committee of the T.C. recommended that in the interests of the town it was desirable that the undertaking should pass into the hands of the Corporation. The General Purposes Committee on Monday endorsed the recommendation which was to be placed before the Council on Thursday, October 10th.

India. Kashmir Hydro-Electric Scheme.—The Durbar are doing all they can to increase the load on this installation. Electric dredging of the river has produced some good results already, by giving a freer outlet to the surplus hill water which hitherto caused disastrous and frequent flooding of Srinagar. The lighting load for this city is steadily increasing, as the authorities are allowing special facilities for bazaar lighting and bungalows. A system of wiring has been instituted which gives every inducement to the poorer bazaar shop-keepers to use electric light in preference to any other.

The question of an electric railway between Srinagar and Rawalpindi has often been mooted, and the line must eventually come, but at present the Durbar do not feel justified in incurring such a large expenditure.

Leeds.—At the City Council on the 2nd inst., Ald. J. Clark, in moving the minutes of the Sanitary Committee, said that as a result of information obtained on visits to other towns as to refuse destructors and the utilisation of steam raised at destructors for the generation of electricity, the Committee recommended that a new destructor be erected as soon as possible, and that the surplus steam thus raised be utilised for the generation of electricity. They had four destructors, and an immense amount of heat escaped from the combustion chambers up the chimney and was absolutely wasted. If they could utilise all the heat that there was in the amount of domestic refuse destroyed during one year, and sell it to the Electricity Committee, it would bring in between £5,000 and £6,000 a year

The City Council at its meeting last week decided, after a lengthy discussion, to refer back the proposal which had been brought forward by the Electricity Committee, that the Corporation should borrow the sum of £10.000 for the purpose of a scheme of establishing a department for the hiring out of electric motors. The active opposition of the local electrical trade to the proposal culminated in a deputation of engineers and electrical contractors attending the meeting to protest against the scheme, putting forward the views that, quite apart from the unfair competition with private traders, the Corporation, with the capital suggested, would not be able to provide a service equal to that which it would displace, and that, also, the Corporation would lose the services of privately employed canvassers who, under the existing system, have been pushing the sale of electricity by urging the public to make a more general use of electric plant. The traders are now to have a further opportunity of emphasising their protest before the Electricity Committee.

Mr. R. Armitage, M.P., said the Corporation had given private traders ample opportunity to supply motors on hire, but, practically speaking, nothing had been done, and nothing was being done by them; in fact, they themselves had told the Committee they did not want to encourage development along those lines, and there was only one firm in the city enthusiastic about it. The Committee's proposal was limited to the hire of motors. The department did not intend to do the installation and wiring; that would be done by contractors, who would thus have more work to do than they had had hitherto. The small trader would benefit by being able to hire a motor at a reasonable price.

Alderman Brown, chairman of the Tramways and Electricity Committee, said he believed there was a call for motors in the city, and he would like the Committee to ask contractors if they were prepared to lend out motors so that a man could have any make of motor he liked at a reasonable price. If motors could be hired at a reasonable price from private firms, he had no desire to press the proposal.

Leigh-on-Sea.—The U.D.C. has now decided to grant Mr. Speight, electrical engineer, an interview respecting his proposed application for a prov. order for electric light. At a recent meeting, as stated at the time in the Electrical Review, the Council declined to consider the matter with Mr. Speight.

Littleborough.—The ring frames at Messrs. Fothergill and Harvey's Greenvale Mills, Littleborough, are now being driven by electric motors installed by the A.E.G. Electric Co., Ltd., of Manchester. The innovation will be watched with interest by other local firms.

Llanfairfechan.—The Council has had under consideration a communication from Mr. W. R. Walton, consulting engineer, in reference to the water supply and electric lighting scheme. It was decided to call a special meeting of the Council to consider the question and to meet Mr. Walton.

London. Southwark.—The accounts of the electricity undertaking show that during the year there was a net loss on the working of £443, which has been transferred to the renewals reserve account. The capital expenditure on the undertaking now amounts to £108,672, of which £7,042 was incurred during the last year, £4,208 being on new machinery. Of the capital expenditure [illegible] has been repaid. The total income, after deducting [illegible] for bad debts, discounts, &c., was £20,714, showing an increase over the previous year of £2,080. The total working expenses were £15,052. The gross profit on the year's working was £5,661, and this amount, which was a reduction on that of the previous year of £531, represented a return of 5¼ per cent. on the total capital outlay. From this gross profit was deducted £2,616 for interest on loans and repayment of capital. The engineer, Mr. D. M. Kinghorn, in his report, stated that the past year was one of which the effects would be felt for some time to come, the series of strikes having undoubtedly caused a very serious dislocation of the business. The result had been in fact extremely satisfactory, and constituted a record from a revenue point of view, but for the prices which had to be paid for coal. The net result was an increase in the coal cost of ·104d. per unit, the highest figure for some years, and £1,895 greater than £3,990, the cost for the previous year. The total units sold were 2,209,826, as against 1,790,983 in the previous year. The average prices obtained were for private supply 2·57d.; public lighting, 2·46d.; and power, 1·03d. The accounts were agreed to.

Hackney.—The Electricity Committee, reporting on the position of the Council's works as regards the possibility of breakdowns due to fire, states that at the time the works were constructed every precaution known at the time to prevent or minimise the effects of a fire was adopted. The switchboard is of the cellular type, in which each switch, &c., is placed in an independent fireproof compartment. Where the cables come together under the switchboard special precautions have been taken. The cables are all lead-covered, and are laid on roller racks, so as to be guarded from injury. There are no joints whatever in these cables, and the terminal ends are placed in secure positions, where a short circuit in any one of them would not affect anything else. It cannot be certified that a burn-out would be impossible, but the Committee is confident that it would be most improbable. The only possible improvement here would be to substitute armoured cables. In the extension works which have recently been designed, combustible material has been practically eliminated, and the plant has been so arranged that each generating set is practically an independent source of supply. The switchboard will be of metal, brickwork, concrete and porcelain only, the cables will be lead-sheathed and copper-sheathed, and there will be so few of them that there will be no two cables so close together that a burn-out on one would affect another. A switchboard fire, or, indeed, any sort of fire, will be impossible. When these works and ring mains and sub-stations are completed, Hackney will have at least two entirely independent sources of supply under one management, which can be connected at the main works and at three distinct sub-stations; total failure of supply due to fire will then be impossible.

Islington.—At the last meeting of the Borough Council, a letter was read from the County of London Electric Supply Co., suggesting that, in view of the recent fire at the Council's electricity station, it might be worth the Council's while to again consider as to the advisability of taking, as a matter of insurance, a bulk supply from the company's mains, and offering to submit a more favourable quotation for such a supply than that submitted on a former occasion.

Westminster.—The Works Committee report that the period during which the City Council and the Westminster Electricity Supply Corporation, Ltd., are empowered to review the contract between them for the public lighting of the parish of St. George, Hanover Square, with a view to the improvement of the lighting, expires on the 17th inst. As negotiations for such improvement have not been completed, the company are to be approached with a view to the period being further extended for six months.

Lytham.—The Council on October 3rd passed a resolution authorising application to the B. of T. for provisional powers to supply electricity within the township.

North Berwick.—At a meeting of the T.C. on Friday last, a letter was read regarding the transfer of the agreement between the Council and Messrs. Crompton, regarding the supply of electric lighting to the burgh, to the North Berwick and District Electric Light and Power Co., Ltd. The Council approved of the transfer.

Queensbury (Yorks.).—Messrs. Bruce Peebles, Ltd., are supplying two 500-kw. three-phase turbo-alternators to the Black Dyke Mills (John Foster & Sons). These will be driven by Adamson-Rateau reducing type turbines at 3,000 r.p.m., and will supply 440-volt 50-cycle current for the mills.

Rochdale.—The E.L. Committee has agreed that specifications be prepared and tenders invited for a 1,000-kw. three-phase steam alternator, with the necessary foundations, condensers, pipe-work, &c., and that plans and estimates be prepared for further extensions of the engine and boiler houses, together with steam alternator, condensers, pipe-work, boilers, coal stores, elevators, also settling tank and other necessary plant, with a view to making application to the L.G.B. for sanction to borrow the necessary moneys.

Rochford.—By 21 votes to 14 the B.G. has rescinded the recent decision to have the workhouse premises lit by electricity, on the ground that the expenditure (£7,000 for heating and lighting) is excessive. The Board has appointed a Committee to invite certain firms to tender for the heating and lighting work.

Royston (near Barnsley).—The U.D.C. has under consideration a proposal to apply to the B. of T. for a prov. order for electricity supply. It is estimated that the cost of converting the system of lighting would be about £700. Representatives of the Council recently had an interview with Mr. Woodhouse, of the Yorkshire Electric Power Co., and it is suggested that a deputation should visit some township already lighted by the company where all necessary information could be obtained. The question is to come up for further consideration at the meeting of the General Purposes Committee.

Rushden.—The Rushden and District Electric Supply Co., Ltd., has been formed, with a capital of £25,000, to supply electricity, under a prov. order obtained by Messrs. F. H. Thornton, B. Sampson and J. Clark, to Rushden, Higham Ferrers and Irthlingborough. The company hopes to give a supply of current by next summer.

St. Helens.—The T.C. has applied to the B. of T. for sanction to erect overhead lines in order to supply electricity to the works of the British Electric Detonator Co., Ltd.

St. Paul's Cray.—The Bromley R.D.C. has consented to the Chislehurst Electric Supply Co., Ltd., supplying consumers at St. Paul's Cray.

Sevenoaks.—At a meeting of the U.D.C. on October 1st it was reported that Messrs. Crompton & Co., to whom the Council proposes to transfer its E.L. order, had formed a company, and were completing negotiations for land for the generating station. The clerk stated that he hoped that within a few days the whole thing would be quite ready to go on.

Sheffield.—Instructions have been given the city engineer to report on the question of lighting by gas, electricity or otherwise the whole of the bandstands in the city, together with an estimate of the cost. It has been decided to light the reconstructed baths in Corporation Street with electricity.

South Africa.—Somerset East ratepayers have polled in favour of a proposed local electric lighting scheme which is to cost £8,000.

An electric lighting scheme for Stellenbosch prepared by Prof. Bohle has been adopted by the municipality, and full plans and specifications will shortly be made public.—*British and South African Export Gazette.*

The Johannesburg municipal authorities are about to purchase a large supply of electricity meters for new services which are being undertaken.—*British and South African Export Gazette.*

Stafford.—The Electricity Committee has decided that application be made to the L.G.B. for sanction to borrow the sum of £25,000, to cover the anticipated expenditure on the installation of mains and service cables during the next few years.

Stoke-on-Trent.—The L.G.B. has deferred consideration of an application for sanction to borrow £1,000 for electric wiring, motors, &c., for the new Mining and Potteries Institute, pending the receipt of further particulars.

Tunbridge Wells.—The T.C. has received from the L.G.B. sanction to loans of £2,000 for mains, £250 for sub-station pillars, £300 for transformers, and £350 for house services.

The B. of T. has given the Council permission to supply electricity for lighting to residences at Speldhurst.

Turton (Lancs.).—The U.D.C. is inquiring as to the cost of lighting certain additional roads in its jurisdiction.

U.S.A.—The city of Chicago has contracted for 10,000 street arc lamps for the sanitary district. The lamps are 10-ampere flame arcs, and burn 90 to 100 hours per trim.

Uruguay.—The Congress has commenced to discuss the Government Bill creating a monopoly of all electric light and power stations in the country.

Wakefield.—In connection with the electricity department of the Corporation, it has been decided that application be made to the L.G.B. for sanction to borrow £3,000 for mains, £500 for sub-stations, and £500 for transformers.

Walmer.—Mr. W. T. Pressland, of Westminster, has informed the U.D.C. that he intends applying to the B. of T. for a prov. order for electric lighting. There is an order already in force, and the promoters are formulating a scheme.

Watford.—The U.D.C. has applied to the R.D.C. for consent to its application for powers to supply electricity in the rural area in the parishes of Watford Rural and Sarratt. The R.D.C. has decided first to consult the Parish Councils affected.

Wednesbury.—The annual report of the Corporation's electric light undertaking has been issued, and is regarded as very favourable. The sales of electricity show a total increase of 216,568 units, which is considered satisfactory, and the report adds that it is clear that the output will soon reach 1,000,000 units sold. The financial results are given subject to correction, and show a gross profit on trading of £2,486, as compared with £2,141 last year, the net surplus on the year's working being £854, as compared with £583 in the previous year. The amount available for disposal is £1,619, as against £1,309. The gross profit has, it is stated, increased by nearly £350, which is also considered satisfactory.

Woodbridge.—Mr. E. Charrington has approached the U.D.C. respecting the establishment of electricity works by a company formed to supply small towns and rural districts with electricity. He has informed the Council that the company would put down a small station in the town, if the Council would undertake not to apply for a prov. order for 21 years, or support any other company. The Council has referred the matter to a Committee for consideration.

Worksop.—The U.D.C. has received from the L.G.B. sanction to loans of £2,926 for street mains and services, £840 for meters, and £294 for improved street lighting.

TRAMWAY and RAILWAY NOTES

Argentina.—In view of the fines imposed by the Province of Buenos Ayres on Messrs. Otto Francke & Co., concessionaires for an electric railway between La Plata and Buenos Ayres, for delay in commencing the work, the concessionaires appealed against the decision. The Department of Engineers, to whom the appeal was sent for report, state that the real reason why the work has not been commenced is solely that the necessary capital has not been obtained. The concessionaires maintained that the delay was due to the fact that they could not obtain the plans for the route from the Government.—*Review of the River Plate.*

The Paraná municipality has granted a concession for the installation of an electric tramway in that city.

The Electric Light Co., of Pergamino, has applied for a concession for electric tramways.

Australia.—It is stated that the decision of Mr. C. H. Merz, as regards the system of electric traction to be adopted in the case of the Melbourne Suburban Railway scheme, is in favour of H.T. direct current, with 1,500 volts on the trolley wire.

A report on an electric tramway system to connect Port Adelaide with Adelaide is being prepared by Mr. W. G. T. Goodman, general manager of the Tramways Trust.

Chester-le-Street.—The U.D.C. recently received a letter from the Gateshead and District Electric Tramways Co., Ltd., stating that the question of constructing an extension of its system from Low Fell to Chester-le-Street had been considered, but it was thought the prospective traffic would not justify the outlay. Instead, it had decided to run a regular service of motor-cars between the centres.

Continental Notes.—Russia.—The *Commercial and Industrial Gazette* (St. Petersburg) states that the electrical energy generated for working the St. Petersburg municipal tramways is inadequate, and that proposals have been put forward for enlarging the central electric generating station, and also for increasing the number of tramcars belonging to the system. The total cost is estimated at about £77,000.

Crewe.—A Committee of the Corporation has had under consideration a preliminary report by the electrical engineer respecting railless cars and motor-omnibuses, and has resolved that the chairman of the Committee (Alderman Briggs) and the electrical engineer be authorised to visit Leeds and Birmingham as early as possible and inspect the motor-omnibuses and railless cars in operation there.

Dunfermline.—In connection with the proposed new roadway between Dunfermline and Rosyth, there is a suggestion to have a double line of tramways, so that the workmen at the Naval Base may enjoy the advantages of Dunfermline's Carnegie Trust attractions. The matter has been before the Town Planning Committee.

Edinburgh.—After discussing the report of the burgh engineer regarding new tramway routes, the Tramway Committee of the T.C. last week agreed to recommend the Council to apply for Parliamentary powers to run motor-'buses on the suggested routes. At one time it seemed possible that Edinburgh would follow the example of Dundee and adopt the railless traction system, but although this proposal was advocated at the meeting, it was ultimately decided not to adopt it, there being a feeling against the introduction of another system into the city.

Elland.—The D.C. has decided to defer the question of the provision of tramways, but has approved of the calling of a ratepayers' meeting on the subject.

Glasgow.—At the last meeting of the T.C.'s Committee on Tramways, the general manager submitted demand notes for the municipal assessments for the current year on, *inter alia*, the tramway lines in the city, and pointed out that the assessments had been imposed on the full valuation of the said lines, notwithstanding that it had been decided this year in the King's Bench Division of the English Courts, in the case of a company who worked as one connected system a tramway and a light railway, that the tramway was "land used only as a railway constructed under the powers of an Act of Parliament," and for assessment purposes, consequently, liable to be assessed on only one-fourth of the valuation of the lines. An amendment was carried that an appeal be made to the Special Committee on

Objections to Assessments, and, if necessary, to the Sheriff, against the said assessments in so far as they were calculated on the full valuation of the lines.

Halifax.—At the monthly meeting of the T.C. on the 2nd inst., Alderman Morley objected to the agreements by the Tramways Committee with various local authorities, and to the extension of the period within which such local authorities could require the tramways now or hereafter to be worked by the Corporation within their districts. He considered it would give the Tramways Committee *carte blanche* power in regard to tramway matters. Alderman Thomson considered the terms of the resolution were too widely drawn, and he proposed the addition of the words "subject to every agreement being scheduled to the Bill proposed to be presented to Parliament by the Corporation during next Session." The Council approved of the additions to the resolution. Mr. Fawcett then moved that the Tramways and Electricity Committee be authorised to purchase a motor-omnibus for £830, and that the chairman be empowered to give an order later for two additional motor-omnibuses at a similar price. He said it was proposed to establish a service of motor-'buses from Halifax to Mount Tabor. The Committee proposed later to ascertain whether it would be justified in recommending the extension of the tramways to Stainland and Ripponden. The recommendation of the Tramways Committee was approved.

Horwich.—The Council, on October 3rd, received an application from Bolton T.C. for the refunding of three-fourths of the district rate paid on the tramlines in Horwich, in consequence of the Tottenham decision. The Clerk reported that the Tottenham Council was appealing to the House of Lords, and suggested that the matter be left over pending the result. This course was resolved upon.

Hull.—At the meeting of the Corporation Tramways Committee, on the 3rd inst., it was stated that the tramway extensions to Spring Bank West would be proceeded with after Hull Fair, and would be followed by extensions to Hessle Road and Pickering Park.

Leeds.—The City Council last week decided to apply for powers for tramway extensions, which will include the following routes on the railless system, which has proved very satisfactory in Leeds: Guiseley to Otley, via Menston; Menston to Ilkley via Burley-in-Wharfedale: Farnley to Drighlington; Rodley terminus to Calverley; Rodley terminus to Farsley and Stanningley; York Road terminus to Crossgates. At present there is no sign of active opposition by the districts concerned, although Ilkley and Burley, pleasure resorts, have expressed a preference for being left without a service.

It is understood that the Tramways Committee will shortly give consideration to the question of introducing ½d. fares on the tramway system in the residential suburbs of Headingley, Chapeltown and Roundhay, which are at present excepted from the privilege. The ½ mile for ½d. system, which has been in operation in other parts of Leeds for six or seven years, has served the purpose of a great many people who would not otherwise have used the cars, and in this way has provided an additional source of income to the Corporation.

Lincoln.—At the City Council meeting on the 1st inst., the chairman of the Electricity Committee said the question of tramway accommodation for parts of the city not now served was under consideration. Owing, however, to the cost of extending the present system, the Committee was inclined to favour the introduction of railless cars or petrol-driven 'buses.

Little Hulton.—Negotiations are proceeding between the Little Hulton District Council, the Farnworth D.C. and the South Lancashire Tramways Co., with the object of laying a tramway from Walkden to Little Hulton, and thence to Farnworth, making a seven miles' circular route. The proposed tramway would connect with the company's existing lines at Walkden and Farnworth.

Little Lever.—The Farnworth and Little Lever District Councils are asking the South Lancashire Tramways Co. to extend its tramways to Little Lever.

Llandaff.—It has been decided to call in Mr. J. B. Hamilton, Leeds, to report on a proposal for a railless traction service between Llandaff and Cardiff.

London.—The L.C.C. has applied to the B. of T. to sanction experiments with petrol-electric tramway cars on the route from Woolwich Free Ferry to Abbey Wood. The route has been electrified, but it is desired to test the new cars exhaustively.

Newcastle-on-Tyne.—A new route has just been completed, opening up the thickly populated area of Shieldfield and connecting it up with the pleasure resorts of Jesmond. The line was inspected by the members of the Tramways Committee and other members of the Corporation on the 3rd inst. Councillor J. H. Rodgers, in the course of a short speech, said they had two miles of track through Shieldfield, and with two junctions, one a double one, the total cost was less than £14,000. He said they would be calling considerably on the reserve fund—which now amounted to £104,670—during the next 12 months. The new electrical equipment was going to cost £16,800 and there was need for 30 more cars. They were awkwardly placed in Newcastle, as they had about 80 cars which would only negotiate three routes, and they would not negotiate the new route to Newburn. He thought the suggestion of the manager that they should convert 30 of the old bogie cars, at a cost of £10,000 at the most, was a good one; it would mean a saving probably of £9,000. The lines in Grainger Street, Shields Road and Northumberland Street would have to be relaid. Altogether he estimated the cost at from £45,000 to £50,000.

Royston (near Barnsley).—The U.D.C. has received a communication from the Barnsley Electric Traction Co., asking whether the Council has any licensing powers in respect of vehicles plying for hire in the district. It is stated that the company contemplates introducing a railless traction system.

Salford.—The Corporation has confirmed a proposal authorising the laying of a double tramway track in Radcliffe New Road, Whitefield, in lieu of the existing single track, at a cost to the Corporation of £350.

Thames Valley Electric Railways.—The clerk to the Teddington Council has been informed by the Central London Railway of its decision to apply for Parliamentary powers at an early date, to extend the railway into the Lower Thames Valley. The exact route proposed is not yet known.

TELEGRAPH and TELEPHONE NOTES.

Chile.—The new wireless station on Mocha Island has been opened.—*Review of the River Plate.*

Deferred Telegrams.—The system of deferred telegrams in plain language at half rates has been adopted by Uruguay, Argentina, the Western Telegraph Co. and the Central and South American Co., in connection with various countries.

Imperial Wireless System.—The debate on the Marconi agreement is to take place in the House of Commons today. The Postmaster-General intends to move that a Select Committee be appointed to investigate the circumstances connected with the negotiation and completion of the agreement, and to report thereupon, and whether the agreement is desirable and should be approved; the Committee to have power to send for persons, papers and records.

International Radiotelegraphic Convention.—The text of the Convention of London, together with the detailed service regulations for wireless telegraphy at sea, is printed in full in the *Journal Télégraphique* for September 25th, 1912.

New Cables.—The Telegraph Construction and Maintenance Co. has recently completed the laying of a cable between Alexandria and Gibraltar, providing direct communication between Alexandria and the head office of the Eastern Telegraph Co.

The German South American Telegraph Co. has begun to lay the new cable between Monrovia (in Liberia) and Togoland and the Cameroons, to provide independent communication between these Colonies and Germany.—*Board of Trade Journal.*

New Telephone Relay.—The *E.T.Z.* reports that a telephone relay has been invented by Mr. R. von Lieben, in the construction of which a kathode-ray tube plays an essential part.

The Poulsen System.—The Federal Telegraph Co., of San Francisco, has acquired the patent rights for the Poulsen system of wireless telegraphy in the United States and their dependencies, and will erect a large number of stations. It is claimed that messages can be transmitted and received at a speed of 400 words per minute. The company already possesses 14 stations on the Pacific Coast.—*Journal Télégraphique.*

Is is reported that Mr. A. G. Baxendale has resigned his appointment as manager of the Pacific Cable Board to take up the management of the Universal Radio Syndicate. In an interview with a *Morning Post* representative, Mr. Baxendale expressed his confidence in the Poulsen system. He believed that in less than a year's time the syndicate would be able to give the public a telegraphic service to Montreal which would compete seriously both in speed and accuracy with the existing cable service, and, while granting a rate of 3d. a word to the public (as compared with the 1s. at present in force), would yield a fair profit. If the Government required a demonstration of long-distance telegraphy by the Poulsen system, the syndicate would be prepared to give one across the Atlantic in the course of six or seven months.

The Titanic Memorial.—About £400 has been subscribed towards the memorial which is to be provided at Godalming in memory of Mr. J. G. Phillips, the Marconi operator who went down with the *Titanic*; a further £200 is needed.

London-Amsterdam Telephone.—Successful experiments have been carried out by the Post Office in telephoning from London to Amsterdam and Arnheim

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—October 15th. Balancer and switchgear for the U.D.C. See "Official Notices" October 4th.

Australia.—South Australia.—October 22nd. Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" September 13th.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" September 13th.

November 27th.—18 miles paper-insulated cable, 155,000 jointing sleeves, also switchboard cable (Scheduled 248). Office of High Commissioner for the Commonwealth, 72, Victoria Street. S.W.

December 17th. Three sections of common battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" September 13th.

October 22nd.—(*a*) 37,000 carbon filament lamps, and (*b*) insulated lead-covered copper cables, for the Melbourne City Council. See "Official Notices" October 4th.

November 12th.—Deputy P.M.G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 19th.—One mercury vapour converter, for the P.M.G.'s Department. See "Official Notices" to-day. Also two batteries and a 4-K.V.A. single-phase transformer. High Commissioner in London.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Offers will be invited shortly for the supply of plant required in connection with the electric lighting of Jamestown (South Australia). Messrs. Lincolne & MacDougall, Melbourne, are consulting engineers.—*Tenders, M. and E. Review.*

Austria.—Vienna.—October 24th. The Austrian State Railway authorities in Vienna are inviting tenders for an installation of electric lighting in the railway workshops and material stores at Gmurden.

Barrow-in-Furness.—October 29th. Electrical and steam plant, &c., in connection with the electricity works extensions, for the Corporation. See "Official Notices" to-day.

Bradford.—October 19th. The tramways department are inviting tenders for miscellaneous stores during the year ending December 31st, 1913. Specifications, &c., from Tramway Offices, 7, Hall Ings, Bradford, on payment of £1 1s., returnable.

Canada.—October 31st. One 500-B.H.P. Diesel engine, alternator, exciter, switchboard, tungsten street lighting apparatus. Specification will shortly be available at Board of Trade Commercial Intelligence Department in London.

France.—Dole.—October 26th. Supply and installation of a transformer and an electric motor. Particulars from the Sous-Intendance Militaire, Quartier Bernard, Dole (Jura).

Gillingham.—October 22nd. One 500-H.P. Diesel engine and alternator, for the Corporation. See "Official Notices" October 4th.

Great Western Railway.—October 14th. Stores for a year. See "Official Notices" September 27th.

Grimsby.—October 21st. Fine slack coal for a year, for the Corporation electricity department. Mr. W. A. Vignoles, Borough Electrical Engineer.

Knottingley.—October 12th. E.L. installation, new picture theatre. Lunn & Kaye, architects, 14, John William Street, Huddersfield.

London.—October 15th.—6,000 steel tires for driving wheels and 5,000 steel tires for pony wheels for electric tramcars for the L.C.C. for a period of 12 months. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

L.C.C.—October 15th. Installation of electric lighting, bells and telephones at the Highgate Secondary School, St. Pancras, N.W. See "Official Notices" October 4th.

Maidstone.—October 17th. Coal for a year for the Corporation electricity works. Borough Electrical Engineer, Fair Meadow.

Nottingham.—October 24th. The Tramways Committee is inviting tenders for (1) steel tramway poles; (2) malleable-iron pole fittings; (3) cast-iron pole fittings. Specifications and forms of tender (21s., returnable) from Mr. Arthur Brown, City Engineer, Guildhall, Nottingham.

Rio de Janeiro.—November 11th. Tenders to the Directoira Geral de Correios, Telegraphos e Illuminacão, Ministerio da Viaçâo e Obras Publicas, Rio de Janeiro, for the construction and working of an overhead or underground telephone system designed to join up the cities of Rio de Janeiro and São Paulo. The concession will be for not more than 35 years, 5,000 milreis (about £335) to be deposited by way of guarantee with the Brazilian National Treasury. The adjudication will be decided on the percentage of royalty on gross receipts offered by the tenderer to the Brazilian Government. Local representation is necessary. The *Diario*, containing further particulars, may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

Rochdale.—October 23rd. Steam turbo-alternator, condensing plant and pipework, for the Corporation. See "Official Notices" to-day.

Rotherham.—October [illegible]th. One 1,000-KW. steam turbo-alternator, condensing plant, piping, H.T. switchgear, &c., for the Corporation. See "Official Notices" October 4th.

Spain.—October 29th. The municipal authorities of Carballo (province of Coruna) are inviting tenders for the concession for the electric lighting of the town.

The municipal authorities of Mundaca (province of Vizcaya) have just invited tenders for the concession for the electric lighting of the town.

Tasmania.—The Mount Lyell Mining and Railway Co. are in the market for the supply of hydro-electric power plant and motor-driven centrifugal plant for the reduction works at Queenstown, Tasmania. Specifications, &c. (21s.) from the London office of the company (Palmerston House, Old Broad Street, E.C.).

Tonbridge.—October 28th. One 100-KW. Diesel engine and generator, and alterations and additions to switchboard, for the U.D.C. See "Official Notices" to-day.

Watford.—October 15th. One 500-KW. steam alternator and a switchboard machine panel for the U.D.C. See "Official Notices" September 27th.

CLOSED.

Aberdeen.—The Tramways Committee, after considering tenders for six double-deck "P.A.Y.E." cars, recommended the Council to accept the offer of the British Westinghouse Electric and Manufacturing Co. for the electrical equipments. In regard to the car-bodies, a local offer (J. T. Clark & Co., Ltd.) was £102 higher than one by the Brush Electrical Engineering Co. On these offers the voting was equal, and it was decided to leave the matter to the Council to settle.

Accrington.—The Electricity Sub-Committee has accepted the following tenders:—

British Thomson-Houston Co., Ltd.—Switchgear [illegible] sub-station, £[illegible].
Ferranti, Ltd.—Switchgear, [illegible] supply, £41.

Australia.—Hopetoun and Beulah, Victoria.—The Reason Manufacturing Co., Ltd., has received from these two towns their contracts for electrolytic meters.

Sydney.—According to *Tenders* (*M. and E. Review*), the Council has placed orders as follows:—

Ferranti, Ltd.—[illegible] electricity meters, 10, 25, 50 and 150 amp., £1,[illegible].
Australian General Electric Co.—[illegible] electric meters, 5 amp., £212.
B.I. & Helsby Cables, Ltd.—Cables, £[illegible].
W. G. Watson & Co.—[illegible] and [illegible], £612.
[illegible] Australia, Ltd.—[illegible], £321.

Melbourne.—P.M.G.

I.-R., G.-P. & T. Works, Co., Ltd.—1,000 earth-plates, £842.
Commonwealth Art Pottery Co.—6,200 porcelain insulators, £129
Hobbs & [illegible].—250 cast-iron covers and frames for manholes, £2,112.
Theodore Zwicker & Co.—10 tons sal-ammoniac crystals, £325.
Siemens Bros. Dynamo Works, Ltd.—Voltmeters and other instruments.

Australian Mining Standard.

Blackburn.—The T.C. has approved of a contract with the Wigan Coal and Iron Co. for the supply of steam coal for the Electricity Department.

Blackpool.—The Corporation has accepted the tender of Messrs. J. W. Fielding & Co. for installing an intercommunication telephone system at the gas works.

The Tramways and Electricity Committee has accepted the tender of Messrs. Walter Scott, Ltd. (Leeds Steel Works) for 100 tons of tram rails.

Bootle.—Under the scheme for the new works, the Corporation has decided to order from Messrs. G. & J. Weir, Ltd., a feed pump, at £74; from the Rees Roturbo Co., a patent rotary feed pump, at £142; five new Hopkinson main steam valves, from Messrs. Hopkinson & Son, Ltd., at £94; and from Messrs. Brown, Duncan & Co., steelwork for turbine foundations, £105, and steelwork for switchboard gallery, to include staircase, £121.

Tenders for the supply of plant have been accepted by the Corporation as follows:—

British Thomson-Houston Co.—Supply of 250-KW. rotary and transformer, £677; high-tension switchgear, £249; low-tension switchgear, £170; erection of high-tension gear, £27.
British Electric Transformer Co.—Supply of 250-KW. transformer for existing rotary, £270.

The tender of the Northern Electrical and Ventilating Co., Ltd., of Liverpool, for the maintenance of the telephone system for 12 months has been accepted by the Corporation Hospital Committee.

Bradford.—The Corporation Tramways Committee has accepted the following tenders:—

J. Sagar & Co., Ltd.—Wood-working machinery for use at Thornbury car works, £262.
Siemens Bros. Dynamo Works, Ltd.—Motors, resistances and current breakers, £5,389.
Dick, Kerr & Co., Ltd.—Controllers, £1,152.
Phœnix Dynamo Manufacturing Co., Ltd.—300-KW. rotary converter at Thornbury sub-station, £798.

The Corporation has placed a contract for an electrical installation at Esholt Hall with Messrs. A. Ridgway & Co., at £166.

Bridlington.—The T.C. has accepted the tender of Messrs. Sidney & Co. for ¾ pea slack Haigh Moor Beanshaw coal for the electricity Works, at 13s. 9d. per ton.

Croydon.—The T.C. has received the following tenders for a lift for the Town Hall :

Easton Lift Co.	£118
Waygoods, Ltd.	135
Smith, Major & Stevens	149
Otis Elevator Co.	213

Dartford.—The U.D.C. has accepted the tender of Messrs. E. J. & W. Goldsmith, Ltd., for 2,400 tons of Aberpergwm anthracite rubbly culm coal for the electricity works, at 15s. 7d. per ton.

Germany.—The Prussian State Railway authorities have lately placed an order with Messrs. Brown, Boveri & Co., of Mannheim, for two 1,200-H.P. electric locomotives, for the haulage of goods trains on the Lauban-Konigszelt railway.

Gloucester.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for rough small steam coal for the electricity works, at 10s. 8d. per ton.

Halifax.—The Guardians have placed an order for electrical fittings for the workhouse and hospital for six months ending March 31st, 1913, with Messrs. S. Hodgson & Co.

Huddersfield.—For installing the electric light at the new premises of the West Yorkshire Bank, Ltd., Market Place, the tender of Messrs. Garton & Son has been accepted.

London.—ISLINGTON.—The B.C. has accepted the tender of Messrs. Richardsons, Westgarth & Co., Ltd., at £14,708, for a turbine and condenser of their own manufacture, coupled to a Westinghouse alternator.

HAMMERSMITH.—The following tenders have been accepted by the B.C. for annual supplies of coal to the electricity department :—

Cory Bros. & Co. Notts. Gedling. 12s. 5d. per ton.
Harrison, Tidswell & Co.—Notts. Bedstone main, 12s. 8d. per ton.
Myers, Rose & Co.—Notts. Gedling, 12s. 1d. per ton.

Maidenhead.—The T.C. has accepted the tender of Messrs. Tangyes, Ltd., of Birmingham, for a motor and pump, at £50.

Newcastle-on-Tyne.—The City Council on the 2nd inst. sealed a contract with Messrs. C. A. Parsons & Co. for the supply of a new turbo-alternator, at £7,049.

Newport (Mon.).—The T.C. has accepted the following tenders :—

Babcock & Wilcox, Ltd.—Boiler, superheater, &c., £1,580; and ash conveying plant, bunkers, &c., £590.
Underfeed Stoker Co., Ltd.—Stoker, £222.
Matthews & Yates, Ltd.—Forced and induced draught plant, £334.
Coal for the electricity works.—James & Emmanuel, Ltd. (3,250 tons); Partridge, Jones & Co. (3,250 tons); and Stephenson, Clarke & Co. (6,000 tons).

Shipley.—The U.D.C. has accepted the tender of the Western Electric Co. for high-pressure cables subject to a guarantee as to the maintenance for five years, in preference to a lower tender for Continental cable. The Council has also accepted the tender of Messrs. Sutton & Co. for cable ducts, at £645 ; and that of the General Electric Co. for machinery for Dockfield Works, at £1,046.

Sunderland.—The T.C. on Wednesday accepted the following tenders recommended by the Electricity and Lighting Committee :—

H. E. Pitt.—Air shaft for Hylton Road generating station.
Cox-Walkers, Ltd.—Regulator for turbine.
Falkirk Iron Co.—Brackets for arc lamp.
Drake & Gorham.—Cast-iron bases.
Ferranti, Ltd.—Meters.

Torquay.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a turbo-alternator, &c., at £5,458.

Worthing.—Acting on the recommendation of the Electricity Committee, the T.C. has accepted the tender of Messrs. F. A. Greene (London) for switchboard extensions, at £85, and that of the Callender's Cable and Construction Co., Ltd., for cable work, at £1,046. The following were the other tenders received :—

SWITCHBOARD EXTENSIONS.	
Cox-Walkers, Ltd.	£90
Switchgear & Cowans	101
CABLE WORK.	
Western Electric Co.	£1,106
Johnson & Phillips, Ltd.	1,118
British Insulated and Helsby Cables, Ltd.	1,120
W. T. Henley's Telegraph Works, Ltd.	1,121
W. T. Glover & Co., Ltd.	1,126
Siemens Bros. & Co., Ltd.	1,149

FORTHCOMING EVENTS.

Institution of Post Office Electrical Engineers (Metropolitan Centre). Monday, October 14th. At 6 p.m. At the I.E.E. Paper on "Correct Time," by Mr. R. Myles Hook.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 12th. At 2 p.m. At the Wood Memorial Hall, Newcastle. Papers on "The Ignition of Coal-Gas and Methane by Momentary Electric Arcs," by Prof. W. M. Thornton, and "Electrically-Driven Winding Engines in South Africa," by Mr. A. W. Brown.

Electro-Harmonic Society.—Friday, October 18th. At the King's Hall, Holborn Restaurant. Smoking concert.

Engineering and Machinery Exhibition.—At Olympia. Daily to October 26th.

NOTES.

The 'Bus and the Road: A Hackney Report.—Mr. Norman Scorgie, the borough engineer, in a report to the Works and General Purposes Committee of the B.C., deals with the extra cost of maintenance of roads within the borough since the advent of motor traffic. Dealing with seven typical wood-paved roads, constructed between 1897 and 1903, he finds that the total cost of maintenance during 1906-9, was £258 ; 1909-12, £3,141 ; and for the period April 1st to August 31st, 1912, £813. Statistics bearing on five roads in the borough show, as an average of two days' record, that the 'buses varied from 724 to 1,346 in the period 8 a.m. to 10 p.m., and other mechanically-propelled vehicles varied similarly from 270 to 509. Eight 'bus services traverse the borough, and four have termini in the borough. Mr. Scorgie says that such extensive services, coupled with the other traffic, must continue to have a very injurious effect on the roads; in nearly every case where repairs have been found necessary by reason of sinkages, it has been due not to surface wear, but to disintegration of the concrete foundations. Considerable extra expenditure was incurred in repairing macadam roads in the same way. Mr. Scorgie deals with the question of the accumulated petrol tax, pointing out the unfair treatment of the London Councils in its appropriation. He estimates that 2,202,520 'bus-miles per annum are run in the borough, which at ·3d. per 'bus-mile (equal to the tax), represents £2,750 per annum, derived from vehicles there, which should go towards the repair of roads in the borough.

Indentures Cancelled.—Messrs. D. Napier & Son, Ltd., of Acton Vale, at Acton Petty Sessions on October 4th, summoned Mr. R. J. Hammond, of Regent's Park, and his son, Ernest R. G. Hammond, the first named as the person liable under an indenture of apprenticeship for the good conduct of his son, and the latter as the party with whom a dispute had arisen.

Mr. Curtis Bennett, barrister, remarking that the summonses were a little out of the ordinary, said that the Bench could order the payment of damages, or rescind the contract entered into. The indenture was executed in April, 1909, the father being bound for the good behaviour of his son, who undertook diligently to serve the complainants. For a considerable period he worked quite well, and no fault could be found, but for some little time now he had neglected his work. In the first year he received 9s. a week of 54 hours, and in the fourth 16s. It was also open to apprentices to increase those amounts by piecework. From July of last year the son had not earned 16s. a week, and there had been a loss of over £14 on his work. The father was written to, and he saw Mr. Schofield, the firm's accountant, and subsequently, as no improvement was made, it was decided to bring the case to the notice of the Bench. There was no question whatever as to the son's ability, but evidently he had made up his mind to do as little as he could.

Evidence was then called.

Mr. Schofield said that on the average, apprentices could earn about 40 per cent. extra on their wages.

Hammond, jun., said he did not agree with this statement.

Mr. Schofield replied that some did earn less ; that was about 2 per cent. of the total number of apprentices—over 200. There was no other apprentice who had acted like Hammond.

Wm. Sugden, demonstrator, said that Hammond took a long time over his work ; and John Rhodes, foreman, said he was told by defendant that he did not intend following the trade when his time had expired.

Defendant alleged that he was neglected, and had to pick up what he could. Certain work he was not shown how to do.

Alderman Geo. Wright, J.P., chairman of the Bench, said that defendant's conduct had been very bad indeed. He had, moreover, acted very foolishly in his own interests, as with a satisfactory record from a firm of such high standing as Napier & Son, he would have been able to get a job anywhere. The indenture would be cancelled, and as no damages were asked for, the summons against the father would be dismissed.

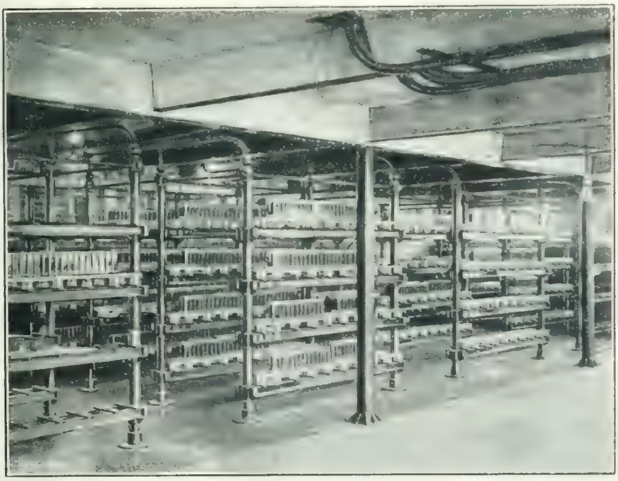
Lightning Conductors for Trees.—It has recently been suggested that lightning conductors should be fitted to trees, if not to all those of timber value, at least to those which by their beauty or rarity deserve preservation. The conductor should consist of a simple galvanised iron, or preferably copper, wire of about ¼ in. diameter, carried from a branch in the upper part of the tree down the trunk, and after encircling the latter two or three times, driven into the ground. Special protection would thus, it is claimed, be given to the trunk, which is usually the seat of vital injury ; the spiral turns allow automatically for the growth of the tree, and thus the conductor, which is cheap to install, requires negligible maintenance. We may point out, however, that the spiral round the trunk would have a detrimental effect, as its inductance would compel the lightning to leave the wire. A better plan would be to bend the wire in a ziz-zag alongside the trunk. It is necessary to ensure thoroughly reliable contact between the earth and the lower part of the conductor. The latter should be carried away from buildings or roads and should terminate in a metal plate buried in damp soil. In the case of trees near buildings or in spots frequented by man or animals, a larger conductor section is desirable, and special care must be taken to ensure permanently efficient earthing. It should be remembered that the most severe storms will very probably occur when the ground is parched by a previous drought.

(*Continued on page* 585.)

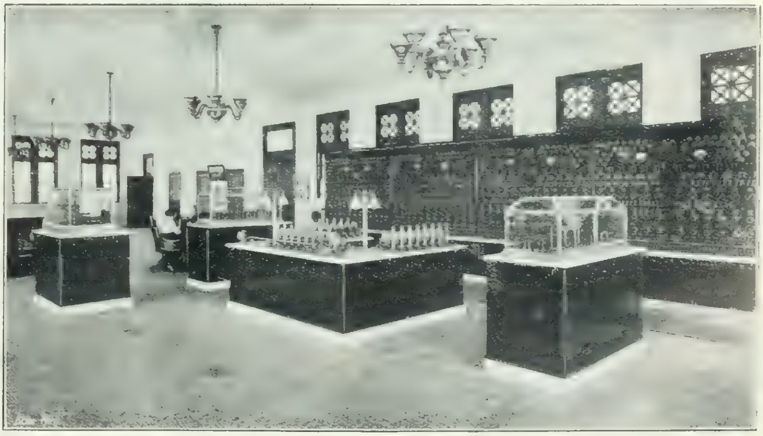
A MODEL FIRE-ALARM STATION.

A fire-alarm central station which is a model of construction, efficiency and architectural beauty has been installed in Oakland, California, where it occupies space in one of the local parks. The building itself is an ornament to the city, a low, one-story edifice with a deep basement, of a severely classic design. It is built of a creamy Utah sandstone, with metal doors and window frames, concrete roofs and floors and a wainscot of Vermont marble. Thus it will be observed that it is fireproof, and therefore the city is not in danger of being left without protection by reason of a conflagration in its fire-alarm department. Formerly this was not the case, for the system was installed in a loft over an engine house, and it would have been a very serious matter for the city if that wooden building had happened to catch fire.

An interesting fact in connection with the equipment of this station is that the electrical apparatus was installed by the Electrical Department of Oakland, under the supervision of the city electrician, George R. Babcock. This was not only a guarantee that the work would be properly and efficiently done, but it resulted in a thorough familiarity on the part of the department's employés with the delicate and intricate mechanism, so that in making future changes or repairs, no outside assistance would be required.


Batteries Installed in the Basement.

With the population of the city approaching the 200,000 mark, and with prospect of its going far beyond that, as western cities have a habit of expanding rapidly, the station was designed to admit of additions and changes without altering the building or existing cable systems.


Receiving and Registering Instruments, Oakland Fire-Alarm Station.

A roomy and well-lighted workshop occupies about a third of the main floor, which is a saving of both money and time to the city, and in the case of emergency repair work, is invaluable.

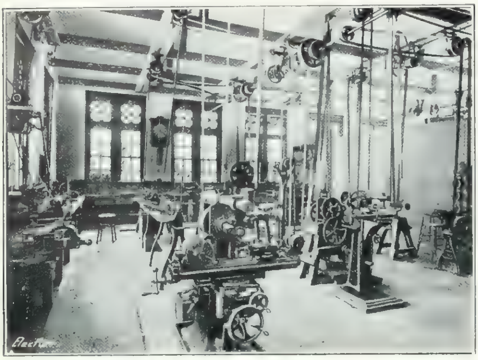
The Oakland Central Fire-Alarm Station.

Here may be found the equipment of a modern machine shop with shaping machines, drill presses, lathes, emery wheels and milling machines, and the department is able to turn out such complex devices for its needs as automatic lighting switches, police boxes, fire boxes, tape registers, horse releases, &c., with the assurance that they are properly constructed.

The basement is occupied by the storage battery which is mounted on a system of metal racks. Both glass and porcelain insulation is provided. All the wiring is in conduit, including wires from battery to board, and shows only at the battery terminals. The basement floor is provided with trap doors so that any part of the room may be reached from any other part without cutting the floors; this is to provide for changes in the conduit system which may be needed in future years.

The large and attractive main room has an indirect system of illumination, the last word in electric lighting; and as the walls, ceiling and floors are white or light in tone, the reflected rays are diffused and softened, giving ample light without glare.

In this room are the delicate and complicated instruments for receiving and registering the alarms. The fire alarm equipment, as described in a report by the city electrician, consists of four 12-circuit main line storage battery slate-base panels, mounted on steel frames, and so wired that the office may be operated either manually or automatically. "When automatically operated, two repeaters take up the alarm from the fire box and transmit it to the engine houses through gong lines. The latter are connected in series through each repeater, the operating table, the manual transmitter and the gong panel to the engine houses.


Workshop, Oakland Fire-Alarm Station.

"For manual operation both the box and the gong lines are brought to the relay and tape registering table shown in the illustration. Here the box circuits are connected to the closed-circuit tape machines and relays. Blinker lights are provided to flash their warning to the operator should his attention be distracted from any cause, and a telegraph key permits him to signal on the box lines whenever that becomes necessary. The gong lines are also connected with keys on this table. One line passes through a master tape and time-registering machine, which not only punches the number of the alarm, but also at the same time records the time of sending the alarm to the engine houses. When the apparatus is to be operated by hand, the automatic repeaters are switched off and the gong lines are operated either through the manual transmitter or the keys on the relay and tape-register table. In addition to the regular gong lines, high speed tapper lines are provided, to be used principally for reporting engines out or returned to service, and they are also used to signal fires. A two-dial, four-plate manual transmitter with which both gong and tapper lines are connected, gives perfect control of this service. Thus the engine houses may be signalled by the repeater, by the keys on the table, or by the manual transmitter.

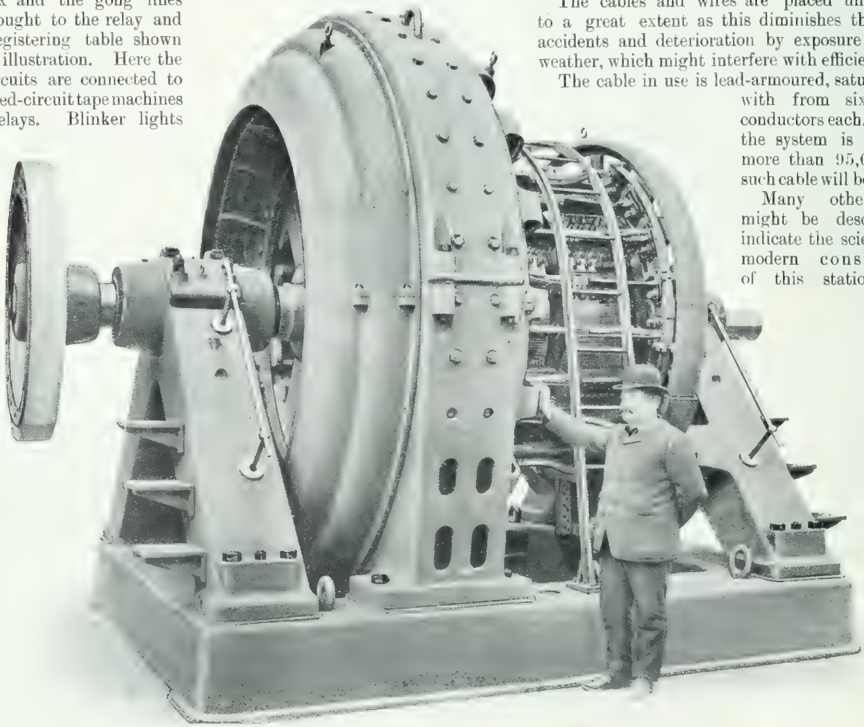
"The use of the tapper lines is further seen in the operation at the engine houses. The alarm, whether sent out automatically or manually, is there received first on the tapper line at a high rate of speed as a preliminary warning and registered on a tape, and is followed closely by the alarm on the gong line given much more slowly. Companies that are not to respond to an alarm signalled by the tapper shut off the gong line, and all the subsidiary apparatus, so that the sleeping men and the horses may not be unnecessarily disturbed, but the man on watch stands ready to get a possible second or third alarm that then must sound on the gong and send the company out."

By use of the manual system it is possible to transmit the alarms rapidly to the central office and thence to the engine houses, keeping the lines clear for following calls, which in a city of considerable size often come in rapid sequence.

A private exchange telephone board of large capacity is also in operation to handle the alarms sent in by 'phone, and this is connected with the lines of both the local companies. It is equipped with red lamps which flash out to call the operator's attention.

The cables and wires are placed underground to a great extent as this diminishes the risk of accidents and deterioration by exposure to rough weather, which might interfere with efficient service. The cable in use is lead-armoured, saturated core with from six to 180 conductors each, and when the system is completed more than 95,000 ft. of such cable will be installed.

Many other details might be described to indicate the scientific and modern construction of this station, which seems to have been planned with unusual forethought and skill, and which is remarkable not only in being adequate for the present needs but for the ease with which its capacity may be increased to meet the expansion of the rapidly growing city.


A Large Oerlikon Direct-Current Generator for Electro-Chemical Work (page 581).

LARGE DIRECT-CURRENT GENERATORS FOR ELECTROCHEMICAL PURPOSES.

[By our Berlin Correspondent.]

The advantageous results obtained in connection with their machinery induced the Aluminium Industrie, Ltd., of Neuhausen, to entrust the Oerlikon Machine Works with the construction of two large direct-current generators intended for an extension of their works at Chippis (Valais). These machines, by their output, speed and dimensions, are among the most remarkable direct-current generators ever constructed.

The three generators were designed to meet the following requirements:—

Normal output, 2,650 kw.; power consumption with normal operation, 3,850 h.p.; output, 7,800 amperes at 340 volts, and 300 r.p.m.

The speed was determined by the water head existing at the place of installation; the generators were further to comply with the following conditions:—

1. A permanent overload capacity of 3,000 kw.
2. An overload capacity of 25 per cent. during two hours, of which 10 per cent. corresponds to the pressure and 15 per cent. to the current.
3. An overload capacity of 50 per cent. during half an hour, 10 to 15 per cent. corresponding to the pressure and 40 to 35 per cent. to the current.
4. An increase in the speed to 1·8 times its normal value (540 r.p.m.), the strain on the material not exceeding half the elastic limit.
5. A guaranteed efficiency of 94·5 per cent. and 93 per cent., as determined from measurements of the various losses, at full and half load respectively.

The maximum increase in temperature on full load, with day and night operation, was fixed at 45° C.

Actual tests have shown all these requirements to be complied with. These machines seem to be not only the first ever designed for the relatively high speed of 300 r.p.m., with the outputs and current stated, but the largest, as far as their output is concerned, of any machines so far constructed for electrochemical purposes. This is the more remarkable seeing that the current is collected from a single commutator.

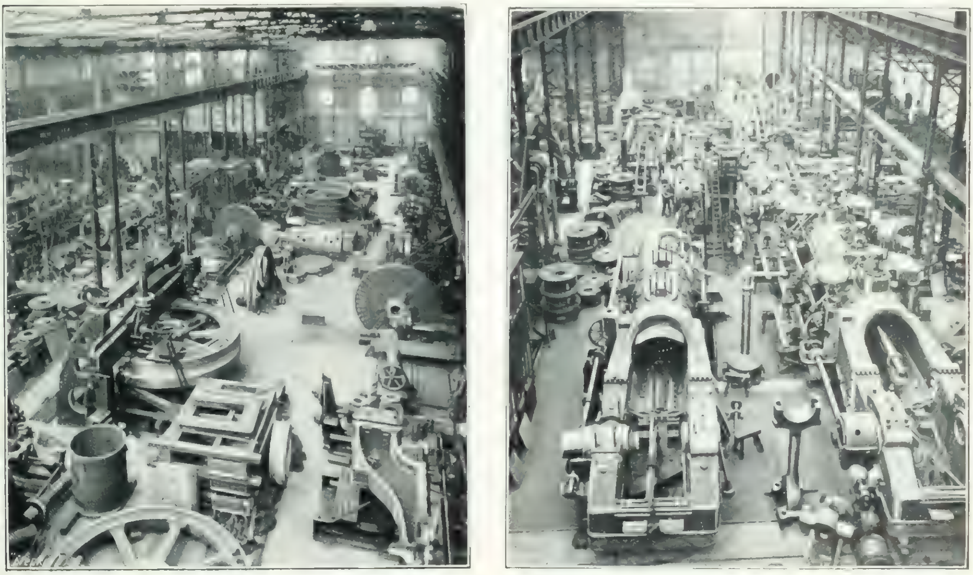
Easy access from all sides, especially to the lower part of the commutator and the corresponding brushes, is ensured by the high position of the shaft; a ladder spanning the collector and insulated from the iron frame of the machine also makes the upper part of the collector readily accessible. Current is collected by carbon brushes which, like the brush-holders, are, even during operation, readily exchangeable separately and independently of one another.

The generators are designed with shunt windings for self-excitation, and have reversing poles excited by the main current. Commutation is, of course, effected without sparking at all pressures and loads, without any shifting of the brushes.

ENGLISH GAS-ENGINE PLANT FOR JAPAN.

Some time ago the Lilleshall Co., of Oakengates, builders of the well-known Nuremberg gas engine in this country, secured an important contract to supply the Japanese Government with four 1,500-kw. engines of this type, which are coupled to Dick, Kerr alternators, and supplied with gas from Mond producer plant made by the Power Gas Corporation.

This plant is installed in a power station at Kamata, and will generate energy at 11,000 volts and 25 cycles for use on the electric railway between Tokio and Yokohama.



Large Gas-Engines under Construction in the Shops of the Lilleshall Co.

The gas engines are of the tandem double-acting type, with cylinders 47¼ in. in diameter and 51⅛ in. stroke. The engines will run at 94 r.p.m., and each will develop about 2,130 b.h.p., which is slightly under their normal rating of 2,400 b.h.p. at 100 r.p.m.

The total weight of each engine and fly-wheel is 400 tons, the fly-wheel with magnet poles weighing 100 tons.

Each cylinder weighs about 25 tons and the bed-plate 55 tons, the latter being made in two parts for the sake of transport from the coast to the place of delivery.

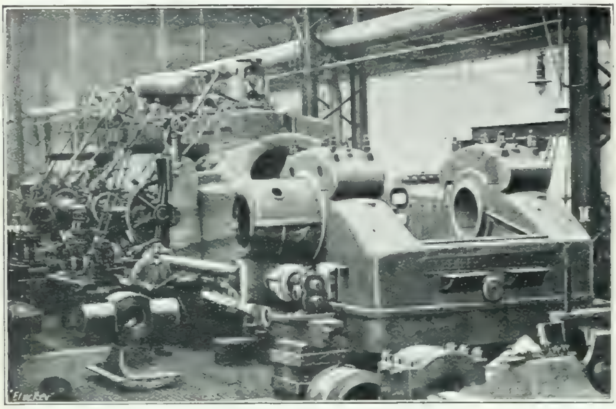
The cylinders are of cast-iron and of symmetrical shape, thus lessening the risk of unequal stresses in the castings. Large cooling water spaces are provided, and are arranged so that the coldest water flows past the hottest part of the cylinder. The inlet valves are above and the exhaust valves below the cylinders, the exhaust valve chests and cylinder covers being water-cooled, while the latter can be removed independently for internal inspection of the cylinders or valves.

The pistons are water-cooled through hollow crucible steel piston rods, pistons and rods being carried by three crossheads which take the wear off the cylinders, &c. The glands are fitted with floating metallic packing and lubricated by means of oil presses.

The valve gear is very simple, one eccentric operating each set of inlet, mixing and exhaust valves at each end of the cylinder, while the inlet valve is controlled by the governor, giving both varying quantity and quality of gas.

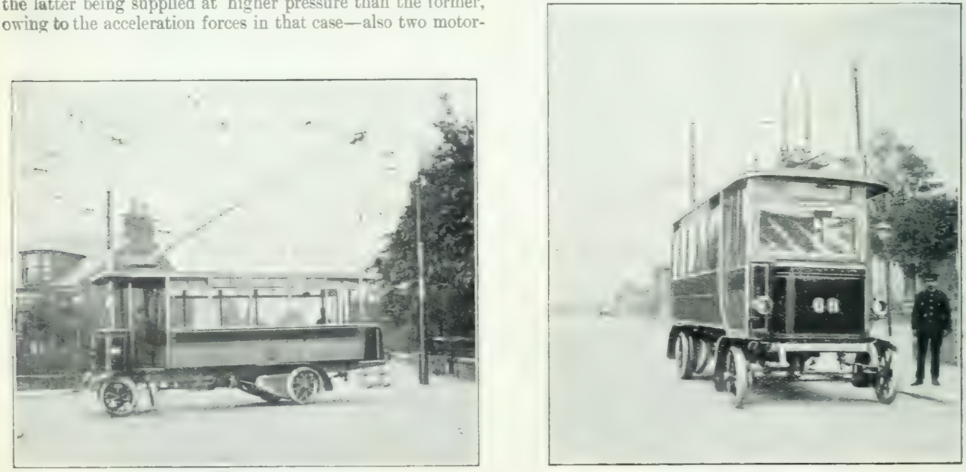
Forced lubrication of all outside parts is provided, and low-tension accumulator ignition, while the engines are started with compressed air.

The fly-wheels are specially built with a soft steel ring cast into the rim for electrical reasons, to take the magnetic flux between the poles. Each engine draws its gas from a large receiver coupled to the principal gas main, while it also exhausts through a tubular boiler which provides steam for working the producer plant.



Large Gas Engine in Course of Erection.

At one end of the station certain auxiliaries are provided, these including four electrically-driven pumps for cylinder cooling water, two similar pumps for piston cooling water—the latter being supplied at higher pressure than the former, owing to the acceleration forces in that case—also two motor-driven air compressors supplying air at 300 lb. pressure to an air receiver near each engine, for starting. The engine room is spanned by an electrically-driven 40-ton travelling crane.



Railless Electric Traction in Dundee: View of Cars and Overhead Construction.

The engines operate in conjunction with an ammonia recovery plant, and the sale of the ammonia sulphate will nearly cover the cost of the coal burned.

The engines are undoubtedly much larger than anything yet made in this country, especially when it is considered that the whole power passes through one crank.

Our various views show the engines in course of construction at the Lilleshall Co.'s Works, and give some idea of the massive proportions attained. We are indebted to the above company for enabling us to give this short description of the plant.

RAILLESS ELECTRIC TRACTION IN DUNDEE.

Dundee was one of the first cities to investigate the possibilities of railless electric traction. The Town Council sent a deputation to the Continent to investigate the working of the system, and for the past three or four years it has been under consideration, finally taking definite form with the opening of Clepington Road route.

Dundee has secured the distinction of being the first city north of the Border to adopt the system, Leeds and Bradford having forestalled it in the South.

Col. von Donop inspected the route on September 3rd; after commenting favourably on the whole equipment, the Colonel remarked that this was the first occasion on which he had been called upon to inspect a railless trolley system. Mr. A. P. Trotter, of the B.O.T., accompanied by Mr. H. Richardson, the city electrical engineer, inspected the overhead equipment, and the route was opened for general traffic on the 5th. The smooth running and comfort of the cars have secured their present and future success. Clepington Road, where the system has been installed, is a very important district in the north of the town, joining up the Fairmuir and Forfar Road tramway sections; the length of route is 2,110 yards, and, with the exception of one or two sudden bends, the road is fairly straight.

The Corporation Electricity Department erected the overhead equipment, which is carried out on the span-wire system, two sets of positive and negative wires running the whole length of the route.

The 00 gauge grooved trolley wires are held in position by mechanical ears, and line hangers of the twin straight gun-metal type are used, while for curves, single and double pull-offs are fitted.

The span wires are held in position by Brooklyn strains attached to straps on the poles. Finials are the only ornaments on the latter, bases and collars having been omitted. In some parts of the route, rosettes are attached to suitable buildings to secure the span wires.

The average distance between the poles is 105 ft. Where telephone wires cross the road, guard wires have been erected. At three points on the route section boxes have been placed, each fitted with positive and negative switches, and a lightning arrester on the line wire.

The two cars at present running were supplied by the R.E.T. Construction Co., London, and they are designed to carry 28 passengers. The entrance to the cars is at the back on the near side, and glass screens are fitted to both ends, to protect the driver and conductor during stormy weather.

The chassis were constructed by Messrs. Milne, Voss & Co., Birkenhead, and the electrical equipment, consisting of two 20-H.P. series motors, a special controller made for this class of traction, and the usual circuit-breakers, was all supplied by Messrs. Siemens Bros., Ltd. The motors are connected to a countershaft by worm gearing, and from the countershaft there is a chain drive to the rear wheels.

Two brakes are fitted, one a foot brake which acts on the countershaft, the other a hand brake fitted on the hubs of the back wheels.

The time occupied on the journey is six minutes, at an average speed of 14 miles per hour.

To enable the cars to travel on the ordinary tramway track, one of the trolley arms is held from the overhead wires by a bracket, and a trailer, which is used to connect the return wire to the rail, is lowered from the conductor's platform. The trailer is furnished with a small wheel which fits into the groove of the rail, and two massive copper blocks are provided to ensure proper contact.

Our views show the general appearance of the cars, and curves on the overhead equipment.

THE ENGINEERING EXHIBITION AT OLYMPIA.

There is now running at Olympia a very large engineering and machinery exhibition, which, while it only here and there directly represents electrical manufacturing, is undoubtedly worthy of a visit from all of our readers who can spare the time. It will appeal particularly to technical men who desire to keep themselves posted with regard to the latest progress in machine tools and some other departments of engineering, and we have no doubt it will attract many buyers, both home and foreign, between now and October 26th—the closing date. One of the outstanding features of the Exhibition is the very practical illustration that it affords of the advantages of co-operative effort among exhibitors in securing an effective working demonstration. This result has been secured by the display being organised by the Machine Tool and Engineering Association, with Messrs. C. H. Luke and F. W. Bridges as organising managers. It is claimed by these gentlemen that the collection of machine tools represents "the finest specialised machinery display ever held in this country." Whether that be so or no, it is a fact that a very large portion of the building is occupied by machine tools of all makes and types which are exhibited performing their manifold operations, the machines being representative of the latest stages of development of design. In addition to these, there is a whole host of mechanical engineering, and some electrical and general exhibits, the number of exhibitors all told being about 250.

The prospect from the gallery is certainly more pleasing than we have observed at some other exhibitions in the same building, for in the main area there is a notable absence of built-up offices and high partitions. Although the number of purely electrical exhibits is naturally very small—the electrical trade had its own big effort last year, and few of our firms were ready for another at the same place so soon—electricity plays so essential a part in connection with modern machine-tool engineering, that it is not surprising to find the electric motor rendering unfailing service here, there and everywhere. In order to give a better idea of the extent to which the machinery is electrically driven, we may mention that the British Thomson-Houston Co., Ltd., of Rugby, alone have supplied to exhibitors no less than 85 of their motors and control panels for driving machine tools, some of which are being operated by silent "Fabroil" pinions, where absence of noise is a consideration. These pinions are self-lubricating and impervious to oil or water, and are stated to be unaffected by rats or other vermin. The following is a list of the firms at whose stands these motors can be seen by the visitor :—

Alldays & Onions; Archdale & Co.; Bailey & Co.; Colchester Lathe Co.; Consolidated Pneumatic Tool Co.; Darling & Sellers, Ltd.; Hoffmann Manufacturing Co.; Smith & Coventry; H. W. Ward & Co.; Holbrook & Sons; S. N. Bray, Ltd.; H. [illegible] & Co.; Humpage, Thompson & Hardy; Burton, Griffiths & Co.; The Judson Jackson Co.; Harper Sons & Bean; Coventry Chain Co.; Denham Engineering Co.; Frederick Pollard & Co., Ltd.; Cambridge Scientific Instrument Co.; Wadkin & Co.; J. W. Barnes; A. Herbert, Ltd.; Parkinson & Sons; Schuchardt & Schutte; Dickinson Machine Tool Co.; Redman & Son; Timbrell & Wright; Jones, Pollard & Shipman, Ltd.; Charles Churchill & Co.; Osborne and Co.; G. Richards & Co.; G. H. Alexander; Theodore Butler, Ltd.; E. G. Wrigley & Co.; Armfield & Co.; Mayer & Schmidt; The Carborundum Co., Ltd.; Broom & Wade, Ltd.; The Tormo Manufacturing Co.; The United Machine Tool Works.

There are several excellent exhibits of electrical instruments, to which we shall refer later, and here and there one comes across a stand with electric light fittings or lifting magnets and electromagnetic chucks, forced-draught and superheater plant, steam fittings, CO_2 recorders, friction clutches, small electric generators, water softeners, turbine plant, power hammers, castings, an electro-galvanising process, engine and other oils, pumping machinery, oxy-acetylene welding apparatus, and a great variety of engineering supplies and stores.

At the opening ceremony, which was performed on the afternoon of October 3rd, Earl Selborne, in his speech, made reference to the great importance of the prospective foreign markets to the British engineering manufacturer and to the necessity for nursing them; the competition of foreign firms, and the need to meet that competition by co-operation and efficient organisation on the part of British firms in order to ensure the world knowing the truth about our abilities. Earl Selborne was followed by Mr. J. M. Robertson, M.P., of the Board of Trade, who also dwelt upon the importance of rival firms in a particular trade co-operating in order to secure proper representation at international exhibitions.

Bonecourt Surface Combustion, Ltd., (Parliament Mansions, Victoria Street, London, S.W.).—One of the most interesting exhibits is that of the system of heating with gas developed by Prof. Bone and Mr. McCourt, which has already been described in our pages. Some examples of furnaces and stoves fired on this system are shown, and in the yard is a gas-fired boiler supplying steam to several of the exhibitors. The boiler is designed to evaporate 550 lb. of water per hour at 120 lb. pressure, and is supplied with gas and air by Sturtevant fans at a pressure of about 18 in. of water. The water level is controlled by a Crosby automatic feed regulator. The tubes of this boiler are about 3 in. in diameter, and are filled with small lumps of refractory material, which baffle the gases and ensure that they shall impart their heat to the boiler, the gross efficiency of which is stated to be no less than 95 per cent., and the net efficiency, after allowing for the driving of the fans, 92 per cent., without an economiser. Most of the transfer of heat takes place in the zone of active combustion at the front end of the tubes, and the result is an energetic longitudinal circulation of the water in the boiler; but the tubes show no undue wear at any part of their length. Tests made by an independent boiler expert on a boiler at the Skinningrove Iron Works, capable of evaporating about 4,000 lb. per hour, and fired with coke-oven gas, in July last, showed a net efficiency of over 90 per cent., although the boiler was not lagged. The condition of the combustion inside the boiler is indicated by a short section of tube containing refractory material, through which a small amount of the gas and air mixture is allowed to pass, the appearance of the white-hot lumps enabling the attendant to judge when the proper mixture is attained. This is the first occasion on which the system has been publicly exhibited.

Messrs. Hindle, Maitland & Co. (100, Deansgate, Manchester).—This firm show their patent electric press, suitable for pressures up to 30 tons and designed for baling goods, which has been fully described in our pages; we understand that a considerable number of these presses have been installed by some of the largest textile houses, superseding hydraulic presses, as they show a very large economy of energy. The press exhibited will bale 100 times, up to its full capacity, with one Board of Trade unit. Other exhibits are the Ensign electric fire, and Tinol paste solder. Messrs. Neville, Williams & Co. are the London agents for the press.

Eyre Smelting Co., Ltd. (Barden Road Works, Tonbridge).—At this stand are shown "Bamber's" non-encrusting zincs for primary cells, in a variety of shapes; an enormous number of these have been supplied to the Post Office, as well as other authorities. Their new "Household" zinc rods are exhibited. Anti-friction metals form the bulk of the exhibit.

The Hoffmann Manufacturing Co., Ltd., Chelmsford.—An exhibit of moving machinery running entirely on "Hoffmann" ball bearings is shown, as well as specimens of the various types of ball and roller bearings manufactured by the firm.

The machinery is driven by a 10-H.P. British Thomson-Houston D.C. motor, ventilated type, shunt wound. This is fitted with "Hoffmann" ball bearings; grease is used for lubricant, and therefore no trouble is experienced from excess of oil getting on the windings and commutator. Also it is impossible for the bearings to seize or to wear and drop the armature on the pole-pieces. When a motor is once charged with grease, it will run for many months, or even years, without attention.

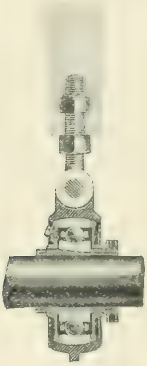


Fig. 1. Hoffmann Hanger (Section).

The motor drives a line of 2½-in. shafting running on "Hoffmann" ball-bearing hangers, of which we reproduce a section (fig. 1). Driven from this shaft is a 10-in. "Churchill" internal grinding machine, mounted on "Hoffmann" ball bearings and running at the extremely high speed of 30,000 R.P.M. There is no difficulty in running it continuously at this speed, and as the wear in ball bearings is practically nil, the machine keeps its accuracy unimpaired, and the micrometer adjustment to the slide on which the grinding spindle is mounted gives accurate readings to ·00025 in. diameter of work.

Driven from the same shafting through a countershaft (also running on "Hoffmann" ball bearings) is a "Churchill" vertical surface-grinding machine mounted throughout on "Hoffmann" ball bearings. As this machine is some 12 ft. overall in length, it is capable of dealing with the heaviest work, and also, if desired, work of comparatively small size. A magnetic chuck 36 in. × 10 in. is used with this machine.

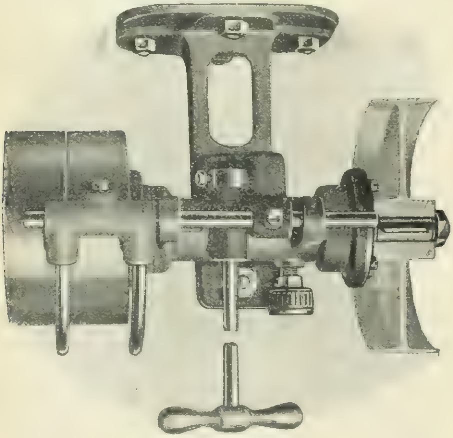


Fig. 2.—Hoffmann Ball-Bearing Countershaft.

Various models are shown to illustrate the free running of ball bearings, as well as the countershaft which is illustrated herewith. This is very easy to erect, as there is only one bracket to fix. The main spindle is mounted on two rows of ball bearings, and the loose pulley on another. The belt-shifting gear is automatically locked in both positions.

W. Silversteen & Co., 147, Cannon Street, E.C.—This exhibit comprises various types of electromagnets. A magnet of rectangular shape, 3 ft. long × 8 in. wide × 8 in. high, is shown, capable of lifting iron blocks up to 36 cwt. for loading and transporting pig-iron, bars, tubes, &c. The power consumed in exciting the magnet is small in comparison with the load, owing to the advantageous arrangement and good utilisation of the active materal, a low tare resulting therefrom as well. The power consumption is 400 watts, and the tare 4¾ cwt. The starting is effected by a controller, fitted with a magnetic blow-out. The wiring is arranged in such a way that the magnet is first excited with part of the standard voltage only; then the lifting commences, and the whole voltage is put on. When stopping, the magnets are depolarised to ensure a quick and safe release of the load. This is of importance when scrap and turnings are being handled, as otherwise they remain in position owing to the remanent magnetism. To take up the slack in the electric cables when the load is being lifted, a cable drum is provided, with automatic winding-up gear.

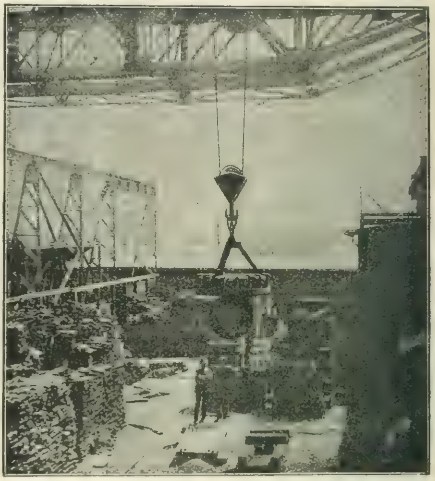


Fig. 3.—Silversteen Lifting Electromagnet in Use.

For separating iron parts from any raw material, such as palm kernels, cotton, flour, cocoa beans, &c., or from foundry sand, brass turnings and waste of any kind, electromagnetic separators are now being supplied instead of the permanent magnets hitherto in use. A machine is exhibited which is capable of treating about 5 to 6 cwt. of turnings per hour. The driving power required is ⅙ H.P., and 110 watts is used for exciting the magnets. The magnetic drum is 3 in. in diameter × 9½ in. long, running at 350 R.P.M., whilst the driving shaft runs at 120 revolutions. A feeding hopper and long shaker are provided for the filling and distribution of the material to be treated. A starter is fixed to the machine. These machines are in use in various factories.

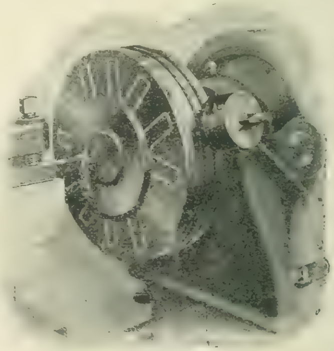


Fig. 4.—Electromagnetic Chuck.

A number of rectangular chucks for milling, planing, shaping, surface grinding machines, &c., are shown, also circular ones for ordinary and horizontal lathes, grinders, &c. They represent a great saving in labour in setting up work on machine tools, and should be of great use for repetition work. The circular chucks are made in sizes from 4 to 59 in. in diameter (fig 4), and the rectangular ones from 10 in. × 5½ in. up to 63 in. × 16 in. Owing to the stronger magnetic action required, all sizes are made of wrought, instead of cast iron. A depolariser for removing all traces of magnetism from iron or steel, a hand magnet of 3½ in. diameter to lift 66 lb. with about 20 watts, and an eye magnet for hospitals and factories are also on show

The following are some of the gallery exhibits :—

MESSRS. MOSSES & MITCHELL, of 122-124, Golden Lane, London, E.C., show a representative collection of their vulcanised fibre goods for electrical and many other purposes, "Moorit" steam jointing, ebonite sheets, rods, &c., the "M. & M." bonded asbestos brake lining, Blake's insulated staples, and—what will probably interest many of our readers personally—a line of fibre golf clubs.

THE VACUUM OIL CO., LTD., of Caxton House, London, S.W., exhibit their various lubricating oils for steam, gas and Diesel engines, turbines, transformers and switches; also a number of lubricators, including a forced feed automatic one for cylinder lubrication.

PRICE'S CO., LTD., of Belmont Works, Battersea, S.W., also show lubricants for steam engines and turbines, oil engines and electrical machinery, as well as insulating oils for transformers, oil-break switches, &c. Other exhibits illustrate the various stages in oil production and refining, and apparatus for oil-testing.

MESSRS. EDGAR VAUGHAN & CO., LTD., Corporation Street Birmingham, also have close at hand a display of oils for steam, gas engine and motor service.

The "Comptometer" adding and calculating machine will be found at the stand of the Felt & Tarrant Manufacturing Co. (Bank Buildings, W.C.); several types of silent chains, roller and block chains, and chain sprockets are exhibited by Messrs. Brampton Bros., Ltd., of Oliver Street Works, Birmingham; Messrs. Valite, Ltd., demonstrate their oxy-acetylene welding and cutting plants, and show acetylene lamps and lighting plants; the Efandem Co., Ltd., 83, Upper Thames Street, E.C., include among their exhibited lines the "T.E.C." patent spring terminals; jointings, packings and rubber sheetings and other cognate lines are exhibited by Messrs. James Walker & Co., of Garford Street, West India Dock Road, E.; Mr. H. C. Slingsby, of Old Street, E.C., is once again present with his patent trucks and ladders, and the L.E.B. Engineering Co., Ltd., of 68, Pentonville Road, London, N., have on view a model of a new system of fixing tubes in a steam surface condenser, and a new system of piston rings especially adapted to internal combustion engines, and so on

There is a large instructive and interesting collection of engineering work done by the students at the Polytechnic and Technical Institutes controlled by the L.C.C. Education Department, and the Board of Trade (Exhibitions Branch), has with commendable enterprise put on view a model (one-hundredth full size) of the British Pavilion at the Ghent International Exhibition of 1913. It is to be hoped that a study of this model and of the large and useful plans on the wall, together with the courteous and convincing arguments of the gentlemen in charge thereof, will so impress the minds of exhibitors and other visitors at the present Exhibition, that the British machinery display at Ghent will be a complete success.

THE LINOLITE CO., LTD., 25, Victoria Street, S.W., effectively show their "Tubolite" system of electric lighting, with aluminium reflectors, for picture, show-case and other service, and on the same stand they also exhibit the Woodhouse patent system of steel casing for electrical conductors, with which our readers are already familiar.

MESSRS. JOHN DUGDELL & CO of Failsworth have a good collection of their movable electric lighting fittings and accessories for all classes of service, and adjustable for almost every conceivable position. New adaptations of these fittings are continually being introduced by the firm, and we were interested in several of these applied to brackets, pendants, standards and special work. We may mention the following:—The No. 235, 7-ft. extensible floor standard for car-sheds, erecting shops, &c.—this fitting is supplied also in polished brass, bronze, nickel, &c., for domestic service; and No. 313, a dining-room pendant fitting which can be either raised or lowered or extended lengthwise whichever way the dining table has to be lengthened. We understand that the firm have experienced a great success with their speciality, and the gratifying reception accorded to them in the foreign markets has encouraged Messrs. Dugdell to place their fittings on exhibition at the Boston electric show now in progress.

(To be continued.)

NOTES.

(*Continued from page 578.*)

The Electro-Harmonic Society.—This Society opens its twenty-seventh season on Friday next, October 18th, with a smoking concert in the King's Hall, Holborn Restaurant. The dates of other concerts are as under:

Monday, November 18th, ladies' night.
Friday, December 13th, smoking concert.
Friday, January 10th, 1913, smoking concert.
Tuesday, February 25th, ladies' night.
Friday, April 4th, smoking concert.

Rectifier for Tramway Work.—The Canadian *Electrical News* recently mentioned that Dr. Cooper Hewitt had developed a mercury vapour rectifier capable of supplying energy to tramway cars. With this new apparatus an output of 700 amperes has been obtained as compared with 50 with the old type.

Red Tape, or High Finance?—An extraordinary procedure has been adopted by the Corporation of Liverpool, in connection with what is called "the Current Official List of Corporation Contractors." A circular has been issued to the contracting firms which are at present on the list, informing them that the list will expire at the end of this month, and that "the name of any firm on the present list can only be inserted in the list for the ensuing 12 months upon payment of a registration fee of 5s." before October 31st.

We have, unfortunately, had occasion to place on record many instances of contemptible meanness on the part of local authorities towards their own employés—their electrical engineers in particular—but now, it seems the scope of their operations is to be extended; extortions are to be levied upon those who, though beyond the control of the Corporation, can yet be taxed on the plea of registration.

The fee in itself is of small amount at present, but these items always tend to increase, and who can say what value the Corporation of Liverpool will eventually attach to the privilege of admission to the official list, and of taxation? And what will this tax upon industry amount to when we multiply the average fee by the number of manufacturers and also by the number of municipal authorities? The principle is, in our opinion, wholly wrong, and we are surprised to find that it was adopted by a resolution of the Council. The practice savours rather of the methods of a pettifogging solicitor, or of a Chancellor of the Exchequer, than of the authority controlling one of our most progressive and enlightened centres of industry, and we trust that this unworthy and undignified resolution will soon be expunged from its honourable records.

Imports and Exports in September.—The trade returns issued this week show that there was a continuance of the increased activity in our foreign trade during last month, whereas in September last year certain labour struggles were still in progress. Of course it has to be remembered that the figures include manufactures which were "held up" during the labour trouble at the docks, also that in many cases prices had been raised. Another fact to be borne in mind, however, is that this year September had one working day less than the corresponding month of 1911. The electrical and machinery figures, so far as available, are most satisfactory, being as follows:—

Imports.	*Sept., 1912.*	*Inc. or dec.*
Electrical goods and apparatus, other than machinery and telegraph and telephone wire...	£114,569	Dec. £10,859
Machinery	£489,012	Inc. £62,033

For the nine months down to date, the total of electrical goods and apparatus is £1,036,476, showing an increase of £23,733, and that of machinery £4,995,829, showing an increase of £584,181.

Exports.	*Sept., 1912.*	*Inc. or dec.*
(*a*) Electrical goods and apparatus (as above)	£486,356	Inc. £277,024
(*b*) Machinery	£2,874,666	Inc. £756,186

For the nine months the totals for these two classes of exports show that the advances have been (*a*) £1,207,918, and (*b*) £1,520,440 respectively. The total for (*a*) has been £3,198,770.

Fatalities.—An inquest was held at Guisborough on Friday last upon the body of a 16-year old lad named Tom Welburn, who was killed in the Spawood Mine the previous day. John Morley, a youth, stated that shortly after deceased had passed him going to his work the electric lights went out, and he heard a cry. Very soon afterwards he found Welburn lying with the broken end of an electric wire in his hand. Witness ran and switched off the current. Artificial respiration was tried without effect. Mr. Dent Oliver, chief electrician at the mine, said he went to the scene of the fatality two hours later and found one of the wires broken and the insulation of the other damaged. In his opinion deceased had taken hold of the wires and forcibly pressed them together, thus damaging the insulation. When that was done the live wires would come into contact and a short-circuit be established. The neutral wire was broken and the live wire insulation damaged. The wires were over 6 ft. above the roadway, and did not sag downwards. The wires were all properly insulated, and the boys had no right to touch them, though sometimes they played with the switches. The pressure was 250 volts. There had been no fall of roof which might damage the wires. In recording a verdict of "Accidental Death," the Coroner observed that it was the first fatal accident due to electricity which had occurred in the Cleveland mining centre.

On October 3rd the Liverpool Coroner held an inquest into the death of Paul Lyon, 39, labourer, who was killed in the controller house at Messrs. Bibby's extension in King Edward Street three days before. The man who was working for the building contractors was engaged in the concreting of the electric motor house. There was only about a foot of room between him and the electric lift, and it appears that the current which operated the lift was switched on, and deceased came in contact with the apparatus and received a shock at 220 volts, with fatal results. Mr. Thos. Davies, an expert witness, said the building was based on steel girders, and the conditions could scarcely have provided better conductors. The jury returned a verdict of "Accidental Death."

A correspondent states that a distressing fatality occurred on Monday morning at Messrs. Jones's Sawmills, Larbert, Stirlingshire. Overnight the storm had broken one of the overhead wires conveying current to the works, and on Monday morning a lad aged 15 years, named Thomas Hannah, was found dead under the wire.

Economy not Fraud.—A curious illustration of the economy resulting from the use of metallic-filament lamps was recently reported in the German Press. At the Criminal Court of Duisburg, an engineer a few weeks ago was accused of having tampered with electric meters, and of thus having, on behalf of his employer, cheated the local electricity works of several hundred marks. The evidence brought by the plaintiffs showed that there was an enormous reduction in the electricity bills rendered for the meter in question.

The accused engineer indignantly denied the charge, and stated that the large difference in the consumption was due to the installation of Osram lamps; in one year the amount of bills for energy was M. 587, while in the following year, after these lamps had been installed, the amount was reduced to M. 188. It was conclusively shown that Osram lamps effected a saving of at least 70 per cent., and the jury returned a verdict in favour of the defendant, with costs

Travelling Expenses to India.—In the City of London Court on Tuesday, Mr. E. C. Ives, of West Ealing, sued the Calcutta Electric Supply Corporation, Ltd., Salisbury House, London Wall, for £17 2s. 3d., the difference between first-class and second-class passage from India to London.—Mr. R. W. Turner appeared for the plaintiff and Mr. Roland Smith for the defendants.—It seemed that the plaintiff, a cable jointer, was engaged by the defendants to go to Calcutta in 1907 for five years at a salary of £200 a year, with increments, and he went. On his return he claimed to be entitled to first-class passage home; and as the defendants would only give him second-class passage, he now claimed the difference. His agreement provided that if he was ill and the engagement terminated during the five years he should have a second-class berth; but if he stayed for the full period he was then to have first-class accommodation.—Defendants said that was a clerical error on the part of their London office, and that the plaintiff had been paid £34 in full discharge (including second-class berth), which plaintiff had accepted.—Mr. Turner said that the cheque was accepted only on account, after warning the defendants.—Mr. Francis R. Reeves, defendants' secretary, said he had engaged many mechanics to go to India, but he had never heard of one of them going first class. A man like the plaintiff would be in a very uncomfortable position in the saloon of a first-class mail steamer. He recently sent a man out at £600 a year, who went second class. They were not defending the action because of the amount in dispute.—Judge Lumley Smith, K.C., thought that when commercial people like the defendants made mistakes they were generally held to them. The mistake was not mutual.—Judgment for the plaintiff with costs.

Clyde Diesel Engine Builders.—According to the *Standard*, the Burmeister & Wain Co. have acquired from Messrs. Harland & Wolfe the engine shops recently taken over with a shipyard which the latter purchased, and will build Diesel engines; the Beadmore engine is at present built at Dalmuir, Carel engines at Port-Glasgow, and F.I.A.T. engines at Greenock. It is also roported that an Admiralty order has been placed for a M.A.N. engined ship with another Clyde firm. It thus appears that five types of Diesel engines will shortly be built by local firms.

The Gas Campaign.—On Tuesday this week the British Commercial Gas Association met at Manchester, some 500 members being present at a reception by the Lord Mayor in the Town Hall. Early in the proceedings a touch of humour was introduced by Alderman Phillips, of Salford Gas Committee, who said they were not there merely as traders seeking a profit, but they had a nobler purpose; they were missionaries who were going to do their utmost to purify the atmosphere, and make the lives and homes of the people brighter than they were at present. They wanted to increase sunshine. Papers and discussions occupied the day, and late in the afternoon Prof. Vivian Lewes delivered his customary eulogium of gas as the exact opposite of what it is universally believed to be. The interest of the meeting to electrical engineers, however, lies mainly in the evidence it affords of the ability of the gas suppliers to get together, and to carry out a great co-operative effort, in the hope of stemming the flowing tide of electricity supply. The three great labours which the Association had undertaken, said the president, were publicity, sales organisation, and service development. The Association is carrying out its programme with admirable energy and efficiency, and we strongly recommend the suppliers of electricity to give close attention to its proceedings, which will have a material effect upon their own business unless they go and do likewise.

Re Newcastle Exhibition.—Referring to Mr. Potter's letter in our last issue regretting that the machines in the Laundry Section of the recent Exhibition at Newcastle were not heated by electricity as well as driven by electric motors, we are informed that Mr. Buckell took the matter up with Messrs. Eastman & Warne, who promised to do whatever was possible, they having an extensive experience in the equipment of electric laundries. Unfortunately, at present, most of the complete equipments are installed in public institutions, and on shipboard, where the voltage is 100 or thereabouts, and no machines for 240 volts were available. Since these machines have to be adjusted to run at certain definite temperatures, and the watts consumption is proportional to the square of the voltage, it is evident that the high-voltage loadings would have been very poor stock, and for this reason the proposition was found impracticable.

Mr. L. E. Buckell, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., writes, with regard to the concluding paragraph of the account of the exhibits in our issue of September 27th, stating that "it is quite incorrect to say that there were innumerable stands of interest to those concerned in the use of electricity in the works, and in its application to the industrial question. As a matter of fact, there were not more than three or four of such stands altogether in the whole exhibition, and the success of the exhibition, from the point of view of both the attendance of the public and the volume of business done by the exhibitors, may be traced entirely to the fact that exhibits of this nature were not encouraged, and that practically the whole of the exhibits were such as would be of considerable interest to the domestic user."

Educational Notes.—Mr. Stanley Parker Smith, D.Sc., Assoc.M.Inst.C.E., A.M.I.E.E., chief designer for the General Electric Co., Witton, has been appointed lecturer and instructor in dynamo design in the City and Guilds (Engineering) College, South Kensington, as successor to the late Mr. W. E. Robson. Dr. Smith took up his new duties on October 1st. These include ordinary third-year work in dynamo and motor design and electric traction, and post-graduate work on the design, construction, and manufacture of dynamo-electric machinery, in which a special full-time advanced course (30 hours per week for a whole session) was established last year. As preparation for a teaching career, Dr. Smith has had six years' academic training, and seven years in works. For some years he was at the Armstrong College, Newcastle, under Dr. Thornton, and for two years with the late Prof. E. Arnold, of Carlsruhe, as 1851 Exhibition Scholar. Subsequently, he entered the design office of Messrs. Siemens Bros. Dynamo Works, Stafford, and for some years has been chief designer to the General Electric Co., Witton. Quite recently he was awarded a Telford Premium by the Institution of Civil Engineers for a paper on "Single Phase Commutator Motors for Electric Traction on Long-Distance Railways." We wish him every success in his new vocation.

At the Willesden Polytechnic on Wednesday last week, Mr. F. H. Taylor delivered a lecture on "Electrical Engineering" dealing especially with the training of an electrical engineer.

At the County Technical School, Peterborough, a course in electrical engineering is provided, under Mr. R. Rowland, mains superintendent at the electricity works.

Mr. H. Hirst will take the chair at the inaugural lecture on "The Management of Public Electric Supply Undertakings," by Mr. A. Hugh Seabrook, at the East London College on Monday next.

For Sale.—The Blackburn Corporation Electricity Department has for disposal three Lancashire boilers and one set of Green economisers. See our advertisement pages to-day.

Appointments Vacant.—Third-class clerk for the Fulham B.C. Electricity Department (£80); cable jointer, for the Port Elizabeth Municipality (13s. per day). See our advertisement pages in this issue.

The Anchor Hospital and Distress Fund.—The second annual general meeting of members of this fund, in operation at the Anchor Cable Works, was held on October 1st, Mr. J. Bowyer presiding. The objects of the Fund are: (*a*) The granting of annual sums to hospitals and convalescent homes, &c., thereby ensuring to members hospital treatment in case of accident or other sickness, and (*b*) the granting of temporary relief to members in exceptional distressed circumstances, so that shop collections may be discontinued. The hon. secretary, Mr. A. Crooke, reported that every one of the employés at Leigh, including the staff, were members, each member paying 1d. per week. He pointed out the useful work which had been done by the Fund. Members have been sent to convalescent homes and to sanatoria, in addition to recommendations having been issued to members requiring attention at various institutions. Thanks to the generosity of the directors of the company, the committee were enabled to provide, during the coal strike, free dinners to needy members. The families which were in reduced circumstances were also assisted, and the sum of £12 was contributed to the Mayor of Leigh's fund for feeding necessitous children. There was a balance in hand of £72, out of which it was resolved to make the same grants as last year to hospitals and infirmaries, amounting to £47. The following officers were reappointed: President, Mr. James O. Callender; Trustees, Mr. J. Bowyer and Mr. C. Hulme; Hon. Secretary and Treasurer Mr. A. Crooke.

Inquiry.—Makers of the Richardson fuse bridge are asked for.

L. & S.W. Railway Electrification.—In the *Pall Mall Gazette* of Wednesday there appeared an authoritative statement to the effect that the general scheme of electrification has been settled, and the company hopes to have electric trains from the Thames Valley running into Waterloo Station in 18 months.

Holborn Lighting.—On Wednesday night the new system of street lighting in the Borough of Holborn was put in operation. In High Holborn, clusters of three-large Osram lamps in lanterns, supported by tall columns, have been employed, with excellent effect. We shall return to the subject in a later issue.

OUR PERSONAL COLUMN.

The Editor [illegible] electrical [illegible] whether connected with the technical or the commercial side of the [illegible] and industry, also electric tramway and railway officials, to keep [illegible] of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials. MR. GRAINGER, who for many years acted as assistant electrical engineer to the Paisley Town Council, received an appointment under the Limerick Corporation some three months ago, and left for that town. The office vacated by him was advertised, 175 applications were received, and the Council had got as far as a short leet, when it was learned that Mr. Grainger would be quite well pleased to return to his old job after his three months' experience of life in Ireland. The Committee gladly accepted the offer, and agreed to abandon all the applications lodged.

MR. HERBERT FOSTER, who, after eight years' service as engineer in the electricity department of the York Corporation, has become North-Eastern district representative for the Electrical Co., Ltd., of London, has been presented with a handsome 14 days' clock, as a mark of the esteem of his colleagues in the York electricity department.

MR. STANLEY J. BRUFORD has left the Newcastle Electric Supply Co., Ltd., and is to sail to-day to take up a position with the Madras Electric Supply Corporation, Ltd., as assistant station engineer, in Madras.

The marriage took place at All Saints' Church, Evesham, last week, of MR. HERBERT HORTON SMITH, of the Worcester Corporation electricity works, and Miss Margaret Newton Lufin. From the staff and employés of the electricity department, Mr. Smith received a divan armchair.

The Bridlington T.C. has appointed MR. F. FFRENCH, the present mains superintendent, as chief assistant at the electricity works, at a salary of £130, rising to £160, and MR. LESLIE A. THAIN, of Fleetwood, as charge engineer.

Tramway Officials.—On Sunday morning last, according to the *Western Mail*, an interesting function, illustrating the happy relationship existing between the manager and staff of the Cardiff Corporation tramways, took place at the tramway offices, when MR. ARTHUR ELLIS was presented with a suite of silver candelabra by a large section of the uniformed staff of the department, as a tribute of the affection and esteem in which he is held by the men under his control, and in celebration of the completion of ten years' service under the Corporation. Mr. Howell David presided, and the presentation was made by Mr. Henry Bishop, one of the oldest tramway drivers in the service, he having been engaged continuously in his occupation for nearly 40 years. In acknowledging the gift, Mr. Ellis, speaking with much feeling, expressed pleasure at the unexpectedness of the presentation, and referred with pride to the goodwill existing between all grades of the department.

MR. W. T. ROBINSON, assistant engineer to the Hull Tramways Committee, has resigned his position to take up the general managership of the South Shields tramways.

MR. T. HARRINGTON, of the Torquay Tramway Co.'s electrical staff, who is taking up an appointment in the Maidstone tramway department, has been presented by his colleagues with a silver cigarette case.

General.—MR. J. W. BUCK has resigned his position with Messrs. Siemens Bros. Dynamo Works Co., Ltd., and has joined Messrs. Turner & Burger, electrical manufacturers, of Aubrey House, Ely Place, Holborn, E.C.

MR. ALFRED H. GIBBINGS, of the firm of Alfred H. Gibbings and Co., 564, Cangallo, Buenos Ayres, will be in England on a short business visit during November and December, and his address while here will be 91, Palmerston House, Bishopsgate, E.C. Messrs. Alfred H. Gibbings & Co. are engineers and contractors and have an important business in South America, and among other representations they are the agents for Messrs. James Howden & Co., Ltd., of Glasgow, for turbines, steam engines, boilers, forced draught, oil fuel apparatus, &c. Mr. Gibbings is open to negotiate with firms desirous of representation in the Argentine.

At a farewell dinner, held on the 2nd inst. at the Reggiori Restaurant, MR. DOBSON, senior assistant electrical engineer, was presented with a handsome marble clock, as a mark of esteem, by the electrical staff of the Metropolitan Railway, on his leaving the company to take up an appointment with the L. & N.W. Railway, in connection with the electrification of their line. Mr. Page (chairman), on making the presentation, spoke of the past experience and work of Mr. Dobson, during his connection with the company, in highly complimentary terms. Mr. Dobson suitably replied. The evening was concluded with various vocal and instrumental contributions by members of the staff.

MR. J. FRANK JONES, foreman electrician in the installation department of the Ebbw Vale U.D.C., has been appointed installation inspector under the municipality of Shanghai.

MR. JUSTUS ECK, engineer-in-chief to the Union Electric Co., Ltd., and deputy-chairman of the Electrical Trades Benevolent Institution, sails on October 11th by the ss. *Osterley*, *en route* for Australia. After a tour in the interests of his company—covering, amongst other places, Fremantle, Adelaide, Melbourne, Sydney, Brisbane and Tasmania—Mr. Eck will proceed to New Zealand, returning home *viâ* Canada and New York. His complete journey will occupy some eight months.

Obituary.—MR. W. E. ROBSON.—We regret to record the death of Mr. W. E. Robson, lecturer and instructor in dynamo and motor design in the City and Guilds (Engineering) College, South Kensington. Mr. Robson joined the staff of the college in 1906, after he had had some teaching work in evening classes, and a large and varied practical experience with several well-known firms. Amongst these may be mentioned Messrs. Scott & Mountain, Gateshead; Messrs. Armstrong, Whitworth & Co., Elswick; the Brush Electrical Engineering Co., Loughborough, and the British Electric Plant Co., Alloa. He made many improvements in the teaching of design during the six years he was engaged in this work. Last session he conducted an advanced course of instruction on "The Systematic Design, Construction and Manufacture of Dynamo-Electric Machinery," in which the ground covered by college courses was greatly extended. Of these subjects he had made a special study, and in addition to pure design, the many questions involved in the construction of machines, and the organisation of factories for systematic manufacture, were discussed in detail. His untimely decease is a great loss to the college, and to his colleagues, students and friends, with whom he was deservedly popular. As successor to Mr. Robson, DR. S. P. SMITH, chief designer to the General Electric Co., Witton, has been appointed.

It is reported from Canada that, while out in a canoe fishing, MR. WILLIAM MCCAFFREY, assistant manager of the Canadian Electric Co., his wife and three children, were drowned in the Pidgen River, Ontario.

NEW COMPANIES REGISTERED.

Silent Electric Clock Co., Ltd. (124,4[illegible]).—This company was registered on September [illegible], with a capital of [illegible] shares of £1 each [illegible] carried on at 192, [illegible] Road, E.C., as the "Silent Electric Clock Co.," and to carry on the business of [illegible] manufacturers of all kinds of clocks, watches, &c. The subscribers (with one preferred share each) are:—H. W. P[illegible], 4, [illegible] gentleman; L. W. Mert[illegible], 1[illegible], St. P[illegible] Road, H[illegible], N. [illegible] Private company. The number of directors is not to be less than three or more than five; the first are T. W. B[illegible], G. B. B[illegible] and A. G. G[illegible]; qualification, 2[illegible] ordinary shares; [illegible]. Registered office, 192, [illegible] Road, E.C.

Sevenoaks and District Electricity Co., Ltd. Prospectus [illegible] £40,000 in £1 shares [illegible] 40,000 [illegible] B[illegible], 21, La[illegible] Lane, E.C.

County of Dorset Electric Supply Co., Ltd. (124,372.) Registered September 23rd by S. Morse, 1, Kingsway, W.C. Capital, £75,000 in £1 shares. Objects, to carry on the business of electrical and general engineers, electricians, contractors, manufacturers of electrical apparatus, generators, producers and suppliers of light, heat, sound and power by electricity, galvanism, magnetism and otherwise, suppliers of electricity for all purposes, &c. The signatories are:—W. H. Baxter, The Wilderness, Sherborne, brewer, 250 shares; F. W. Reynolds, Acorn Works, Edward Street, S.E., engineer, 250 shares; Lieut.-Col. C. C. Castleman-Smith, Brenty, Blandford, 250 shares; J. A. Hosker, J.P., Kirkleatham, Bournemouth, 250 shares; J. A. Purvis, 6, Pennsylvania Park, Exeter, engineer, 1,000 shares; H. B. Renwick, Moorgate Court, Moorgate Place, E.C., company director, 1 share; T. W. Cole, Moorgate Court, Moorgate Place, E.C., secretary, 1 share. Minimum cash subscription, 1,500 shares. The first directors, to be not less than three or more than seven, are W. H. Baxter, F. W. Reynolds, Lieut.-Col. C. C. Castleman-Smith, J. A. Hosker, J.P., and A. J. Woodroffe, J.P., Ware, Lyme Regis; qualification, £250; remuneration, £50 each per annum (£25 extra for the chairman). Registered office, Moorgate Court, Moorgate Street, E.C.

International Marine Signal and Carbide Co., Ltd. (124,378).—This company was registered on September 23rd, with a capital of £1,000 in £1 shares, to manufacture and sell marine signal appliances and carbide and such accessories as are required in lighting, telephoning and transmitting signals with or without wire or other lines over, under or through land, water or air. The subscribers are:—Hon. C. Sifton, Ottawa, Canada, chairman of Conservation, 900 shares; W. B. Sifton, 29, Charing Cross, S.W., director of companies, 50 shares; A. P. Collier, 29, Charing Cross, S.W., engineer, 50 shares. Private company. The number of directors is not to be less than two or more than five; the first are Hon. C. Sifton, W. B. Sifton and A. P. Collier; qualification, 50 shares. Registered office, 29, Charing Cross, S.W.

Auto-Electric Transmission, Ltd. (124,446).—This company was registered on September 26th, with a capital of £10,000 in £1 shares, to acquire any inventions relating to other electrically-operated self-propelled vehicles, the electrical or other transmission of power, &c., and to adopt an agreement with H. B. Van Daalen and P. H. Schreiber. The subscribers (with one share each) are:—A. A. Knight, 36, Denbigh Road, West Ealing, engineer; E. W. Roberts, Ashtree Cottage, Dulwich Village, S.E., manager. Private company. The number of directors is not to be less than two or more than five; the first are H. B. Van Daalen, managing director, A. A. Knight O. A. Knight, E. W. Roberts and W. T. Pritchard; qualification, £25. Registered office, 8, Southampton Street, Holborn, W.C.

Glasgow Electrical Engineering Co., Ltd. (8,391).—This company was registered in Edinburgh on September 24th, with a capital of £1,000 in £1 shares, to carry on the business as electrical engineers, &c. The subscribers (with one share each) are:—J. Stevens, 39, Randolph Gardens, Crow Road, Partick, Glasgow, electrical engineer; J. L. Murray, 124, St. Vincent Street, Glasgow, chartered accountant; J. W. Galloway, 157, St. Vincent Street, Glasgow, solicitor. Private company. The numbers of directors is not to be less than two or more than four; the first are J. H. Garby and J. Stevens; qualification, 100 shares. Registered office, 47, Pitt Street, Glasgow.

Electrograph, Ltd. (124,420).—This company was registered on September 25th, with a capital of £3,000 in £1 shares, to carry on the business of advertising agents and contractors by means of the exhibition of electric and other signs, &c. The subscribers (with one share each) are:—J. M. McLaren, 150, Leadenhall Street, E.C., chartered accountant; E. F. Moy, Greenland Place, Camden Town, N.W., engineer; R. H. Gillsspie, 29A, Charing Cross Road, W.C., chartered accountant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, £1. Registered by Smith, Rundell & Dods, 9, John Street, Bedford Row, W.C.

Farad Electrical Co., Ltd. (124,421).—This company was registered on September 25th, with a capital of £1,500 in £1 shares to carry on the business indicated by the title. The subscribers (with one share each) are:—H. J. Whitehead, Farad House, Fairfield Street, Wandsworth, S.W., electrical engineer; H. A. Bysouth, 81, Northcote Road, Wandsworth Common, S.W., electrical engineer. Private company. H. J. Whitehead is the governing director. Registered office, Farad House, 20, Fairfield Street, Wandsworth, S.W.

Johnsons Signs, Ltd. (124,398).—This company was registered on September 24th, with a capital of £3,000 in £1 shares (100 management) to take over the business of advertising agents, designers, producers and manufacturers of banners, showcards, electric and other signs, &c., carried on at 177A, Edgware Road, W., by J. Johnson and W. C. Johnson as "Johnson Brothers." The subscribers (with one share each) are:—J. Johnson, 177A, Edgware Road, W., sign specialist; W. C. Johnson, 177A, Edgware Road, W., sign specialist. Private company. The number of directors is not to be less than two or more than five; the first are J. Johnson and W. C. Johnson. Registered office, 177A, Edgware Road, W.

Invicta Engineering Co., Ltd. (124,426).—This company was registered on September 25th, with a capital of £5,000 in £1 shares, to carry on the business of makers of and dealers in cash registers, adding, weighing, calculating, measuring and other machines (automatic, electrical, pneumatic or otherwise) for the delivery or supply of electricity, air, vapour, liquids or solids (manufactured articles or raw materials), &c. The subscribers (with one share each) are:—V. L. Robinson, High Street Chambers, Coventry, solicitor; A. Howard, 10, Clifford's Inn, E.C., solicitor; E. A. Raves, 21, Salisbury Road, Bexley, mechanical engineer. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, 50 shares. Registered office, 61, The Broadway, Bexley Heath, Kent.

International Bleachers' Corporation, Ltd. (124,578).—This company was registered on October 3rd, with a capital of £5,000 in 4,500 ordinary shares of £1 each and 10,000 founders' shares of 1s. each, to acquire from Electric Bleachers, Ltd., certain inventions for, or connected with, bleaching, and all improvements thereof, and to carry on the business of mechanical and electrical engineers, manufacturers of and dealers in apparatus, &c., used in connection with electric, electrolytic or chemical bleaching, &c. The subscribers (with one share each) are:—W. T. Pollard, 4, Clement's Inn, Strand, W.C., clerk; C. Brant, 5, Kentish Town Road, N.W., clerk. Private company. The number of directors is not to be less than two or more than nine; the subscribers are to appoint the first; qualification, 100 shares; remuneration as fixed by the company. Registered office, 4, Bedford Chambers, Covent Garden, W.C.

Abingdon Electric Supply Co., Ltd. (124,484).—This company was registered on September 28th, with a capital of £10,000 in 900 cumulative preference shares of £5 each, 2,000 preferred ordinary shares of £1, and 3,500 ordinary shares of £1 each, to carry on the business of electric light and power company. The subscribers (with one share each) are:—S. Williams, 38, Parliament Street, Westminster, solicitor: J. H. Edwards, 127, Victoria Street, Bristol, engineer. Private company. The number of directors is not to be more than six: the first are not named; qualification, 50 shares. Registered by Seymour Williams & Co., 38, Parliament Street, S.W.

Works Control, Ltd. (124,607).—This company was registered on October 4th, with a capital of £150 in £1 shares, to carry on the business of manufacturers of and dealers in recording apparatus and instruments necessary for the control of machinery of every description, electric, mechanical, and general engineers, tube makers, wire drawers, lorry proprietors, &c. The subscribers (with 50 shares each) are:—P. de Bruyn, Dusseldorf, Germany, manufacturer; K. Huessener, for the Coke Oven Machinery Co., Ltd., 37, Cole Park Road, Twickenham, civil engineer; C. E. de Bruyn, Castlebury Farm, Wareside, Herts., mechanical engineer. Private company. The number of directors is not to be less than two or more than five: the first are P. de Bruyn, K. Hauessener and C. E. de Bruyn. Registered by Jordan & Sons. Ltd., 116-7, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Construction Co., Ltd. (39,292).—Return dated August 1st, 1912 (filed August 2nd). Capital £400,000 in £2 shares (50,000 pref.); 112,100 ord. and 31,390 pref. shares taken up; £2 per share called up on 2,100 ord. and 18,245 pref.; £ 0,690 paid; £246,290 considered as paid on 110,000 ord. and 13,145 pref. Mortgages and charges: £175,000.

Electrical Power Storage, Ltd. (30,313 C).—Return dated August 1st, 1912 (filed August 13th). Capital £100,500 in £5 shares (20,000 ord. and 100 founders'); 66 founders' and 18,592 ord. shares taken up; £5 per share called up on 66 founders' and £4 per share on 3,132 ord., £13,332 paid (including £474 paid on four founders' and 405 ord. shares forfeited; £77,800 considered as paid on 15,460 shares. Mortgages and charges: £20,000.

James Keith & Blackman Co., Ltd.—Issue on September 17th, 1912, of £100 debentures, part of a series of which particulars have already been filed. A memorandum of satisfaction in full on May 22nd, 1912, of debenture dated October 29th, 1901, securing £200, has been filed (notified September 18th, 1912).

T. Clarke & Co., Ltd. — Equitable mortgage on leasehold premises in Chelsea, known as 129, Sloane Street, and 237, Pavilion Road, dated August 23rd, 1912, to secure all moneys due, or to become due, from the company to the London County and Westminster Bank, Ltd., 4, Lothbury, E.C.

Acton Lamp Co., Ltd.—Issue on September 13th, 1912, of £500 debentures, part of a series of which particulars have already been filed.

Merthyr Electric Traction and Lighting Co., Ltd. (57,908).—Return dated March 31st, 1912 (filed July 14th). Capital £100,000 in £5 shares (10,000 pref.); 6,000 pref. and 6,000 ord. shares taken up; £60,000 paid. Mortgages and charges: £48,400.

Sloan Electrical Co., Ltd. (61,528).—Return dated August 7th, 1912 (filed August 16th). Capital £15,000 in £1 shares (5,000 pref.); 5,000 pref. and 2,754 ord. shares taken up; £1 per share called up on 1,254 ord.; £1,254 paid; £6,500 considered as paid on 6,500 shares. Mortgages and charges: Nil.

Electrical Utilities Corporation.—Quarterly dividends of 1¼ per cent. on the preferred stock and ½ per cent. on the common stock has been declared.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared an interim dividend of 4s. per share, being at the rate of 8 per cent. per annum, less income-tax, on the ordinary share capital for the June half-year.

Sao Paulo Tramway, Light and Power Co., Ltd.—The directors have declared a quarterly dividend at the rate of 10 per cent. per annum.

Mexico Tramways Co.—The directors have declared a dividend of 1¾ per cent. for the quarter ended September 30th.

CITY NOTES.

Bahia Tramway, Light and Power Co.

The directors' report for 1911 (as printed in the *Financier*) states that the work of improving and extending the installations at Bahia has been continued, and the property is being brought into better physical condition as rapidly as available funds will permit. The improvements already made are evidenced by the fact that while the gross earnings have increased, the operating expenses for the year show a reduction compared with the figures of the preceding year. Further work has been carried out on track renewals, and about half a mile of additional single track for branch lines has been constructed, the total length of track being now about 18 miles. The rolling stock has also been improved, and the company possesses 34 passenger and freight cars with motors and 24 trailers without motors. Special attention is being devoted to further improvements of the track and rolling stock with the object of securing more economical operation. In the electricity department the erection of the new gas producer plant of 1,500 H.P. has been completed, and the plant is running satisfactorily. In order to provide for future expansion of business and for a sufficient reserve of power, it has been decided to extend the power house and to install an additional generator plant of 1,100 H.P., which will bring up the total effective capacity of the plant to 3,100 H.P. Orders for this plant have been given, and it is expected that with the additional output of electrical energy which will be obtained therefrom no difficulty will be experienced in supplying the much larger demands for electric light and power which will come from new consumers as soon as the final decision has been obtained in connection with the lawsuit instituted by the company's subsidiary, the Cie. d'Eclairage de Bahia, to which reference was made in previous reports. The gasworks has been further improved in the course of the year.

The following are the earnings in Brazilian currency of the three departments for the year 1911, compared with those of the preceding year:—Tramways, net earnings 1911, $364,427; 1910, $261,482; electric light and power, net earnings 1911, $117,820; 1910, $71,338; gasworks, net earnings 1911, $235,986; 1910, $137,927; total net earnings, 1911, $718,233; 1910, $470,749. For the first seven months of 1912 the net earnings at Bahia of all departments show an increase over those for the same period in 1911 of £2,312, or 8 per cent. The fact that the company's subsidiary, the Compagnie d'Eclairage de Bahia, through whom the gasworks and electric lighting and power business is carried on, has not been able to work in full enjoyment of its privileges, has continued to affect adversely the operating results. An important intermediate decision was obtained last year, as mentioned in the last report, but the final decision in the suit has not yet been given by the Federal Judge at Bahia. The delay in obtaining this decision has allowed the violation of the privilege of the Cie. d'Eclairage de Bahia at Bahia to be continued, and seriously affected its earnings, which in turn has handicapped it in the provision of funds for improving its property. Efforts are now being directed to bringing this long-drawn-out lawsuit to a conclusion, and, as the legal advisers expect that it will ultimately result in establishing the Cie. d'Eclairage in its rightful position, that company will then have a claim for heavy damages against the Municipality of Bahia. When the lawsuit above mentioned is concluded a large expansion of business and increased earnings must result, which will enable the question of funding the company's floating debt to be taken in hand.

Dick, Kerr & Co., Ltd.—The report of the directors, which will come before the annual meeting at Cannon Street Hotel, E.C., on Tuesday next, shows that the profits earned during the 12 months' trading to June 30th, 1912, amount to £3,275, which, added to the sum brought forward from last year (£36,892), makes a total of £40,167. Out of this sum the debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £11,851, leaving a balance of £28,316 available for appropriation as under:—Dividend of 6 per cent. per annum on the preference share capital (the half-yearly dividends to December 31st, 1911, and June 30th, 1912, have already been paid), £18,300; carry forward, £10,016. The directors are unable to recommend the payment of a dividend on the ordinary shares for the year under review. They regret that the anticipations expressed in the last report of more prosperous business have not been fulfilled. To some extent this is due to the effects of the railway and coal strikes, which delayed the completion of orders, but principally to unexpected losses on certain contracts which were completed during the year. Mr. John Kerr and Mr. Geo. Richardson, for private reasons, resigned their seats on the board during the year, and the place of the former, as chairman of the company, has been filled by Mr. Cayley, and his place as deputy chairman by Mr. Prestwich.

Suffolk Electricity Supply Co., Ltd.—A financial daily states that the directors declared a dividend on the ordinary shares at the rate of 5 per cent. per annum, the reserves being raised to £3,220.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 3½ per cent. on the preference shares for the six months ended October 31st.

Sunderland District Electric Tramways, Ltd.

THE directors' report for the 12 months ended October 31st, 1911, which was submitted at the meeting held on October 3rd at Winchester House, E.C., stated that during the period under review the traffic receipts were collected by the Receiver, Mr. Charles Eves, who was appointed by the Court on June 2nd, 1910, on the suit of the prior lien and first mortgage debenture-holders. Since that date, although the board had not been relieved from the control of the undertaking, they had, nevertheless, been deprived of their managerial powers owing to their having no funds at their disposal for the purposes of the company. After providing for interest on the prior lien bonds and the first and second mortgage debentures, and the Receiver's remuneration and expenses, the accounts showed a loss on the year of £688, bringing the aggregate loss to date up to £16,890. During the year the traffic receipts had shown an increase of £1,712, and the working expenses (including the Receivership expenses) had also shown an increase of £1,190. During the year the board was constantly occupied in preparing and considering schemes for the reorganisation of the company, and in carrying on negotiations with various parties for providing working capital, as well as with the Receiver and the principal debenture-holders as to the proposed reorganisation. Ultimately a scheme was agreed upon and submitted by the Receiver to the Court, who directed that meetings of the three classes of debenture-holders should be convened for the purpose of considering, and, if thought fit, of approving such scheme. The meetings were duly held, and the scheme was unanimously accepted. The Court in due course gave its sanction to the adoption of the scheme, which now remains to be carried into effect. The report then proceeds to state briefly the principal features of the scheme.

MR. H. R. HOGG, who presided at the meeting, said that during the past year the moneys received by the company had still been in the hands of the Receiver, and the board had been hard at work getting through the scheme which was referred to in the report. Several schemes had been previously proposed by which the company should be taken out of the hands of the Receiver and come back to the shareholders, but a scheme had now been agreed upon by the various bodies. There were no fewer than five different bodies interested in the scheme, each of which had the power of stopping any arrangement, and therefore it was a matter of difficult negotiation to get them all into line. However, he was happy to say that that had been done, and the scheme had received the sanction of the Court, and as soon as the Courts again met, he hoped it would only take a week or two before the undertaking again came into the shareholders' hands. The expenses of carrying on a business like that under a Receiver were, unfortunately, heavy, and although the year under review was the best year they had ever had, still there was a deficit of £688, if they reckoned all the payments. Under the scheme, the interest was to be funded in the form of income debentures, and the interest due to the debenture-holders and to the prior lien holders was to be paid off with prior liens. They had arranged for the money for the new prior liens, and as the interest on the first mortgage debentures was being reduced from 5 per cent. to 4 per cent., the standing charges would come down to about £6,300. The chief drawback they had had to contend against, was that the cars were in very bad order, and the Receiver, although he had had their affairs in hand for two years, had not been allowed to spend any money on the renewal of cars. A good deal of money had been spent on renewals of track, but owing to the coal deposits beneath their property, it was a very difficult thing to keep the track in order. Two miles of the track had sunk so much that it was quite dangerous, and required to be renewed altogether, but if they were to spend the money necessary to do this, the fact remained that there was another 7 or 8 ft. of coal to take out, and doubtless the track would again sink. Fortunately it was not a very important portion of their line, as it was only a branch of the main line to Fencehouses Station, and they thought they might be able to arrange motor-omnibuses for the necessary service. They were late issuing their accounts, but this was due to the fact that they could not get the accounts from the Receiver till quite recently. The receipts during the present year, since October 31st last, had been £300 better than in the previous year, which was then the best year they had had, so that by working economically he trusted, in the future, there might be something left over after paying the standing charges. The scheme provided for their borrowing £30,000 on the prior lien bonds, if it was required, and they were issuing £20,000 of them, which would pay off the present prior liens which became due in consequence of the line being put into the Receiver's hands. There was a fair amount of money in the hands of the Receiver, and with the new money brought in they hoped to improve the service very materially. They had already ordered 10 new cars, and he thought they would have to order another 10 as soon as they got the money into their hands to pay for them.

MR. R. PARKER seconded the motion, and the report was adopted without discussion.

Prospectuses.—*Brazilian Traction, Light and Power Co., Ltd.*—The list of applications was to close on Tuesday last of an offer of £1,880,000 5 per cent. 50-year first mortgage bonds of the Sao Paulo Electric Co., Ltd., at 95 per cent.

The Anglo-Argentine Tramways Co., Ltd.—The list is to close on Tuesday next for an issue of £1,500,000 of 5 per cent. debenture stock at 98½. This is part of the total of £6,000,000 authorised, of which £3,000,000 has already been issued. As our readers are aware, this company has absorbed a number of tramway undertakings in Buenos Ayres, and it now owns a unified system of more than 339 miles of track, with 2,436 cars. During 1911 over 299 millions of passengers were carried.

Russian Capital Expansion.

The Russian Allgemeine Electricity Co., has applied to the Government for sanction to increase the share capital for the purpose of extinguishing the loans obtained from the financial group, and increasing the company's working capital in consequence of the requirements imposed by existing orders. It is proposed to issue new shares of £400,000, and to offer them to present shareholders in the proportion of one new to two old shares at the price of 130 per cent. The augmentation will raise the ordinary share capital to £1,200,000, which does not include bonds of £181,000. The existing shares and bonds were introduced on the Berlin Stock Exchange last February at the prices of 135 per cent. and 97 per cent. respectively, and a few days ago the quotations were 178 per cent. and 101 per cent. respectively.

The Russian Industrial Accumulator Co. of St. Petersburg, in which the Berlin Accumulator Works Co. is prominently interested, intends to raise its share capital from £120,000 to £240,000 for the purpose of extending the manufacturing works and being able to deal with the expansion in business. The company, which paid a dividend of 14 per cent. for 1911, proposes to offer the new shares to existing shareholders at par, plus the slight addition required by the Russian law concerning the ratio of share capital to the reserve fund. It was in contemplation to apply for the admission of the shares to quotation on the Berlin Bourse, but it is stated that the directors have now decided to withdraw the proposal to this effect at the forthcoming meeting.

Drake & Gorham, Ltd.—The following report for the year ended June 30th, 1912, will be presented at the annual meeting on October 16th: "After payment of all charges, including bonuses due to staff, there remains a net profit of £9,021, which, with £1,302 brought forward from the previous year, makes a total of £10,323, which it is proposed to appropriate as follows: By payment of a dividend at the rate of 4½ per cent. per annum, £5,625; by writing off from underwriting commission, £3,000; by carrying forward £1,698. The turnover has increased considerably, and the public are realising that superior electric work is the cheapest in the long run. The firm has repeatedly been asked to advise as to the remodelling of plants where efficiency has been sacrificed to first cost. The reduction in cost due to the advent of metal lamps has opened up a new field in the lighting of small houses for which formerly the initial outlay was prohibitive. The additional warehouse for the wholesale business is fully occupied, and this department also shows improved results."

Stock Exchange Notices.—The Committee have appointed special settling days as under:—

Wednesday, October 16th.—Callender's Share and Investment Trust, Ltd.—£115,000 5 per cent. debenture stock.

Thursday, October 17th.—British Columbia Telephone Co., Ltd.—Fully-paid scrip for £400,000 4½ per cent. first mortgage debenture stock.

And ordered the undermentioned securities to be quoted in the Official List:—

Callender's Share and Investment Trust, Ltd.—£115,000 5 per cent. debenture stock.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Certificates of deposit for 361,492 shares of $100 each, fully-paid.

Sao Paulo Tramway, Light and Power Co., Ltd.—Certificates of deposit for 85,599 shares of $100 each, fully-paid; and certificates of deposit for 5,197 shares of $100 each, fully-paid, marked "*ex* all dividends."

STOCKS AND SHARES.

Tuesday Evening.

THERE is little to write about this week, so far as stocks and shares are concerned, business in the markets having been restricted materially by the reported outbreak of war in the Near East. This has placed a check upon business all round the Stock Exchange; and in spite of the fact that Capel Court, as usual, clung tenaciously to the idea that the Powers would not be involved, prices were put down impartially lest the unexpected should happen after all.

Home Railway stocks remain dull at the lower levels to which they were reduced on the advent of the formidable situation abroad. Having got down to the extent of a point or two, prices stuck, there being insufficient enterprise to buy the stocks or to sell bears of them. The Undergrounds are quiet, and there has been a further advance in City and South London Ordinary, the price to-night showing a rise of 1 on the week, while the company's two junior Preferences are again a point apiece higher. Nothing has yet materialised as to any agreement with the Midland, but the recent circulators of the idea persist that it will turn out to be correct. Central Londons are somewhat easier. The Company's proposed extension into the Thames Valley is receiving cordial welcome from some of the local authorities concerned; and it is expected that the company's Bill will go through without arousing much opposition. Metropolitans dipped to 59½, which leaves the price 1¼ lower on the week. Districts on balance are ¼ down. Railway officials speak gloomily of the prospects of the Bill which is to be introduced into the session which opened this week, and prophesy as though they had not much faith in the Government's promise to help them in the matter of freight rates. But this seems rather like drowning their chickens before they are hatched, and is a somewhat ungracious attitude to adopt.

Metropolitan Electric Tramway Ordinary shares added $\frac{1}{16}$ to their rise of last week, the recent good report being responsible, of course, for the improvement. The Debenture stock, however, came on offer, and is a trifle lower. London United Tramways Preference shed 5s. of its previous 25s. rise, but the Debenture stock is again a point to the good, it being hoped that the company will be able to place its finances on a thoroughly sound footing by reason of the payment of the Hammersmith Council in respect of the small part of the undertaking recently acquired. The only changes in the British Electric Traction group are falls of 1 in the 4½ per cent. Second Debenture and of ½ in the 5 per cent. Debenture.

No doubt before this appears in print the issue will have been made of £1,500,000 5 per cent. Debenture stock by the Anglo-Argentine Tramways Company at about 98½. Upon advance information of this the present stock fell 1 to 101, and the First Preference shares are ¼ down at £5 middle. Sao Paulo Electric Tramway 5 per cent. First Debenture stock is ½ lower upon the offer of £1,880,000 5 per cent. First Mortgage bonds of the Sao Paulo Electric Company, Ltd., at 95. The shares of the Tramway Company are 5 lower at 280; but, seeing that they had a rise of 17 points just before, the reaction does not amount to much. Rio Trams are 2 lower, and Mexico Trams fell a similar amount, the latter company's 6 per cent. bonds easing off to 102½. Dullness in the British Columbia Electric Railway group has lowered the prices of four issues quoted overleaf, the Preferred, Deferred and 5 per cent. Preference being the principal sufferers. Calcutta Trams are unaffected by the declaration of an interim dividend of 5 per cent. Other changes in this department are negligible.

Latin-Canadians as a whole are somewhat irregular. Montreal Light, Heat and Power shares, instead of being quoted with 10 points between the selling and buying prices, have been narrowed to a five-point limit, and nominally the price is 1½ better. Canadian General Electric Common spurted substantially, the price gaining 7; while Shawinigan Water, on the other hand, fell back 2, the Company's bonds and Debenture stock also declining. Mexican Light and Power Common shares continue to droop, in consequence of the unsettled state of the country. Cordoba Light and Power has come into some notice, and the price improved to 96½. Kaministiquia Common enjoyed the distinction of being amongst the very few stocks to improve to-day, Tuesday, the price being 2 up at 145.

In the English Electricity Supply list the solitary change is a rise of ⅛ in Urban Preference. Save for this, the whole of the stocks and shares quoted are unaltered, the market, however, being extremely firm, with buyers ready to take shares on any decline in prices

The Telegraph market has had another little bout of excitement in West India and Panama Ordinary. Momentarily the price was run up from 3⅜ to 3¾, reacting afterwards to 3½ middle. Apparently there is still a stale bull account left in the shares, and with the general feeling of caution abroad, it is only necessary for buyers to cease their operations for the price to go back at once. The American division is a little duller. Anglo-American Telegraph Deferred fell ¼: the usual three-monthly dividend of 1½ per cent. on the Preferred stock was declared at the end of last week. Direct United States cable shares fell ⅛. The Eastern section, however, continues firm, and "China" shares hardened to 13½. Western Telegraphs improved to 13⅝, and Reuters still feel the influence of the augmented dividend, the price improving to 11⅝, which is an advance of 5s. on the top of the 7s. 6d. rise last week. It is pointed out, with a certain amount of grimness, that a war in the Balkans would probably benefit Reuters considerably. A little speculative buying of National Telephone Deferred caused the price to put on a point; while amongst other Telephone issues, United River Plate Ordinary rose ⅛ to 7⅝. Marconis rose to 5¼, to react to $4\frac{15}{16}$: the market welcomes the announcement that a Select Committee of the House of Commons is to be appointed to consider the Marconi contract with the Government.

Callenders are steady at 10⅝ upon the declaration of the regular 10 per cent. interim dividend. Henley's Preference rose to 5, their par value, and British Insulated and Helsbys at 7¾ are ⅛ higher, attention having been directed to them by reason of the handsome return which the shares offer at their present price. Dick, Kerrs are flat on the disappointing nature of the report just out. The Ordinary shares have to go dividendless, and, after allowing for Debenture interest, there remains a loss of £8,000 on the year Babcock & Wilcox lost their small gain of last week, and other Manufacturing stocks and shares are mostly steady. Rubber shares, like many other industrials of the speculative-investment type, were depressed by the foreign political outlook, while the Stock Exchange markets that are affected by the prices of baser metals gave way for a similar reason. The Stock Exchange is rarely pessimistic, but even some of the cheerful souls confess that if peace were to break out—as they put it—this week, time will be required to restore confidence and public bullishness. With money tightening, a 5 per cent. Bank Rate comes within the immediate range of prospect, so that, what with one thing and another, markets are predisposed to go softly in any event just now.

United Electric Tramways Co. of Caracas, Ltd.—The sixth ordinary general meeting of the shareholders of the above company was held on Wednesday at Dashwood House, New Broad Street. A representative of the Electrical Review, who attended to report the proceedings, was informed that the meeting was private. A reference to the report appeared in our issue of October 4th, page 546.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, October 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	per lb.	2¾d.	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	"	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16 10	..
a Copper Sulphate	"	£26	10s. dec.
a Lead, Nitrate	"	£26 10	..
a " White Sugar	"	£25 10	..
a " Peroxide	"	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a " Chlorate	per lb.	3¼d.	..
a " Perchlorate	"	4⅝d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	"	7¼d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5 5	..
a Soda, Caustic (white 70/72 %) ..	"	£10 5	..
a " Chlorate	per lb.	3⅝d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..

METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
b Aluminium Ingots, in ton lots ..	per ton	£82	..
b " Wire, in ton lots ..	"	£102	..
b " Sheet, in ton lots ..	"	£120	..
p Babbitt's metal ingots	"	£88 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	..
c " Tube (brazed)	"	11¼d.	..
c " " (solid drawn) ..	"	10d.	..
c " Wire, basis	"	9⅛d.	..
c Copper Tubes (brazed)	"	1/0⅝d.	..
c " " (solid drawn) ..	"	11¾d.	..
g " Bars (best selected) ..	per ton	£95	..
g " Sheet	"	£95	..
g " Rod	"	£95	..
d " (Electrolytic) Bars ..	"	£82 10s.	..
d " " Sheets ..	"	£100 10s.	..
d " " Rods ..	"	£89	..
d " " H.C. Wire	per lb.	10½d.	..
f Ebonite Rod	"	5/8	..
f " Sheet	"	4/9	..
n German Silver Wire	"	1/7	..
h Gutta-percha, fine	"	..	..
h India-rubber, Para fine	"	4/7	¼d. dec.
j Iron Pig (Cleveland warrants) ..	per ton	66/8	2½d. dec.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Pig	"	£21 15 to £22	15s. dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8	5s. dec.
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e " " " medium	"	3/6 to 6/-	..
e " " " large ..	"	7/6 to 11/-	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/0½	..
p " " rolled strip & sheet	"	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£231 to £232	£1 inc.
n " Wire, Nos. 1 to 16	per lb.	2/7	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£31 12 6	10s. inc.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent. for the quarter ended October 31st.

Direct United States Cable Co., Ltd.—The board have resolved to pay an interim dividend of 2s. per share, less income-tax, payable on and after 31st inst., making with the interim dividend already paid a total distribution of 4 per cent. for the half-year ended September 30th last.

Calcutta Tramways Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum (2s. 6d. per share) for the June half-year.

Callender's Cable and Construction Co., Ltd.—The directors have announced an interim dividend at the rate of 10 per cent. per annum.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share. *	Dividends for 1911.	1912	Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9¾ — 10¼	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	.	4 12 4
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100	..	4 10 0
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 — 100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	.	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4⅞	..	4 11 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
City of London, Ord.	10	8	6†	17 — 19	..	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12¾ — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 — 122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 3
County of London, Ord.	10	6	4†	11½ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11¾ — 12¼	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 — 108	..	4 3 1
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 8 3
Edmundson's, Ord.	5	Nil	.	1⅛ — 1⅜	.	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛ xd	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛ xd	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9		7½ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7 — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½		1⅝ — 2⅛		3 10 8
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	1⅜ — 1⅝	..	4 17 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 — 102	..	4 8 8
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4⅝ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	8½ — 9½	..	5 5 3
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88		3 19 7
Smithfield Markets, Ord.	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	3 — 3½		5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 — 101	.	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1¼	.	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99 xd	..	4 11 0
Urban, Ord.	£3	Nil		¼ — ½	..	..
Do. 5 % Cum. Pref.	5	2		2⅜ — 2⅞	+ ⅛	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½ — 88½ xd	..	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼		5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 8 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5¾	..	5 4 1
Calcutta, Ord.	5	8½	..	7½ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95 — 97	..	5 3 1
Canadian Gen. El. Com.	$100	7	7	120 — 125 xd	+7	5 12 0
Do. 7 % Pref.	$100	7	7	118 — 122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	⅞ — 1	..	8 0 0
Do. 5 % Deb.	100	5	5	95 — 98 xd	+1	5 3 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 6 0
Kaministiquia Power, 5% G. Bs.	$500	5	5	104 — 106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105	..	4 15 3
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	87 — 89	..	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	93 — 96	1	4 3 4
Do. 7 % Cum. Pref.	$100	7	7	108 — 111	..	6 6 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	..	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	86½ — 88½	..	5 13 0
Montreal, Lt., H. and Power	$100	8	9†	244 — 249	+1½	3 12 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5*a*	39 — 42	..	..
River Plate, Ord.	Stock	10		240 — 250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 — 114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	102 — 104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 — 100 xd	—1	4 10 0
Shawinigan Water, Capital	$100	5	5	150 — 154	—2	3 5 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107½ — 109½	— ¼	4 11 4
Do. 4½ % Per. Deb.	Stock	4½	4½	103½ — 105½	— ½	4 5 4
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ — 101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	94 — 97	..	5 3 1
Victoria Falls Power, Pref.	1	11⅞d.	17⅞d.	31/32 — 1 1/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	1	..	7¼ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	147 — 149 xd	..	5 7 5
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph	Stock	8	8	68 — 70	..	5 7 2
Do. 6 % Pref.	Do.	6	6	113½ — 114½	..	5 4 10
Do. Def.	Do.	80/-	..	26⅜ — 26⅝	½	5 12 8
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	7	8	7⅜ — 7⅞	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½ xd	..	4 14 8
Cuba Telegraph	10	6	..	9½ — 10½	..	5 14 8
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 8
Direct Spanish Telegraph, Ord.	5	4	4†	8 — 8½ xd	— ¼	5 14 4
Do. 10 % Cum. Pref.	5	10	10	6½ — 7 xd	..	7 2 10
Direct United States Cable	10	5	4	7⅜ — 7⅞	— ⅛	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 — 133	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½ — 101½	..	3 18 10
Eastern Extension	10	7	7†	13¼ — 13¾	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	99 — 101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	11 — 11½ xd	..	5 4 4
Do. 6 % Pref.	10	6	6	12¾ — 13¼ xd	..	4 10 7
Great Northern Telegraph	10	18	18	28¾ — 29¼	..	6 1 0
Indo-European Telegraph	25	13	..	57 — 59	..	5 3 5
Mackay Companies Common	$100	5	5†	87 — 91	..	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	..	5 12 8
Marconi's Wireless Telegraph	1	20	.	4⅞ — 5	+ 1/16	4 0 0
Do. 7 % Cum. Partic. Pref.	1	17	..	4¼ — 4½	+ ⅛	4 0 0
Monte Video Telephone, Ord.	1	6	..	1 1/32 — 1 5/32	..	5 6 8
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
National Telephone Def.	Stock	6	.	155½ — 157½	+1	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	101 — 102	..	4 8 3
Oriental Telep. and Elec.	1	8	.	1¾ — 1⅞	..	4 5 4
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	11⅜ — 11⅞	+ ¼	8 8 6
Submarine Cables Trust	Cert.	6	6	129 — 132	..	4 11 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ — 101½	..	4 8 8
United River Plate Telephone	5	8	..	7⅛ — 7⅜	+ 1/16	5 3 3
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32 — 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3⅛ — 3⅝	+ 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅞	..	5 10 4
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 — 103	.	4 17 1
Western Telegraph, Ltd.	10	7	7†	18⅜ — 18⅞	+ ⅛	5 1 0
Do. 4 % Deb.	Stock	4	4	96½ — 98½	— ½	4 1 3
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 — 103	..	4 7 5

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/8 — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	¾ — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81 xd	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	12 — 14	..	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	..	..
Do. 5 % Perp. Deb. ..	100	5	5	95 — 98 xd	+ ½	5 2 0
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 83	..	5 7 2
Central London Railway, Ord.	100	3	3†	77 — 79	—1	3 16 0
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2		76 — 78	—1	2 11 3
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1⅜	1⅜†	42½ — 43½	+1	3 3 2
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	105 —107	..	4 13 6
Do. Do. 1901	100	5	5	105 —107	+1	4 13 6
Do. Do. 1903	100	5	5	104 —106	+1	4 14 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1¾ — 2¼	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	..	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	69 — 74 xd	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5¼ — 6	¼	..
Do. 4 % Deb.	100	4	4	73 — 77	+1	5 4 0

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	59¼ — 59¾	—1¼	2 14 5
Do. Surplus Lands	100	2⅞	2¾†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	40½ — 41	— ¼	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 8
Do. 4½ % First Pref.	100	4⅛	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1 7/32 — 1 11/32	+ 1/16	4 9 0
Do. Def.	1	Nil	..	¼ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	97½ — 99½	— ½	4 10 6
Do. 5 % Deb.	100	5	5	97½ — 100½ xd	..	4 19 6
Potteries, Ord.	1	2½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	— ⅛	Nil
Do. "A"	1/-	..	..	21/32 — 23/32	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	90 — 92	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	5 — 5¼	+ ¼	5 7 4
Do. 2nd Pref.	5	5½	5½	5 1/16 — 5 5/16	..	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	1	4 18 0
Auckland Trams, 5 % Deb. ..	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	..	7¼ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	144 —149	-3	5 7 5
Do. Pref. Ord.	100	6	6	117 —120	-4	5 0 0
Do. 5 % Pref.	100	5	5	105 —108	—3	4 12 7
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —106	..	4 5 0
Do. 4¼ % Con. Deb.	100	4¼	4¼	101 —103	½	4 2 6
Calcutta Trams, Ord.	5	7	..	6¼ — 6¾	..	5 3 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5	5½ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c.
La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	..	1 1/16 — 1 5/16	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 95	..	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	124 —128	—2	5 9 5
Do. Gen. Con. 5 % Bonds ..	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	101½ —103½	½	5 16 6
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7½ — 7⅞	..	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½ —102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	158 —163	—2	3 1 4
Do. 1st Mort. 5 % Bonds ..	..	5	5	101¾ —102¾	—1¼	4 17 4
Do. 5 % Mort. Bonds ..	100	5	5	97¾ — 98¾ xd	—1¼	5 1 3
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	275 —285	-5	3 10 2
Do. 5 % 1st Deb.	$500	5	5	104 —106	- ½	4 14 4
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85 xd	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½ —103½	..	4 7 0

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	6	..	11/16 — 13/16	— 1/16	8 0 0
Do. 6 % Pref.	1	6	6	11/16 — 15/16	..	7 7 8
Babcock & Wilcox	1	28	..	3⅝ — 3⅞	— 1/16	4 2 10
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	⅜ — ⅝	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝ — ¾	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 13 8
B.I. & Helsby Cables	5	10	8†	7⅞ — 8 xd	+ ⅛	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	[illegible]	Nil	Nil	3/16 — 5/16	..	Nil
Do. Deb...	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	99 —102 xd	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10½ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	3 11/16 — 3 15/16	..	5 1 7
Do. Deb...	100	4½	4½	103 —106	..	4 5 0

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 8th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	½ — ¾	— 3/16	..
Do. Pref.	1	6	6	15/16 — 1 1/16	..	5 13 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	9/16 — 13/16	..	Nil
Do. fully paid	5	Nil	..	1⅝ — 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb. ..	100	5	5	72 — 75 xd	..	6 13 4
Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95 xd	..	4 4 3
Henley's, Ord.	5	17	5†	12¼ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅞ — 5⅛	+ ⅛	4 7 10
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11½ — 12½	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13
Do. Deb...	100	4	4	98 — 100	..	4 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

ELECTRICAL FITTINGS AND THE LAW OF LANDLORD AND TENANT.

[FROM A LEGAL CONTRIBUTOR.]

Questions frequently arise as between landlord and tenant as to the ownership of electrical fittings. A tenant who incurs the expense of fitting out an old house with a complete electrical installation not unnaturally resents the complete annexation of all the fitments which he has himself purchased, while the landlord, relying on the ancient maxim *quicquid plantatur solo solo cedit*, asserts his rights as owner of the soil by saying that whatever is annexed to the house or building must of necessity become his property.

It may be convenient to discuss this question from the severely practical point of view by considering the legal bearing of certain cases which must be of comparatively frequent occurrence; but before proceeding to consider the particular cases, it may be well to understand the general principles of law by which fixtures become vested in a landlord. The consideration whether the article is essential to the enjoyment of the premises on the one hand, or whether it is a mere convenience on the other, is a material element in deciding the character of the annexation as being complete or incomplete respectively. There are, however, certain articles which are removable as between landlord and tenant which have so become removable by custom, having regard to the reason of the *purpose* for which such annexation was made. Amongst these are certain articles of trade, agriculture, ornament and convenience. The reason for the relaxation of the general rule in respect of these articles seems to be founded on the essentially temporary purpose for which the annexation is designed, and on the inconvenience which would arise to tenants if, by every slight attachment to the freehold, the landlord should obtain the absolute property in the article annexed. The privilege in the case of ornaments seems to be of a more limited nature than that in respect of trade fixtures. Thus it extends only to articles which are perfect chattels in themselves—and which serve for the most part as substitutes for mere movable furniture—and not to things such as conservatories or glass houses in the nature of a building or erection, though of a temporary character and easily movable. The right of removal in any particular case depends on the particular circumstances, and all that can be said in a general way is that such right *may* be defeated either from the mode of the annexation, or from the permanent nature of the purpose for which the annexation was made (as showing that the fixture is essentially a part of the building), or from the physical injury to the freehold which would be likely to result, if the injury caused by removal would be one of a substantial nature.

Applying the foregoing principles to the solution of the problem in hand, it will be seen that electric fittings, though, *primâ facie*, some of them may be fixtures, must to a certain extent be treated as removable. Roughly speaking, the line appears to be drawn in practice between those parts of an installation which are necessarily of a permanent character, and those parts which may be altered to suit the fancy of a particular tenant. Regard must also be paid to the extent to which any particular article is affixed to the freehold. It is obvious, for instance, that wires embedded in the plaster of a wall could not by any stretch of the imagination be regarded as a fixture which a tenant was entitled to remove. It would be as fair to say that a gas pipe put in by a tenant as part of a lighting system did not become the property of a landlord. On the other hand—to go to the other extreme, it is clear that a mere incandescent lamp could not possibly be looked upon as the property of the landlord.

It is somewhat remarkable that the only case which throws any clear light on the subject is one in which it was held that gas fittings do not vest in the landlord. There appears to be no reported decision on the subject of electrical fittings, and the questions relating to them must be answered by having recourse to first principles.

It is now proposed to deal with certain concrete cases :—

(*a*) A tenant wires a house which he holds under a lease for years. Do the wires vest in the landlord at the end of the term?

It is clear that in this case the wires and the casing of the wires vest in the landlord, and could not be removed by the tenant unless pursuant to special powers conferred upon him by his lease. A tenant would be liable if he attempted to remove the wires.

(*b*) A landlord wires a new house, and the tenant puts in switches, distribution boards, and lamp brackets. Can he remove them at the end of his tenancy?

With regard to switches and distribution boards, these appear to the writer to fall within the category of articles which are of a permanent character, and would have to be used in practically the same form in relation to any installation. At any rate, he would be sorry to advise any tenant to remove them only to leave blank spaces on the wall to which they were affixed. With regard to lamp brackets, these appear to fall within a different category. They are often fanciful in design and very expensive. They can be removed without doing damage, often by the mere turn of a screw. In these circumstances, it appears to be clear that they are tenant's property, which he can remove at will.

(*c*) A tenant puts in a transformer at his own cost and expense. Does the transformer vest in the landlord?

With regard to a transformer, this appears to be a separate instrument, which would clearly be easily detached, and must, in the writer's view, be treated as a tenant's fixture, which he can remove.

(*d*) A tenant puts in ceiling roses, made of metal or porcelain, and wall sockets. Do any of them belong to the landlord?

Ceiling roses appear to be very much on the border line, but it would seem that, inasmuch as they are generally ornamental objects, they should be treated as tenant's fixtures. It is probable that in case of a dispute, a reasonable landlord would agree to treat an ornamental rose as the property of his tenant and the ordinary white roses as landlord's fixtures. As to a wall socket (*i.e.*, the part into which the plug is fitted), it is conceived that this would be a tenant's fixture, as it might easily be removed and replaced by a permanent connection to a wall or bracket lamp.

(*e*) Assuming a tenant installs electric light throughout a house, can any action be brought against him by his landlord, if on finding that the landlord refuses to pay anything towards it, he deliberately cuts or damages the wires without defacing the decorations?

It is clear that if a tenant does any damage, whether by removing landlord's fixtures, or improperly removing his own, he can be held liable to make it good. The ordinary covenant to repair, and leave in repair, would clearly impose such a liability upon him.

THE ELECTRIC DRIVING OF WASHING MACHINES.

[COMMUNICATED.]

In the search for new day loads, the central station engineer cannot afford to neglect the possibilities of electric driving of washing machines (of the drum and centrifugal types), wringing machines and other laundry machines used in large and small houses. Electric motors have already been considerably employed in this connection in America and in Germany. The machines in question offer a fairly steady day load during the time they are in use, but in private-house installations it is naturally usual to carry out laundry work during the early part of each week, and the central station could count on little laundry demand in such cases after, say, Wednesday. Electrically-driven washing machines are, however, most likely to be installed by large houses and in common washeries attached to blocks of flats, &c., and, particularly in the latter case, there is likely to be a considerable demand throughout the week. Where public wash-houses, or wash-houses attached to blocks of flats, are concerned, the reduction in the time occupied in performing a given amount of washing where electric motors are employed offers a valuable solution to the present overcrowding difficulties experienced during the early part of each week.

The labour-saving and hygienic merits of electric driving in this connection are obvious and are very considerable; even as compared with hand-driven washing machines. In the smaller installations it is generally convenient to place the motor at the foot of a pedestal carrying the countershafting and pulleys necessary to drive the machines employed. In any case, it is necessary to make allowance for the damp atmosphere in which the motor works, and, in the case of a motor fixed on the ground level, the machine must be totally enclosed and waterproof. It must also be remembered that any complex mechanism is here out of place, for it will receive little skill in usage and less care in maintenance. Gearing and belting must be so enclosed that there is no risk of soiling or damaging clothes or more serious accidents.

A well-known German firm gives the following estimates of the cost of washing by hand alone, by hand-driven machines and by an electrically-driven equipment. It is assumed that the clothes to be used weigh 220 lb. when dry; this total is made up as follows:—20 bed covers, 45 lb.; 20 sheets, 40 lb.; 40 pillow cases, 25 lb.; 100 handkerchiefs, 33 lb.; 90 serviettes, 29 lb.; 20 table cloths, 26 lb.; 25 shirts, 22 lb.

The proportions of this "wash" are rather peculiar and show an extraordinary shortage of underlinen, but this does not affect the following data:—

		s.	d.
By hand.—			
22 lb. bar soap, at 4d.		7	4
11 lb. soda		0	6
220 lb. coal		2	6
Two washerwomen, two days		8	0
Board „ „		4	0
	£1	2	4
Hand-Driven Washing Machines.—			
11 lb. of powdered soap		3	0
110 lb. of coal		1	3
Two washerwomen, one day		4	0
Board „ „		2	0
		10	3
Electrically-Driven Washing Machines			
11 lb. of powdered soap		3	0
110 lb. of coal		1	3
½-H.P. motor, 3 hours; 0·9d. unit at 5d.		0	4½
		4	7½

A similar comparison by Ritter, based on a test carried out with the monthly "wash" from a household of four persons, is as follows:—

	s.	d.
By Hand.—		
One washerwoman, for 1½ days	4	6
Board „ „	2	3
Maid servant (no extra wage)	0	0
Coal	2	0
8 lb. of soap, &c.	2	9
	11	6
Maid Servant occupied 8 hours.		
Energy cost (lighting tariff)	0	3
Coal	0	10
5 lb. soap, &c.	1	11
	3	0

The cost of the same amount of washing sent to a laundry would be 25s. 6d.

The above comparisons show a large direct saving in favour of electric driving (even when using electricity supplied at lighting rates); the saving is sufficient to cover the capital cost of the installation in a year or two at the most. Further obvious advantages of electric driving include reduced manual labour, healthier conditions and better appearance of clothes.

As a rule it would be possible to arrange for the supply of the necessary motors at power rates, and the energy bill then becomes negligible, and the only items of importance are the cost of soap and coal. The cost of soap is practically irreducible, assuming full advantage to be taken of the various modern cleansing agents, but there is a considerable field of application for electric heating in place of coal or gas. Where a house has a central water heating boiler, the various vessels can be filled from the hot-water pipes, and brought to and maintained at boiling point by electric heating elements. There is no reason why an electric water heating plant of 100 per cent. load factor should not be installed in public wash-houses, and in wash-houses common to blocks of tenement dwellings, &c., smaller heating elements being employed to keep the water boiling during its use in the various vessels. Electric heating allows of accurate heat control and maximum cleanliness, and enables vessels to be located in any convenient spot, but, as a rule, gas heating of the "copper" and other vessels is more economical, practically as convenient, and, in this service, as safe as electric heating, though lacking the hygienic merits of the latter. In the power application mentioned, gas cannot at all compete with electrical energy.

A FEW REMARKS ON COOKERS.

By E. P. AUSTIN, A.M.I.E.E.

The attention that is being focused on the electric cooking and heating load and its developments will, no doubt, result in the consumption of energy for domestic purposes forming one of the principal items of the central station output.

The question presents different aspects, depending entirely on the social life or conditions of any particular district or community. There is already much information available relating to this subject as far as residential flats and suburban districts in and around London are concerned, but the greater number of provincial supply engineers are still feeling their way in the matter, being much exercised in their minds on such questions as the effect on mains and services, choice of apparatus, overlapping the peak, and, in natural sequence, the tariff.

The practicability, and in many respects the superiority, of electric cooking has long been well established, but the reliability of the apparatus is still a matter of doubt in some people's minds. That such misgivings are only the remnants of prejudice, germinated by unpleasant experiences of comparatively remote date, is very evident from, amongst other things, the manufacturers' substantial guarantees, the quantity of apparatus sold, and the excellent results obtained in many towns.

Any lingering misgivings a person may have respecting reliability would be quickly dispelled by a tour of the manufacturers' workshops.

The writer recently had the privilege of visiting some of the principal firms who make cookers and heaters, and of inspecting their goods in all stages of manufacture and test, and was much impressed by their robust construction and the ingenuity displayed in the design and application of various standard heating elements.

The choice of apparatus is governed by the capacity of distribution mains and services and the size of the houses to be equipped. In many provincial towns, the bulk of the domestic supply will be for houses ranging between £20 and £35 per annum rent, where the house-wife does most of the cooking for a small household, and consequently desires more than anything else cleanliness, comfort and quickness from the cooking apparatus. For such houses the maximum demand should be as low as is consistent with good work, the apparatus simple and robust, for however much an ingenious device may appeal to a man, a woman will not take more than a passing interest in tools that are not essentially useful to her.

A very useful article is the electric grill, arranged so that it can efficiently perform two operations simultaneously. It should reach working temperature in about 30 seconds, without waiting for a mass of metal to become heated up. Thermal storage is not required in this class of apparatus, since they are used largely in preparing breakfast, and the knowledge that a stove will cook after the current has been switched off is not much consolation to a man who has missed his early train through waiting for his breakfast. For quick work and general utility an outfit comprising a grill, boiling plate, and self-contained water-boiler has a wide range of usefulness.

The self-contained utensil has much to recommend it for speed and efficiency, and its development along lines that allow of its immersion in water for thorough cleansing will do much to keep down the maximum demand.

In any case a self-contained kettle or saucepan should form part of a cooking outfit, for boiling small quantities of water quickly.

For larger work than can be performed by the previously-mentioned articles there are many useful patterns of complete cookers to choose from, although some of the types have formidable maximum demands. Many original designs are used, but the majority of cookers follow the lines of the familiar gas cooker, since a certain standard of convenience has been set up. In fact, many electric cookers are built up from gas-oven patterns with the necessary adaptation and improvement of internal arrangements required by electrical methods.

For the type of house mentioned above, a cooker outfit with a maximum possible demand of 2,500 to 3,000 watts is all that should be installed. For families comprising six or eight persons, a cooker of 4,500 watts' capacity would probably be required. These ratings do not of course apply to the oven alone, but include all hot plates and grill.

Although there are many ingenious designs of breakfast cookers obtainable, the initial outlay is in almost every case higher by far than that required for a corresponding gas or oil cooker. For instance, an electric cooker with two heating elements, one for a small closed space for roasting with there regulations, and one for grilling and boiling on top, can be sold retail for about £4 10s. A similar gas cooker can be bought for 25s. to 30s. Comparisons between other types of cookers give much the same result, but not so marked in the larger domestic cookers, and when the constructions are compared there seems to be a large margin for the additional cost of assembly and heaters, which latter can generally be renewed when necessary at a small cost.

There is at least one grill on the market that boils fairly quickly and grills and toasts excellently at the same time, that can be sold at £1 complete. The majority cost from 10s. to 15s. more than this, retail. As far as the writer has been able to ascertain, this is the cheapest article on the market, considering its usefulness. Its principal drawback, common to all similar apparatus, is the length of time required to boil; but when other operations are carried out at the same time, the drawback is not felt, and the cooker is very efficient.

Supply engineers must look to a large number of consumers using electric cooking and heating at small individual consumption for the bulk of the domestic purposes output, rather than a few consumers with large consumptions.

The applications should be rendered as popular as possible, and not treated as a sort of luxury. The more popular electric cooking becomes, the more diverse will be the load, particularly in the smaller towns, where dining late is the exception.

The advantage, from the load-factor point of view, of reaching the small householder is more apparent in the North and North Midland towns than in the South, for in these districts the midday meal time is extended over a longer time due to many works, &c., stopping at 12 noon and a large number of business houses and offices adjourning one hour later.

Popularising the smaller apparatus will do much to raise the load factor, and many engineers are on the lookout for an efficient boiling plate with substantial connecting arrangements that will sell at about 12s. to 14s. to the consumer. There are excellent plates at the price, but the method of connection is always faulty, except in one or two cases of high-priced articles. A hot plate should have a tubular metal handle, with the cable passing through it well beyond the reach of spilled liquids, &c. Heat regulation should be done by means of switches, as the three-pin method is dangerous, particularly in a house where there are children, who will most certainly get a shock from such a device at some time or other.

Most towns now supply heating units at 1d., and it only requires a cheap line of fool-proof cookers to accelerate the popularity of electric cooking.

There are, as indicated in the foregoing, some reasonably priced devices, and improvements in the connections of these would be more welcome than a reduction in price.

There have recently appeared on the market some useful designs intended to act as incentives to consumers to use more ambitious apparatus. The makers are inclined to be optimistic in their claims for the capabilities of these things, and it is well for electricity supply people to act cautiously in this direction, or a device excellent in its way may produce a wrong impression on a consumer through injudicious description.

Radiators and convectors are more reasonable in price than cookers, but are at present likely to prove a little costly for heating large rooms. Their great advantages in other directions are well known. The position in a room is an important point, and they should not be used directly in front of an open fireplace. The hot air does not, as a rule, pass up the chimney, as the chimney is cold; but a cold draught comes down the chimney and brings soot with it, to be deposited on the walls by the heated air from the radiator. This remark applies equally to other forms of radiator as well as electric appliances. Low temperature convectors with large elemental heating surface give the most pleasant results, as the heated air is not excessively dried, and is evenly distributed about the room,

The cheapest article on the market is the electric iron, and this is no doubt due to the competition in that direction, and the large quantities sold.

Incidentally, the methods of connection are generally better than the existing hot-plate connection. Several makes that can be sold at 9s. 6d. complete, or a little less, leave little to be desired, and are certainly better for their purpose than anything else on the market of any system.

Since the above lines were penned, several makers have come forward with well-constructed boiling plates with complete protected cables and control switches at prices that admit of hiring out, as a demand has now arisen for what Mr. Sankey has termed the "electric gas ring."

PROCEEDINGS OF INSTITUTIONS.

Rolling-Mill Practice in the United States.

By J. Puppe, D.Ing. (Breslau).

(*Abstract of paper read before the* Iron and Steel Institute, *October*, 1912.)

Early in 1911 the author visited the majority of those ironworks of the United States where typical American rolling-mill practice is followed, for the purpose of studying the latest methods and improvements.

Amongst other features observed, a striking difference between German and American practice was the rate of diminution of the draught of cogging rolls. Whereas in Germany a reduction of 14 per cent. is hardly ever exceeded, and with harder material an average of 11 to 12 per cent. reduction is the rule, the reduction in the draught from one groove to the next often amounts to 20 per cent. in American practice. The roughing rolls of the rail mill at Lackawanna even give an average reduction of 24 per cent. per pass in the first six passes. How far the structure and quality of the material suffer in the case of rails is a question which will be discussed further on.

The shortness of the rolling period is further accounted for by the manner of controlling the auxiliary engines, which now very generally consist of electric motors. The controllers are operated with very short levers with short ranges, and there are only three notches, "stop," "forwards," "backwards," with no intermediate steps.

It appears that American cogging mills differ considerably from German ones both in point of construction and design and also in the method of working; the high rate of production is chiefly rendered possible by the very much simpler plan of rolling, which consists in rolling to larger sections, thus shortening the rolling period, and by the rapid and accurate handling of the auxiliary engines.

When a single rail mill, such as that at the Edgar Thomson works or at Gary, turns out from 3,500 to 4,000 tons in 24 hours, it is a question whether that amount of care is bestowed on the work which is desirable in view of the great importance of obtaining the requisite high quality in the finished rails. This supposition would seem, to some extent, to be confirmed by the fact that rail breakages on American railways are of much more frequent occurrence than in Europe, notwithstanding that, for a long time past, various commissions of rail manufacturers and consumers have been investigating the causes of this trouble, and have endeavoured by various means to improve the quality. It must be admitted that the conditions of railway service in the United States are far more severe than with us, and that the loads and speeds have been very much increased since the eighties. The risk of breakages must have increased considerably, especially in view of the low temperatures sometimes prevailing during the winter months.

Proposals for the improvement of the structure of the metal by lowering the temperature at which the rails were finished, and a specified permissible maximum contraction, have not proved a sufficient remedy in increasing the resistance to shock and jarring. In 1903, the Rail Commission of the American Society of Civil Engineers received a pronouncement from a railway engineer-in-chief as follows: "The combining of the rail-rolling mills has resulted in a continuous deterioration of the rail material, and every effort must be made to counteract this tendency."

The question whether the number of rail-breakages are due to inferior quality resulting from the rapid production on a large scale in conjunction with the acid Bessemer process, which has long held the field, or are to be attributed to the severe conditions of service, is one which is not yet solved. The fact is, however, noteworthy that the production of rails of special steel is now continually on the increase in the United States, and there has of late been a considerable decline in the output of acid Bessemer rails.

It is also noteworthy that at the Indiana Steel Co.'s works at Gary, open-hearth furnaces alone have been decided upon, from which it is clear that American railway engineers prefer open-hearth to acid Bessemer steel rails. At the same time, the increase in the production of open-hearth rails is also in some respects due to the increasing scarcity of suitable ores for smelting Bessemer pig.

Naturally the treatment during rolling has a particularly important influence on the rail quality. The initial and final temperatures, the cross-section and length of ingot, the proportion of initial and final section to the number of passes, the roll draughting and the treatment of the finished rails, all play an important part.

It is clear that it cannot be immaterial whether a comparatively hard material is rolled down to its final shape in 30 passes with a reduction of 12 per cent. in section at each pass, or in 15 passes with a 23 per cent. reduction. The finishing temperature is bound to be enormously influenced by the number of passes and the reduction of draught; moreover, the structure of the steel, especially at the lower temperature required in the case of the harder kinds, suffers through the too severe squeezing of the metal.

Comparative figures for American and German rail-rolling mills show a much greater uniformity in favour of the latter, which entirely confirms the foregoing considerations. The German figures besides show a smaller average reduction of draught for the roughing passes and all the succeeding passes.

At the rail mill of the Indiana works it may be mentioned that the ingot section is 20 × 24 in., and it is rough rolled in nine passes to about 8 × 8 in., and finished off in nine more passes without reheating. The average reduction of draught in the first nine roughing passes is 21 per cent., which must be regarded as very high; in German roughing mills 15 to 17 passes would be required for this work. The shape of the grooves indicates the tendency to reach the finished profile as soon as possible, and the reductions of section are very considerable.

A New Type of Large Gas Engine.

By Alan E. L. Chorlton, M.I.Mech.E., A.M.I.E.E. (Manchester).

(*Abstract of paper read before the* Iron and Steel Institute, *October*, 1912.)

The theoretical economical advantages of large gas engines as prime movers are so well known in this country, particularly when using the waste gases from either blast-furnace or coke ovens, that some explanation must be sought to explain the relatively slow progress which has taken place in their use when compared with that on the Continent, especially in Germany. The importance of these economies, as affecting cost of production, is probably greater for the iron, steel and coal industries than for any other, and is of such obvious moment that the disadvantages of the gas engine that are held to exist in this country, as compared with Germany, must be of very real significance indeed to account in anywise for the relatively small extent of their usage in these industries.

The limitations which have prevented the progress of the large gas engine are primarily due to—

(*a*) The prevalence of the belief of unreliability.

(*b*) The comparatively high total first cost of installation.

This view of unreliability has, of course, been formed from the troubles experienced in the past. It may be said constructionally to refer to the cracks and breakages of important parts of the engine (undoubtedly a too common occurrence in the past).

Generally, these troubles sprang from initial foundry strains set up between the inner and outer walls of the casting when these were cast in one piece, as was the original practice. These initial strains, augmented by those set up through the different temperatures of the parts when working, eventually caused cracks and failures. This more than ordinary occurrence of cracks compelled makers first to discover the reason and then to amend their designs to prevent them; and the final forms of all types had the inner and outer skins of metal connected only as far as possible in one place, the other ends being left free to allow all the differential expansion and contraction set up in the foundry and in working to take place freely. A flexible connecting membrane completed the jacket to retain the cooling water in place.

From the practical point of view, it appears that the cylinder should have no valve pockets, that is, it should approximate to a simple pipe, and that the jacket should be a separate casting.

The next source of unreliability is in the valves and valve gears, subject to the heat and stress of the explosion. This is a frequent cause of failures in all prime movers. Obviously, therefore, an improved engine should, if possible, be valveless; have cylinders of simple pipe form; and have separate jackets.

The only large engine with cylinders of pipe form without valve pockets, &c., and where the two pistons perform the various valve functions successfully, is the Oechelhaeuser; the disadvantages of this type, which have restricted its use, although its thermal economy is well known, spring from other causes, as high first cost, large floor area covered (horizontal type), &c.

The success of a valveless action was confirmed by the author's English experience with the working of the central exhaust ports by the piston in the Körting type of engine—an experience which clearly indicated that there was no apparent reason why the air and gas inlet to the cylinder should not be controlled by a similar method in an adjacent cylinder. The outcome of this was the adoption of two parallel cylinders, with ports about the middle, connected by specially shaped passages at their ends; one piston thus controlling the inlet through the ports in one cylinder, and its fellow expelling the exhaust through a similar set of ports in the other cylinder. This design was more or less bound to be of the two-cycle type, and he naturally leaned to such a principle, seeing that his experience had convinced him that by retaining, amongst other things, small cylinder diameters, it was the most suitable form for large powers.

From fig. 2 it will be seen that the cylinder consists of two single-walled "U" tubes placed end to end, the inlet and exhaust ports being about the joint; flanges on the cylinders—set back somewhat from this juncture—hold in between them the exhaust and inlet boxes.

The whole cylinder unit presents extremely simple forms of single-walled castings, particularly suitable for successful and economical foundry work without setting up casting or expansion strains, and also for use in internal-combustion work itself, as there are no pockets or irregular shapes; all sections are more or less cylindrical, including the connecting passages. No heavy flanges or joints occur about the points of maximum pressures and temperatures as in the ordinary type of engine. This form gives most effective cooling to all parts, as, being inherently of a strong section, they can be made with comparatively thin walls. The efficiency of the cooling is further increased by the accessibility of the water to all parts of the combustion chamber, the usual thick flanges and joints there being avoided. Thus, the engine may run at a higher temperature than is usual in the present large sizes. In fact, on test, full load has been maintained continuously with the jacket water boiling, and under such conditions the amount used can be considerably reduced (allowing in some cases the motor-car type of cooler to be used, with its advantages of small space occupied, &c.). Further, the absence of joints and cavities in the combustion chamber reduces the risks of pre-ignition, and improves the efficiency of scavenging. High compression can be used without the disadvantages of water injection.

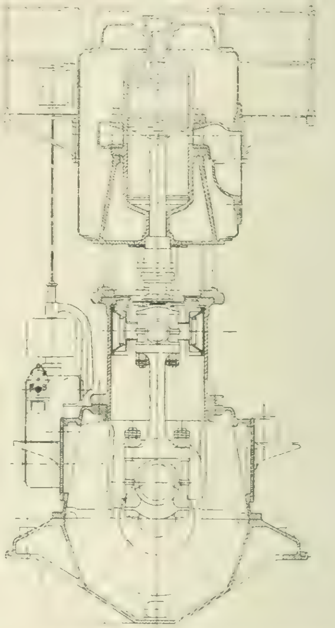

Fig. 1.—"Duplex" Engine (Transverse Section).

All the cylinder, &c., walls being single, the jacket must be provided in a suitable manner to retain the necessary water, and this is most readily done by dropping the whole "Duplex" cylinder into a simple tank, as shown in fig. 1, the cylinders resting by their central flanges on stools on the tank bottom or engine entablature. By this construction is secured at once complete allowance for temperature expansion without restraint; the exhaust outlet, the only connection to the outside, passes through the tank wall by a stuffing box, or a flexible membrane is used, the connection to the charging pumps being within the jacket tank. It will further be seen from this design, that in casting complete expansion is allowed in all directions, and no strains are set up, all the cylinders, &c., being single-walled. Difficulties with valves are done away with, for though these are now much rarer than in the past, still the exhaust valve of all four cycle engines remains a part requiring considerable attention. No doubt the present large horizontal gas engines with their simplified valve gear are a great improvement over the previous types; still the further great advantage of an engine with no valve gear must be apparent, particularly when taken into account with the possibilities of higher rotational speed.

There still remains the disadvantage of heavy capital outlay when the present large engine of the horizontal type is considered.

For large powers the present comparatively slow-speed horizontal is the only one in the field, and the large amount of room taken up by this type, with its expensive foundations, &c., is well known. The cheaper prospect, judging from steam usage, and some work already done in medium-powered gas engines, is in the vertical design.

The reduction in cost effected by installing the large vertical "Duplex" type as against the present horizontal engine is 20 per cent.

The engine may run at considerably increased rotational speed, and from the fact that there is a compression on each stroke of the two-cycle engine balancing the inertia of the reciprocating parts, a higher piston speed than is usual can thus be adopted with the attendant thermodynamic gain.

Ordinary air and gas-charging pumps driven by an auxiliary eccentric are provided at one end, within or alongside the tank, and connect direct to the inlet valve box of one cylinder. The "Duplex" power cylinder is so arranged that the exhaust piston has a lead over the inlet piston. The governor is gear-driven, and acts on a simple control valve on the pumps. The ignition is of the rotary magnetic high-tension type in duplicate. The other details of the engine construction are similar to standard high-speed steam engine practice.

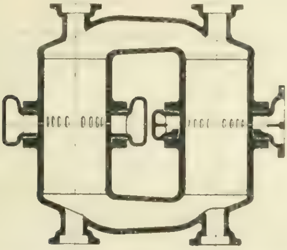

Fig. 2.—Section of "Duplex" Cylinders.

In order to indicate the large powers for which these engines can be built, the cylinder dimensions of a vertical twin "Duplex" of 6,000 B.H.P. may be noted (fig. 1). These cylinders are but 36 in. in diameter × 43 in. stroke, and the speed of revolution is 140 per minute. The fly-wheel is 12 ft. 3 in. in diameter and 60 tons in weight, and the floor space taken up by the engine is 475 sq. ft.

These sizes are by no means the limit, and the author sees no reason why cylinders of 48 in. diameter should not be successfully used. A triple "Duplex," with 48-in. diameter cylinders and 4-ft. stroke, running at 125 R.P.M., would give about 16,000 B.H.P. at quite a moderate mean pressure. The moving parts under explosion stress for engines of equal turning moment, "Duplex" and four-cycle horizontal, number respectively 4 and 20.

Horizontal Engine and Vertical Duplex Engine with Equal Numbers of Impulses per Revolution.

Twin tandem four-cycle horizontal.		Twin duplex two-cycle vertical.	
Cylinders ...	... 4	Two duplex ...	... 4
Pistons ...	... 4	Pistons	... 4
Inlet valves	... 8 with gear.	Inlet valves ...	... None.
Exhaust valves	... 8	Exhaust valves ...	... None.
Piston rod packing	8	Piston rod packing	... 4
Total ...	... 32	Total	... 12
Total moving parts subject to heat stress—20.		Total moving parts subject to heat stress—4.	

Recovery of waste heat from the exhaust is an interesting part of the internal-combustion engine problem, and one in which the author has had considerable experience with large horizontal engines of the two-cycle type. The results obtained in the way of evaporation with this type, where the proportion of heat discharged by exhaust to jacket is greater than that of four-cycle engines, have been as high as 3 lb. per B.H.P.-hour, the boiler being fed with hot feed from the jackets and economiser pipes.

The steam generated in these boilers can be used in various ways. When the source of the gas is an ammonia-recovery producer plant, all that is evaporated will be required for the producers to keep the temperature down. The value of the steam generated, 0·02d. per B.H.P.-hour, is equivalent to the value of the gas taken by the engine with the present price of by-products; thus the gas engine need not be debited with the gas used, and consequently the cost per B.H.P.-hour generated is extremely low. On electrochemical work, with 100 per cent. load factor, the net cost of energy for a 3,000-B.H.P. plant is 0·047d. per B.H.P.-hour, assuming interest and depreciation at 10 per cent.

In other cases, the steam can be used for power purposes, driving a steam auxiliary cylinder on the main engine. Or it may be used for any auxiliary plant, such as water pumps, or charging pumps, when these may be separately driven. These exhaust boilers act as very effective silencers.

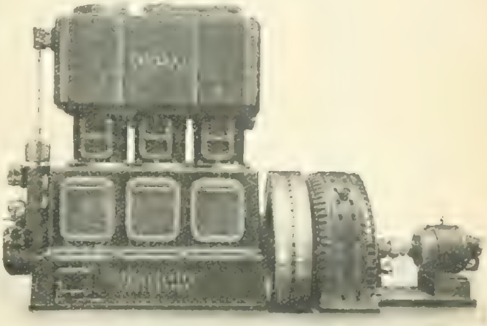

Fig. 3.—"Duplex" Gas Engine and Electric Generator.

A standard high-speed engine of the vertical "Duplex" type, upon which very exhaustive tests have been made on the shop test plate, gave the following figures

Mechanical efficiency	85 per cent.
Heat consumption per B.H.P.-hour ...	10,500 B.TH.U.
Water consumption per B.H.P.-hour ...	4 gallons.
Oil consumption per B.H.P.-hour ...	0·0004 gallon.
Governing, full load on and off	1½ per cent. rise—steady afterwards.

These results are from cylinders 15½ in. in diameter by 18 in. stroke, and will doubtless be improved upon with larger cylinders and further refinements.

The first engine built was running on load in parallel with other gas sets within two hours of its first starting up on gas, a result that with a new type of gas engine is without precedent.

The Magnetic Properties of Manganese and Nickel Steels.

(*Abstract of papers read before the* Iron and Steel Institute, *October*, 1912.)

Dr. S. Hilpert (Charlottenburg) and Dr. W. Mathesius (Worcester, U.S.A.) read a paper on this subject. As the result of tests on various nickel and manganese steels, the authors find that in all the steels the magnetisability after quenching from 1,200° C. was greatly increased, as compared with that of the same material after similar treatment at lower temperatures, and also after slow cooling. By means of systematic thermal treatment in combination with magnetic measurements, it has been found that at high temperatures (above 1,050° C.) substances are formed which at ordinary temperatures are strongly magnetic, but in spite of quenching cannot be obtained in a pure state.

All the steels, with the exception of nickel steel with 31 per cent. of nickel, showed both in the quenched and in the slowly-cooled specimens an increase in the magnetisability when annealed at temperatures between 400° and 450° C. This is not, in any case, an ageing phenomenon, but is the result of a new state which is obtained only by a heating process. In general, it has been shown that the question whether the heat treatment has been carried out under a rising or a falling temperature has a decisive influence upon the magnetic properties.

The metallographic investigation in relation to the magnetic properties showed that there was no distinctive structure which was characteristic for magnetic and non-magnetic steels.

Dr. E. Colver-Glauert (Sheffield) and Dr. S. Hilpert (Charlottenburg) dealt with the thermal-magnetic behaviour of 25 per cent. nickel steel, in continuation of previous researches. The range of temperature covered was 1,250° C. to − 180° C.

In fig. 1 they have plotted their results in the form of what may be regarded as the "life" of the alloy in respect of thermal-magnetic transformations.

The lower temperature-hysteresis loop of this diagram is essentially that discovered by Prof. Hopkinson, with the exception of minor differences as to the temperatures at which the transformations occur and the completeness thereof, as noted in the authors' earlier paper. The upper temperature-hysteresis loop explains the difficulties experienced in investigating the reasons for slow cooling results in a magnetic product, and the very different behaviour of quenched and slowly cooled specimens. If we assume this alloy to be heated to a high temperature and then allowed to cool, it follows the curved line to 950° C., after which the vertical line is followed to slightly below zero. Cooling below this point results in a sudden increase in the magnetisability, when − 10° C. is reached, followed by a gradual increase to − 180° C. Subsequent heating produces a slight gradual increase up to 450° C., with a (magnetic) softening of the material. Above this temperature there is a rapid falling off in the magnetisability, this reaching a minimum which is practically zero at 700° C. On continuing the heating above this point an increase occurs, reaching a maximum at 950° C., at which point the original curve is regained and followed in an upward direction. A specimen cooled or quenched on a heating curve from any point between 700° C. and 950° C. will follow a vertical line from that point to — 10° C., further cooling resulting in an increase in the magnetisability until the line below zero in the diagram is reached and followed. Further, a specimen, unless it has been rendered non-magnetic, in which case it follows a vertical line, will, on being reheated from any temperature between 400° C. and — 180° C., follow a line parallel with that from — 180° C. to 450° C. until the cross line is cut, when the latter will be followed.

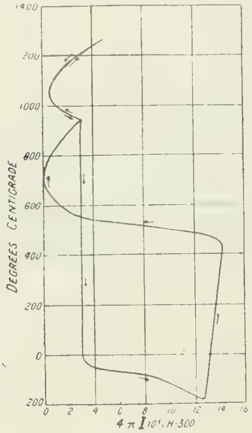

Fig. 1.

The chief point which the authors bring forward is the existence of the temperature-hysteresis loop in the alloy between 450° C. and 900° C. These further experiments and facts only strengthen their view that the allotropic theory of iron alloys in regard to their magnetic properties is totally untenable.

Cast-Iron Pipes and Superheated Steam.

In a paper on "The Growth of Cast-Irons after Repeated Heatings," **Prof. H. F. Rugan**, of New Orleans, gives the following conclusions:—

1. The strength of the outer fibre of the scale surfaces of a casting is greater than that of the metal taken from other portions of a casting.
2. The temperature encountered in pipe lines using superheated steam is sufficiently high to produce disintegration in a casting, causing it to grow and become correspondingly weak.
3. Grey cast-iron fittings of ordinary mixtures are unfit for use in pipe lines designed for superheated steam.

The Institute of Metals.

At the Autumn meeting of the Institute of Metals, held last month, the proceedings dealt mainly with the physical characteristics, and the effect of various methods of treatment on the microstructure of metals and alloys. Copper and alloys of copper with other metals figured largely in these researches, but the observations made as a rule had no obvious bearing on the use of copper in the electrical industries.

The effect of the presence of oxygen in brass was dealt with by **Prof. T. Turner**, of Birmingham University, who stated that brass poured at a lower temperature than usual was apt to be of inferior quality, and that the inclusion of oxide of zinc in this way might account for the rapid and irregular corrosion of condenser tubes that was sometimes met with. The oxygen must be present as oxide of zinc, because metallic zinc was proved to reduce copper oxide to metallic copper; and the zinc oxide was probably not dissolved, but mechanically entangled in the substance of the alloy. Unfortunately, no suitable process for the accurate determination of oxygen in brass appeared to be available.

The influence of oxygen on the properties of metals and alloys was also investigated by **Mr. E. F. Law**, who emphasised its extreme importance, and pointed out that, nevertheless, the subject had been almost entirely neglected on the scientific side, partly on account of the experimental difficulties attending the determination of oxygen. The trouble with oxidised metals was that they frequently passed the mechanical tests, and it was only when they were put into service that the real trouble began. It was in connection with the subject of corrosion that the question was of the most vital importance. The comparative freedom from corrosion of the Sandberg steel was due to its deoxidation by the addition of silicon.

Two papers dealt with the joining of metals. **Mr. A. E. Tucker** discussed the various methods in practical use. The highly injurious effect of the presence of zinc in tinman's solder was pointed out; when this occurs, a little acid in a soldering solution is a great help. Antimony increases the strength of the joint. The author drew attention to the beneficial effects of heating the parts to be joined, squeezing out as much of the soldering medium as possible, rubbing the surfaces together or with the soldering iron to improve the cohesion, &c. For joining thin steel tubing, as in bicycle frames, he would prefer soft soldering to brazing if the lugs were carefully machined to a close fit, as the metals employed in brazing and soldering injure the steel if sufficiently heated, though they have no similar effect on brass or copper, and soft solder flows better into the joint. One of the best fluxes for ordinary soldering contains chloride of ammonia, as well as chloride of zinc. The best "brazing" is done with silver solder, which is used in the blading of turbines. The alloy used consists generally of about 60 per cent. silver, 23 per cent. copper, and 17 per cent. zinc, with borax for the flux, with or without carbonate of soda. This mixture is very liquid in the molten state.

The presence of tin in brazing solder is highly detrimental to iron and steel parts, and results in unsatisfactory and unsafe joints.

By wrapping suitable brass wire round a joint and heating the joint by passing an electric current through it, while surrounded with a reducing gas, such as hydrogen or coal gas, a very perfect joint is obtained without the use of any flux, with the great advantage that there is no borax to clean off the joint. High-speed steel tools can be joined to mild steel shanks by using copper sheet or wire as the brazing solder; the joint is exceedingly strong, and withstands hardening temperatures. The Pick process for brazing cast-iron by first decarburising the iron with copper oxide and brazing with brass solder is very effectual.

Most of the special methods for soldering aluminium break down when the joint is exposed to warm steam, a very severe test. The best results are obtained with solder consisting almost entirely of aluminium, the flux being a mixture of alkaline aluminium chloride with potassium or calcium fluoride, damped with alcohol. Aluminium alloys can be joined with soft solder if the parts are first coppered by electro-deposition.

The rest of Mr. Tucker's paper, and the whole of that by **Dr. F. Carnevali**, of Turin, related to autogenous welding, which has extended enormously in recent years, and has replaced other methods in many cases.

Mr. Tucker laid down the following conditions for success as applying to all welding with acetylene or other hydrocarbons:—The use of pure gases; the use of a metal rod of approximately the same composition as that of the work to be joined; thorough fusion of the inside surfaces before the additional metal is applied; cleanliness of the parts, and when desirable the use of suitable deoxidising and fluxing powders, such as charcoal and borax; and the use of a blowpipe capable of complete control in respect of size of flame and proportion of mixture. He anticipated the general substitution of this method for ordinary brazing in work of the first quality. Acetylene and electric welds in steel should not be hammered while the weld is being made. A good fusion weld very seldom breaks at the point of welding.

The author, referring to the Thermit process, spoke of its extreme beauty and simplicity; "we have here a small steel foundry not much larger than a silk hat, from which the metal pours in a perfectly liquid state." He thought it very probable that in point of strength most Thermit welds were superior to those electrically made.

A couple of pages were devoted to arc and resistance welding. The use of "spot-welding" instead of riveting was described; a skilled workman can make 1,000 welds per hour with the spot-welding machine on plain sheets. Water-tight welding is also practised, the seam being passed slowly through the machine, which is coming into very extensive use. Enamelled goods thus welded instead of riveted are much superior to riveted goods. The welds are permanent even when exposed to alternate heating and cooling, which often loosens rivets. The manufacture of compound sheets of different metals welded together was also described.

Dr. Carnevali's paper described investigations which he had carried out on the autogenous welding of copper, brass, bronze and aluminium. The paper was illustrated by a number of photographs of actual welds and weld fractures, as well as of microphotographs highly magnified in order to illustrate the structure of the welded metals.

Dr. Carnevali showed, in the case of copper and its principal alloys, that rapid heating and sudden fusion of the metals subjecte to welding, profoundly modified their physical and mechanical properties, developing within them strains and structural alterations which were detrimental to the metal. In the case of copper there was an average reduction of 50 per cent. in the capacity to resist fracture, and an increase of about 30 per cent. in brittleness, while the percentage of ductility was reduced to about a tenth of the original. In the case of bronzes and brasses it was not found possible to determine the extent of the deterioration in the mechanical properties, but this deterioration increased as the number of the constituents of the alloys subjected to welding increased. In the case of alloys made up of several constituents, these might be improved after welding by a suitable heat treatment, thus relieving the internal strain set up by the sudden temperature changes involved in the process of welding.

The author concluded that the oxy-acetylene welding of copper and its principal alloys had a practical application limited to those

Parts of machinery which were not of large dimensions, and which were not subjected to severe mechanical stresses.

As regarded the autogenous welding of aluminium, the author observed that the sudden heating and rapid fusion of the metal subjected to the welding process altered the physical and mechanical properties in a manner analogous to that noticed in the case of copper, but to a less degree. The structural modifications principally took the form of coarse crystallisation of the metal. His experiments showed that both by hammering and by re-heating to 450-500° C. the homogeneity of the weld zone was increased; and that whenever aluminium contained small quantities of other elements easily oxidised at high temperatures, *e.g.*, copper, the oxidisation of the metal by fusion was facilitated, also the inclusion within it of granules of oxide detrimental to the mechanical properties of the weld-zone.

However, when carried out with the necessary precautions, the oxy-acetylene autogenous welding of aluminium was held by Dr. Carnevali to be capable of extensive practical application, especially for the welding of small machine parts.

TRADE STATISTICS OF JAPAN, 1911.

The following statement, showing the imports into and exports from Japan of electrical and similar goods during the year 1911, is taken from the recently issued official trade statistics; the figures for 1910 are given for purposes of comparison, and notes of any increases or decreases are added:—

	1910. Yen.	1911. Yen.	Increase or decrease. Yen.
Galvanised iron wire.—			
From Great Britain ...	59,000	109,000	+ 50,000
„ Germany ...	1,979,000	1,963,000	— 16,000
„ Belgium ...	75,000	67,000	— 8,000
„ Austria ...	15,000	11,000	— 4,000
„ United States ...	150,000	179,000	+ 29,000
„ Other countries ...	3,000	13,000	+ 10,000
Total ...	2,281,000	2,342,000	+ 61,000
Rails.			
From Great Britain ...	53,000	229,000	+ 176,000
„ Germany ...	782,000	1,837,000	+ 1,055,000
„ Belgium ...	161,000	216,000	+ 55,000
„ United States	599,000	3,220,000	+ 2,621,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	1,596,000	5,504,000	+ 3,908,000
Posts for electric wire, materials for building, &c.—			
From Great Britain ...	365,000	719,000	+ 354,000
„ Germany ...	34,000	205,000	+ 171,000
„ United States ...	332,000	1,138,000	+ 806,000
„ Other countries ...	20,000	58,000	+ 38,000
Total ...	751,000	2,120,000	+ 1,369,000
Submarine and underground cables.—			
From Great Britain ...	1,045,000*	179,000	— 866,000
„ Germany ...	438,000	197,000	— 241,000
„ United States ...	109,000	—	— 109,000
„ Other countries ...	3,000		— 3,000
Total ...	1,595,000	376,000	— 1,219,000

* Abnormal year.

	1910. Yen.	1911. Yen.	Increase or decrease. Yen.
Insulated electric wire.—			
From Great Britain ...	825,000	1,490,000	+ 665,000
„ France ...	35,000	66,000	+ 31,000
„ Germany ...	403,000	1,758,000	+ 1,355,000
„ Italy ...	22,000	85,000	+ 63,000
„ United States ...	343,000	297,000	— 46,000
„ Other countries ...	9,000	4,000	— 5,000
Total ...	1,637,000	3,700,000	+ 2,063,000
Parts of electric cars.—			
From Great Britain ...	247,000	199,000	— 48,000
„ Germany ...	113,000	496,000	+ 383,000
„ United States ...	464,000	764,000	+ 300,000
Total ...	824,000	1,459,000	+ 635,000
Steam engines.—			
From Great Britain ...	397,000	364,000	— 33,000
„ Germany ...	14,000	60,000	+ 46,000
„ United States ...	194,000	123,000	— 71,000
Total ...	605,000	547,000	— 58,000
Gas engines, petroleum engines, and hot air engines.—			
From Great Britain ...	448,000	758,000	+ 310,000
„ Germany ...	23,000	237,000	+ 214,000
„ Belgium ...	7,000	—	— 7,000
„ Sweden ...	19,000	49,000	+ 30,000
„ United States ...	19,000	32,000	+ 13,000
„ France ...	5,000	33,000	+ 28,000
Total ...	521,000	1,109,000	+ 588,000
Steam boilers.—			
From Great Britain ...	462,000	1,465,000	+ 1,003,000
„ Germany ...	4,000	27,000	+ 23,000
„ United States ...	18,000	185,000	+ 167,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	484,000	1,678,000	+ 1,194,000
Electrical machinery.—			
From Great Britain ...	611,000	1,081,000	+ 470,000
„ Germany ...	634,000	2,755,000	+ 2,121,000
„ Belgium ...	1,000	6,000	+ 5,000
„ Italy ...	26,000	16,000	— 10,000
„ United States ...	902,000	1,811,000	+ 909,000
„ Other countries ...	18,000	42,000	+ 24,000
Total ...	2,192,000	5,711,000	+ 3,519,000
**Hydraulic motors.—*			
From Great Britain ...	29,000	64,000	+ 35,000
„ France ...	16,000	35,000	+ 19,000
„ Germany ...	159,000	494,000	+ 335,000
„ Belgium ...	7,000	14,000	+ 7,000
„ Italy ...	–	19,000	+ 19,000
„ Switzerland ...	–	10,000	+ 10,000
„ United States ...	136,000	6,000	— 130,000
Other countries ...	2,000	—	— 2,000
Total ...	349,000	642,000	+ 293,000

* New heading in 1911.

	1910. Yen.	1911. Yen.	Increase or decrease. Yen.
Lifting machines.			
From Great Britain ...	256,000	394,000	+ 138,000
„ Germany ...	11,000	46,000	+ 35,000
„ Belgium ...	18,000	—	— 18,000
„ United States ...	41,000	136,000	+ 95,000
„ Other countries ...	—	2,000	+ 2,000
Total ...	326,000	578,000	+ 252,000
Caoutchouc and gutta-percha crude.			
From British India ...	91,000	237,000	+ 146,000
„ Straits Settlements	1,246,000	1,383,000	+ 137,000
„ Dutch India ...	142,000	161,000	+ 19,000
„ Great Britain ...	959,000	935,000	— 24,000
„ Germany ...	42,000	7,000	— 35,000
„ United States ...	246,000	253,000	+ 7,000
„ Other countries ...	316,000	84,000	232,000
Total ...	3,042,000	3,060,000	+ 18,000

The exports of dynamos and electric motors from Japan in the years 1910 and 1911 were as follows:—

	1910. Yen.	1911. Yen.	Increase or decrease. Yen.
To China ...	52,000	161,000	+ 109,000
„ Kwantung Province ...	151,000	145,000	— 6,000
„ Corea ...	104,000	—	— 104,000
„ Asiatic Russia ...	2,000	—	— 2,000
„ Philippine Islands ...	3,000	3,000	—
„ Siam ...	7,000	4,000	— 3,000
„ Australia ...	5,000	3,000	— 2,000
„ Hong Kong ...	—	34,000	+ 34,000
„ British India ...	—	7,000	+ 7,000
„ Straits Settlements ...	—	7,000	+ 7,000
„ United States ...	—	5,000	+ 5,000
„ Other countries ...	3,000	9,000	+ 6,000
Total ...	327,000	378,000	+ 51,000

Yen = 2s. ½d.

Electrochemistry in Norway.—Det Norske Nitritaktieselskab is the title of a company which has been launched by Det Norske Aktieselskab for Elektrokemisk Industri and the Société Générale des Nitrures. Its capital is 15,000,000 fr., and it is intended to work the French patents of the Serpek process for the production of ammonia. A power station of 25,000 H.P. is to be built in the Arendal, in Norway, making use of a local waterfall.—*Elek. Zeitschrift.*

Ship Struck by Lightning.—The *Times* reports that the barque *Helios*, from Antofagasta, meeting with bad weather in the South Atlantic, was struck by lightning, which brought down the foretop-mast and foretop-gallant-mast with all the yards attached.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,573. "Telephone switchboards." W. Aitken. September 23rd.

21,586. "Manufacture of artificial filaments." L. Sarason. September 23rd. (Complete.)

21,645. "Electric circuit interrupting devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 23rd.

21,664. "Telephonic receivers." A. Marr. September 24th.

21,700. "Trolley heads for electric tramcars, locomotives and the like." L. Johnson and G. W. Green. September 24th.

21,725. "Holders for telephones." G. B. Stern. September 24th.

21,739. "Electrodes for galvanic cells." Friedrich Dietz (firm of). (Convention date, September 26th, 1911, Germany.) September 24th. (Complete.)

21,743. "Wireless telegraph systems." W. H. Shephard and A. E. McKechnie. September 24th.

21,761. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 24th.

21,762. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. September 24th.

21,782. "Electric fittings." W. Geipel. September 25th.

21,813. "Electrical regulating apparatus." Soc. Ed. Gabreau et P. Delaux. (Convention date, February 9th, 1912, France.) September 25th. Complete.)

21,822. "Cooling arrangements for dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., and E. O. Kieffer. September 25th.

21,831. "Safety devices for the cables or overhead conductors of direct and alternating-current installations." Bergmann Elektricitats-Werke Akt.-Ges. (Convention date, September 25th, 1911, Germany.) September 25th. (Complete.)

21,832. "Electrically operated means for restoring the equilibrium of inclined bodies." J. M. Smits. (Divided application on 15,667, 1912, August 7th.) September 25th.

21,866. "Ventilation of dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. September 25th.

21,867. "Electric oil switches." British Thomson-Houston Co., Ltd. Allgemeine Elektricitäts Ges., Germany.) September 25th.

21,882. "Telescopic, teinoscopic, deep-sea detachable observatory, combined with bellows bodies, air tight chambers, air compressors, vacuum and hydraulic pumps, lenses, recording instruments, hollow ram cable, attachers, magnets, telephone, wireless telegraph instruments, drills, lathes, explosive ejectors, firing appliances, electric light, heat, and power searchlights." T. H. Holroyd. September 26th.

21,898. "Securing electric conduit fittings and the like." D. L. J. Broadbent. September 26th.

21,913. "Electric switches" A. P. Lundberg, G. C. Lungberg and P. A. Lundberg. September 26th. (Complete.)

21,917. "Portable electric lamps." Hartmann & Braun, Ltd., Akt.-Ges. (Convention date, September 30th, 1911, Germany.) September 26th. (Complete.)

12,921. "Carbon electrodes for electric batteries." British Ever-Ready Electrical Co., Ltd. (A. Heil, Germany.) September 26th. (Complete.)

21,932. "Dynamos, motors, and like electrical machines." A. A. Price. September 26th. (Complete.)

21,939. "Electrical indicating or alarm apparatus." E. E. Weikel and D. Weikel. September 26th. (Complete.)

21,946. "Seats or holders for connecting cord plugs for telephone exchanges and similar apparatus." Siemens Bros. & Co., Ltd., and E. A. Petithory. September 26th. (Complete.)

21,970. "Electric arcs for lighting or heating." C. J. Montgomery and R. C. Royston. September 27th.

21,971. "Conduit or tubular fittings for electrical conductors." E. P. Cottier and H. L. Downes. September 27th.

21,974. "Combined electric control for alternating and direct-current motors." C. B. Pinkerton and A. E. Wason. September 27th.

22,036. "Alarm devices for use with wireless telegraph systems." W. H. Shephard and A. E. McKechnie. September 27th.

22,049. "Portable electrically-driven centrifugal fans." S. C. Davidson. September 27th. (Complete.)

22,053. "Electric accumulators." G. Fuller, L. Fuller and G. J. A. Fuller. September 27th.

22,054. "Electric heating and cooking devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 27th.

22,093. "Electric pocket lamps." W. Knopf. September 28th. (Complete.)

22,099. "Electric motor and hand-driven sounding-machine." F. W. Clark. September 28th.

22,118. "Electric switches." H. H. Berry and W. J. Markham. September 28th.

22,127. "Controlling or regulating devices for electric lamps." E. Johnson. September 28th. (Complete.)

22,129. "Electrical protective apparatus." S. de Stefani. September 28th. (Complete.)

22,131. "Railway control telephone systems." J. N. C. Kennedy. September 28th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford: price, post free, 9d. (in stamps).

1911

Electrical Terminals and Fuses. E. S. Ahless. 17,593. August 2nd. (February 2nd, 1912.)

Transmitting Apparatus for Wireless Telegraphy. L. Rouzet. 19,948. September 7th.

Electric Contact Devices for Clock Movements. L. P. E. Appoullot. 20,149. September 11th. (September 9th, 1910.)

Electrically-Heated Cooking Ovens and the like. A. F. Berry. 20,172. September 11th.

Electrically-Operated Boat Hoists. J. Fielding. 20,383. September 14th. (Cognate application, 2,910 of 1912.)

Diaphragms of Telephonic Receivers and like Instruments. A. Marr. 20,434. September 15th.

Telegraphic Relays. S. G. Brown. 20,451. September 15th.

Production of Coffee by Electrolysis. R. Douvreleur. 21,593. September 30th.

Combination Locks for Electrical Lamps and like Electrical Fixtures. G. Barker. (Midland Electrical & Manufacturing Co.) 22,276. October 10th.

Sparking Plugs. A. E. Fletcher. 24,941. November 9th.

Electric Arc Lamps. G. E. Tate. 29,035. December 23rd. (Cogdate application, 6,807 of 1912.)

1912.

Feeding Mechanism for the Electrodes of Electric Arc Lamps. F. Steinert. 1,755. January 22nd.

Method of Multiple-Control for Electric Motors. R. Richter and Maffei-Schwartzkopff-Werke Ges. 3,117. February 7th. (April 21st, 1911.)

Speed-Regulating Devices for Electric Motors, more especially for use in connection with Electrically-Controlled Continuous Spinning Frames. Firm of Jacquet Fréres. 4,691. February 24th. (February 24th, 1911.)

Telephone Exchange Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 4,698. February 24th. (Addition to 11,251 of 1910.)

Instrument for Measuring Frequencies, Self-Induction Coefficients and Capacities, and Ratios of Self-Induction Coefficients and Capacities. W. P. Thompson. (Ges. fur Drahtlose Telegraphie.) 7,657. March 29th.

Electrodeposition of Metals. A. Leuchter. 9,075. April 17th.

Electric Measuring Instruments. C. Hubert. 9,411. April 20th.

Insulators. T. Wittrin. 9,734. April 24th.

Combined Telephonic Transmitters and Receivers. W. P. Thompson. 12,545. May 28th. (June 20th, 1911.)

Selector for Automatic or Semi-Automatic Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 18,430. August 10th.

Electric Driving of Thrashing Machines.—Recent tests by MM. Coupan and Vuaillet in the village of Chambly (Oise), compared the cost of thrashing by horse-power and by electrical energy. The same thrasher was used in each case, and was of the stationary type with a simple winnowing attachment; the beater was 1·6 m. long × 0·4 m. diameter, and the winnower 0·8 m. long × 0·6 m. in width. The cost of the thrasher alone was 900 fr., or 1,400 fr. complete for horse operation. Two horses drove the machine at speeds varying from 690 R.P.M down to 538 R.P.M., and thrashed 890 sheaves, each weighing 8·25 kg., per 10-hour day (assuming 50 minutes actual operation in each hour). Under this system, 34 days were required to thrash the complete crop of 30,000 sheaves.

The capital cost of the electrical equipment subsequently used, including a 5·5-H.P. motor and the necessary rheostat, cables and meter, was 1,000 fr., making a total investment, including the thrasher, of 1,900 fr. With electric drive the thrasher speed averaged 756 R.P.M., and owing to this high, constant speed, the output amounted to 1,275 sheaves per 10-hour day (still assuming 50 working minutes per hour); the whole crop could thus be thrashed in 24 days. The electrical consumption averaged 1·74 KW., costing 0·78 fr. per hour. In both cases four men were required to feed and operate the thrasher, and the actual costs of operation were as follows:—

	Horses.	*Electric motor.*
10 % depreciation and 4 % interest on 1,400 fr.	196 fr.	—
Do. on 1,900 fr.	—	266 fr.
2 horses, 34 days at 4 fr. 50 c. ...	306 fr.	—
Electrical energy, 340 KW.-hours at 45 c.	—	153 fr.
4 men, 34 days at 4 fr.	544 fr.	—
" 24 days at 4 fr.	—	384 fr.
Oil, 34 days at 0·5 fr.	17 fr.	—
" 24 days at 0·75 fr.	—	18 fr.
	1,063 fr.	821 fr.

For these data it appeared that the average cost of thrashing was 1·235 fr. per cwt. by horse labour, and 0·954 fr. per cwt. by electric motor, thus showing a saving of 22·8 per cent. in favour of electric driving. Of the total electrical input, 54·5 per cent. and 25·6 per cent. was respectively required to drive the beater and winnower unloaded: the total light load consumption of the thrasher = 80·1 per cent. of the full load input, and the consumption for thrashing without winnowing, was 0·52 KW. Such a motor as employed above could be applied to innumerable farm duties (including the preparation of cattle foods, &c.); hence, the whole capital charges should not be debited to the thrasher. Allowing for this, the advantage of electrical operation is yet greater in the above case.

The Cooper Hewitt Diffusing Lamp.—The *Electrical World* describes a system devised by Dr. P. Cooper Hewitt for obviating glare from metal-filament lamps and diffusing the light without sensible loss of efficiency; a series of fine, smooth, parallel grooves is formed on the outer surface of the bulb of the lamp, constituting a system of prisms, which may be either longitudinal or transverse. The grooves are less than one-hundredth of an inch in width, and are formed by dipping the bulb in wax, and then, after baking, ruling lines in the wax by means of a simple machine. Next the bulb is dipped in hydrofluoric acid for a suitable length of time, and finally the wax is removed, leaving etched grooves in the glass. The chemical method of grooving the glass has the advantage of preventing the fractures which might occur with a mechanical method, and it is possible to apply the chemical procedure to any commercial bulb. The effect of the treatment is to make the whole bulb appear luminous, and if the grooving is transverse, the distribution of the light is greatly modified, the horizontal illumination being diminished and the vertical illumination increased both upwards and downwards. Dr. Hewitt states that the loss in efficiency due to the grooving is negligible.

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ON GOING ABROAD.

IN these days when there is far more electrical engineering work in progress and prospect abroad than there used to be, and when for this and other reasons there is a willingness, nay, an eagerness, on the part of so many young electrical engineers to leave the Mother Country, our inquiry box contains many interesting questions from those who want to know whether we would advise them to go to this country or to that rather than to remain at home. We are asked to furnish them with names of individuals or companies with whom they ought to correspond in order to "get a job," sometimes we are asked to advise as to climate, cost of living, and on the question of agreements between parties entering into engagements. Quite a large number of men have availed themselves of the information that we have in the course of years been enabled to bring together or to publish in our pages, and scores of them now stationed thousands of miles away from home in very different surroundings from those prevailing here, will be reading these lines and recalling the occasion upon which they sought our humble counsel. It has always been a pleasure to us to assist in every way in our power those who felt a disposition to remove to a less crowded sphere of operations, but we have endeavoured to make it plain that our information was intended to guide them in forming their own conclusions. It would be unwise for us to say either "Go!" or "Don't go!"

Our duty and responsibilities are at an end when we have placed before our correspondents facts and reports received from men of experience or obtained from records upon which reliance can usually be placed. But where one man may have seen signs of satisfactory openings, and may have actually succeeded, another may in experience not do so well. Further, information relating to one part of a country may not have an accurate application in respect to another part a hundred miles away. What may be healthy and congenial climate and surroundings for one man may not be so for another. An agreement in certain terms may have met the case between two parties under certain circumstances, but may prove totally unsatisfactory for other parties and different circumstances. One man may be able to manage admirably and save money on a specified income, while another, because of extravagant tastes and dispositions, may be on the verge of poverty half the time. The mere mention of these few considerations will illustrate how difficult it is to give guidance which shall in every case prove, in matters of detail, to be perfectly accurate. All we can pretend to do is to satisfy the thirst for information by advising in broad terms, giving recorded facts, and publishing letters and articles from men of experience in the countries in which our readers are interested.

An aside here may be pardoned. As in connection with many other phases of electrical work, we are surprised to find how little the rank and file in the profession and industry seem to make use of electrical directories. These are to be found in thousands of offices in the kingdom, and it ought not to be difficult to gain access to them. The man who contemplates going abroad and does not know where to go or to whom to write would, we should have thought, regard such a publication not only as one of the essentials for study before going, but one to be put away in his trunk when he leaves, for many men abroad change from one place to another and find it more difficult to secure directory information there than they need do at home. Scores of times we have been asked for information respecting colonial and foreign cities and firms that could have been obtained with facility from published volumes. Just the same thing continues to obtain in regard to the voltages, and so forth, respecting electrical systems abroad, and names of makers of specialised electrical articles, and such information is frequently sought by firms who have no need to be asking for something for nothing. We do not say this as a protest—we continue to answer questions with as good a grace as may be, knowing from experience how strange and wonderful are the claims made upon an editor's time, especially since the telephone became so essential a weapon in connection with industry, and we are glad to render reasonable assistance when it lies within our power, but when publications are specially prepared to meet particular requirements, a wider use of them might be desirable.

But, returning after this digression to the subject of electrical situations abroad, we would say that the advice that is given in our pages regarding different countries is tendered by men who know what they are talking about, *because they have been through the mill*. It would be folly for any reader to imagine that in his own case he was going to reproduce all the characteristics and circumstances that have made up the experience of the expert observer who goes to the trouble of giving us all the benefit of his advice. If he have a grain of common sense, he will know that such writers do not communicate their views for the fun of the thing. A correspondent who writes criticising some recent remarks of our Canadian contributor does so in a spirit that we are not inclined to encourage in our "Correspondence" columns. We wonder whether he will be impressed with the sincerity of our representative if we tell him that he is a Britisher who has had many years of practical electrical experience in this country learning the conditions here, followed by several years in electrical service in Canada, part of the time roughing it and observing from close quarters the conditions relating to electrical employment there. When he selected an advertisement from a Canadian paper for a text it was with a sincere intention to save young electrical men, who knew little of Canada, from making a mistake. Articles of this character are hardly intended for the education of those who pride themselves upon the possession of a more complete knowledge and a higher intelligence.

Electrical Engineers in India.

It is very satisfactory to learn from several authorities that the electrical industry in India is, generally speaking, in a very flourishing condition just now. In the annual review of the trade of India for the year ending March 30th last, the Director-General of Commercial Intelligence says there has been a falling-off in the imports of machinery of all kinds except electrical. Electrical machinery, with its total of £266,700, reached its best figure on record, while electrical instruments and apparatus were imported to the value of £440,128, as compared with £343,382 in 1910-11. From an authority of lengthy experience in the country we learn that, notwithstanding that competition is far keener than it used to be, and prices consequently are ruling lower for contracts large and small, and although there are far more local electrical firms doing business, and many more home manufacturers' representatives on the spot than formerly, still, everyone seems busy and fairly full of orders. Judging by the advertising columns of the newspapers in Bombay, Madras, Calcutta and other large centres, the supply of electrical engineers is not equal to the demand, and owners and managers of contracting firms are finding it hard to get the right man locally. Lest these remarks should be an encouragement to some of the more enterprising and adventurous youths of the electrical profession at home to wander out to India on the offchance of a good berth, let it be said here that this is not an advisable thing to do. A raw youth from home is not of very much service to a firm until after, say, a probationary period of 12 months, during which time he is getting accustomed to the ways of things and acquiring a smattering of the language.

Again, we understand that a pure European from home is very often looked upon as an adventurer of sorts if he is not covenanted out in the orthodox way, that is, sent out either with or without an agreement by the home head office of firms trading in India. "The best method of procedure, therefore, for anyone wanting to come out is," says our correspondent, "to watch the advertisements in the home leading electrical weeklies." A man to have hopes of being a successful applicant must, first of all, be physically sound; secondly, he ought to have had a good general engineering training, both mechanical and electrical; a knowledge and experience of isolated plants, house wiring and estimating, is of far more use to the average contractor's engineer in India than, say, a knowledge of central station work. A man should be resourceful, so as to be equal to emergencies when carrying out work far away from help; he should have unlimited patience to enable him philosophically to endure the petty vexations, the sometimes crass stupidity, of the native workman or coolie; and he should have a fund of tact and diplomacy, so as to help him to keep friendly, and, in fact, become popular with the subtle native with whom he probably will come into close touch. A golden rule for a young and, indeed, any class or age of engineer is to treat an Indian customer as a gentleman, whether or not he is one; and to treat an Indian workman with justice and firmness. Both the former and the latter soon recognise the qualities of a sahib and treat him accordingly.

A good deal might be written about the pay and prospects and life generally of electrical men in India; enough for the present, however, to say that a man going out under covenant "should not agree to accept less than 300 rupees a month as a minimum, with an annual increment of 50 rupees per month; if he accepts less than this, he is either too young to leave home or too modest as to his deserts. In addition to this, he should bargain for a trip home for six months every four years either on full pay, he to pay his own passage money, or half-pay with free passage home and back provided. To a man earning, say, £2 or £3 a week at home, £20 a month (which is the equivalent of 300 rupees), may seem a thumping big sum, but he will want every pice of it. Ordinary living, clothes, and little luxuries are far more costly in India than in England."

As our readers may have imagined, the life of an engineer in India will be brimful of interest and experience, and it is said that nowhere under the sun can a man with imagination and a love of the picturesque enjoy life with such keenness, even despite the sometimes adverse conditions of health and climate.

An Important Case as to the Measure of Damages.

It is not often that reports of engineering cases appear in the records of legal proceedings. They are generally settled by arbitration or before some tribunal whose decisions are not recorded in print. The "Law Reports" for October, however, contain a note of a case which involved a very important principle in relation to the measure of damages where machinery, as delivered, fails to come up to specification.

The case in question is the now famous one in which the British Westinghouse Electric and Manufacturing Co. sought to recover from the Underground Electric Railway of London for certain turbines which failed to satisfy the conditions of the contract as to economy of working. The railway company accepted the machines, reserving their right to damages for the breach of contract, and subsequently, in order to avoid the expense of the continued use of the machines, bought Parsons turbines to replace them. It appeared that if the railway company had continued to use the Westinghouse machines, the loss which they would have suffered in consequence of the breach of contract would have represented a larger sum than the price paid for the substituted Parsons machines. Their loss would have been the amount by which the cost of working the machines supplied, during a period of years representing the normal life of a Westinghouse machine, would have exceeded the cost of working Westinghouse machines constructed in accordance with the contract for the same period.

An arbitrator found that the railway company were entitled to recover, as damages, the costs of providing the Parsons machines. The Court of Appeal held that he was fully justified in arriving at such a decision, although the Parsons machines were so superior to the others that it would have been to the pecuniary advantage of the railway company to have effected the substitution at their own cost, even if the machines had been supplied in accordance with the contract. Lord Justice Buckley stated the principle (which seems to be the embodiment of common sense) very clearly, when he said: "If a man who has taken a third-class ticket from London to the North by one of the great companies is, by the negligence of that company, damaged by their breach of contract to convey him, and he, to reduce the damages, goes to another of the great companies, and takes a ticket by the next train on that line, and is thus enabled to reach his destination by the contract time, but cannot travel by that train unless he takes a first-class ticket, his damages may well be the whole of the sum he has to pay for that ticket, although the result is that he has enjoyed a greater luxury of travel."

This decision may be summarised by saying that the purchasers of a machine which is not capable of doing the work required of it will take note that they are entitled to replace it by another and recover the cost from the purchaser. It is the duty of a disappointed purchaser to reduce his damage as much as possible, and this is but one method of doing it.

Industrial Banks.

The subject of industrial banks for the assistance and furtherance of industrial enterprise, or sectional electrical banks or other analogous institutions for the electrical industry, has been discussed at great length again and again, and it may be that one reason why we hear less about it at the moment is found in the general trade prosperity in which the electrical industry is sharing. But it will assuredly come forward again in course of time, when the position becomes less rosy again, and when Continental electrical firms score new successes by the same means. The functions and practice of our ordinary banks do not seem to be conducive to industrial business in the form that some critics would desire to see, and it may well be doubted whether banks, as we know them, afford any material support to industrial enterprise, but, as has been said before, much of the business that would be done by industrial banks, were they in vogue, has been and is being done by financial houses and certain quasi-investment undertakings. We have, however, witnessed on notorious occasions the loss of important foreign transactions and works by this country, because of the greater readiness of foreign banks, having competent electrical advisers, to snatch them up.

There would appear to be scope for an electrical bank or some similar undertaking, formed and conducted upon proper lines; but it is a *sine quâ non* that it should be absolutely free and independent in its formation and government. A, B and C are, say, directors of such an institution, and they are also connected, say, as directors or in the management of certain electrical undertakings; D, E and F, who are not directors, but who are similarly interested in electrical enterprise, and require certain objects financing, would hesitate to approach the bank or institution in which A, B and C figured, to whom they would be required to impart much of the inner history or objects of the enterprise in view. And rightly so.

Plant Extensions at Leeds.

An interesting report bearing on the future of electricity supply in Leeds, with accompanying curves and plans, has been presented by Mr. Dickinson, of the electricity department, to his Committee, and is summarised elsewhere in this issue.

Incidentally, it emphasises the fact that here, as elsewhere in both Lancashire and Yorkshire, the price of electrical energy is reaching a sufficiently low level to attract the attention of the textile and allied trades, and that in consequence the latter are becoming more generally appreciative of the possibilities of electrical driving.

Mr. Dickinson makes a comprehensive survey of the prospects of the area in "10 to 15 years'" time, and he evidently anticipates a rosy future for his department, as he bases the motor-load at that date on the total usage of power in the city at present, viz., 115,000 h.p., allowing 1 kw. then for every 3½ h.p. installed now.

But if this forecast is rather on the high side—and it would be something new in electricity supply work if it were—his estimates of lighting and heating and cooking are on a most modest scale. The estimated lighting load at Christmas, 1911, after 11 years' working, was about 5,700 kw., and, he says, "this should be doubled within the next 10 to 15 years"; further, that "electric heating and cooking is now making rapid progress, and it is reasonable to assume that the maximum load in 10 to 15 years may be increased, say, by 2,500 kw."

We trust that events will prove Mr. Dickinson to have made a most conservative estimate, otherwise those engaged in the electric lighting and cooking business will be reaping the reward which attaches to a nearly stationary industry.

But to sum up: With the above loads plus 5,000 kw. for auxiliary machinery at the power station, and 6,000 kw., which it is assumed will be transferred from the tramways station on the score of price, Mr. Dickinson arrives at a total of 57,900 kw., which the Corporation may be called on to provide in the next 10 to 15 years, excluding possibilities in the matter of railway electrification, extension of the city boundaries, and normal growth of local industry.

In order, however, not to appear too optimistic, he assumes a load of only 40,000 kw., and having shown that the Whitehall Road stations will accommodate 30.440 kw. of plant, capable of taking a load of 20,000 kw., he proceeds throughout the remainder of the report to prove that the restrictions of this site in the centre of the city render it unsuitable for the operation of the large plant proposed. We quite agree with him; the absence of railway communication and coal storage alone, irrespective of other argument, seems to settle the matter, but then Mr. Dickinson has to deal with a municipal council. In each case the estimates apparently allow for some 30 per cent. of spare plant, although why this very liberal allowance should be necessary is not at all clear.

With load curves leaping upwards, it is obvious that supply problems must be tackled by big units in order to reduce standing charges to the utmost, and we trust that Mr. Dickinson will look as far ahead in this direction as he has done with regard to the future prospects of electricity supply in his area.

IS AMERICA GOING TO LEAD IN THE ELECTRICAL PROPULSION OF SHIPS?

[COMMUNICATED.]

No fair-minded critic can accuse the British Admiralty of any backwardness in the adoption of new ideas in naval construction. Most of the experiments which they make, although sometimes regarded askance by the critics, usually vindicate the Admiralty as represented by their engineers: and Britain continues at present to lead the rest of the world in all departments of the construction game, hull, engines, armament, and so on.

For the sake of the national pride in the maintenance of this splendidly high standard, it is to be hoped that the British Admiralty is closely watching the work which has been done in America on the electrical propulsion of ships in order that, in the event of the complete success of the American experiment now being made on the *Jupiter* (a success which is almost inevitable), they may themselves be ready to get right to work on the equipping of British war vessels with electrical machinery for the main drive. The Admiralty cannot be blamed for their policy of secrecy in regard to their attitude towards experimental schemes; and without knowing more of what constitutes their attitude in the present instance, it would certainly be absurd to censure them for not having already given some practical encouragement to the advocates of electric ship propulsion. One remembers with some feeling of uneasiness, however, that, in the naval game, a lead snatched early in the race is usually a lead which can be fairly comfortably held; and it looks at present as though the United States, by the end of next year, will have acquired a useful lead.

Englishmen interested in naval engineering matters are probably familiar with the particulars, as all the matter on the *Jupiter* equipment which has been published in American engineering papers has since been reprinted in the columns of the English technical Press. The *Jupiter* is a Government collier of about 20,000 tons, and is designed to operate at 14 knots. The generating unit consists of a six-stage Curtis turbine connected to a bipolar alternating-current generator, the speed at 14 knots being about 2,000 R.P.M., and the voltage about 2,200. The generator delivers current to two motors, each of 36 poles, and rated at 2,750 H.P, at a speed of 110 R.P.M. The ratio of synchronous speed reduction between generator and motors is 18 to 1, the propeller turning 110 R.P.M. at 14 knots. A water-cooled resistance is supplied for each motor, and is connected in series with the rotor circuit during the process of reversing and also when manœuvring the boat. There are two distinct positions of the control equipment for operating the ship—the manœuvring position, and the running position in which the motors are run with the resistance all cut out of circuit. The speed of the motors is changed by variation in the speed of the generating unit, the ratio remaining fixed at approximately 18 to 1. The change of generator speed, however, is not achieved by throttling as usual, but is obtained through the medium of a special governor with which the turbine is equipped, and which is so arranged that it is capable of automatically holding the speed at any point from about five knots up to the maximum.

The electrical equipment was thoroughly tested out at the Schenectady factory during the last summer, and came through its guarantee trials very successfully. The vessel itself was launched on the Pacific coast in August last, but will not be ready for sea until probably the middle of next summer. Without delay she will enter on her sea trials, and if the propelling equipment fails to meet its guarantee under service conditions, the Government has the option of returning the complete outfit to the manufacturer. No one who is in the least familiar with the conditions imagines that there is the slightest chance of this occurring; and we may regard it as reasonably certain that, by the fall of 1913, this electrically-driven vessel of 20,000 tons will have thoroughly indicated the wisdom of the United States naval authorities in deciding to give at least a practical trial to the arguments of the theorists, in a vessel of any considerable size. Further results will be that a foreign Government will have acquired experience in the new field (they can use the *Jupiter* for whatever test purposes they may desire, in undertaking further and bigger work along this line): and that it will be foreign electrical engineers, and a foreign factory, that will have acquired a valuable education in electrical marine engineering—an education which will be the source of the greatest encouragement and confidence for them in the tackling of the bigger problems which will follow. It is quite safe to say that they will follow. The electric propulsion proposals apply well to the *Jupiter*; they apply with far greater force to a two-speed battleship, and most electrical engineers who have studied the matter at all are convinced that the ultimate adoption of this method of propulsion for the battleships of all the great naval powers is simply a matter of time. Their reasons for so thinking are simple and direct; but the argument has not been set out so clearly, nor ventilated so widely, as one would have thought its importance has warranted: and it may be of value if the line of reasoning is here vindicated in as brief space as possible.

Steam is the source of energy used in the engines of the vessel (Diesel engines, for the moment, not being considered). The most efficient steam engine is the steam turbine. The most efficient steam turbine is the high-speed turbine. The most efficient propeller, for vessels the size of the modern battleship, is a low-speed propeller. To obtain maximum efficiency of the propelling machinery these two elements must be preserved—the high-speed turbine and the low-speed propeller. Any compromise between the ideal speeds of either results in a loss of efficiency. The turbines and propeller may be direct-connected (as in the case of the *Mauretania* with a propeller speed of 196 R.P.M.—much too low for the turbine, and too high for the propeller). It is preferable to interpose gearing, in order that the ideal speeds of the two elements be preserved. Shall this be mechanical? It is a matter of great doubt whether mechanical helical gears can be built which will carry the load required and will give the reduction which is necessary, or rather the reduction which it is actually highly desirable to obtain. The electrical gearing is entirely suitable on all grounds. The conditions present the electrical engineer with no intricate problems, no problems, in fact, which he has not already solved scores of times on land. Three-phase generators may be connected to the turbines, and be made to run at their most efficient speed, whatever that may happen to be. Cables are carried from the generators to three-phase slip-ring induction motors, which run at some low speed, within a very small percentage of the revolutions specified by the propeller requirements, whatever they may be. If the ship is to be a constant-speed vessel, as in the case of the *Jupiter*, which in steaming will nearly always require a speed somewhere around 14 knots, the speed control (what little is required) may be obtained by control of the speed of the motor, or at the throttle of the turbine. This briefly is the main argument for vessels of this class, although there are other points of importance which have been intentionally omitted (such as the doing away with cumbersome and costly reversing engines, when the necessary reversal can be achieved by a simple change over of the motor connections). And it is to this argument that the American Government authorities have yielded in proceeding with the *Jupiter*. The argument, we believe, will be vindicated, and the results in every way satisfactory.

But if the electrical system is successful in the case of a one-speed vessel like the *Jupiter*, it is easy to see that it would be vastly more suitable for two-speed battleships. A *Dreadnought* may be said to have a speed of 23 knots. In practice this level is hardly ever touched; and, except on occasional full-speed trials, the engines are never worked for this condition, but are run for the manœuvring speed of 14 or 15 knots. What, then, is the result? A daily violation of all the laws of economical steam consumption. The turbines (assuming the ship is provided with turbines) are designed to give a high efficiency around the full speed of 23 knots. For virtually the whole of their working life they will be run to give a speed of, say, 14 or 15 knots. Under the first condition they may have a consumption around, say, 11 or 12 lb. per H.P.-hour. For the low-speed condition their consumption is bound to be as high as 18 or 20 lb. per H.P.-hour. This awful waste is prevented by the interposition of electrical gearing. Whatever may be the speed of the vessel as required by the exigencies of the moment, warfare or peace trials, full speed or manœuvring speed, the turbines may be run at constant speed, and the necessary change in speed effected by a simple change-over switch in the motor-circuit, by means of which the number of poles may be changed from, say, 50 to 30, and the propeller speed, of course, in the same ratio. There is nothing new about the change-speed induction motor; and a clever designer could ring the changes on the turbines and motors to obtain a number of efficient combinations. The thoughtful reader may work out some of these for himself. They have all been proposed and discussed, and details of the different arrangements may be found in text-books and in various papers which have been presented before engineering societies during the last 10 years. The turbines would be run as much as possible at constant speed, or whatever speed gave the most efficient consumption for the particular loads. At half-load, full-speed, the consumption would never be very bad: while, at speeds between full speed and manœuvring speed, throttling the turbine (supposing this method of control were employed) would never approach the condition which is reached when, as is now necessary, the turbines are run throttled down to manœuvring speed through practically the whole of their working life.

The American engineers who handled the *Jupiter* are fully prepared for the battleship proposition to come along. They have been advocating electric propulsion for battleships, and have worked out scores of designs to prove the strength of their arguments. Up to the present nearly all that has actually been accomplished in ship propulsion has been their work, and in the end they will get the battleship business. The equipment of the *Jupiter* was joyfully undertaken, not because that vessel represented an ideal case for the electrical system, but because it was a chance at least of showing what the system would accomplish in the case of a large ship. The engineers regard this as the thin edge of the wedge, the thicker part being reached with the application of the electrical system to liners, cruisers and battleships. Meanwhile it must be disheartening for those English engineers who have been hoeing their own lonely row in this same field, with equal care and diligence. The time for the experiment is ripe now; but, even if it were not, one could almost believe that it would be sound policy for the British Government to place a contract with some firm of British engineers for the electrification of a new *Dreadnought*. The advocates of the electrical system in England have shown resource and ingenuity. They must also exhibit great perseverance. One of these engineers was in close touch with the Admiralty on a *Dreadnought* proposition *as long ago as* 1906; and he is still waiting for a practical try-out. I have not the pleasure of his acquaintance, and may not disclose his name, but I know that he came within a very short distance of definite business. It must, indeed, require a great pluck to continue his labours, with the fruits of successful achievement still withheld from him. He and one or two other of the English set are no whit inferior to their American rivals; but they are deserving of greater official support in that they are acting more in the capacity of private individuals than the Americans, and have not behind them the resources of a great and powerful industrial organisation. Their efforts in the past have, therefore, been all the more meritorious on that account. Let us hope that the Admiralty at home are simply holding their hand, with a watchful eye on the moves of their competitors. The electrical industry in Britain is apparently improving, but is still far from what it should be. The acquisition of some of this marine business might result in a big boom for the home manufacturers, and a well-deserved reward to those few engineers who have been pleading their cause, with such skill, perseverance and pluck, but with no tangible recognition for so many years.

Correspondence Stolen. — The British Central Electrical Co., of 84, Hatton Garden, London, E.C., desire it to be known that their letter-box was broken into on 11th inst., and correspondence stolen. They would accordingly be glad if firms who communicated with them on the 10th inst., and have not received a reply, would kindly send them copies of such communications.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Use of Mica in the Insulation of Electrical Apparatus.

Having had considerable experience in the manufacture of mica and micanite insulation, I should like to say a word on this interesting subject.

As regards the relative advantages and disadvantages of the two methods of using mica as an insulator—in spite of Messrs. Wiggins's claim for pure mica tubes, &c.—apart from commutator work, each has its own sphere of usefulness, and how often is it that one has the choice of using both? Who would think of using micanite for telegraph condensers, cooking apparatus, &c.? On the other hand, what manufacturer or workman wants to handle an insulation about five-thousandths of an inch thick alternately with mallet and wedge, for instance, and with armature coils that are not always straight until forced home, often under continuous tapping? Again, it is not advisable to use thin insulation for another reason, viz., in switchgear, where often a bush and two washers are resorted to, to insulate a live piece of metal. How would our friends the pure-mica advocates suggest forming a good insulating joint between the bush and washers, where in practice often the mica is increased to ¼ in.—not that the mica is not of sufficient resistance, but to increase the distance between the live and dead metal through the joint of the mica? Then, again, where apparatus is subject to severe dampness, and often worse, in using exceptionally thin mica, which for commercial purposes would probably not exceed 10 thousandths, is there not a possibility of moisture collecting on the edges, bridging the mica, and incidentally causing a short circuit, whereas with micanite its greater thickness would make this an impossibility, except under exceptional circumstances?

How is thin mica, as advocated by our friends, going to fare in the hands of the ordinary workman—no little consideration when he is on piece work, in which "micanite" does not always escape damage? If Messrs. Wiggins & Sons were to see how micanite gets treated sometimes, as I have done, they would soon alter their opinions somewhat, and I am afraid we mica merchants would soon have to close down for the want of raw material—no little cause for anxiety even now.

It would be interesting to know how a foot of pure mica tubing would compare with a foot of micanite ditto at the present ridiculous prices. No, I say most emphatically, pure mica will never oust micanite where price is a consideration; but the dissatisfaction with the latter material can be remedied by using better quality splittings, which means increased prices. Micanite one-sixteenth inch thick might contain splittings to the value of anything from 1d. to 1s. 6d. per lb. and the buyer not be any the wiser.

Coming back to mica again, I would say from experience that any engineer using heavily spotted mica, except for low voltages, is seeking trouble; and referring to our friends' comparison between Bengal clear and spotted mica, perhaps it is as well to mention the exceptional tendency of spotted mica to allow what is known as "creeping." I have placed the electrodes of a 2,000-volt circuit on the edges of a piece of heavily spotted mica about 4 in. wide, and the result has been a fine miniature firework display, whereas the breakdown of air would require about 40,000 volts for this distance. I think it is commonly agreed that there is no insulation resistance—above that of air—running parallel with the laminæ, the above effect being due to the almost continuous path of magnetite.

I think that if Messrs. Wiggins would inquire of their friends why they have no objection to using "hard" mica they would find that, apart from ignorance and indifference as to quality, it is either because they use it on slow-running machines or because they resort to the now common practice of undercutting the mica, *i.e.*, cutting the mica below the adjacent copper bars.

I would like to say, in conclusion, that I have made these few remarks in a perfectly unbiased manner, and speak as the result of experience, the common forms of mica and micanite not entering largely into our manufactures. Where are our electrical engineers and buyers that they do not have anything to say on this important matter? Surely they could give us some enlightenment.

H. E. Ashdown, *Managing Director.*
The Birmingham Mica Co., Ltd.

Birmingham, *October* 12*th*, 1912.

Important to Exporters.

May I point out to British traders the great amount of trouble with the Customs that is liable to be caused unless material is carefully invoiced, so as to be easily classified under the various headings given in the Customs schedule of duties? For instance, rubber-insulated cable is charged on the weight (900 reis per kilo), while lead-covered cable, paper or rubber-insulated, is charged 20 per cent. duty *ad valorem*. In one case a leading firm shipped a number of motors, but instead of shipping the starters in the same packing cases, sent these separately, and thus increased the amount of duty payable by over £85. The Custom House people will seldom listen to any protest of the customer, so that too much care cannot be given to the above matter. Neglect is often the cause of goods being delayed in the Custom House for weeks, and even months.

Inglaterra.

Rio Janeiro, *September* 16*th*, 1912.

New Machine for Alternating Load Tests.

Regarding the interesting B.A. paper by Mr. B. P. Haigh, B.Sc., in the current issue of the Electrical Review, a description and drawing is given (fig. 2, page 531) of an alternating-current magnet for generating the stresses applied to the specimen.

Here the lines of induction pass through a yoke *viâ* a gap into an armature and again cross a central gap.

The pull developed is stated to be $B^2/8\pi$ dynes per cm. for the central gap. He then takes the area of the pole face, and states quite correctly that A B is the flux at the gap (central). From this the formula $F = k\,(E/c)^2$ is deduced.

What I wish to point out is that in magnets of this description the total pull is by no means equal to the pull calculated from the central gap, since there is in addition a quite considerable pull at the top of the armature, viz, that near parts marked P_2, P_3 in fig. 2. This rather spoils the simplicity of the formula arrived at, and the relation in question cannot hold unless the fluxes are distributed in a definite and constant manner over this area as well as the gap in question.

It would be interesting if Mr. Haigh could give a table of the pulls calculated from his formula and those observed. It will be found that the observed pull differs considerably for the reason above stated, and cannot be neglected.

In such cases I have often, by making alterations in the magnet system, obtained the necessary two equations enabling the two pulls to be determined.

W. H. F. Murdoch.

Mill Hill, *October* 12*th*, 1912.

HIGH-PRESSURE GAS v. FLAME ARCS FOR STREET LIGHTING.

[communicated.]

The oft-cited experience of the city of Berlin is not valid in determining whether high-pressure gas lamps or flame arcs are economically the better for street lighting. The city has its own gas works, but no municipal electricity works, hence there is a great initial bias in favour of gas lighting. The question must be determined on a purely technical basis, and the following data, collected from practical tests and presented by Heyck in a recent contribution to the "Kommunalen Rundschau," are specially valuable, and show an undoubted advantage in favour of flame arcs.

High-pressure gas lamps develop about 2,000 c.p., and may be suspended from masts or span wires. The lamps must either be hung so low that they can be reached by a ladder, or flexible or jointed piping must be arranged so that the lamps can be lowered for cleaning and trimming. The first alternative results in very uneven illumination, while the second involves high capital cost, risk of leakage and derangement by frost, and frequent mantle breakage due to shock and vibration when handling the lamps.

Flame arc lamps (with inclined or vertical carbons) are the only type which need be considered in the present connection. From 1,500 to 3,000 or higher mean hemispherical c.p. is developed per lamp, and there is no restriction as to the height of suspension, for the lowering tackle employed is quite cheap, and is as effective for great as for small heights. The polar distribution of candle-power is of great importance in determining the uniformity of lighting effected. The inclined-carbon lamp with dioptric globe gives the best distribution; next comes the vertical carbon arc, while the pressure gas lamp has the most concentrated and least advantageous light distribution. For a given height of suspension and distance lamp to lamp, flame arcs give a much more uniform distribution than pressure gas lamps, and tests showing the contrary have been based on comparisons with obsolete types of arc lamps.

It has been found that the same average ground illumination can be obtained with pressure gas lamps of 2,000 nominal c.p., and inclined flame arc lamps of 1,700 hemispherical c.p. fitted with dioptric inner globes and opal outer globes. Lamps of these sizes are, therefore, compared below.

Capital Cost.—Including pipes and erection on a span wire or 8-m. mast, with the necessary flexible piping or joints, the cost per gas lamp averages £55-£60, and the interest and depreciation charges, at 15 per cent., amount to £8 10s. per annum. The cost per flame arc, including the erection of a span wire or mast at 9 m. above street level, is £36, and the annual interest and depreciation charges amount to £5 10s.

Attendance and Gas or Electricity Costs.—Assuming 2,000 burning hours per annum, the cost of lighting and extinguishing, mantle replacements, globe cleaning and renewals, and miscellaneous repairs, averages £4 10s. per gas lamp per annum. The corresponding charge per flame arc, including carbons and trimming, cleaning and repairs, is £4. At a moderate estimate, the gas consumption for this size of lamp will be 35 cb. ft. per hour, and the annual cost of gas per lamp per annum therefore $= 70\ 6 \times g$, where g = pence per 1,000 cb. ft. A 1,700-c.p. flame arc requires 500 watts (including ballast loss), and the cost of electrical energy per annum therefore $= 1{,}000 \times p$, where p = pence per kw.-hour.

Excluding gas and electricity costs, each gas lamp costs £13 per annum and each flame arc £9 10s. per annum. The total cost per lamp per annum, assuming various values for g and p, is as follows:—

g.	Gas per lamp per annum (shillings).	Total per gas lamp per annum (shillings).	p.	Elec. energy per lamp per annum (shillings).	Total per flame arc per annum (shillings).
0s. 6d.	35	295	0·2d.	16·60	207
1s. 6d.	106	366	0 6d.	50·0	240
2s. 6d.	176	436	1·0d.	83	273
3s. 0d.	212	472	1 4d.	116·5	307
3s. 6d.	247	507	1·8d.	150·0	340
4s. 6d.	318	578	2·2d.	184	374

Electricity for street lighting purposes is very frequently supplied at 1·5d. per unit. In the above case, this corresponds to an energy cost of 125s. per lamp per annum, and a total charge of 315s. The fixed charge per gas lamp per annum being 260s., this leaves, in order to attain the same total annual cost, only 55s. for 70,600 cb. ft. of gas (*i.e.*, 9½d. per 1,000 cb. ft.). Electricity at 1·5d. per unit, employed, in inclined-carbon flame arcs with dioptric globes, is therefore equivalent, on a purely commercial basis, to town gas at 9½d. per 1,000 cb. ft. used in modern high-pressure gas lamps. From the illuminating standpoint, the electrical equipment is much the better, the "diversity" factor being only half as great in arc as in gas lighting installations.

The general conclusion to be drawn from these comparisons is that flame arc street lighting is much cheaper than high-pressure gas lighting at the usual prices of electricity and gas. It is interesting to note that the standing charges (interest, depreciation and the various items included under attendance) equal the electricity and gas costs respectively when the price of electrical energy is 2·28d. per unit and when gas costs 3s. 8d. per 1,000 cb. ft. The energy or gas charges amount to practically 40 per cent. of the total in the above cases when energy costs 1·5d. per unit and gas 2s. 6d. per 1,000 cb. ft.

PROCEEDINGS OF INSTITUTIONS.

The Ignition of Coal-Gas and Methane by Momentary Electric Arcs.

By W. M. Thornton, D.Sc., D.Eng.

(*Abstract of paper read before the* Institution of Mining Engineers *at Newcastle-on-Tyne, October* 12th, 1912.)

The conditions under which single electric sparks fail to ignite mixtures of gas and air form a question of the first importance in regard to the safe use of electricity in coal mining.

Wüllner and Lehmann investigated ignition by hot wires, and note the interesting fact that the gaseous mixture appeared to be ignited by iron and copper wires at the moment of fusion, at which point ionisation becomes active.

Heise and Thiem broke 196 small incandescent lamps, running at voltages from 65 to 220, in explosive mixtures of pit gas and air; their chief conclusion was that thick filaments were more dangerous than thin ones. They further examined the effect of opening switches in an explosive mixture of methane and air, making about 800 breaks in all, and found that ignition first occurred at 1·75 amperes on a 100-volt direct-current circuit. They concluded that voltage as well as current had to be considered, that fuses in melting fired gas always, that white-hot carbons did not, that the sparking of continuous-current motors when starting did, and, finally, that all visible sparks may be looked upon as dangerous, a point still generally accepted by mining men. A fuller research of a similar nature has recently been carried out by Prof. Lemaire, of Mons, Belgium, on both carbon and metallic-filament lamps. His conclusion is that the incandescent filament of any lamp, however low the voltage, will cause ignition if exposed in an explosive mixture.

The new Coal Mines Act of 1911 prohibits the use of electricity where more than 1¼ per cent. of gas may be present, and limits the pressure to 20 volts in signalling circuits where the bare wires used may be touched together. It seemed well, therefore, to re-examine the whole case of the ignition of gas by single sparks such as may possibly arise in mining practice, especially at signalling voltages, with special reference to the influence of voltage, percentage of gas and of differences between direct and alternating current. To connect these with gas engine researches, experiments were also made with coal gas—that is, the usual town supply for lighting and power.

The occasions in which open sparking—as it is called—may mostly arise in practice are, when a power cable is brokenby a fall, of roof, and on signalling circuits either at momentary or vibrating contacts. In all these cases the final separation is between points of metal. The simplest way of obtaining a spark between metals at a point which may be renewed is that used in the present work by making contact between two round wires touching at right angles. The arrangement of these and of the explosion vessel used is shown in fig. 1. The latter was of well annealed glass, 5·5 centimetres in diameter, and had a volume of 300 cb. centimetres. The vertical exit tube at the top was fitted after each explosion with a plug of cotton wool, the mercury then raised to the level of the inlet, the air in the pipe fully swept out by gas from the reservoir, the top of the tube closed with the finger, and the explosive mixture drawn in by lowering the mercury. After the chamber had been filled with gas, the vertical tube was further covered with an india-rubber cap, which prevented diffusion and blew off easily at ignition. The pole-rods could be rotated by hand through an arc of 90°, and the speed of separation was found by trial to be nearly the same throughout at 3·5 radians a second. A metronome, set to a convenient frequency, served to give uniformity in the make and break when desired.

The rods used were of iron, copper and nickel, the first to represent more especially the conditions of mining signalling wires, but to cover also the case of armouring in possible contact with live conductors; the second to give the case of breakage of a conducting wire; and the third chiefly as a control. To determine each point on the curves, observations of 600 breaks were on an average recorded, or over 50,000 in all.

The procedure was to guess at a current and to make a hundred contacts in succession. If no ignition occurred, the current was raised and the trials repeated. When a current had been found which gave ignition after the first few contacts, this was considered to be too high. The limiting igniting current was taken to be one which fired the gas within 50 sparks, slowly repeated. Near the critical current many trials were made, with fresh charges of mixture, 10 or more in difficult cases. Reliance is placed on the average from a great number of trials, and upon having the contacts in as nearly the same condition as possible throughout.

It being difficult to obtain pure fire-damp in large quantities, the first ignitions were made in a mixture of coal-gas and air.

In the case of mixtures of methane and air it was decided to make all trials in the mixture giving perfect combustion, that is, 9·36 per cent. The results are noted in Table I.

TABLE I.—Least Direct Current to Ignite a 9·36 per Cent. Mixture of Methane and Air. Atmospheric Pressure; Temperature 18° C.

Volts.	Amperes.		
	Iron poles.	Copper poles.	Nickel poles.
50	4·00	4·000	4·00
100	[illegible]	0·900	1·15
240	0·40	0·175	0·55
480	0·10	0·050	0·15

At voltages below 50 the currents increase very rapidly, and it would appear to be impossible to ignite even the most explosive mixture of fire-damp and air by single break-sparks from a signalling circuit at the maximum voltage of 20 allowed by the Coal Mines Act. At these low voltages electrical signalling may be used with safety in any part of a coal mine, provided that care is taken to prevent wires from remaining in contact on short-circuit and, by local heating, from becoming red hot where they touch, an improbable occurrence. The bells should be preferably of the single-stroke pattern; no bell of the trembler type is safe in gas, unless the sparking contact is enclosed in an explosion-proof case.

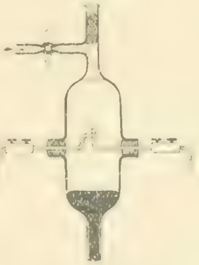


Fig. 1.—Explosion Vessel.

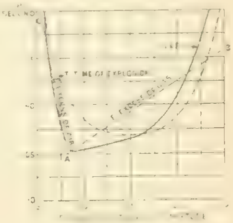


Fig. 2.—Suggested Synthesis of the Curves obtained.

In order to examine the influence of the size of the wire, the igniting currents of mixtures of coal-gas and of methane with air were found with poles of iron, copper and nickel in three sizes, at constant voltage. In all cases the igniting current is a linear function of the diameter.

The higher currents required at the larger diameters appear to be proportional to the surface of the metal in contact with the arc and to its cooling action.

With low-voltage apparatus, the inductance of the circuit is of the first importance from the point of view of safety at break. To examine this, inductances of from 0·0025 to 1·35 henries were placed in a 20-volt circuit and the resistance adjusted until the current just failed to ignite an 11 per cent. mixture of coal-gas and air. The small copper poles were used, with the results noted in Table II.

TABLE II.—Influence of Inductance on Ignitions.
11 per cent. Mixture of Coal-Gas and Air. Voltage, 20. Direct Current.

Inductance, in henries	1·53	0·76	0·325	0·217	0·108	0·069	0·056	0·013
Least igniting current, in amperes	0·27	0·5	0·75	0·93	1·4	1·65	2·05	3·75
Energy of arc, in joules	0·06	0·091	0·091	0·093	0·10	0·09	0·12	0·09

The risk of ignition increases rapidly as the inductance is raised, and no direct-current signalling circuit could be regarded as safe with a total inductance of 0·1 henry. In practice they have, as a rule, much less than this, and a typical mining signalling circuit connected through the explosion chamber failed to show any signs of igniting the most explosive mixture of coal-gas and air, when the contact was broken in it. The maintained spark at the spring contact in a trembler bell is known to ignite gas.

The least energy required to ignite the mixture remains nearly constant at about 0·10 joule. It is in thermal units about 0·025 small calories, equivalent to the combustion of 4·1 cb. cm. of coal-gas, or of 37 cb. cm. of an 11 per cent. mixture. At the highest inductance the energy was less, corresponding to the combustion of

21 cb. cm. of mixture. It is agreed that the cause of the period of induction observed in all gaseous explosions is the slow combustion of a certain volume of gas before enough heat is set free to enable the mixture to ignite itself; but there can be no doubt that the ignition of only a few cubic centimetres—in a test-tube, for example—is necessary to start an explosion. A similar pause is observed in coal-dust ignitions. With both gas and coal-dust it is longer when the source of ignition is an incandescent wire than with an arc, possibly to some extent in the latter case on account of the clear space around an incandescent wire in gases investigated by Lodge and Clark, but in the former more probably on account of the "combustion by stages" of the paraffins in the presence of hot wires. Momentary arcs of the kind considered here appear to ignite gas with difficulty, in comparison with the shattering sparks from condenser discharge.

The least current required for ignition in a circuit at a constant voltage varies considerably with the richness of the gaseous mixture.

With methane, the results were as follows (Table III):—

TABLE III.—Variation of Igniting Current with Percentage of Methane in Air. Voltage 50: Small Iron Poles.

	5	6	7	8	10	12	13·5	14
Percentage	5	6	7	8	10	12	13·5	14
Amperes	5	3·8	3·2	3·7	4·6	5·75	7·0	12

No ignitions could be obtained at 4 or above 14 per cent. The limiting values under the present conditions would appear to be 4·25 and 14·25. The limiting percentages of mixture may, and probably do, depend on the method of ignition, and upon the presence of small quantities of more highly combustible gases. In the present case analysis did not reveal any of these in quantities to be readily detected in the gas upon which the percentage experiments were made. Hydrogen or acetone, if present, was less than 0·2 per cent. In the final Report of the Royal Commission on Accidents in Mines, 1886, it is stated that "In some of our experiments an ignition, with all the characteristics of an explosion, has been produced throughout the whole of our apparatus by a Davy lamp, when the current contained very little, if any, more than 4·25 per cent. of marsh-gas."

The shape of the methane curve is very similar to that for coal-gas. There is first a sharp drop curved to a point, from which there is a linear rise to a less well-defined bend, above which the mixture rapidly become inert. The suggested explanation of this is as follows:—The two controlling factors appear to be (1) the "time of explosion," and (2) the reduction of sensitiveness to ignition by excess of either constituent of the mixture. In fig. 2, A is the most inflammable mixture. On either side of this the lines A-B and A-C give for any percentage the amount of dilution—to the left with air, to the right with the active gas, the upper limits being perfectly inert mixtures. The time of explosion, T, of a combustible gas is found in all the recorded cases to reach a minimum value, and to rise again as the strength of the mixture is increased. For petrol vapour the curve is a parabola symmetrical on either side of the minimum value; the time of explosion then increases as the square of the percentage excess of either air or vapour.

With coal-gas the curves of variation of T with richness of mixture are not so well defined. At the upper and lower limit T approaches 0·4 second; the minimum—which is very nearly the same in all the recorded cases—is 0·05 second at atmospheric initial pressure, and occurs at 14·5 to 16 per cent. On either side of this T increases with excess of gas or air, but the branches are not usually symmetrical. No figures are available for methane, but the reciprocal of the velocity of explosion gives a curve similar in character, with a minimum at 13 per cent. In every case of a combustible gas mixed with air, the time of explosion reaches a minimum in a mixture several per cent. richer than that required for a perfect combustion. The curve of T lies between the upper and lower percentages limiting ignition, and is shown in fig. 2 symmetrical within them. The product of the excess of gas or air and the time of explosion is a curve agreeing closely in shape with that of the observed least igniting current. It would appear from this that these are the chief, if not the only, factors which determine the direct current or power required for ignition when the voltage and poles remain the same. This relation remains much the same when the duration of the arc is increased by the use of higher voltage, although an examination of the influence of voltage with different strengths of mixture indicates that it is only below about 150 volts that much difference in the igniting currents is to be expected. At this point, also, the difference in the duration of the arcs begins to increase.

In the previous work, the influence of the time of duration of the spark, although masked by that of voltage, has been always in evidence. It was to be expected, therefore, that very different values from the above might be obtained by the use of alternating currents. The first experiments on this were made at 40 periods with coal-gas and air, and with the same density of mixture (11 per cent.) throughout. To avoid disturbing effects, pure sine waveforms were used. The currents required for ignition were all much greater than the direct currents at the same voltages, the ratios of alternating to direct being as shown in Table IV.

TABLE IV.—Ratios of Least Alternating to Least Direct Igniting Currents. Coal-Gas and Air, 11 per Cent.; 40 Periods, Non-Inductive Circuits.

	50	100	200	300	400	500
Volts	50	100	200	300	400	500
Rates, A.C./D.C. ...	3·0	4·9	6·2	9·0	10·8	12·5

There may be, therefore, a very real increase in safety from gas ignitions by the use of alternating currents compared with direct, although when open sparking does occur it is generally in excess of the minimum values found here. An interesting result followed the addition of small inductance (0·0025 henry) to the circuit. At the higher voltages, which were first examined, a perceptible but not great diminution of the igniting current was observed. At 200 volts the difference was greater, although the ratios were much the same, but at 100 volts there was evidence of an unexpected drop. At 50 and 25 volts the gas was more readily fired than at 100. No variation in the conditions, such as polishing the poles or making fresh mixtures of gas and air, changed the result. The flattened form of the curve suggests some instability similar to that familiar in the liquefaction of gases by compression. With copper rods, under the same conditions of frequency and density of mixture, the addition of the same inductance produced a similar divergence in the curves at about the same current, but both non-inductive and inductive curves now show a flattening beginning at about 200 volts as the voltage is lowered. Both curves are remarkably deflected between 50 and 100 volts, and again at the higher voltages. There is clearly some critical condition introduced by the use of alternating current in all these cases, or rather a third factor of equal importance with voltage and current. The influence of inductance on the iron curve further suggested that time might be this factor, and that the shape of the curves might be greatly affected by the frequency of the current.

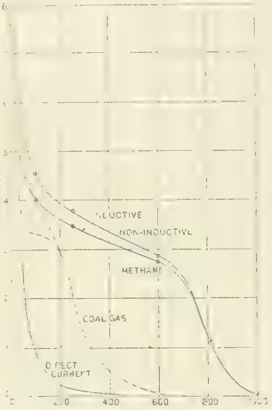


Fig. 3.—Alternating Igniting Currents for Methane, 9 36-per cent. Mixture. 40 Periods per Second. Copper Poles.

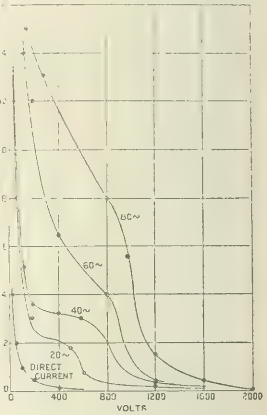


Fig. 4.—Influence of Frequency on Igniting Current in a 9·36 per cent. Mixture of Methane and Air. Iron Poles.

Frequency is not, however, the only important factor, for the currents for iron and copper, although similar, are not identical, and the difference is still further brought out with nickel poles. The currents here are less than for either iron or copper, and so differ from the results with direct voltages. There is also in this case a remarkable sensitiveness to the composition of the gas.

With copper poles (fig. 3) and at low voltage, the currents are rather greater than with iron; at the higher voltages they are lower, but the curves are very similar in shape. Both with coal-gas and methane the igniting currents are much lower with nickel than with iron or copper poles.

Experiments were made to ascertain the least igniting currents at various frequencies in 9·36-per cent. mixtures of methane and air, with small iron poles, and non-inductive circuits throughout. The results are given in fig. 4. The influence of increase of frequency in raising the least igniting current, when the frequency is low, is very marked; there appears to be a critical point between 40 and 50 periods and at about 100 volts. The figures are given in Table V, on the next page.

As previously mentioned, the initial period of induction always recorded in experiments on gaseous explosions provides an explanation of the influence of frequency on ignitions of the kind considered. The full "time" of explosion is rarely less than 0·05 second, and the period of induction is generally of this order. When the contacts are separated, the arc which is formed has to restart itself across the gap after passing through its zero value, and unless the air is being strongly ionised, a small gap suffices to prevent the

TABLE V.—INFLUENCE OF FREQUENCY ON LEAST IGNITING CURRENTS. METHANE 9·36 PER CENT. ATMOSPHERIC PRESSURE.

Frequency ...	20	40	60	80
Volts.	Amperes.	Amperes.	Amperes.	Amperes.
[illegible]	8·00	[illegible]	—	—
100	3·80	[illegible]	[illegible]	15·00
200	3·00	[illegible]	[illegible]	14·00
400	[illegible]	3·25	—	[illegible]
600	[illegible]	[illegible]	5·0	[illegible]
800	[illegible]	2·00	[illegible]	8·00
1,000	0·25	[illegible]	[illegible]	5·75
1,200	[illegible]	[illegible]	[illegible]	[illegible]

arc from restarting. If the break [illegible] when the current is [illegible] passing through zero value [illegible] or maximum value, the arc is created [illegible] the poles are separated; and unless the initial current is sufficient to have strongly ionised the gap, the current, on reaching zero, will be unable to re-form the arc in the opposite direction. The most favourable point in the cycle for the break to take place, in order that an arc should be formed with minimum energy, is on the rising side of the current wave.

It is evident that at the lowest circuit voltages the current must be large in order to cause ignition by the liberation of a greater number of ions from the material of the pole. When, however, the maximum voltage gradient approaches 10,000 per cm., as it does on a 500-volt system at 0·01 cm. [illegible] within a third of a period at a frequency of 40—the arc will be maintained whatever the current may be, and small currents then ignite the gas. At voltages between these limits of ionisation by large currents on the one hand or high voltage on the other, the igniting current must be controlled by both: and since it has been shown that there is in the case of methane an evident relation between duration of arc and current required for ignition, the simplest expression taking account of duration and voltage is that the current is inversely proportional to the product of voltage and time of duration. The influence of the alternation of the current can be regarded as that of a time-filter or screen which retards the influence of voltage and brings out that of time of duration of the arc.

It is probable that the fact of alternation has less influence with longer periods of induction. This can, in fact, be shown experimentally by working with very dilute mixtures, in which the time of explosion is much longer.

It may be concluded that when the duration of an arc approaches the period of induction of a gaseous mixture, ignition becomes increasingly difficult.

All the foregoing results are for currents in circuits opened by a single clean break.

In conclusion, it may be said that, for the same voltages, the ignition of gaseous mixtures by direct currents would appear to depend chiefly upon the material of the poles, and ignition by alternating currents upon the nature of the gas.

The use of low-voltage alternating currents for signalling purposes gives a much greater margin of safety than is possible in direct-current working.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Installation Work" writes:—"I shall be glad to have your legal contributor's opinion on the points raised below, which are continually arising in connection with electrical installation work, as there seems to be no definite decision available at present:—

"(*a*) Have the electrical department of a Corporation any authority to require an installation to be wired with 2,500-megohm C.M.A. grade cable, when 600-megohm ditto has been specified by the consulting engineer?

"(*b*) Can they reasonably insist on s.p. main fuses being earthed, when their own cut-outs and meters are not so treated? Personally, from past experience, I have always found it more dangerous to earth the cast-iron cases of main fuses, and as a matter of fact, this is absolutely prohibited by the Corporation of Glasgow.

"(*c*) Under what regulation or rule can they insist on 6-ft. space being maintained between the outers of a three-wire supply? It seems very illogical to insist on a distance of 6 ft. between the two wires in the meter room, and then bring the same wires into a d.p. switch where they cannot possibly be spaced more than 3 in. apart.

"(*d*) In one case, I have been debarred from fixing the motor-generator in the lantern room on the ground that the motor was connected to a 200-volt circuit (Home Office Rules restrict pressure to 100 volts on a projector arc circuit), while no objection was raised to fixing a similar switch, operating on the same voltage, to an extract fan motor.

"(*e*) The position with reference to the clause "Completion of Contract" of a contractor who puts non-union men on to the job, and then receives notice that the other tradesmen will strike, unless he substitutes union men for those he has previously employed."

[illegible] appear to be quite clear whether they relate solely to the supply of electricity in a cinema theatre. So far as is known, the only regulations dealing with such a supply are those made by the Secretary of State under the Cinematograph Act, 1909 (February 18th, 1910), and these do not appear to touch upon any of the points mentioned. As to these queries it is difficult to answer them without any information as to the provisional order or Special Act under which the Corporation supplies or makes rules for the supply of electric light. With regard to query (*b*), is not this governed by Rule 39 of the Regulations made under the Electric Lighting Acts, 1882 and 1888, which provides that "All electric lines and apparatus placed on a consumer's premises shall be highly insulated and thoroughly protected against injury to the insulation or access of moisture, and any metal forming part of the electric circuit shall not, unless efficiently connected with earth, be exposed so that it can be touched. All electric lines shall be so fixed and protected as to prevent the possibility of electrical discharge to any adjacent metallic substance." The questions (*a*), (*b*) and (*c*) could be much more satisfactorily answered if the querist would apply to the Corporation for a copy of their rules, and also for a copy of the special order under which those rules were formulated.

As to (*d*), Clause 12 (*c*) of the Cinematograph Theatre Rules above mentioned, provides that:—"Cables for cinematograph lamps shall be taken as separate circuits from the source of supply, and from the supply side of the main fuses in the general lighting circuit, and there shall be efficient switches and fuses inserted at the point where the supply is taken, and in addition an efficient double-pole switch shall be fitted in the cinematograph lamp circuit inside the enclosure. When the cinematograph lamp is working, the pressure of the current across the terminals of the double-pole switch inside the enclosure shall not exceed 110 volts." The pressure of "100" volts does not appear to be mentioned in these regulations.

With regard to (*e*), if the usual strike clause is to be found in the contract, it appears to be clear that the contractor would not be liable for the delay occasioned by a strike, even if that strike were brought about by his employing non-union men. For instance, the form of contract sanctioned by the Institution of Electrical Engineers provides (by Clause 38) for delay caused by (*inter alia*) "general or local strikes or lock-outs, or combinations of workmen." This is done by the engineer, on application, granting such extension of time as may appear to be reasonable. In the absence of a strike clause, however, it is to be feared that an employer who has undertaken to carry out works within a specified period is very much at the mercy of his workmen.

PROPOSED ELECTRICITY EXTENSIONS AT LEEDS.

One of the matters to be dealt with in the Bill which the Leeds Corporation intends to promote in the next Session of Parliament is the acquisition of a site for a large new generating station in connection with the supply of electricity in Leeds.

Mr. Harold Dickinson, the manager of the Electric Supply Department, has presented a report to his Committee setting out the reasons why such a step is desirable. It states that the capacity of the plant now installed at the works in Whitehall Road is 15,440 kw., and an additional turbo-generator is on order with a capacity of 7,500 kw., while still another generator of the same capacity can be accommodated at the Whitehall works, bringing up the total capacity to 30,440 kw. Allowing for spare plant, it is suggested that this would not enable the Corporation to deal with a greater load than, say, 20,000 kw.

The maximum load which the station has had to bear up to December last was 9,570 kw., and the additional orders since received make it probable that the load in December this year will reach 12,000 kw. Assuming the increase to continue at the same rate, the capacity of the works will be fully taxed in the year 1915, and it is regarded as quite probable that the rate of increment will be considerably augmented. It follows that further plant must be available by the winter of 1915-16, and it is suggested that three years should be allowed for preliminary negotiations, land purchase and the design, building and equipment of a new station.

Mr. Dickinson discusses the alternative courses of reconstructing a portion of the present buildings, so as to accommodate a plant of larger capacity, and possibly purchasing adjoining land for further extensions; and purchasing land at a distance from the present station and erecting additional works there.

The first point to be considered is the amount of business which the department may reasonably be expected to have to deal with within a measurable space of time, and Mr. Dickinson sets out numerous facts and calculations with a view to the elucidation of this point. An interesting table shows that the estimated amount of motive-power used in Leeds for industrial, commercial and domestic purposes is 155,585 h.p. Out of this 17,472 h.p. is furnished from the Corporation's Electricity Supply Department, the greater part of which—10,136 h.p.—is supplied to engineering works, while the printing trade also takes 1,531 h.p. The figures given are correct up to March 31st last; the total h.p. now connected is over 20,000.

The textile manufacturers in the city are estimated to have 19,500 h.p. of engines installed, and up to the present the motors installed in such mills have a total capacity of only 270 h.p. Mr.

Dickinson is of the opinion that the prices charged for electricity are now getting to a point where the textile user will be attracted, and he refers to the applications now being received for this class of work, as evidence in support of his opinion. He looks forward to the time when it will pay the user, in practically all cases, to take his supply of power from the Corporation, and anticipates an increase in the demand for current to be used for lighting purposes and cooking and heating. Other possibilities are the supply of all the current used in connection with the tramways from the main power station, and the electrification of railways, and without taking the latter item into account, Mr. Dickinson anticipates that the Corporation may be called upon to provide, in the next 10 to 15 years, for a total load of 57,900 kw., but in order not to appear too optimistic he bases his proposals upon an assumption that a maximum load of only 40,000 kw. will be attained within the period mentioned.

The report contains a number of charts to illustrate the progress that has been made. It is theoretically possible to extend the Whitehall Road works so as to accommodate machinery with a total capacity of 66,600 kw, which, after providing for the necessary reserve of plant, would allow a maximum load of 46,100 kw. to be dealt with, but Mr. Dickinson calls attention to a number of reasons for his conclusion that such a course would not be the most satisfactory that could be followed.

For instance, he anticipates that 164,000 tons of coal will be used in a year, and in order to obtain this large quantity it is desirable to be in a position to purchase for delivery either by rail or water. There is also the question of storage to consider, and it is suggested that accommodation should be available on the site for at least a three months' stock, say, 45,000 tons in the winter, whereas the capacity of storage at the present works with the greatest possible extension would not exceed about 10,000 tons.

By the adoption of another site suitable for obtaining coal from a wider area, an advantage in the cost of coal would be secured, varying according to different conditions from £2,084 to £4,166 yearly.

Another argument in favour of a new site is that as a very large proportion of the increased load upon the works will probably arise in connection with the supply of power in the Hunslet area, a considerable saving in the cost of cable, estimated at £30,000, would be effected by the provision of works in that district.

Among the minor, but still important factors, to be considered is the possibility of combining refuse destruction with the generation of electricity, and it is estimated that if a suitable site were chosen, about 500 tons of refuse per day could be dealt with in such a way as to produce steam sufficient for the generation of 17,000,000 units per annum, which would otherwise involve a consumption of about 27,000 tons of coal yearly. Such a combination would be quite impossible at the Whitehall Road works.

Another point is that the risk of an entire breakdown is very largely reduced by having two generating stations instead of one.

The extension of the Whitehall Road works to their utmost capacity would involve an outlay of £546,000, whereas the provision of a works at a new site, and with the same capacity as the extended Whitehall Road works, would cost £595,000. The difference between the two sums is accounted for by the additional provision for coal storage and handling, railway sidings, and the much larger area of land. This larger area would, of course, leave room for extensions which might be necessary in order to cope with requirements over and above the 40,000 kw. assumed as the maximum load, and it would, in addition, provide space for a destructor.

Mr. Dickinson gives figures indicating that the annual expenditure upon two separate stations, would be, after allowing for contingencies, £2 000 more than in one large station, but against this should be set the extra cost that would be incurred if offices and cable and coal stores had to be provided at a distance from the generating station.

In summarising his report, he repeats that his calculations only refer to an output which is confidently expected to be attained within 15 years. After that time further increases will still have to be provided for, and if there is doubt as to the possibility of dealing at the present site with the problems arising out of the supply that has been contemplated, the difficulties after that period will be enormously increased, and it would certainly then be necessary to erect works upon another site.

In conclusion, Mr. Dickinson expresses the opinion that the balance of advantages is in favour of the erection of a new station upon a separate site after the present engine house is filled up with plant, and recommends that steps should be taken forthwith to obtain powers to acquire the necessary site, and this recommendation has been endorsed by the Tramways and Electricity Committee.

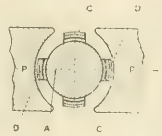
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Omega.

Under this name **Mr. Robt. W. Paul**, of New Southgate, London, N., is now introducing a new portable self-contained insulation meter, comprising, in one case, a generator, together with a moving-coil ohmmeter of novel construction, designed by Mr. G. W. Harris.

As is well known, the usual moving-coil construction in true ohmmeters, comprises two narrow-limbed coils, similar to those used in moving-coil voltmeters and ammeters, mounted on a common spindle at an angle to each other, and pivoted in an uneven magnetic field. This general arrangement is shown in sectional diagram in fig. 1, where C C are the limbs of the control coil, D D the limbs of the deflecting coil, A is the iron core, and P P are the magnet pole-pieces. On the passage of a current through C, the system takes up the position shown. If now a current passes through D, the whole system will rotate, D moving into a weaker part of the field, and carrying C into a stronger part, until the torques balance.

Fig. 1.



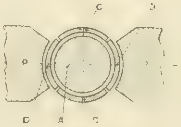


Fig. 2.

Since the current in C is arranged solely to depend upon the testing pressure, and that in D upon the current through the resistance under test, the position for balanced torque, depending as it does upon the relative strengths of these currents, is a measure of the value of such resistance, and is independent of change in testing pressure, since both currents will vary in the same proportion with this pressure. Consequently the scale can be marked off in values of resistance.

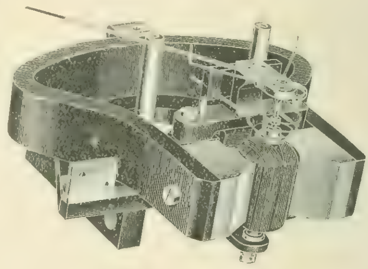


Fig. 3.—Mechanism of the Omega.

The Omega system differs from this, in that coils with wide angle limbs are used, working in a substantially even and concentrated field, turns in one winding moving out of the field while turns in the other move into it as the moving system rotates, until the balance of torques is reached. The principle will be made clearer by reference to fig. 2, which shows a horizontal section through an Omega movement, with core and pole-pieces. The control coil C C and the deflecting coil D D are wound at right angles to each other on a single hollow cylindrical former, the coil limbs each subtending an angle of 90°. The windings thus cover the whole surface of the former. The fixed iron core A is supported on a stem passing through an aperture in the bottom of the former, which is pivoted on an axis concentric therewith. The ends of the former are dome-shaped, making a very strong and light construction.

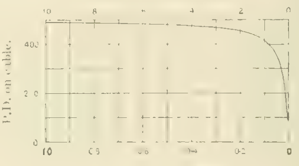


Fig. 4.

As before, on the passage of a current through the winding C, the system will take up the position shown. If a current now passes through D, the whole system will rotate, coil-turns in D passing from under the pole faces and bringing coil-turns in C under their influence until the balance of torques is reached. The complete system is illustrated in fig. 3.

A comparison of the figures shows that the increased winding space in the Omega ohmmeter, fig. 2, gives a much greater number of active turns in the deflecting coil D; the concentration of the field resulting from the narrow pole faces still further increases the deflecting forces. In this arrangement, therefore, increased force is gained both by the increase in the number of ampere-turns and the increase of field strength, the total advantage being proportional to the product of the two gains.

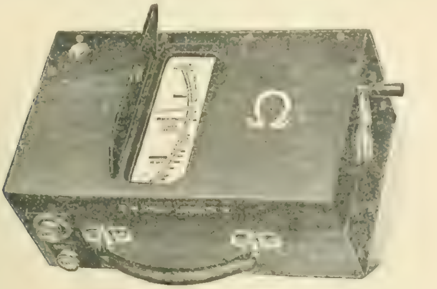


Fig. 5.—The Omega.

One result of the improved construction is that it is possible to construct an instrument measuring up to 400 megohms (at the mark next to INF) using a 100-volt generator, or up to 2,000 megohms using a 500-volt generator. This is a much higher figure than is usually demanded in practice, a top reading of 20 megohms per 100 volts of testing pressure generally sufficing, in which case there is a large margin of reserve force.

In the Omega, the indications prove to be little affected by external magnetic fields, so that compensating devices or magnetic shields are entirely unnecessary. The calibration curve over the whole angle of deflection has a convenient characteristic for resistance measurements from 0 to INF. It is not necessary to include a high internal resistance in series with the deflecting coil in order to utilise only that part of the scale which has a suitable characteristic. The Omega needs only sufficient internal resistance to prevent an excess of current in case of a breakdown in the cable under test. Therefore, the greater proportion of the pressure is available on the insulation.

This is illustrated in fig. 4, which shows the small internal loss of pressure when measuring low resistances. This curve was obtained on an Omega having a generator of 500 volts and a range to 100 megohms.

The standard ranges cover measurements from ·0005 to 200 megohms, but special instruments are made for much higher insulations; the generator most used gives 500 volts testing pressure, but generators are also made to give 250 and 1,000 volts.

Each Omega has an upper and lower range, the latter being put into operation by depressing a plunger; this plunger is held down by being slightly rotated. With the plunger in this position the readings on the scale are to be divided by 10. The pointer gives correct indications at almost any speed of the generator, and comes smartly up to the reading, the movement being critically damped.

There are no loose or detachable parts on the Omega, nor any projecting parts liable to damage; the terminals are of a novel type, and grip the connecting wires by a spring action either in a hole or between two flanges. The pivots are practically indestructible, and the whole apparatus is constructed for hard and continuous service.

In addition to the insulation-testing Omega, the principle above described is being applied to other electrical measurements.

Simplex Stage Plug and Socket.

A plug having a capacity of 50 amperes has been introduced by Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., for stage work or for power appliances generally in factories, and so forth. It is designed to comply with the latest requirements and the most up-to-date practice. The body is cylindrical, and is made in two pieces; the main casting is tapped at one end for conduit up to 1½ in. diameter, and has four lugs for fixing. Inside is a specially shaped and prepared fibre piece, which carries the terminals for connecting the main circuit wires and the plug pins. This fibre, which gives very high insulation resistance, is held in position by a key cast on to the inside of the body. The plug is of aluminium and of the three-pin type, the third pin being used for earthing, and enters the side of the cast body of the socket. A hinged spring cover is fitted, which closes the socket holes when not in use, being held fast by a spring catch, which is also utilised to hold the plug firmly in, when this is in position. All the terminals are of ample size, and the design generally is on liberal lines.

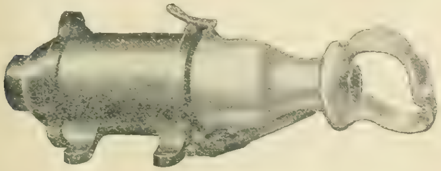


Fig. 6.—Simplex 50-ampere Plug and Socket.

Sealing-wax Heater.

The British Prometheus Co., Ltd., of Salop Street Works, Highgate, Birmingham, have sent us particulars of their new pattern sealing-wax heater, which is suitable for commercial houses. This heater is made with a polished copper body and brass fittings, and has the advantage of an adjustable cast-iron stand. The consumption is 50 watts, which permits of this heater being worked off the ordinary lighting circuit. The trigger provided allows the supply of wax to be regulated as desired. There is with this type of heater an entire absence of fire risk; the heater is also portable.

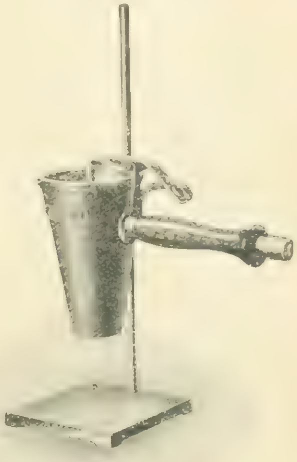


Fig. 7.—Sealing-wax Heater.

A New Self-Regulating Constant-Current Dynamo.

The dynamo, illustrated in section in fig. 8, is of novel and ingenious construction, and can be adjusted to maintain a given output, such output being kept constant through a considerable range of speed. The principle of construction is simple, and can be adapted for many purposes where automatic control and regulation of output is essential.

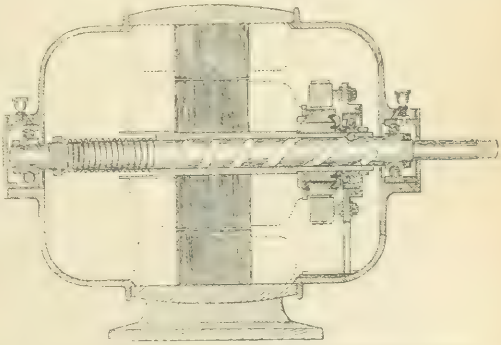


Fig. 8.—Self-Regulating Constant-Current Dynamo.

The armature and brush gear is built up on a sleeve which is mounted on the shaft, and driven by balls which engage in spiral grooves cut in the shaft; the armature is held in position between the pole magnets by a coil spring, which is partly recessed in the sleeve, the tension of which is adjusted by a nut. When the dynamo has attained a speed sufficient to give the required output, the reaction between the armature and the field magnets will cause the armature to wind along the shaft and partly compress the spring, leaving its normal position and moving to a region where it is traversed by a smaller magnetic flux, thus automatically taking up a position compensating for the increase of speed. The same action takes place on reduction of speed, but in the opposite direction, the armature winding itself back into a stronger field. It is claimed that the voltage remains constant from 800 to 3,800 R.P.M., and the machine is specially suitable for the lighting of motor-vehicles; it is very economical in its action and can be constructed for either a forward or reverse drive. Further particulars can be had from the inventor, MR. A. A. PRICE, 28, Rathbone Place, W.

Adams Igranic new Self-Acting Rheostat.

The new "Z" type self-acting rheostat recently developed by the ADAMS MANUFACTURING CO., LTD., of Bedford, is suitable for controlling small D.C. motors up to 3 H.P., and is a considerable improvement on their old "Leaflet 29" type of apparatus in several details. In the "Z" type there are always four steps, one of which is used for making the circuit and the others for controlling the starting resistance, and all these make contact by pressing two surfaces together, so that there is no sliding contact at all. Another point is that in the "Z" type the speed of starting is fixed by adjustment of the dashpot, and is the same whether the load is heavy or light. Being an air dashpot, it is not affected by changes of temperature, but may be relied upon to act always in the same way.

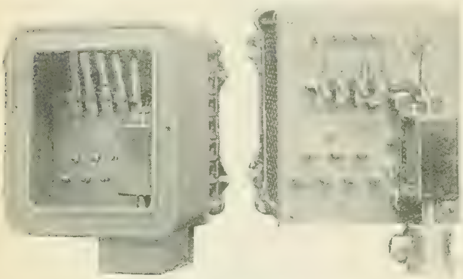


FIG. 9.—ADAMS "Z" TYPE STARTER.

In the old starter the speed of starting depended upon the development of the back E.M.F. of the motor, and this introduced difficulties under widely varying loads, such as are common in connection with lifts, &c. The "Z" type starter, which is illustrated in fig. 9, has none of these disadvantages, and is a robust and reliable piece of apparatus. It can be used for automatically controlling electrically-driven pumps, air compressors, lifts, or for remote control, and can be operated by means of a single-pole float switch, a pressure regulator, a start and stop push-button box, or an ordinary tumbler switch. The control circuit is not the main circuit, but a pilot circuit, which only carries a fraction of an ampere.

Remote control from two or more points can be obtained by the use of suitable accessory switches, and in combination with the reversing switch the new self-starter makes a very cheap, and at the same time thoroughly efficient lift controller for small service lifts up to 3 H.P.

Walsall Meters.

THE WALSALL ELECTRICAL CO., LTD., of 57, Bridge Street, Walsall, have during the last nine months commenced manufacturing small meters to compete with those which have been sold in this country of foreign make, and are turning them out at present at the rate of 300 per week. These instruments are identical in construction, with the exception that one has a closed front suitable for rough usage, and the other has an open front (fig. 10).

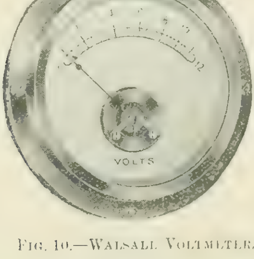


FIG. 10.—WALSALL VOLTMETER.

The makers claim the following advantages over the foreign-made meter: that their meter is absolutely rainproof, the glass being fixed into the case with a rubber buffer in the shape of a ring, and not so liable to be broken; only enamel wires are used for the coils, which are liberally rated; where the leads come through the meter case, ebonite bushes are moulded into the apertures, and there is no possible chance of breakdown; each dial is calibrated and marked off by hand: the movements are accurately balanced, and are also inspected before being inserted into the meter.

In spite of the extra cost which these various improvements have entailed, owing to the special machinery the makers have designed to produce these meters, and the system they have inaugurated, they are able to supply these instruments at the same prices as their foreign competitors. Their new catalogue can be had on application.

Hot Bar Radiators.

Every season the DOWSING RADIANT HEAT CO., LTD., of 105, Great Portland Street, London, W., introduce some new design in the department of electrical work in which they have so long specialised—electric radiators. The list issued by them this week for the 1912-13 season contains as one of its special novelties several styles of new hot-bar radiators, which they claim to be a great advance in electric heating apparatus. We illustrate one of these designs in fig. 11. The radiator is composed of hot bars, the appearance of which, when heated, resembles the pleasant glow of a bright coal fire, although possessing all the advantages of electric heating over the old method. The radiator shown has three patent hot-bar heaters, and is in an oxidised copper frame fitted with patent coppered reflector. Another type (No. 802) has four bars and a polished copper frame, while a third (No. 800), has a black iron and copper frame, and is fitted with a boiling plate.

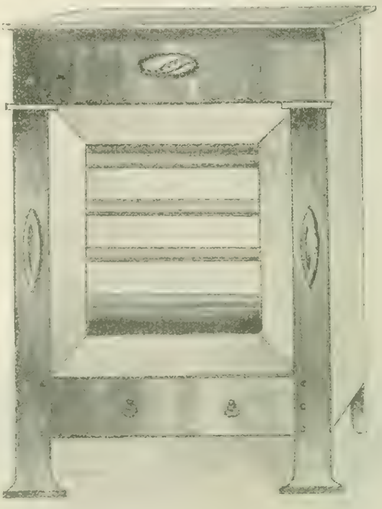


FIG. 11.—DOWSING HOT-BAR RADIATOR.

Benjamin Fittings.

A number of new fittings built up on the Benjamin wireless cluster principle are described in the new list issued by the BENJAMIN ELECTRIC, LTD., of 117, Victoria Street, S.W., and data are given respecting lighting work in which they can be successfully applied. Our readers are already fully familiar with these wireless cluster bodies, which, with their associated devices, are covered in Section I; enamelled steel and opal reflector fittings, tungsten arcs, Holophane-Benjamin steel reflectors of extensive,

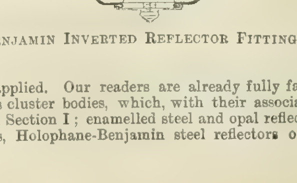


FIG. 12.—BENJAMIN INVERTED REFLECTOR FITTING; SECTION.

intensive, and focusing types, also outdoor lanterns, cargo lights and "Beneo" weatherproof fittings occupy Section II. In the next Section III which is devoted to office and indoor lighting, we notice the inverted reflector type (shown in figs. 12 and 13) which is designed for use with three or four 100-c.p. lamps with a 22-in.

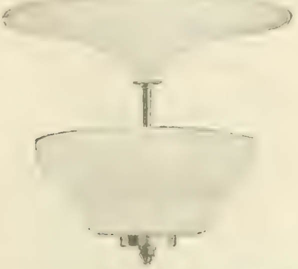


Fig. 13.—Benjamin Inverted Reflector Fitting.

white enamelled top reflector and an opal reflector bowl 17½ in. by 8 in. These fittings can be supplied in either parallel, series or divided circuits. Later sections show various fittings for shop window, show case and picture lighting, colour-matching and light-measuring apparatus, the lightometer, and a collection of globes, reflectors, &c.

LEGAL.

The National Telephone Arbitration.

In the King's Bench Division on Tuesday, October 15th, the Railway and Canal Commission resumed the hearing of the arbitration between the National Telephone Co. and the Postmaster-General, to determine the price to be paid by the latter for the acquisition of the National Telephone Co.'s undertaking. The Commission consists of Mr. Justice A. T. Lawrence (president), Sir James Woodhouse, and Mr. Gathorne Hardy. At the commencement of the main arbitration proceedings last sittings, the claim amounted to over 20 millions, but during the many days of exhaustive examination and negotiations which followed both inside the Court and out before the summer vacation, that huge figure was materially reduced.

The counsel engaged are :—Sir A. Cripps, K.C., Mr. Danckwerts, K.C., Mr. Forbes Lankester, K.C., Mr. E. Morten, K.C., Mr. H. H. Gaine, and Mr. Aubrey T. Lawrence, for the company. The Attorney-General (Sir R. Isaacs, K.C., M.P.), the Solicitor-General (Sir J. Simon, K.C., M.P.), Mr. Buckmaster, K.C., M.P., Mr. Schwabe, and Mr. Branson, instructed by Sir R. Hunter for the Postmaster-General.

Sir A. Cripps, at the commencement of the proceedings, said the Court would recollect that it was stated in the course of the last hearing in regard to certain items of value or prices, that there was not a great deal of difference between the parties. He was glad now to be able to tell his Lordship that with regard to part of the case an arrangement had been come to, and figures agreed upon between the parties. He was bound to say there never was any great difference between them on these figures, but other matters of a highly argumentative character would have to be dealt with in due course. The arrangement he had mentioned meant that a figure of £10,313,765 had been agreed upon between the Post Office and the National Telephone Co. The figures with regard to depreciation, &c., had not been considered ; the above agreement was in regard to what they called the fundamental cost of construction.

Sir J. Woodhouse : Do you mean the cost ? We have had a statement with regard to the matter which gives figures for "cost," whilst the statement you have just handed in speaks about "value."

Sir A. Cripps : I do not think there is any confusion about it at all.

Mr. Justice Lawrence : So long as you are agreed upon that, it is all right, but this document does not show it.

Sir A. Cripps : It means value before depreciation. There is no question about it between the parties.

The Attorney-General agreed that there was no difference between them on the matter. The cost of construction and figures of value involved the question of depreciation. Here they were simply dealing with the cost of construction.

His Lordship : But it does not say so.

Sir A. Cripps : If I may be allowed to go on with my explanation, the Attorney-General and myself are absolutely agreed, and there is not the slightest question as to what the arrangement means.

Mr. Justice Lawrence : Well, there is this difference, we are disappointed.

Sir Alfred, proceeding to deal with the table of agreed figures, said the first item, including materials supplied, manufacturers' profit, wastage, &c., and coming under the heading "cost of material," amounted to £7,016,500. Another item upon which at one time differences were threatened, but which had now been agreed, was that of freight, including cartage, &c., and the figure in this case was £377,904. Other matters agreed upon were wages and expenses up to and including gang foremen and casualty insurance. What had been included in these agreed figures was the cost or value before depreciation. Of course, as regarded the cost of depreciation, the parties were not at one. Among the matters still outstanding, Sir Alfred mentioned storing material, temporary storage and cost of raising capital, additional charges of obtaining subscribers' agreements, plant recovered after the day on which the inventory in any centre was taken, &c.

Sir J. Woodhouse said he had been devoting his time to getting a mass of figures into his mind, and now he had to start with a fresh lot of figures.

Sir Alfred Cripps : The object of the amended figures is not to get rid of pleasant memories in the past.

The Attorney-General : It is the result of my learned friend's long-vacation work.

Sir James Woodhouse : Do you think if you had another vacation you could agree to the rest of the figures ?

Sir A. Cripps : It would have to be another long vacation.

Continuing, Sir Alfred said the total estimated cost of construction partly agreed to came to £18,133,193. Upon the adjustment, the company's claim for conduits was put down at £2,337,971. Other items of agreed fundamental cost were underground cables, £1,856,753 ; poles and standards, £1,284,343. Aerial cables were depreciated from £[illegible] to £[illegible]; exchange equipment and central batteries from £1,512,739 to £1,363,621 ; and subscribers' charges appeared at the depreciated figure of £2,952,444.

The Solicitor-General then proceeded to deal with the figures and show how they were to be used. The company's cost of construction, which was originally £19,550,000, was now £18,133,000. On the other hand, the Post Office figure was £11,617,000 originally, but, as a result of the agreement, the Post Office took the view that that figure should be advanced to £12,143,000. It was true there was still a considerable chasm between the parties to bridge over, but it was satisfactory to find that the two armies were not running away from each other. The two large subject matters upon which there was no agreement was what was the proper addition to be made to the fundamental cost, in order to arrive at the total cost of construction ; and, secondly, having arrived at that cost of construction, what was the proper amount of depreciation to be allowed in order to arrive at the figure of value which would be the award.

(*To be continued.*)

Lift Accident.

On Monday last, at the Westminster County Court, a clerk named Askhan was awarded £25 and costs against the London Electric Railways Co., Ltd., for injuries to one of his feet, which, owing to his being pushed, was forced through the lattice work of the lift. At the time of the accident the lift was only half full. Defendants intimated that they would apply for a new trial.

THE ENGINEERING EXHIBITION AT OLYMPIA.

(*Continued from page 585.*)

Mr. Robt. W. Paul, New Southgate, London, N.—The apparatus exhibited consists almost entirely of pyrometers and temperature-measuring apparatus. Outfits are shown suitable for all ranges of temperature, for portable use and for permanent installations. Thermo-couples, both base metal and platinum, are being shown suitable for hardening, case-hardening and annealing furnaces, &c. The Rhodio thermo-couples should be particularly mentioned, as in these the use of pure platinum is eliminated, with the result that no contamination, and therefore no error, occurs due to protracted use of the instruments.

The indicator used with these thermo-couples has its moving coil mounted on a single pivot, the latter being fixed at the centre of gravity of the moving system, on the well-known Unipivot principle. Fig. 5, p. 614, is an illustration of the portable type.

In the case of the resistance pyrometers, the chief feature of interest is the Harris patent indicator, constructed with a differential galvanometer having an electrical control. A small current (obtained from an accumulator or from the supply mains) works the instrument, and the deflection of the pointer at once indicates the temperature. It is claimed that this is the only direct-reading instrument yet placed on the market which requires no manipulation, and which is independent of battery voltage.

A third type of electrical pyrometer is also being shown, called the "Cone Radiation Pyrometer." In this device, the heat rays emanating from a furnace or hot body enter a tube and are concentrated by a reflecting cone on a small thermo-couple fixed at the inner end of the tube. The thermal e.m.f. thus generated in the small thermo-couple is sufficient to deflect a Unipivot indicator, the temperature being read off on the latter instrument. No focusing is necessary, and the time taken to obtain a deflection is from 10 to

15 seconds. No part of the pyrometer is subjected to high temperatures, and hence the deterioration is nil

A few electrical instruments are also shown on this stand,

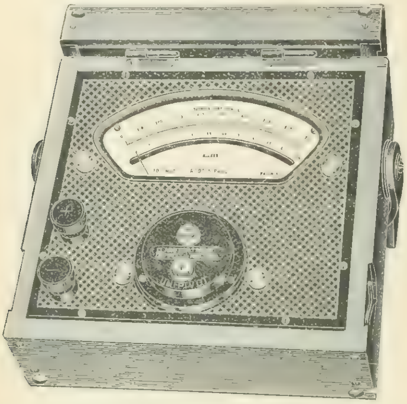


Fig. 5.—Paul Portable Thermo Couple Indicator.

amongst them being Paul's Universal testing set—in effect a portable test-room, and useful for reading voltages, currents, and insulation resistances—the Harris "Omega" insulation testing set, &c.

Foster Instrument Co., Letchworth, Herts.—The exhibits at this stand are mainly connected with pyrometry, and include the well-known fixed-focus radiation pyrometer, which enables the temperature of a furnace to be measured by simply pointing the receiving tube at the hot body with one hand, and reading the indicator held in the other hand. The distance of the tube from the aperture through which the hot body is viewed is immaterial, provided that an upper limit, depending upon the diameter of the aperture, is not exceeded. It is necessary that the hot body shall have a fairly large surface, such as the internal wall of a furnace. Where this method is inapplicable, a similar device can be used with a closed end of refractory material, which can be inserted in the furnace, and then acts as the radiating body. Fig. 6 shows the apparatus in outline, with a cross-ventilating device, which forms the latest improvement, and enables a current of air to be passed across the interior of the tube, preventing hot gases from reaching the thermoelectric couple.

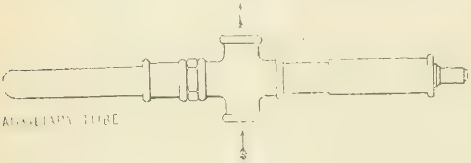


Fig. 6.—Foster Fixed-focus Pyrometer with Cross-ventilating Device.

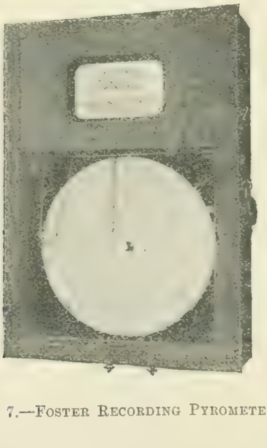


Fig. 7.—Foster Recording Pyrometer.

Either this apparatus or the Hoskins nickel-chromium thermocouple can be used in conjunction with a recorder, illustrated in fig. 7. The chart is circular, this form having the advantages that the whole of the record can be seen at once, and it is easy to replace; the pen is a capillary tube kept moist by an inking pad, which, at intervals of one minute (or less if desired), presses the pen against the chart and marks a dot. The record is waterproof, and cannot be smudged.

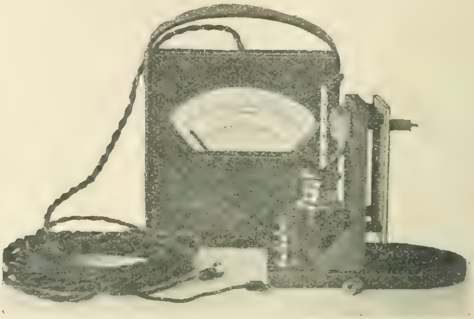


Fig. 8.—Foster Recalescent Outfit.

Another interesting item is a convenient little apparatus for determining the recalescent temperature of steel, which is now so important in connection with the hardening of tools. This consists of a nickel-chromium couple which is covered by a small sample of the steel, an oil-bath for the cold junction, and a portable indicator (fig. 8). The last is set to the temperature of the cold junction, after which the steel is heated to a high temperature with a Bunsen burner, and as it cools the pointer of the instrument continuously indicates the temperature of the sample, showing unmistakably the point of recalescence.

It is interesting to note that the nickel-chromium alloy used for the couples, being highly refractory and little oxidisable, makes excellent triangles for supporting crucibles over a flame, and other useful laboratory accessories. It has the additional advantage, when used in thermoelectric couples, that, unlike platinum, it is unaffected by the presence of emanations from white-hot iron.

The Power Plant Co, Ltd., West Drayton, Middlesex.—This firm has a fine show of double-helical spur gears, bevel gears and racks, which bears striking testimony to the rapid progress made by this type of gearing in popular esteem. Special attention is drawn to the D.H. gears with staggered teeth produced by this firm's patent hobbing process, for which extreme accuracy is claimed; gears produced by the end-milling process are also shown, for the first time by an English firm. Continuous tooth gears of the triple helical type form an interesting feature of the exhibit; but the chief part of the display consists of a long range of self-contained totally-enclosed speed-reducing and raising gears, from a small size, adapted for electrical organ blowing, to a set for transmitting 300 H.P., with a ratio of 5 to 1, for driving a large factory. All ratios up to 15 to 1 are obtained by a single train of D.H. gears; for higher ratios up to 80 to 1 double reduction is employed. A set designed to transmit 24 H.P., increasing from 475 to 3,000 R.P.M., is shown in operation at speeds up to about 5,000 R.P.M., running quietly and without vibration. Similar gears are made by the company for use in connection with steam turbines, turbine pumps and blowers. In the case of the 300-H.P. gear the makers guarantee an overall efficiency of 96 to 97 per cent. A series of flexible couplings, mainly employing leather rings for the elastic connection, is shown, as well as heavier types with the flexible medium in compression. These couplings have no external projections, so that they are free from danger to workmen.

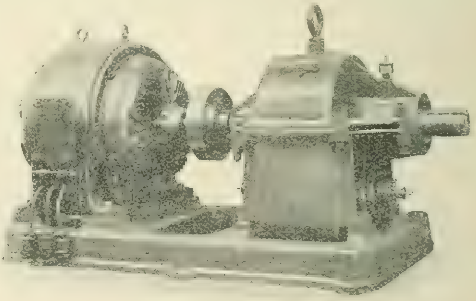


Fig. 9.—Motor with Double-Reduction Gear.

We illustrate in fig. 9 a motor provided with standard double-reduction gear, the construction of which is indicated in fig. 10. It will be seen that the low speed shaft is in line with the high speed shaft, and the whole is neatly enclosed. The high-speed pinion and the low-speed wheel are overhung, and the bearings are specially long on this account. In the larger sizes, the shaft carrying the former is extended and supported in the low-speed shaft. This gear is designed as a substitute for worm gear, and up to 60 : 1 the efficiency at full load is not less than 90 per cent.

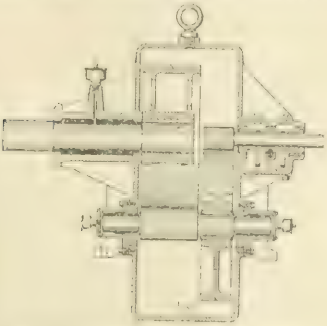


Fig. 10.—Section through Gear-Box

The Hudson Economiser Co. (1907), Ltd., 110, Bishopsgate Street, E.C.—On this stand are exhibited two working models of water cooling towers made under Brown's patent—one of the open type, the other of the chimney type. The special feature of these is the arrangement of the grids; the water overflows from the troughs and drips on to staggered wooden strips, of which three go to form a hurdle, which can be removed independently of the rest. The drops of water fall on to a flat horizontal surface A, fig. 11, which breaks them up, and each strip is bevelled below to a sharp edge, from which the water drips on to the centre of the strip below. The strips are also grooved transversely, to prevent the water from collecting into a thick stream and to ensure its uniform distribution over the whole of the tower. The firm's patent combined feed-water heater and oil separator is also exhibited.

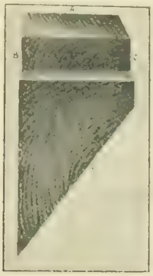


Fig. 11.—Cross-Section of Brown Cooler Bar.

(*To be concluded.*)

BUSINESS NOTES.

Liquidations.—J. L. Manufacturing Co., Ltd.—A meeting is to be held at 85, Gresham Street, E.C., on November 13th, to hear an account of the winding up from the liquidator, Mr. W. L. White.

C. & A. Musker, Ltd., electric lift makers, Liverpool.—Creditors of this company, or of the Receiver of the debenture-holders, who became creditors between November, 1905, and December, 1909, are asked to communicate at once with Mr. H. Derwent Simpson, solicitor, 18, St. Ann Street, Manchester. See our "Official Notice" pages to-day.

With reference to the notice published in our last issue respecting the liquidation of the Pearson Fire Alarm, Ltd., we are asked to point out that this liquidation was a purely voluntary one, and was necessitated by the amalgamation of the Pearson Fire Alarm, Ltd., with the May-Oatway Fire Appliances, Ltd. Both companies now trade under the name of Associated Fire Alarms, Ltd., the head offices being at Jewin House, Redcross Street, London, E.C.

Institute of Wireless Telegraphy, Ltd.—Creditors must send particulars of debts, &c., to the liquidator (Mr. G. P. Taylor, 36, Spring Gardens, Manchester) by October 31st.

Osram Week.—We have received from the General Electric Co., Ltd., a large collection of excellently produced shop window posters, transparencies, leaflets, showcards, postcards, and correspondence labels, such as are being used by the large number of contractors and others who have co-operated with them, in their spirited "Osram week" campaign. The company has certainly thrown ittelf into this huge popular publicity enterprise in a manner calling for congratulation.

For Sale.—The City of Leeds Markets Committee has for disposal 80 Lewes A.C. arc lamps. See our advertisement pages to-day.

Bankruptcy Proceedings.—H. J. Salter and H. Thorpe (trading in co-partnership as Thorpe & Salter, electrical engineers, High Holborn and Eden Grove, Holloway), also Harry Thorpe (separate estate). October 29th is the last day for the receipt of proofs for dividend. Mr. E. S. Grey, Official Receiver, Bankruptcy Buildings, Carey Street, W.C.

Albert Edward Martin (trading as the Midland Electrical Supply Co.), electrical engineer, 39, Gt. Charles Street, Birmingham.—The public examination of the above-named debtor was held at the Court House, Corporation Street, Birmingham, last week, before Mr. Registrar Lowe. The statement of affairs was given in our issue of October 4th, page 537. In reply to questions, debtor stated that on betting he estimated his losses at £50. He drew out of the business about twice as much as it was making. Asked what justification he had for this, the debtor said he was afraid that he had none. He attributed his failure to want of capital, having to pay interest in respect of borrowed capital and insurance premiums, loss on contracts, and the heavy law costs of suing creditors. The case was concluded.

Joseph Perkins, electrical engineer, Plymouth.—A first and final dividend of 7s. 6d. in the £ is payable on October 28th, at 7, Buckland Terrace, Plymouth.

Business in Russia.—A circular inquiry addressed to the electrical engineering firms in Russia in which German capital is very largely interested, has elicited the information that the course of business in the present year has been very satisfactory. The Government orders which had long been expected have now been allocated, and a very active demand is also experienced from manufacturers in general, whilst the formation of new companies and the technical transformations being undertaken in the heavy trades, are likewise resulting in the placing of large orders with the electrical firms. A further stimulus is expected to be imparted by the proposed conversion of railways to electric traction.

Catalogues and Lists.—Messrs. Adnil Electric Co., Ltd, Adnil Building, Artillery Lane, London, E.C.—New pamphlet No. 108 describing their automatic rope-operated lift controllers for D.C. and A.C. motors and giving weights and prices of same; also a price list of their "Autocom" system of single lever interphones.

Messrs. Engineering and Arc Lamps, Ltd, Sphere Engineering Works, St. Albans.—Four-page list, giving particulars and prices of the "Culinan" and "White Star" arc lamps, which are largely used for interior lighting in works and shops.

Messrs. S. Wolf & Co., 115, Southwark Street, London, S.E.—12-page pamphlet, containing some illustrated practical hints for the fitting and care of the "U H" arc ignition magneto. Copies will be forwarded on receipt of a postcard.

Messrs. Boving & Co., Ltd., 9½, Union Court, Old Broad Street, London, E.C.—36-page pocket pamphlet, containing a selection of interesting illustrations of hydro-electric equipments, pipe lines, &c., supplied and carried out by them. A tabulated list is given of representative plants installed (water turbines, pipe-lines and Victoria turbo-pumps).

Messrs. Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—List No. 92 (88 pages), second edition. This is a pocket catalogue of arc lamps, dynamos and motors, switchgear and instruments, in general use for industrial purposes. A great deal of information is compactly set forth, together with prices and illustrations, in four sections, separated by a thumb index.

Messrs. C. A. Parsons & Co., Heaton Works, Newcastle-on-Tyne.—28-page brochure (art paper), dealing fully with the Parsons exhaust steam turbine, and giving brief notes and half-tone illustrations of a number of plants of this class supplied to colliery companies, and gold mining and electricity undertakings. A tabular list of installations of exhaust and mixed pressure plants also appears.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester.—Catalogue containing illustrated descriptions and prices of Bailey's "Tell-Tale" recording gauges for pressure and vacuum.

From Stoffel's Electric Switch Co., Ltd., of 41, Eastcheap, London, E.C., we have received a folder containing drawings and a description of the Weenen patent automatic point and signal control.

The Dowsing Radiant Heat Co., Ltd., 105, Great Portland Street, London, W.—New price list of electric radiators for the 1912-13 season. Many attractive designs of luminous, convector, and illuminated convector radiators are shown, also red glow radiators and an illuminated log fire heater. A new departure is shown in the shape of a series of hot-bar radiators.

The Linolite Co., 25, Victoria Street, London, S.W.—A batch of lists relating to "Tubolite," and the Woodhouse steel casing.

Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Price list of a new line of small portable ammeters and voltmeters, and of small switchboard instruments, both "electromagnetic" and of the moving-coil type.

The Benjamin Electric, Ltd., 117, Victoria Street, London, S.W.—Complete price list and catalogue (80 pages) dealing with the Benjamin wireless clusters and lighting specialities. The list is fully illustrated and shows a number of new fittings, to some of which we refer in our "New Devices" section to-day.

Oil Prices Advance.—The Scottish mineral oil companies have decided to advance the prices of lubricating and fuel oils by 12s. 6d. to 15s. per ton. "Prices show an advance of fully £3 10s. per ton from the lowest point touched during last year's depression."—*Times.*

Trade Announcements. — Mr. W. H. Taylor announces that he has purchased the stock, goodwill, and book debts of the Electrical and Engineering Supplies Co., Ltd., of 36-37, Upper Thames Street, E.C., and will carry on the business as the Electrical and Engineering Supplies Co., at Harold Wood, Essex, and at 77a, Queen Victoria Street, E.C. The new firm will have increased facilities for manufacturing and stocking motors and dynamos, control gear, switches, &c. For the present the telephone number is "6082 Central."

Messrs. Mickelwright, Ltd., manufacturers of electrical apparatus, announce that henceforth all communications should be sent to them at their new address, Well Works, Alperton, Middlesex.

Mr. L. A. Wells, electrical contractor, has removed to larger premises at 6a, Parade, Cantnrbury.

Point Controllers.—Orders for the Collins patent automatic point controllers with patent mercury stuffing box have recently been secured, or executed, by Messrs. Quillian Bros., Salford, as follows:—For Preston, three additional controllers; Newport (order for five controllers); Accrington (repeat order); Sheffield (one machine); Wallasey (three machines).

Advertising in Turkey.—Though it is unlikely that electrical firms will be disposed to enthusiastically pursue energetic advertising schemes in Turkey at this particular moment in the country's history, we mention the following as a criticism (in the *Near East*) that may be worth remembering:—

"Advertising is as necessary to developing and retaining trade in this country as in any other, and yet, with a few solitary exceptions, British manufacturers do insufficient newspaper or poster advertising. Notwithstanding our preponderant share of Turkey's trade, one sees less than one poster in ten of British-made goods, and perhaps even a lesser percentage of advertisements in the local press. It should be remembered that illustrated advertisements appeal more to the Oriental than whole pages of letterpress."

LIGHTING and POWER NOTES.

Abbots Langley.—The P.C. has decided in favour of the Watford U.D.C. having powers to supply current in the rural district, owing to the high price of gas.

Acton.—The difference between the U.D.C. and the Metropolitan Electric Supply Co. (who in 1911 purchased the Council's electricity undertaking by statutory powers) which arose over the claim of the company to the balance of certain unexpended capital taken up by the Council for the purposes of the undertaking, &c., has now been amicably settled, the Council having handed over the balance of capital (£5,710), and in return having received a cheque for £2,710 for payment of loans, interest, &c., for which the company is responsible under the terms of the transfer capital stores; meters purchased out of revenue, and free wiring of installations purchased out of revenue. A friendly arbitration is to settle the amount of rental to be paid the Council in regard to the site of the generating station.

Argentina.—The president of the Banco Francés has sent in his proposal to the Buenos Ayres Municipality for electricity works in the Federal capital. The following are the main points:—Concession to the end of 1957, when all works, plant, &c., erected during the first 15 years, would revert to the Corporation. The capital invested after the first 10 years to be amortised yearly at the rate of 3½ per cent. Tariffs are specified for private houses and offices, public lighting, municipal offices, hospitals, &c., heating and power. The General Electric Co., of New York, are the technical advisers to the syndicate, represented by the French Bank.

The Municipal Council of the city of Buenos Ayres has approved in general the *ad referendum* contract entered into by the Mayor with the Italo-Argentina Electric Light Co., for establishing works in the Federal capital, and it is expected that the project will be definitely approved. The rapidity with which this project has been dealt with by the Corporation, says the *Review of the River Plate*, has called for considerable comment in the daily Press, which desires to know why the other two projects presented could not have been dealt with at the same time.

Australia.—The report of the Sydney municipal electricity department for the year ending December last shows an output of 17,768,210 units as against 14,398,918 units in the previous year. For power over eight million units were sold, and for public lighting 1¾ million units. The gross profit on the undertaking was £77,265, as compared with £56,236 in 1910, and the net profit £54,010. From this £24,504 was contributed to "depreciation reserve," being 3 per cent. on £816,790, the amount of capital expended at June 30th, 1911, and the balance with other items, amounting to £29,710, is carried forward to next year. The department appears to have set aside for sinking fund and reserve some £150,000 in addition.

The announcement recently made by the Melbourne City Council of its intention to seek enlarged powers in order to supply electric light fittings to consumers on the plea that private firms charge too much, has elicited a protest from the Electrical Traders' and Contractors' Association, a deputation from which has discussed the matter with the Electric Supply Committee of the Council.

The North Sydney Council has appointed Mr. G. A. Julius as the consulting engineer to the proposal to install electric light within municipality and also for the erection of a destructor. The applications from firms and corporations willing to carry out the scheme have been submitted to him for consideration and report to the Council. There were six applications, including one from the Sydney City Council and the Public Works Department.

The Municipality of Parramatta (N.S.W.) proposes installing electric light, and applications are being received for the erection of a generating plant and installation for the supply of electricity for public street lighting and private consumption.—*Australian Mining Standard.*

Ayr.—The Corporation electrical engineer reports that, during the past year, 1¾ million units were generated, being a decrease of 1·4 per cent. from the previous year. The capital expenditure to date is £104,824. The revenue for the year was £13,133—a decrease of £1,017 compared with the previous year, and the net surplus on the year's working was £996.

Barnes.—At a recent meeting of the Council a motion to refer back the decision of the Electricity Committee to take no action in the matter of purchasing 50 electric irons, for lending to approved consumers for the purpose of demonstrating the adaptability of the electric service, was passed.

Bromley (Kent).—The Electric Light and Power Co., Ltd., has applied to the B. of T. for an order permitting it to supply current in bulk to the West Kent Electric Co., Ltd., and to the Chislehurst Electric Supply Co., Ltd.

Canada.—The E. B. Eddy Co., of Hull (on the opposite, Quebéc, side of the Ottawa River from Ottawa) has under construction a hydroelectric power plant, which, when completed, will be one of the largest self-owned industrial power plants in the world. The Eddy Co. claims to be the largest wood manufacturing concern in the world.

The supply rates for the city of Winnipeg have been reduced. The matter has been pending since the opening of the new civic power plant. The rates fixed are 3½ cents per KW.-hour for light, with a 10 per cent. discount for cash, which places the light at less than 3 cents (1½d.) per unit. Up to a recent date the Winnipeg Electric Railway Co. had been charging the householders 10 cents per KW.-hour. Power rates, fixed by the city, range from ¼ cent to 1½ cents per KW.-hour. These prices work out on a basis of cost so far below that which obtained heretofore that the citizens are reported to be highly pleased with their own municipal light and power plant.

Another new power development in the vicinity of Montreal, which will soon be looking to London for money for development work, is the Carillion plant, situated 60 miles up the Ottawa River from Montreal, and about the same distance from Ottawa. Carillion is the terminal point of the Ottawa River Navigation Co.; navigation is interrupted here by the Carillion falls, necessitating canals and locks, and for many years a great deal of power has been going to waste at this point. Estimates of the amount of power vary very greatly, some placing it as high as 150,000 H.P. Mr. Henry Myles, formerly president of the Montreal Board of Trade, is at the head of the company which proposes to develop the falls.

A correspondent says that municipal plants in Canada appear to be flourishing, notwithstanding the fact that they have cut the old prices charged by the private companies not only in two, but in some cases, like Winnipeg, in three. The Regina plant will have a surplus this year, 1912, of $70,000, exceeding the early estimates by $28,000.

Peterboro, Ont., has passed a by-law authorising the city to install a hydroelectric power plant to cost $88,000.

Cannock. — At the request of the Wolverhampton Corporation, the R.D.C. has given its consent to the granting to the Corporation by the B. of T., under the provisions of the Electric Lighting Acts, 1882 to 1902, of a provisional order authorising the supply of electricity within an area comprising the parish of Bushbury. The Council has also decided to waive its rights to receive the notice required by the Electric Lighting Act, 1882, to be given to a local authority on or before the 1st day of July.

Chatham.—The T.C. on October 9th accepted a lighting scheme for High Street submitted by the Kent Electric Power Co. as under:—Lighting with 23 600-C.P. metallic-filament lamps, 11 to be extinguished at midnight, £450 per annum; capital expenditure for fixing, £357, less value of lamp columns (£101 10s.).

Cheltenham.—The T.C. has decided to reduce to 1d. per unit the charge for current for power, except for supplies wholly or mainly required during the time of the peak load.

Colchester.—In view of the increased cost of coal, the T.C. has reduced the discount allowed to consumers of current for lighting from 5 per cent. to 2½ per cent.

Continental Notes.—Belgium.—With the title La Société Force Eclairage et Docks de Gand, a company has just been formed in Ghent with a capital of £160,000, to erect a large coke making establishment with by product recovery plant, an electricity generating station in which part of the waste gases will be utilised, and for the working of a new dock at the port of Ghent.

Sweden.—The Storfors Brucks Co. are about to establish a large electricity generating station at Lillfors, in connection with their iron works at Storfors.

France.—The sixth power station on the picturesque Roya River, in the Alps Maritimes, built within the past 10 years, is now under construction at Fontan by the Société des Grands Travaux de Marseilles for the Société Energie Electrique. The building of a seventh power station will, it is stated, be undertaken without delay.—*L'Industrie Electrique.*

Russia.—The Rouchials waterfall, on the river Vuoksa, in Finland, has been acquired for the purpose of developing electric power. The fall will develop 48,000 H.P.

Devonport.—A disorderly scene occurred at the B.C. meeting on the 10th inst. in regard to the discharge of a fitter from the Corporation electricity works. An explanation was given by the engineer (Mr. Spark) that the step was necessary in order to maintain discipline and good order at the works.

Dudley.—A request having been made to the B. of T. for a public inquiry in reference to the sale by the Corporation of the electrical undertaking, a reply has been received from the Board stating that the Corporation is empowered, subject to the conditions specified in Sec. 69 of the Electric Lighting Order, to transfer by deed its undertaking to a company at any time. No deed has, however, been submitted as yet to the Board, who, on receipt of the same, will consider fully the representations that have been made.

A meeting of members and friends of the Dudley Traders' Association was held last week under the chairmanship of Mr. A. E. Longmore, at which Councillor Tanfield delivered an address in reference to the sale. He said that he had taken the advice of a consulting engineer who inspected the works. His engineering friend had assured him that £5,000 would put the plant into a condition sufficient to carry on satisfactorily for the next few years. Mr. George Conaty, consulting engineer, Birmingham, also spoke. He compared the Dudley works with those of 24 similar towns, and argued, therefrom, that there was no reason for the Corporation to rush to a sale.

Dundee.—The concrete piling and foundations for the Dock Street sub-station, situated near the entrance of the Harbour, were completed last week, and building operations are being carried on as fast as possible a sub-station is also being erected in Larch Street.

East Kent.—The South-East Kent Electric Power Co., Ltd., has applied to the B. of T. for permission to erect overhead lines from Tilmanstone Colliery to Eythorne and district in the new colliery area, for the transmission of current at a pressure of 11,000 volts.

Hendon.—The North Metropolitan Electric Supply Co. has applied to the R.D.C. for permission to supply current within the Council's area.

Hereford.—The T.C. has received from the L.G.B. sanction to a loan of £1,000 for services, repayable within 25 years.

Hessle.—The U.D.C. has decided to negotiate with the Hull T.C. and such companies or firms as thought fit, with the object of putting the E.L. Order into force on the best possible terms for the ratepayers.

Hove.—After a lengthy discussion on October 10th, the T.C. deferred for further consideration by members the recommendation (mentioned in the last issue of the Electrical Review) to give the E.L. company notice of the Council's intention to exercise its right to purchase the undertaking.

Hitchin.—The U.D.C. has decided to light the waterworks' engine house by means of a small independent plant at an estimated cost of £43. Gas has cost £16 a year, and electricity will save about £7 per annum.

Japan.—The Tone Hydraulic Electric Power Co. is reported to be in negotiation with reference to the establishment of electricity generating stations at Yoshimok and at a point on the upper reaches of the River Tone. It is stated that the plants to be put down will have a total capacity of 100,000 H.P.

Kendal.—The T.C. has applied to the L.G.B. for a loan of £1,000 for cables (£800), services and meters.

Kingstown.—The question of the electric lighting of Kingstown, Dalkey and Blackrock came before the Kingstown Urban Council on Monday, and an animated discussion followed. Mr. E. H. Andrews, vice-chairman, moved the adoption of the report furnished by the Roads Committee. He said there was a widely-expressed desire for the undertaking, especially amongst the traders. He was confident that the proposed company could be floated, and that the Council's interests would not suffer. If the proposal were frustrated the scheme would be delayed for a number of years. Mr. Evans explained the scheme; the company intended to erect a central generating station for Kingstown, for which it had been offered a suitable site at Glasthule In the station it would install alternators driven direct by high-speed internal-combustion engines, which would supply three-phase alternating current to sub-stations or transformers in Kingstown, Blackrock and Dalkey, and it would be possible to light all shops and houses on the tram line from Dalkey to Blackrock. In addition, it was proposed concurrently to lay 4 miles of low-tension mains along streets and roads. The scheme would at the start light over 7 miles of streets and roads. At the commencement the charge for the light would be 4½d. per unit, and for power 1½d. per unit, and it was hoped in the near future to be able to make a reduction in these charges. The scheme would bring additional work and money into the township and would roughly cost £25,000, the major portion of which would be spent in Kingstown. Mr. Croskerry said that there were three ways in which the company could carry out the undertaking — first, by Act of Parliament; secondly, by provisional order; and thirdly, by the consent of the three Councils to the opening up of the roads and the laying of the mains. It was intended to adopt the third of these alternatives, and thus avoid the very heavy tax which the cost of obtaining Parliamentary powers would put upon the capital of the company. The latter, while not looking for the street lighting, would be prepared, if necessary, to light, clean, and maintain all arc lamps of 1,000 C.P. which the Council might place on any of the streets or roads through which the company's main lines were laid, or within 75 ft. of any high-tension or low-tension main, at the rate of £16 per annum for lamps burning 1,500 hours, or, in the alternative, to supply the Council with current for lighting purposes at cost price, namely, at 2½d. per unit, and to allow the Council to carry out the lighting of the streets itself. It was suggested that, as several members of the Council had financial interests in the proposed company, the matter should be postponed for a month, but after further discussion, the report of the Roads Committee recommending the scheme was adopted.

Ledbury.—Messrs. Brown & Parsons, Ltd., of Leamington, have informed the U.D.C. that they are applying for a prov. order for E.L., and that owing to the absence of these powers they are unable this year to tender for the public lighting, as they had hoped to do.

Llanfairfechan.—A special meeting of the U.D.C. has been held to interview Mr. W. R. Walton, of Manchester, in reference to a lengthy report which he has submitted on the question of lighting the town by electricity. Mr. Walton advises the Council to obtain powers for providing and working such an undertaking, and to immediately make inquiries as to probable consumers in case a supply were available. He estimates the cost of developing water power, building the dam, providing and laying a steel pipe, &c., at about £5,500. If oil engines were used, it would cost about the same. A steam plant would cost £4,900 for the complete installation, and a suction gas plant about £4,650. He estimated the gross net revenue at about £850 per annum. The report was discussed at length with the engineer, and ultimately it was decided that before coming to any decision in the matter, each member be supplied with a copy of the report, and that a further special meeting of the Council be called to consider the matter.

London.—Stepney.—Application is to be made to the L.C.C. for sanction to the borrowing of £2,500 for meters and £2,800 for house services.

Bermondsey.—The Electricity Committee has given instructions for an insurance policy to be taken out against loss of profits through inability to supply consumers owing to the stoppage of supply in the case of fire, at an annual premium of £3. This policy covers £6,000 for three months' period of interruption.

Poplar.—The Electricity Committee has considered a report of the electrical engineer on the subject of low-tension mains. The report points out that the increase in load over last year is quite unprecedented, and that, as the bulk of the increased supply is to consumers on the Isle of Dogs, the number of feeders out of the Millwall sub-station will have to be increased. Owing to the present high value of copper and lead, which would render the cost of the new feeders abnormal, the engineer suggests that the major portion of the work should be carried out with reclaimed dormant cable, at a cost of £1,367, new materials being used for the remaining portion at a cost of £492.

Stoke Newington.—The Public Health Committee reports that it has agreed with the Electric Lighting Committee that, as from March 31st last, the charge to be made against the undertaking in respect of the steam supplied from the refuse destructor for the generation of current shall be at the maximum rate of £1 per 1,000 units for all low-tension units delivered at Edward's Lane station (the minimum charge to be £10 per quarter for water consumed), and the payment of the balance between such minimum and maximum rate to be subject to deduction of the extra cost of the bulk supply consequent upon failure of the steam supply from any cause, each quarter to be calculated separately.

Lossiemouth.—At a special meeting of the T.C. it was agreed to proceed with an electric lighting scheme for the town, various offers having been reported on by Mr. J. A. Bell, of Aberdeen.

Lowestoft.—The T.C. has decided to rent shop premises in High Street at £20 a year for use as a showroom, &c., in connection with the electricity department.

Lytham.—The question of electric lighting which ha excited public interest on many occasions during the past couple of years, has once more come to the front in the decision of the

St. Anne's Urban Council, who already possess a plant, to apply to the Board of Trade for an order to supply current in the Lytham urban district. The Lytham Council, with the support of the tradesmen's and the ratepayers' associations, is also applying for powers to install its own electrical plant, in order to supply electricity for all purposes in its own district; and the rival applications are creating a lively interest in the two towns.

Mansfield.—Some time ago the Mansfield Guardians decided to install the electric light throughout the workhouse, and a committee was appointed to prepare a scheme in order that the L.G.B. might be asked for sanction to a loan. This was done, but it transpired at the last meeting of the Guardians that the lowest tender was £200 in excess of the amount they had obtained sanction for, consequently the committee has been instructed to revise the specification, and to take what steps it deems advisable in the matter.

Midlothian.—The County Council has referred to the General Committee an application by the Colinton Tramways Committee for the consent of the Council to an application to the B. of T. for an order under the Electric Lighting Acts, for an area in the parishes of Colinton and Corstorphine.

New Malden.—After several months' dispute, the final report of the surveyor of the U.D.C. has been accepted in regard to the installation of about 90 lamps in the public offices by a local contractor at a cost of £144, as against a sum of £150 sanctioned by the L.G.B. It appeared that the lowest tender had not been accepted, and that an utterly unfounded allegation had been made as to a business connection between an official of the Council and the contractor. The U.D.C. will shortly consider a scheme for electric street lighting from the mains of the Wimbledon municipal undertaking.

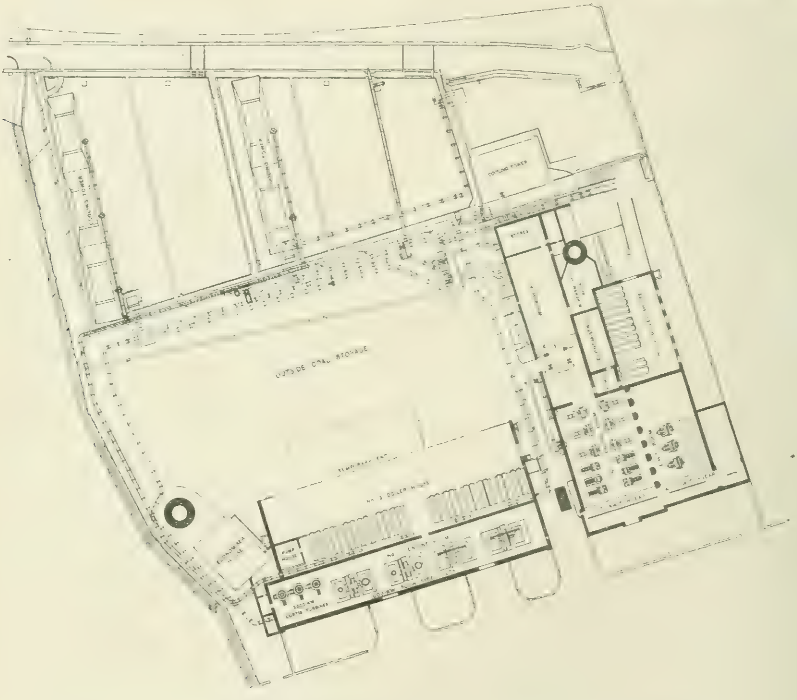


Fig. 1.—Plan of the Valley Road Electricity Works of the Bradford Corporation.

Newport (Mon.).—The T.C. has applied to the L.G.B. for a loan of £3,220 for electricity purposes.

Northfleet.—Mr. E. Castle has applied to the Gravesend T.C. for a supply of current for new cement works he is constructing at Northfleet. The Council desires guarantees for the payment of not less than £500 per annum for a period of five years, with further guarantees for adequate compensation in respect of mains rendered unproductive by the discontinuance of the works.

Nuneaton.—The R.D.C. has consented to an application by the Leicestershire and Warwickshire Electric Supply and Power Co. for the erection of overhead transmission lines in the district.

Pembroke (Dublin).—At a meeting of the Council, the Roads Committee recommended the Council to press on matters connected with the proposed loan of £9,000 for electric lighting improvements. The chairman said that the demand for electricity had grown very much in their district, and it now became necessary for them to extend their generating plant, and to get in a modern engine. It was suggested that a Diesel engine should be obtained. It was also necessary, in consequence of the increased plant, to extend the buildings. The electricity department had been very successful, and at the end of the financial year, he believed, would show a profit of about £1,500. The Committee which went into the matter recommended the Council to apply to the L.G.B. for the loan of £9,000, and this was agreed on.

Port Glasgow.—The protracted negotiations between Port Glasgow and Greenock Corporations regarding the supply of electricity to shipbuilders seem at last to have resulted in bringing about a settlement. At a private meeting of the Port Glasgow T.C. it was resolved to enter into an agreement with Greenock Corporation whereby Port Glasgow will apply during the present session of Parliament for an electric lighting order, authorising it to supply electrical energy for all purposes within the burgh of Port Glasgow. It will ask for power to transfer the order to the Greenock Corporation within 12 months, Greenock to undertake to accept such a transfer. Greenock, it is stated, is to undertake to immediately distribute current for all purposes within the burgh of Port Glasgow, and to bear the whole expense of the order and the deed of transfer.

Scarborough.—The Electric Supply Co. has been holding a series of exhibitions in cooking by electricity at the Albert Hall.

Skelton and Brotton.—The U.D.C. has, by 14 votes to 3, decided to apply to the B. of T. for a prov. order for E.L. A report on the question has been prepared by Messrs. May and Hawes, of London.

Sligo.—The B. of G., after considering tenders and examining the scheme of the engineer in connection with the proposed electric lighting of the town, and also hearing the observations of a representative of Messrs. Parte, has abandoned the proposal for the electric lighting of the workhouse. It appeared, during the discussion, that several members of the Board were shareholders of the Sligo Gas Co., and in the course of a noisy debate, allegations were made that the place would be "blown up" if electricity were used, and that local carters would lose their jobs in carrying coal to the gas works. On the other hand, Ald. Jinks is reported in the *Sligo Times* to have remarked: "It is an awful thing to get up here and speak against the gas company."

Application is to be made by the Corporation to the B. of T. for a provisional order authorising the adoption of an electric lighting scheme for the town.

Swindon.—The T.C. has received the sanction of the L.B.G. to a loan of £6,500 for electricity purposes.

(*Continued on page 623.*)

ELECTRICITY SUPPLY DEVELOPMENTS AT BRADFORD.

Last week as briefly recorded in our pages, the official ceremony of starting the third Curtis turbo-generator, recently installed at the Corporation electricity works, took place.

This development provides another landmark in the history of one of our most enterprising municipal electricity supply undertakings—that history, as our readers are aware, having been closely followed in our own pages.*

The original generating station (No. 1) at Bolton Road, opened in 1889, has long since been relinquished to other uses, while at the second, or No. 2 station, at Valley Road, which was opened in 1897, some equally striking changes have occurred; the boiler house there, with its marine boiler and induced-draught equipment has been transformed into a well-lighted and equipped rotary sub-station or "H.T. annexe," which also houses the extra-H.T. alternating switchgear for the three-phase plant installed in the two Valley Road stations.

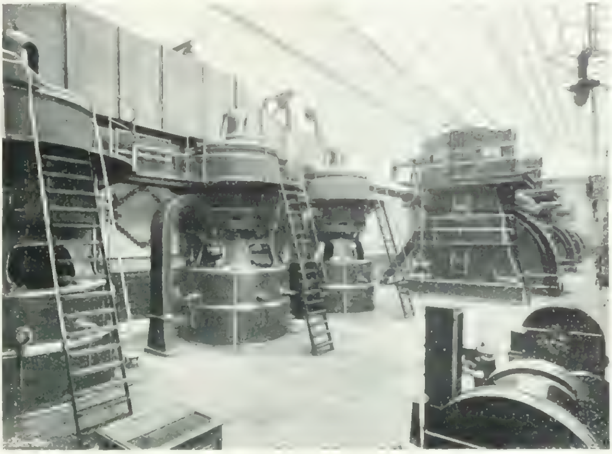


Fig. 2. Interior of the Valley Road No. 3 Station, Showing the Turbine and Reciprocating Engine Plant.

As regards the No. 3 station, it now contains 14,000 kw. of generating plant, including four slow-speed cross-compound vertical Corliss engines of 1,600 I.H.P. each, by Cole, Marchant and Morley, and Musgrave & Sons, coupled to 1,000-kw. Westinghouse direct-current generators and three B.T.-H.-Curtis vertical turbo-alternators, each of 3,000 kw. (5,000 H.P.) nominal capacity. The latter sets are in most striking contrast to the former, both in regard to floor space taken up, viz., 57 sq. ft. for the turbine, as against 683 sq. ft. for the reciprocating set, and steam consumption per unit generated, *i.e.*, 16 lb., as compared to 20 lb.

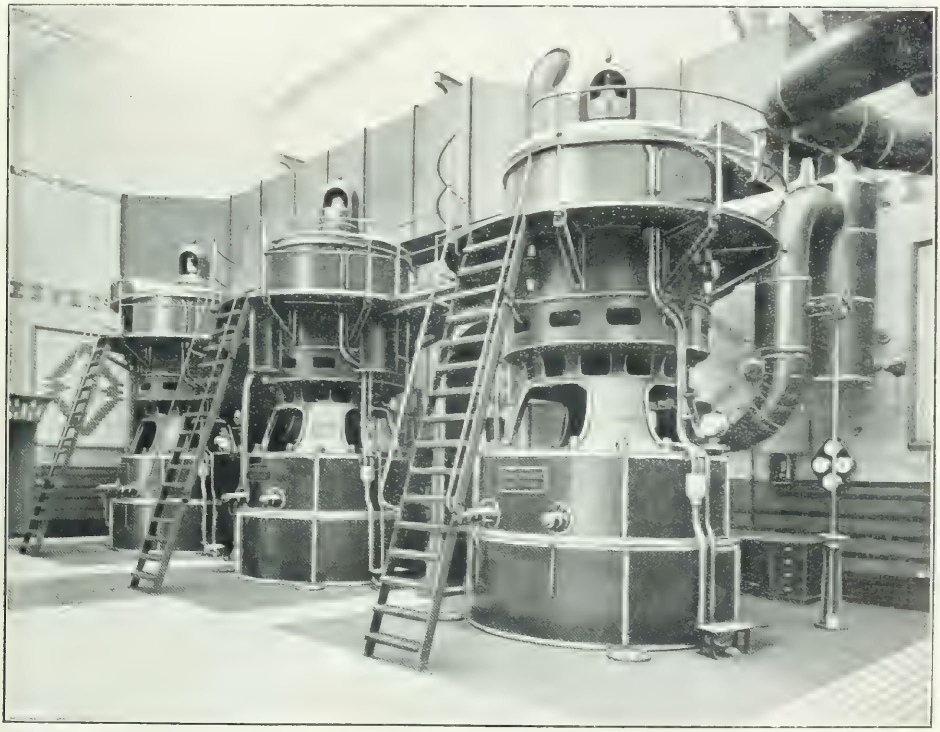


Fig. 3.—Curtis Turbine Plant at the Valley Road No. 3 Station, Bradford.

The new turbine set which we illustrate in fig. 3 with the two previous ones, has been designed to give 4,500 kw. continuously (5,000 k.v.a. at ·9 power factor) at 6,600 volts, three-phase, 50 cycles, when running at 1,500 r.p.m.

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* Elec. Rev., June 10th, 1892, original installation at Bolton Road No. 1 station; November 26th, 1897, Valley Road No. 2 station; December 18th and 25th, 1903, Valley Road Nos. 2 and 3 stations.

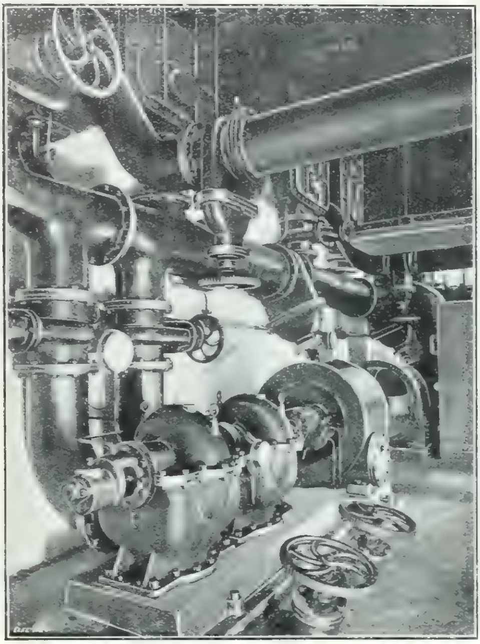


Fig. 4.—Turbine-Driven Circulating Plant in the Basement.

It is the largest vertical turbo-alternator built in the United Kingdom. The two previous sets were designed each to carry 3,000 kw. continuously, and with an overload capacity of 4,500 kw. for a limited period, while the new one is designed to carry 4,500 kw. continuously.

It is mounted similarly to the earlier sets on a sub-base condenser, and the turbine is as nearly as possible similar to the previous ones, the generator rotors being interchangeable.

When developing 3,750 k.v.a. at 6,600 volts, the temperature rise above the surrounding air of any part of the alternator will not exceed 40° C., and at 5,000 k.v.a., and ·9 power factor, it will not exceed 50° C., measured by thermometer.

An exceptionally large and well-lighted basement, some 18 ft. in height, contains the whole of the condenser auxiliary plant for the three turbines, the sub-base condensers being of the Worthington type.

The new condenser when supplied with cooling water at 80° F. and dealing with 70,200 lb. of steam per hour will maintain a 27-in. vacuum. When dealing with 60,000 lb. of steam per hour it will maintain a $27\frac{1}{2}$-in. vacuum; and when dealing with 49,500 lb. of steam per hour it will maintain a $27\frac{3}{4}$-in. vacuum. The cooling surface of the sub-base condenser is 8,200 sq. ft.

The circulating pump is of the twin type, capable of delivering 8,000 gallons of water per minute against a head of 60 ft., and is separately driven by a 200-b.h.p. Curtis steam turbine running at 1,700 r.p.m., shown in fig. 4, which is supplied with steam at 180 lb. pressure and 100° F. superheat. The auxiliary turbine exhausts into a feed water heater, the back pressure of which will not exceed 20 lb. per sq. in. absolute.

This method of driving auxiliaries by small steam turbines is becoming popular, owing to the convenience in starting up the plant and the small space occupied where usually little space is available, and where the exhaust steam from the smaller turbine can be conveniently used in a feed water heater, the efficiency of this arrangement nearly approaches the ideal.

The main turbine speed can be varied from the switchboard at will during the process of synchronising by means of electrical gear and a motor operating upon the governor gear of the turbine.

The air required for ventilating the three turbo-alternators is drawn through a B.T.-H. air filter consisting of 42 removable box sections, each fitted with special filter cloth. These filter sections are supported in a suitable framework, and are individually removable for the purpose of cleaning—two spare sections being provided for this purpose.

The filtered air is passed along through the overhead ducts (shown in fig. 3) to the alternators.

The air filter is capable of dealing with 60,000 cb. ft. of air per minute.

No separate blower fans are provided for circulating the air, the alternator rotors being so designed as to propel the necessary air supply by their own action.

Our illustration, fig. 2, clearly shows the great difference in space occupied by the turbine and vertical engine sets, three of the former occupying the same space, but with over 10 times greater output than one of the latter.

In connection with the earlier turbines, the circulating pumps were driven by 130-h.p. variable speed shunt-wound motors, controlled through Brook-Hirst switch pillars; the three circulating plants, however, together with two Allen steam-driven circulating pumps in the adjoining station

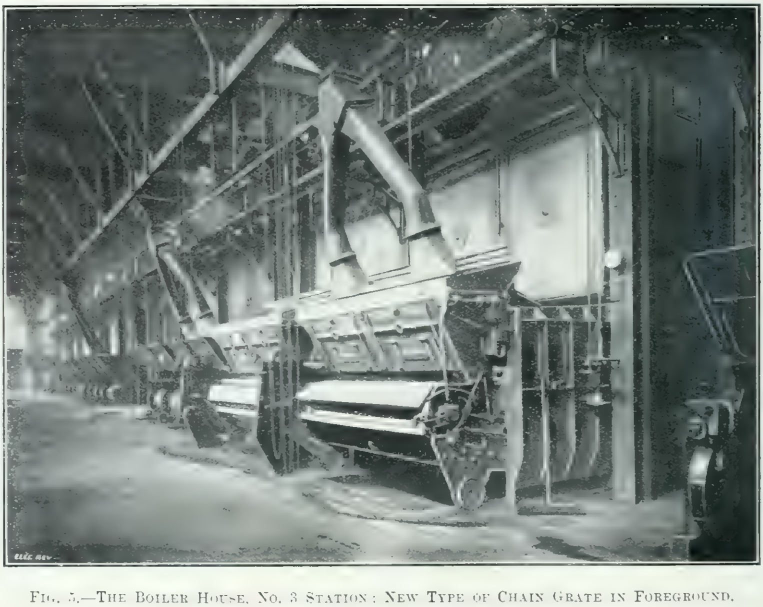


Fig. 5.—The Boiler House, No. 3 Station: New Type of Chain Grate in Foreground.

supply the whole of the condensing water requirements of both the Nos. 2 and 3 stations, the former of which contains some 6,000 H.P. of Willans engines.

Each of the turbine units is provided with a three-throw air pump, gear-driven from a 25-H.P. motor, and duplicate motor-driven three-throw pumps working in conjunction with an accumulator, are installed for the pressure water supply to the turbine footstep bearings.

The boiler house which we illustrate in fig. 5, contains 10 Babcock boilers, each with an evaporative capacity of 18,000 lb. of steam per hour, also two larger boilers by the same makers, each of 25,000 lb. evaporative capacity; these supply steam at 180 lb. pressure, superheated 200° F.

All the boilers are equipped with chain grate stokers, the two latest ones, shown in the foreground in fig. 5, being of the most modern type, having only one wide grate per boiler.

The wide grate is supposed to allow of the use of smaller fuel and is more easily repaired in case of breakage to a link.

In connection with these boilers are overhead coal bunkers of 3,000 tons capacity, feeding the stokers through Avery travelling weighing machines and spouts; also coal and ash-conveying plant, two large economisers and four 10,000-gallon per hour Hall feed pumps.

An interesting little motor-driven apparatus, which has proved very effective in use, is the Hamler Eddy smoke recorder, in the economiser house; this device pumps small quantities of smoke from the chimney, through a fine nozzle on to a recording chart, giving a smoke line of approximately the same density as the chimney discharge, which is examined daily and duly respected by the boiler house staff: another device which has proved very useful, is the Kentometer installed in connection with the turbo-condensers, and which gives directly the percentage of perfect vacuum without reference to the barometric reading.

For operating purposes the works just described are coupled both on the steam and electrical sides to the adjoining No. 2 station, where, indeed, the whole of the extra-H.T. three-phase and direct-current switchgear is installed.

In the latter works the original 12 Willans sets still do service on the peak and for balancing purposes, although one might hazard a guess that in view of the No. 3 engine room being now full of plant, their days are probably numbered.

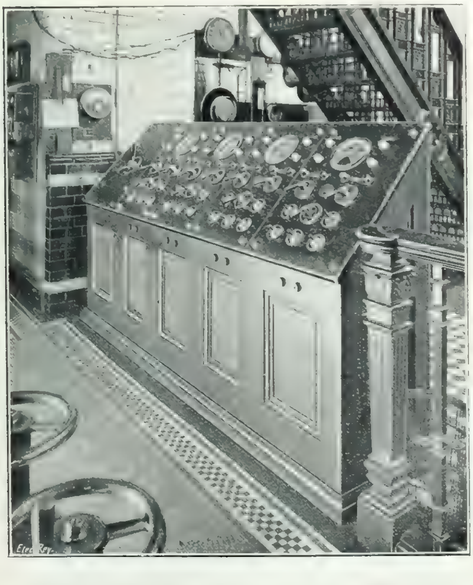


Fig. 6.—Direct-Current Remote Control Board at the No. 2 Valley Road Works.

This station also contains a boiler house with five Babcock units, each of 14,000 lb. evaporative capacity—now used only during the winter months—with economiser, feed-pumps, &c., and condensing plant.

The whole of the condensing plant at both stations is coupled by means of a ring circulating system to three cooling towers, one large Davenport tower with three chimneys, of 365,000 gallons per hour capacity, one by the same maker of 243,000 gallons per hour capacity, and an older Klein tower of 160,000 gallons capacity. These are mounted over reservoirs having a capacity of 2,250,000 gallons, and the larger ones are shown in fig. 9. In connection with this plant a Lescole distance thermometer and plug board is provided in the No. 3 engine room, by means of which the temperature of the turbine condenser inlet and outlet, air pump discharge and cooling tower water, and boiler room feed can be instantly obtained. The general lay

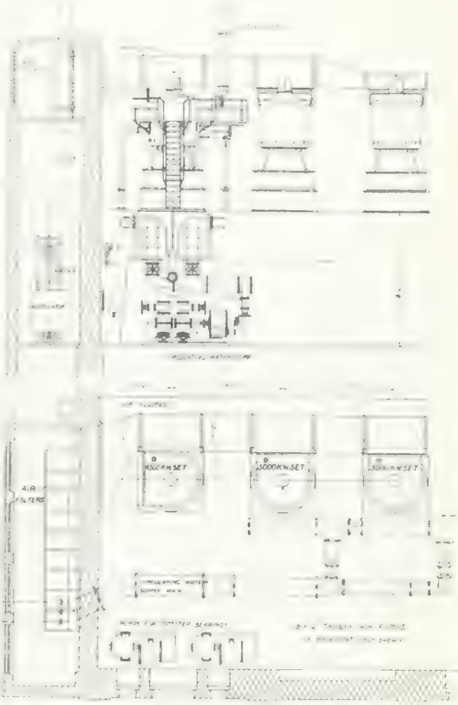


Fig. 7.—Showing the Arrangement of the Curtis Turbine Plant.

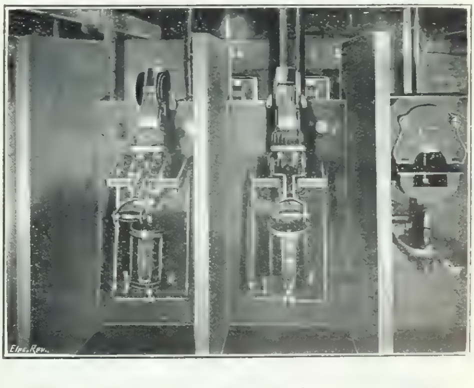


Fig. 8.—1000-kw. Circuit Breakers, Operated from the Board Shown in the Adjoining View.

out of the two stations is shown in fig. 1, page 618; the large area of land between the cooling tower plant and stations is being used for supplementary coal storage, a reserve of 6,000 tons being aimed at in addition to the bunker capacity in the stations. *(To be continued.)*

A 28,000-H.P. ZOELLY STEAM TURBINE.

Messrs. Escher, Wyss & Co., of Zurich, have recently delivered to the Rheinisch-Westfülischen electric power station in Essen, one of the largest steam turbines contained in one casing that has up to the present time been built. This turbine is designed to develop 22,500 h.p. effective, under normal continuous working, at a speed of 1,000 r.p.m., the initial steam pressure being 150 lb. per sq. in. above the atmosphere and the steam temperature, 572° F. at the stop valve, while the turbine exhausts to a vacuum of 27½ in. In this case only a low vacuum is obtainable, as the temperature of the circulating water for the condensing plant is comparatively high, being re-cooled through a cooling tower. The turbine can develop 28,000 h.p. continuously, and even 30,000 h.p. for short periods.

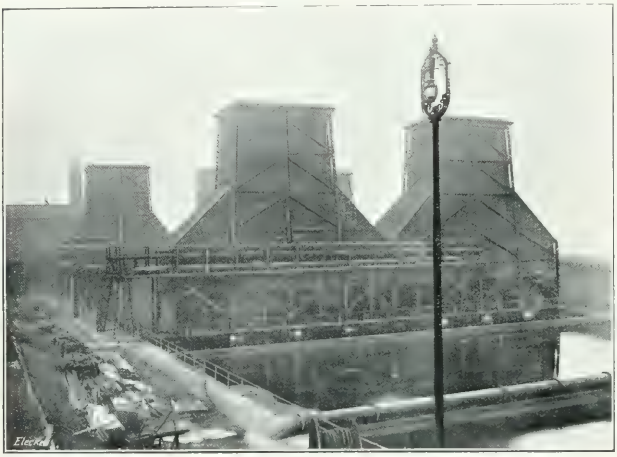


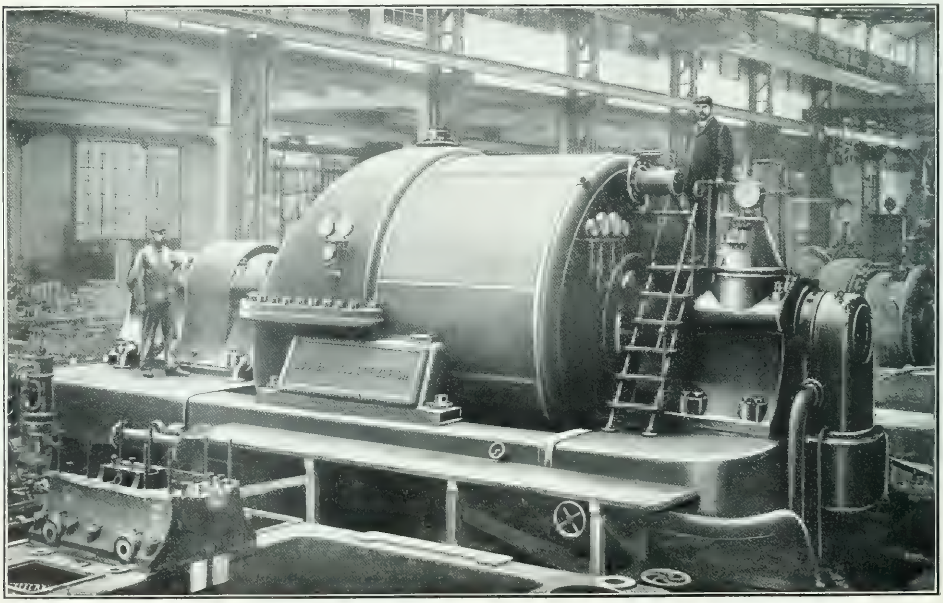
Fig. 9.—Davenport Cooling Towers at the Bradford Electricity Works (See previous page).

The design is of the usual "Zoelly" type, to which Messrs. Escher, Wyss & Co. have already constructed well over 225 machines, with a total of approximately 500,000 h.p. The turbine rotor consists of 14 runner wheels, and the total weight of the rotor, including shaft, is 26 tons. The generator rotor, which is of the Siemens-Schuckert type, is connected to the turbine shaft by means of a rigid coupling, and weighs 60 tons. The generator and turbine rotors are supported by four bearings which are lubricated with about 130 gallons of oil per minute, under pressure. When starting up the turbine, the oil pressure is obtained by a small steam turbine-driven centrifugal oil-pump, and as soon as the turbine has attained its normal speed, a cogged-wheel pump, driven from the main shaft, produces the desired pressure and the centrifugal pump is then shut down. The oil flows from the bearings to an oil tank contained in the bed-plate of the turbine, where it is cooled by means of water coils; it is then pumped back to the bearings by the cogged-wheel pump, and continues the cycle thus described. Only a very small quantity of oil is required from time to time to make up for waste.

The exhaust steam is led through a pipe 3 ft. in diameter to the surface condensing plant situated in the basement of the power house and immediately below the turbine, the circulating water being supplied from a cooling tower. A separate pump delivers the condensed steam into a tank, from whence the boilers are fed by means of feed pumps.

This large turbine, owing to its simple design, requires little more attendance than much smaller units.

Our view shows the turbine during construction in the shops of Messrs. Escher, Wyss & Co., at Zurich.



28,000-h.p. Zoelly Steam Turbine for the Essen Electricity Works.

LIGHTING and POWER NOTES.

(*Continued from page 618.*)

U.S.A.—The longest transmission line so far known is under construction from Los Angeles California, to Big Creek a distance of 248 miles. Power is to be conveyed at a pressure of 150,000 to 175,000 volts.

Uruguay.—It is reported from Monte Video that as soon as the Electric Monopoly Bill receives the sanction of the Senate, it is the intention of the Government to erect State power houses in 15 towns immediately. These are La Paz, Las Piedras Pardo, Punta del Este, Maldonado, San Carlos, Santa Lucia, Canelones, Rosario, Dolores, Nico Perez, Sarandi del Yi, Treinta y Tres, San Fructuoso and San Eugenio. The installation of these services is estimated at from $25,000 to $30,000 gold each, and tenders will shortly be call for them.—*Review of the River Plate.*

Walsall.—Sanction has been received from the L.G.B. to the borrowing of £9,000 in respect of capital expenditure for the undertaking.

Warrington.—The annual statement of accounts shows that the gross profit on the electricity undertaking for the year ended March 31st last was £7,709, and the net profit £1,745. After transferring £500 in aid of rates, and £363 as a contribution to capital, the working balance shows a credit of £3,078, while the reserve fund amounts to £9,358. The capital expenditure was £6,558, and the debt repaid £3,859. The loans outstanding amount to £79,046. The quantity of electricity generated was 4,207,932 units, a considerable increase on the preceding year.

Watford.—A loan of £3,685 for additional generating plant has been applied for by the U.D.C.

Whitehaven.—The T.C. has decided to expend £150 on the purchase of "Tricity" cooking outfits, which are to be installed at rentals ranging from 1s. 6d. to 6s. per quarter. The necessary wiring will be done by the Council through local contractors.

TRAMWAY and RAILWAY NOTES.

Argentina.—Messrs. J. G. White & Co., of Buenos Ayres, have sent an expert to San Juan, with the object of reporting upon the possibility of establishing a system of electric tramways in that town and the surrounding district. *The Review of the River Plate* anticipates that the report will be favourable.

Baildon.—Terms have been settled between the Bradford Corporation and the Baildon U.D.C. with regard to the extension of the Bradford tramways from the present terminus at Baildon Bridge, Shipley, to Baildon. A provisional order will have to be applied for by Baildon, and some time will elapse before the extension is made.

Birmingham.—The Tramways Committee hopes to bring forward shortly a recommendation with regard to the provision of better means of communication between the Selly Oak tramway terminus and Northfield. The Committee is of opinion that no railless trolley system at present known can become a substitute for tramways, as it could never adequately deal with large masses of people owing to the size of the vehicles, which can only carry 28 passengers.

Burley-in-Wharfedale.—A special meeting of the U.D.C. has conditionally approved of the proposals of the Leeds Corporation for the introduction of a system of railless cars from the present terminus at Guiseley to Otley, and also through Burley to Ilkley.

Bradford-Halifax. — Negotiations are in progress between the Tramway Committees of the two Corporations with reference to the proposed running of through cars between Bradford and Halifax, and Bradford and Brighouse.

Continental Notes.—Austria.—The State Railway authorities are about to establish a plant to utilise the water power of the River Saalach, near Kibling, for generating the necessary energy for the operation of the Salzburg, Reichenall and Berchtesgaden Railway, which is at present being converted to electric traction. It is estimated that about 2,000 H.P. will be available.

Italy.—An important scheme has been drawn up for the construction of an electric underground railway in Genoa, between Sampierdarena and the Quarti dei Milli. The projected line would be about 6½ miles in length, of which some 4¾ miles would be in tunnel, the maximum gradient being 19 per cent. It is proposed that the line shall be on the continuous-current third-rail system.

The Italian State Railway department has just placed fresh contracts with the Italian Westinghouse Co., of Vado Liguro, for 45 2,000-H.P. and eight 2,600-H.P. locomotives. The capacity of these locomotives aggregates 110,800 H.P., and with the 40 2,000-H.P. already supplied by the same firm, makes a total of 190,000 H.P. three-phase locomotives acquired, or to be acquired, by the Italian State Railways.—*La Lumière Electrique.*

France.—According to the *Temps*, the conversion to electrical driving of the Suburban State Railways around Paris will be completed in 1916. The lines affected will be the Paris (St Lazare)-Auteuil-Champ de Mars (called the Auteuil group); Paris (St. Lazare)-Versailles-Chentiers-Issy branch-Saint Nom la Breteche (Versailles group); Paris (St. Lazare)-St. Germain en Laye (St. Germain en Laye group): Paris (St. Lazare)-Mantes-Pontoise, through Maisons Lafitte and Argenteuil (Argenteuil group); St. Germain-Etat-St. Germain (grand ceinture). Each stretch will be laid with double lines. Motor coaches, equipped with 250-H.P. motors, running at 80 km. an hour, will be employed. The draft of the Budget for 1913 provides a sum of 28,785,000 fr. for constructive works, and 14,910,000 fr. for rolling stock.

A number of petrol-electric motor vehicles, specially designed to act as travelling repair shops in connection with the Aeroplane Corps, have lately been completed by the Brasier Co., of Paris, to the order of the French Military Authorities. The vehicles are fitted with a range of machine tools, which, like the cars themselves, are electrically driven, the motive power for all the motors being supplied by the petrol engine at the front.

The French State Railway Authorities have granted facilities to the Westinghouse Co., of Paris, to make some trials on the railways in the Cote d'Or district, with a new petrol-electric motor train.

Russia.—Two new lines of electric tramway have just been completed in Moscow; it is proposed to construct next year a new line to give communication with the more distant parts of the city.

Germany.—It is reported from Berlin that the Commission which recently visited London, at the instance of the Prussian Ministry of Railways, to inspect and report upon the working of the underground electric railways in the metropolis, has recommended that the London system of train formation and running, and the signalling arrangements, particularly the latter, should be adopted in connection with the electrification of the railways in Berlin and its suburbs.

Switzerland.—Plans are being prepared in respect of a projected electric railway between Le Locle and La Brevine.

Spain.—The electric tramway, which has been under construction for over two years by a Belgian company between San Sebastian and Tolosa, was opened on August 27th, with customary ceremonial. The line is 25 km. long, and has been built in sections, the first section to Andoain having been completed a year ago. The line affords connection between the capital of the Province of Guipuzcoa and the picturesque industrial town of Tolosa, of 12,000 inhabitants. Power is obtained from the hydroelectric station at Andoain, belonging to the Hidroelectrica Iberica.

East Ham.—The Tramways Committee has decided to agree to a suggestion of the Municipal Tramways Association that local authorities owning tramways should refuse to erect any further guard wires, as they are now asked by the G.P.O. Telephone Department to do wherever telephone lines cross trolley wires, pending the result of the Association's negotiations with the P.O. authorities on the matter.

Lancashire and the Motor-'bus. — A correspondent writes that a company is being formed to link up most of the main towns by motor-'bus. It is proposed to have 12 motor-'bus lines from Manchester; one of the main routes proposed is by way of Bolton and Darwen to Blackburn. Other routes include: by Warrington to Liverpool, and by Huddersfield to Leeds.

London.—Stoke Newington.—The Council has received a letter from the L.C.C. suggesting that the appeals to Quarter Sessions against the rates in respect of the tramway lines in Stoke Newington should remain in abeyance until the decision is given in the expected appeal to the House of Lords in the case of the Tottenham U.D.C. and the Metropolitan Electric Tramways Co., and further suggesting that to save the expense of an appeal being entered against each rate, the final decision relating to the appeal against the general rate made in April last should apply to the current and future rates, and that if the London C.C. can substantiate a claim for repayment of any portion of the rate for the past half-year, the B.C. will make a similar repayment in respect of the current half-year, and any further rates affected by the appeal. The Finance Committee has decided to agree to this suggestion subject to all rates being paid in full, and an undertaking to refund any amount overpaid as from April 1st, 1912.

L.C.C.—At the first meeting of the L.C.C. after the vacation, an adjourned report of the General Purposes Committee, regretting that the Government did not intend to proceed with the establishment of a Traffic Board, was considered. Sir John Benn proposed an amendment declaring the desirability of the Council being made the road authority. The total traffic receipts of the L.C.C. tramways from April 1st to October 2nd were £1,124,836, as compared with £1,183,931 in the corresponding period of 1911. It is recommended that eight horse cars shall be adapted as trailers for use on the Woolwich routes, at a cost of about £1,400.

Yarmouth.—At the last meeting of the T.C., the tramways manager reported that the receipts during the past month were £2,681—a decrease of £560. The aggregate receipts from April 1st were £14,438—a decrease of £1,440. Commenting, Councillor J. Salmon said there must be something wrong when they had a deficit of £1,400. He complained that the cars were run too close together. He had seen as many as seven in a line. Councillor C. A. Campling said the tramways had suffered through the bad weather, but the receipts were still a little ahead of last year. Last week there was an increase of £56, which did not appear in the month's takings reported.

Radcliffe.—The Council has decided to inform the Bury Corporation and the Whitefield D.C. that owing to the large expenditure which would be involved it cannot see its way to double the tramway track from Radcliffe to Whitefield. The argument for the double track was that it would improve the tramway connection between Radcliffe and Manchester.

Rastrick.—The Halifax Corporation notified the Council that it intended to embody in its forthcoming Bill a request for powers to continue the tramway from the Brighouse terminus through Rastrick and into the Fixby area. The Council gave its consent.

Scarborough.—The town clerk has been instructed to communicate with the secretary of the tramway company with reference to the condition of the tramway tracks in the borough. In this connection it is interesting to note that the members of the T.C. met in Committee on Monday, when it was reported that a communication had been received from a company desirous of taking over the effects of the present tramway company and running railless cars. The matter will come up for discussion at a meeting of the Streets and Buildings Committee this evening.

South Crosland.—In connection with the application which the Huddersfield Corporation is about to make to Parliament for powers to extend its tramways in several directions outside the borough, the South Crosland Council has decided to ask the Corporation to include in its application an extension of its tramway system to Netherton.

Sowerby.—The D.C. has consented to the Halifax Corporation's providing tramway extensions or running motor-'buses in the Council's district as the Corporation may think fit, such consent to be without prejudice to the right of the Council to equip and run motor-'buses in the district. It was also decided to agree with the Halifax Corporation in that the period in which the Council may purchase the existing tramways under Sec. 43 of the Tramways Act of 1870, be extended to 31 years from the date of the coming into force of the Act of Parliament, for which the Halifax Corporation proposes to make application during the next session.

Wardle.—The District Council has approached Rochdale Tramways Committee with a view to the latter providing a service of cars from Wardle Lane to Wardle Village. It was pointed out that it would cost about £10,000, the length being nearly a mile, and that Wardle would have to bear the cost of construction and equipment. The cost being so great, the District Council will now consider the establishment of a motor-'bus service.

Watford.—Application has been made to the B. of T. for confirmation of an Order granted by the Light Railway Commissioners for the construction of a light railway at Watford in place of an abandoned scheme.

Wakefield.—Representatives of the Stanley and Ardsley East and West Councils recently decided to recommend that if the Yorkshire (West Riding) Tramways Co. would substitute the railless traction system, the application for withdrawal of the unconstructed lines under the Wakefield Light Railway Orders would not be opposed. The general manager of the company (Mr. England) has since written that unless the local authorities obtained the necessary powers, and provided the capital, it would not be possible for the company to do anything further in the matter this year, and that it must proceed with the application for leave to abandon the unconstructed lines.

TELEGRAPH and TELEPHONE NOTES.

Austria.—A wireless telegraph station is to be set up at Laibach for the distribution of weather forecasts throughout the whole of the province of Carinthea. The German Wireless Co. in Berlin will supply the equipment, including transport and erection, at the price of 12,000 kronen. The antennæ will be set up on the Castle on the Schlossberg.—*Der Elektrotechniker.*

Channel Steamers.—The Northern of France Railway Co. have installed wireless telegraphy on their mail steamers running between Calais and Dover. All the passenger boats using Dover, Calais, Ostend. Folkestone and Boulogne are now fitted with wireless and can communicate with both sides of the Channel. —*The Times.*

Constantinople.—The *Journal* of the British Chamber of Commerce of Turkey says that the Société Anonyme Ottomane des Téléphones de Constantinople expects to inaugurate its service by the end of August, 1913, which is within the period specified in its convention with the Government. The company has now a technical staff of some 30 persons engaged in supervising the laying of its lines. It has to date some 5,000 km. of cable, 3,000 km. of underground wire, and 30,000 km. of piping in position. The installation will be underground in the city proper, to Bebek on the European. and to Scutari on the Asiatic shores of the Bosphorus, and in Prinkipo, the largest of the Princes' Islands. The company has to date received subscriptions for 2,101 stations, representing an annual income of £T15,000, which is in excess of its own estimates of subscribers as the work progressed. Of the subscribers 22 per cent. are purely Turkish. The company has imported from Great Britain 30,000 km. of cable, 10,000 km. of wire and 23,000 pipes, which has been cited as bearing out the economic principle of commerce following capital.

Germany.—Active progress is being made with the erection of the large wireless station at Neumünster. It will be equipped with three masts, each 65 m. high, made out of a special kind of durable and tough wood by the patent process of the firm of Meitzer, of Darmstadt. When finished the station will be worked only by the military authorities. It is intended to serve principally the purposes of the Navy, but it will also be available for the general public. It will form an important link betwixt the stations on the Baltic and on the North Sea.—*Hamburg Correspondent.*

Imperial Wireless System.—On Friday last in the House of Commons, the debate took place on the Postmaster-General's motion to appoint a Select Committee, to investigate the circumstances connected with the negotiation and completion of the agreement between Marconi's Wireless Telegraph Co., Ltd., and the Postmaster-General for the establishment of a chain of Imperial wireless stations. Sir Henry Norman, while dissociating himself emphatically from any suggestion that the transaction was tainted with corruption, which he believed to be without a shadow of foundation, attacked the agreement on the ground that it was a bad bargain. He said they were all agreed that the wireless chain was very desirable, but he held that the stations under the agreement would not be owned by the State, and that the arrangement was unbusiness-like. The Government might have to pay a royalty for 28 years on a patent having a life of only 14 years. If the Postmaster-General determined the agreement, he would still have to pay the company £60,000 for each station, though he could no longer use a single piece of Marconi apparatus. He had the right under the Patents and Designs Act to use any invention for the service of the Crown on terms to be prescribed by the Treasury, but he had contracted himself out of that right. The agreement would have the effect of creating a gigantic monopoly, which would restrict the development of wireless telegraphy. He had no hostility towards the Marconi Co. or Mr. Marconi himself, who had done more than anyone else to make wireless telegraphy commercially practicable. He alleged that a number of different companies were practically carrying out long-distance wireless communication, and ought to have a hearing.

Mr. G. Terrell spoke on similar lines, and pointed out that since July last year the company's £1 shares had advanced from £2 6s. to £8 2s.

Major Archer-Shee, Sir G. C. Marks, Sir F. Banbury and others also criticised the agreement adversely.

The Attorney-General denied that he had been in any way concerned in the negotiations, or had had any dealing in the shares of the company.

Lord R. Cecil, while expressing complete confidence in the integrity of the Government, pointed out the necessity of the fullest possible inquiry into the matter.

Mr. H. Samuel then categorically denied, on behalf of himself and his colleagues, the truth of the rumours that had been referred to, and described the course of the negotiations with the company, which had been supervised by a special committee. He explained that the royalty contract could be terminated by the Postmaster-General at a moment's notice; if the Government ceased to use a patent at any time, payment would cease. Royalties would only be payable for valid unexpired patents. The Post Office could replace or supplement the Marconi apparatus with other apparatus at any time, and the company would have no right to object. He admitted that, according to the agreement, for five years any additional stations would have to be erected by the Marconi Co.; but the company had voluntarily suggested that this provision should be dropped, and the Government had a free hand to introduce any other system at any time for any new station, and to cease using Marconi apparatus at any station, and to cease paying royalty. The engineers of the Post Office and the Admiralty had estimated the cost of the stations, if erected by themselves on the same specification, at £60,800, and the Norwegian Government had entered into a contract with the Marconi Co. to erect long-range stations, excluding buildings and foundations, at £70,000, besides paying a royalty of 10 per cent. on the gross receipts, not for 18, but for 25 years. Under the contract the Post Office obtained the use of the company's patented and unpatented inventions, present and future, its valuable secret inventions, and the experience of long-range wireless telegraphy which the Marconi Co. alone possessed, as well as its technical assistance and advice so long as the royalty lasted. At the end of the 28 years the Government would have the right to use the company's patents, however new, without extra charge; and they were securing the release of the Admiralty and the Post Office from certain restrictions under their agreements. The rise in the value of Marconi shares was not merely due to the conclusion of the agreement; the company paid no dividend at all on the ordinary shares until 1911, for which year 20 per cent. was distributed. Moreover, in October, 1911, the company bought the Lodge-Muirhead master patent, and it had won two test actions against the United Wireless Co. and the Clyde Steamship Co. All these circumstances tended to increase the value of the shares. Nothing was to be paid to the company on account until the stations were completed, and the company proved that communication could be effected over the distance required. They could not be certain that the Poulsen Syndicate could cover the distance both by day and by night, and the Committee decided that the Poulsen offer could not be accepted without a test, which would have occupied 12 months. The Committee of Imperial Defence decided in May, 1911, that the six stations ought to be built, as they were of far greater strategic than commercial importance, and that the matter was one of urgency. Unnecessary delay, therefore, was out of the question. The company's terms were greatly reduced in the course of the negotiations. He asked what other course could have been taken. The motion was agreed to without a division.

Switzerland.—A wireless receiving station for specially long distances has been installed at the Zurich Meteorological Observatory, in order to effect connection across the Alps with Paris, Norddeich and the German Trinity House. The possibility of so doing was unexpectedly demonstrated on the 20th ult. by a message being picked up which had been sent from the Austrian station at Sebenico to an Austrian warship in the Adriatic.—*Der Elektrotechniker.*

Telegraph Clerks' Grievances.—The Select Committee which is inquiring into wages and other conditions of employment in the Post Office resumed its sittings on Tuesday, and Mr. Ash, the chairman of the Postal Telegraph Clerks' Association, submitted a claim for a higher scale of wages, a seven hours' working day, changes in the arrangement of duties, and improvements in regard to holidays.—*The Times.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 5th. Balancer for the U.D.C. See "Official Notices" to-day.

Australia. — SOUTH AUSTRALIA. — November 27th. 18 miles paper-insulated cable, 155,000 jointing sleeves, also switchboard cable (Scheduled 248). See "Official Notices" to-day.

December 11th.—Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" to-day.

December 17th. Three sections of common battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—October 22nd.—(*a*) 37,000 carbon filament lamps, and (*b*) insulated lead-covered copper cables, for the Melbourne City Council. See "Official Notices" October 4th.

November 12th.—Deputy P.M.G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 19th.—One mercury vapour converter, for the P.M.G.'s Department. See "Official Notices" Oct. 11th. Also two batteries and a 4-K.V.A. single-phase transformer. High Commissioner in London.

WESTERN AUSTRALIA.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" October 11th.

Austria.—October 29th. - The Austrian State Railway authorities in Prague are inviting tenders for an electric lighting installation at the railway station at Weseli-Mezimosti.

VIENNA.—November 1st. Tenders are invited for the supply of 657 red larch telegraph poles of various sizes for the Austrian post and telegraph service. Particulars, with printed tender forms, from the K.k. Post und Telegraph Direction, Hetzgasse II., Wien III.

Barrow-in-Furness.—November 5th. Electrical and steam plant, &c., in connection with the electricity works extensions, for the Corporation. See "Official Notices" to-day.

Belgium.—ANTWERP.—November 25th. Tenders are invited for the supply of two moving bridges (ponts basculants), with mechanical and electric equipment, for the Meuse-Escaut Canal. Guarantee 40,000 francs. Particulars (0·40 franc), Chef de Service, Direction des Ponts et Chaussees, Rue van Schoonbeke, 74, Antwerp.

Bradford.—October 19th. The tramways department are inviting tenders for miscellaneous stores during the year ending December 31st, 1913. Specifications, &c., from Tramway Offices, 7, Hall Ings, Bradford, on payment of £1 1s., returnable.

Canada.—October 31st. One 500-B.H.P. Diesel engine, alternator, exciter, switchboard, tungsten street lighting apparatus. Specification will shortly be available at Board of Trade Commercial Intelligence Department in London.

Dublin.—November 4th. General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" to-day.

Electric lighting of Messrs. Brown & Nolan's new printing works. Mr. T. Tomlinson, B.E., Dublin.

November 5th.—3,000-KW. steam turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" to-day.

France.—DOLE.—October 26th. Supply and installation of a transformer and an electric motor. Particulars from the Sous-Intendance Militaire, Quartier Bernard, Dole (Jura).

Glasgow.—The Caledonian Railway Co. invite tenders for stores, including electric lighting material and fittings and telegraph appliances, telephones, &c. Mr. A. J. Easton, stores superintendent, 321, Charles Street, St. Rollox, Glasgow.

Gillingham.—October 22nd. One 300-B.H.P. Diesel engine and alternator, for the Corporation. See "Official Notices" October 4th.

Huddersfield.—October 31st. Slack coal for a year, for the Corporation electricity works. Borough Electrical Engineer, St. Andrew's Road.

London.—A recommendation was before the L.C.C. on Tuesday to purchase a gas engine and alternator (cost, £145) for the Poplar L.C.C. School of Engineering and Navigation.

BATTERSEA.—October 25th. Twelve internal telephone instruments and lines, for the B.C. See "Official Notices" to-day.

L.C.C.—November 4th. Carbons, fittings, insulating materials and lamps, for a year. See "Official Notices" to-day.

Mossley.—The Borough Education Committee is inviting tenders for wiring and fittings for electric lighting of the New Milton Council School. Forms of tender and specification from the architect, Mr. F. Quentery Farmer, 20, Sir Thomas Street, Liverpool.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

Nottingham.—October 24th. The Tramways Committee is inviting tenders for (1) steel tramway poles; (2) malleable-iron pole fittings; (3) cast-iron pole fittings. Specifications and forms of tender (21s., returnable) from Mr. Arthur Brown, City Engineer, Guildhall, Nottingham.

Rio de Janeiro.—November 11th. Tenders to the Directoira Geral de Correios, Telegraphos e Illuminacão, Ministerio da Viação e Obras Publicas, Rio de Janeiro, for the construction and working of an overhead or underground telephone system designed to join up the cities of Rio de Janeiro and São Paulo. The *Diario*, containing further particulars, may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal*.

Rochdale.—October 23rd. Steam turbo-alternator, condensing plant and pipework, for the Corporation. See "Official Notices" October 11th.

South Africa.—November 18th. The Municipal Corporation of Cradock, Cape Province, is calling for tenders for two 50-KW. Diesel oil engines and dynamos complete, also supply mains and public lighting. Specifications from Mr. B. A. Paterson, town clerk, on deposit of £2 2s.

Spain.—MADRID.—November 11th. Applications are invited for a concession to construct and work an electric tramway in Madrid. Provisional guarantee, 2,845·25 pesetas. Particulars of the Ministerio de Fomento, Madrid.

Stockport.—October 21st. 1,000 Osram metal-filament electric lamps for Stepping Hill Hospital, Hazel Grove. Mr. Chas. F. Johnson, clerk to the Guardians, Union Offices, Shaw Heath, Stockport.

Tonbridge.—October 28th. One 100-KW. Diesel engine and generator, and alterations and additions to switchboard, for the U.D.C. See "Official Notices" October 11th.

CLOSED.

Arnside.—The P.C. has accepted the tender of Messrs. Thos. Wilkinson, Ltd., of Arnside, for erecting fittings for public lighting and supplying current.

Australia.—SYDNEY.—The *Australian Mining Standard* reports the placing of the following contracts by the City Council:—

1,[illegible]-KW. motor-generator, £3,145.—[illegible], Ltd.
Wright's maximum demand indicators, £512.—W. G. Watson & Co.

The *Mining and Engineering Review* (*Tenders*) records the placing of contracts as follows:—

Tasmania, P.M.G.'s Department.

Paper-insulated lead-covered cable.—W. T. Henley's Telegraph Works Co., Ltd.
Copper and bronze wire (£1[illegible]), copper cable and electric light cable.—B. I. and Helsby Cables, Ltd.
2,000 dry cells.—J. C. Fuller & Son, Ltd.
6,000 miles.—I.-R. G.-P. and T. Works Co., Ltd.
100 telephones and a switchboard.—Western Electric Co. (Aus.), Ltd.
10,000 porcelain insulators (2½d.).—Noyes Bros.
3,000 insulators (transposition, 1s. 6½d. each).—Bullers, Ltd.
8,000 shackles and 2,000 tubes.—Lawrence & Hanson Electrical Co., Ltd.
Brake material and gear (£1,628 and £1,058).—Westinghouse Brake Co. of Australia.
Electric light cables (£149).—Noyes Bros.

The following appear in the *Australian Mining Standard*:—

Melbourne, P.M.G.'s Department.—

Distributing boxes.—W. T. Henley's Telegraph Works Co., Ltd.
Cable (£11,095) also switchboard cable (£907).—Australian Metal Co., Ltd.
150 open circuit condenser telephones (£3 2s. 6d. each).—Z. W. Garrington and Son.
Carbon and metal-filament lamps.—Unbehaun & Johnstone, Ltd.

Brisbane, P.M.G.'s Department.—

1,500 Cordeau insulators (5½d.).—T. Zwicker & Co.
60,000 porcelain insulators ("A") £1,300.—British and Foreign Indent Co.
60,000 porcelain insulators ("B") 17s. 10d. per 100.—Webster & Co.
Instruments, copper blocks for lightning arresters, &c.—I.-R. G.-P. and Telegraph Works Co., Ltd.
Magneto bells, condensers, receivers, telephones, &c.—J. Paton & Co.
1,000 protectors (8s. 2d. each), telephone sets, receivers, &c.—Western Electric Co. (Aus.), Ltd.
Tinned copper conductors.—Brabant & Co.

Adelaide. P.M.G.'s Department.—

Bells, telephones, &c.—J. Bartram & Son Propty., Ltd.
Condensers, cords, &c.—B I. and Helsby Cables, Ltd.
Condensers, switches, and 600 telephones.—Western Electric Co (Aus.), Ltd.
28 miles of wire. T. Zwicker & Co.; 25 miles of wire.—Callender's Co. (Noyes ; 5 miles of conductors. Lawrence & Hanson Co.
Bells, fuses, &c.—I.-R. G.-P. and T. Works Co., Ltd.

Austria.—The Austrian Siemens Electricitäts-betriebe Gesellschaft, of Vienna, has secured the contract for the electric lighting of the town of Turn.

Barnes.—The U.D.C. has accepted the tender of Messrs. Wm. Cory & Son and Messrs. John Hudson & Co., Ltd, for the supply of 1,000 tons of Harton rough or Hillhouse coal, and 1,000 tons of Wemyss or Bridgness coal, for the electricity undertaking.

Birkenhead.—As Messrs. Worsley & Page, Ltd., whose tender had been accepted for the supply of armature coils to the Tramways Department, had notified the Corporation that they were unable to carry out their contract, the tender of the Manchester Armature Repair Co. has been accepted in place thereof.

Colchester.—The T.C. has accepted the tender of Messrs. Cory & Son, Ltd., for 300 tons of Shirebrook nutty slack coal for the electricity works, at 14s. 10d. per ton.

France.—The French Post and Telegraphs, Paris, have just placed the following contracts with Le Matériel Téléphonique (Ancienne Maison G. Aboilard & Cie), Paris :—15 km. 14-pair cable, conductor 2·5 mm. ; 10 km. 7-pair cable, conductor 2 mm. ; installation of 3,600-line telephone exchange for Roubaix (Nord) ; transfer of the provisional exchange—installed at Gutenberg after the fire of 1908—to the new building.

Ipswich.—Messrs. Venner & Co. have received the contract for Chamberlain & Hookham meters for the ensuing year from the Corporation.

Italy.—La Société Italiana Westinghouse, of Vado-Ligure, have secured a contract from the Italian State Railway authorities in Rome, for the construction of 45 2,000-H.P. electric locomotives and eight machines of 2,600 H.P.

London.—L.C.C.—The Highways Committee received the following tenders for electrical dischargers for use in tramway sub-stations :—

Johnson & Phillips, Ltd.	(recommended)	£2,639
British Westinghouse Co., Ltd.		2,732
Spagnoletti, Ltd.		2,785
General Electric Co., Ltd.		2,861
Ferranti, Ltd.		2,907

Estimate of Chief Officer, £2,200.*

The difference between the estimate* and the tenders is "accounted for by the recent general increase in the price of raw material."

Four patent car-washing platforms for Streatham car-shed extension are to be provided by Messrs. Hayward & Co., Ltd., for £247.

The following tenders were received during the recess for shop trucks and lathes for the third section of the central car repair depôt :—

THREE ELECTRICALLY-PROPELLED SHOP TRUCKS, &c.

Brush Electrical Engineering Co., Ltd.	(accepted)	£690
Scholey & Co., Ltd.		753
S. H. Heywood & Co., Ltd.		908
British Westinghouse Co., Ltd.		916
Hurst, Nelson & Co , Ltd.		975

THREE WHEEL-TURNING LATHES.

	Fitted with screw gear for the headstock rams.	Fitted with power gear for operating the headstock rams.
Buck & Hickman, Ltd.	£2,445	£2,532 (accepted)
Tangyes, Ltd.	2,573	2,659
Pollock & MacNab, Ltd.	2,630	2,720

SHOREDITCH.—The B.C. Lighting Committee is accepting the quotation of the Western Electric Co., Ltd., at £300, for additional lead-covered cable required before the end of the year for mains extensions.

The following contracts for coal required by the Lighting Committee, up to march next, have been placed :—

	Approx. B.T.U's.	Price per ton. s.	d.	Quantity. Tons.
J. Hudson & Co. (Bank, Bridgeness or Wemyss)	12,500	16	9	3,000
G. J. Cockerell & Co. (Cowdenbeath)	12,200	16	7	2,000
ditto (Nailstone D.S. nuts)	13,500	15	6	1,000
Harrison, Tidswell & Co. (Whitwick deep slack)	13,500	13	6	1,000

SOUTHWARK.—The B.C. has accepted the tender of Messrs. Alfred Blackmore & Co. for the supply of 5,000 tons of pea coal, at 14s. 6d. per ton, and 5,000 tons of slack coal, at 14s. per ton, for use at the electricity works.

The following tenders have been received for the supply of (*a*) 440 yds. of ·1 × ·05 × ·1 and (*b*) 440 yds. of ·05 × ·03 × ·05 triple-concentric, paper-insulated lead-covered and jute-served cable :—

		(*a*)	(*b*)
Aubert Grenier & Co.		£122	£77
British Insulated and Helsby Cables, Ltd.		128	79
Callender's Cable and Construction Co., Ltd.		135	84
Connolly Bros., Ltd.		143	91
Drake & Gorham, Ltd.		173	89
Electrical Engineering and Equipment Co., Ltd.	(accepted)	118	73
General Electric Co., Ltd.		137	85
W. T. Glover & Co., Ltd.		127	80
W. T. Henley's Telegraph Works, Ltd.		127	91
Johnson & Phillips		135	83
Siemens Bros. & Co., Ltd.		127	78
R. R. Todd		120	75
Western Electric Co., Ltd.		127	79

Lowestoft.—The tender of Messrs. Wm. Cory & Son, Ltd., for 1,500 tons of Newsted nutty slack coal, at 13s. 6d. per ton, has been accepted by the T.C.

Newcastle.—The Guardians have accepted the tender of Mr. A. Davidson, at £288, for electrically lighting the cottage homes.

Rotherham.—The following tenders have been accepted by the T.C. :—

Reason Manufacturing Co., Ltd.—Electrolytic meters.
Chamberlain & Hookham.—Motor meters.
Siemens Bros. Dynamo Works, Ltd.—Watt-hour meters.
Callender's Cable and Construction Co., Ltd.—Cable.
British Westinghouse Co., Ltd.—Gear wheels and Okonite tape.
Imeson & Finch.—Trolley heads, cheeks, harps, wheels, and controller fingers.
Brecknell, Munro & Rogers.—Trolley bushes, spindles and washers.
Watlington & Co.—Pinion wheels.
Wilson, Ltd.—Slipper blocks.
Le Carbone.—Carbon brushes.
Weldless Chains, Ltd —Brake chains.
Dick, Kerr & Co., Ltd.—Armature coils and axle collars.
Smith Bros., Ltd.—Cable, lamps, &c.
Anti-Attrition Metal Co.—Armature bearings and axle brass keeps.
National Rail and Tramway Appliances.—Brake shoes.
Tenter Foundry Co.—Brake castings, &c.
Sheepbridge Coal and Iron Co., Ltd.—Coal for electricity and tramway departments, at 7s. 8d. per ton.
W. A. Durnford (Earl Fitzwilliam's Collieries).—8s. 6d. per ton.

Rawtenstall.—For the supply of a high-tension switchboard panel, the T.C. has accepted the tender of Messrs. Siemens Bros., Ltd.

Rugby.—The tender of the British Westinghouse Co., Ltd., has been accepted by the U.D.C., for the supply of three transformers.

Southampton.—The Tramways Committee of the T.C. has accepted the tender of Messrs. Wm. Griffiths & Co., Ltd., at £2,210 for reconstructing the tramways in a portion of Above Bar Street.

Stretford.—The U.D.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., at £64, for the supply of ½-mile of single braided and compounded ·125 cable.

Sunderland.—The T.C. on the 9th inst., on the recommendation of the Electricity Committee, accepted the following tenders :—

Averys, Ltd.—Weighbridge.
Cox-Walkers, Ltd.—Regulator for turbine.
Falkirk Iron Co.—Brackets for arc lamps.
Drake & Gorham.—Cast-iron bases.
Ferranti, Ltd.—Meters.

On the recommendation of the Tramways Committee, it was decided to obtain an oxy-acetylene welding plant, at a cost of £22.

Swansea.—The tender of Mr. J. S. Brown has been accepted by the Guardians for wiring the administrative block at the Workhouse.

Tavistock.—The U.D.C. has accepted the tender of Messrs. Stewart & Moore, at £43, for the installation of an electric call system.

Wallasey.—The Tramways Committee has ordered six new tramcars from the Brush Electrical Engineering Co., Ltd.

Walsall.—The tender of Callender's Cable Co., Ltd., has been accepted by the T.C., at £667, for supplying and fixing feeders, pilot wires and conduits.

Watford.—The U.D.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for switchgear for additional sub-stations.

West Hartlepool.—The tender of Messrs. J. W. White and Co. has been accepted by the T.C. for the erection of a new power station and foundations for cooling tower ponds. The tender of the Callender's Cable Co. has been accepted for three-core paper-insulated 6,000-volt three-phase high-tension cables, and for low-tension rubber cables and wiring.

Witney.—The U.D.C., upon the recommendations contained in the report of Messrs. May & Hawes, the consulting engineers, has accepted the following tenders for the extensions of the electric supply undertaking :—

Suction gas plant and accessories.—Daniel Young, Witney, £1,384.
Battery booster.—Crompton & Co., Ltd., £74.
Switchboard.—Crompton & Co., Ltd,, £178.
Boxes and pillars.—W. Lucy & Co., Ltd., £82.
Cables.—Callender's Cable & Construction Co., Ltd., £566.

Worcester.—The T.C. has accepted the tender of the South Wales and Cannock Chase Coal Co., for coal for the electricity works, viz, screened nuts, 15s. 6d. per ton ; bright slack, 9s. 3d. per ton ; No. 2 slack, 8s. 3d. per ton ; and that of Messrs. Underwood and Co. for Tamworth nuts, at 13s. 9d. per ton.

Yarmouth.—The T.C. has accepted the tender of Messrs. Meyers, Rose & Co. for the supply of 3,000 tons of Derbyshire slack coal, at 10s. 10½d. per ton f.o.r.

Yorkshire.—Messrs. Venner & Co. are equipping the Yorkshire (West Riding) Electric Tramways with Chamberlain and Hookham car meters.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers West of Scotland Branch.—Friday, October 18th. At 7.30 p.m. At the Royal Technical College, Glasgow. Presidential address by Mr. M. Brown, presentation of certificates, and paper on "Notes on Electricity Rule No. 7," by Mr. A. B. [illegible].

Electro-Harmonic Society. Friday, October 18th. At the King's Hall, Holborn Restaurant. Smoking concert.

Engineering and Machinery Exhibition. At Olympia. Daily to October [illegible].

Junior Institution of Engineers. Wednesday, October 23rd. At 8 p.m. At the I.E.E., Embankment, W.C. Paper on "Scientific Shop Management on the Taylor System," by Mr. G. C. Allingham.

Physical Society. Friday, October 25th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The [illegible] Lines Examined by an Echelon Grating and a [illegible] Plate," by Prof. H. Nagaoka and T. Takamine, "Note on the Mutual [illegible] of Two Coaxial Circular Currents," by Prof. H. Nagaoka, and "The Absorption of the [illegible] Vacuum Tube," by Mr. S. R. [illegible].

Institution of Mechanical Engineers.—Friday, October 25th. At 8 p.m. Paper on "Characteristic Dynamical Diagrams for the Motion of a Train during the Accelerating and Retarding Periods," by Prof. W. E. Dalby, and paper for discussion, in writing only, on "Theory and Experiment in the Flow of Steam through Nozzles," by Prof. J. B. Henderson.

Association of Engineers-in-Charge.—Saturday, October 26th. At the Holborn Hall. Whist drive and dance.

NOTES.

Erratum.—In the third line from the end of our first leaderette on page 605, the word "purchaser" should read "seller."

Electricity in Agriculture.—An International Congress of Electroculture will be held at Rheims on October 24—26th.

For Sale.—The York Corporation Electricity Department has for disposal two Lancashire boilers. See our advertisement pages in this issue.

The Electro-Harmonic Society.—The first smoking concert of the season will be held to-night, Friday, October 18th. at 8 o'clock, at the Holborn Restaurant (King's Hall). The artists are as follows: Vocalists, Senor José de Moraes (tenor), Mr. Herbert Heyner (baritone); violoncello, Mr. W. H. Squire; conjuror and ventriloquist, Mr. Arthur Besoni; entertainer at the piano, Mr. Warwick Pryce; demonstration of memorisation, Memora; humorists, Mr. Fred Curtis, Mr. J. M. Campbell; solo pianist and accompanist, Mr. Bernard Flanders, A.R.A.M.

Libel Action.—In the London Sheriff's Court on 10th inst., a jury awarded Messrs. Debenham Storr & Sons £400 damages, and Mr. Benton, an auctioneer in the service of that firm, £100 damages, in an action brought against Mr. C. S. Northcote for libel in connection with a sale of some of his household goods. Execution was stayed for a week.

The Liverpool Appointment.—The applications received for the appointment of city electrical engineer have been referred to a special sub-committee, to select not less than three and not more than six candidates to appear before the Electricity Committee.

Institution and Lecture Notes.—ASSOCIATION OF MINING ELECTRICAL ENGINEERS (W. OF SCOTLAND BRANCH).—A meeting was held in Kilmarnock on October 5th, at which Mr. Alexander Anderson, of Wishaw, vice-president of the Association, delivered a lecture on "Electricity: From the Generator to the Coal Face."

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER LOCAL SECTION).—The first meeting for the 1912-13 session will be held in the Banqueting Hall of the Midland Hotel, Manchester, on Friday, November 1st, at 7.30 p.m. As Mr. A. A. Day, the chairman, will, for reasons of health, be unable to be present and read his address, this will be read by Prof. E. W. Marchant, the vice-chairman. A smoking concert will follow. The other meetings of the session will be held at the Physical Laboratory of the University of Manchester. The list of papers, authors, &c., is as follows:—

Tuesday, November 5th.—Mr. F. Creedy, on "The Turbo-Converter. A High-speed Direct-current Generating Unit."
November 19th.—Mr. J. S. Peck, on "Earthed v. Unearthed Neutrals on Alternating-current Systems."
December 3rd.—Messrs. J. G. Cunliffe and R. G. Cunliffe, on "Some Problems in Traction Development—Street Railway Feeding Networks."
December 17th.—Mr. P. Bucher, on "Electric Welding."
January 14th, 1913.—Mr. F. C. Aldous, on "Starting and Speed Control on Induction Motors."
January 28th.—Mr. F. H. Whysall, on "The Use of a Large Lighting Battery in Connection with Central Station Supply."
February 11th.—Mr. H. Clifford Palmer, on "Advertising Electricity."
February 25th.—Messrs. S. L. Pearce and H. A. Ratcliff, on "Some Recent Developments in the Manchester Street Lighting."
Friday, February 28th.—Annual dinner.
March 11th.—Dr. E. Rosenberg, on "Self-starting Synchronous Machines."
April 1st.—Mr. W. Browning, on "Electric Driving of Textile Factories."
April 8th.—Annual General Meeting and lecture by Prof. E. Rutherford, M.A., D.Sc., F.R.S., &c.

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.—The opening of the winter session of the North-Western Centre took place at Preston on October 9th, when Mr. H. R. Kempe, M.I.C.E. (Council chairman), read a paper on "Reminiscences of Telegraphy of the Past." Mr. T. E. P. Stretche (superintending engineer) presided. The lecturer dealt with the progress made in the various branches of telegraphy from 1837 until the present day, and the paper was copiously illustrated by specially prepared lantern slides.

On Monday, at the I.E.E., Mr. H. Samuel presented the prizes for papers which had been read, and stated that a decision had been reached regarding the classification of the Engineering Department which, he thought, would prove satisfactory to very many of the staff. Mr. R. M[illegible].

INSTITUTION OF [illegible].—The [illegible] meeting for the new session will be held on Thursday, Nov. 14th.

Gas Exhibition Next Year.—The *Gas World* reports that at a meeting of the Council of the Institution of Gas Engineers, held at Manchester last week, the Provisional Joint Committee of the Gas Exhibition reported that it had been decided to hold the Exhibition in October, 1913, at Shepherd's Bush. The necessary steps have been taken to carry out the work of organisation, and a number of halls have been secured at the White City for the purpose. Houses and flats, shops, workshops, a hospital, a schoolroom, a laundry, offices, &c., are to be equipped with gas lighting and heating, and the most up-to-date apparatus associated with the production of gas will be exhibited.

Appointment Vacant.—Assistant tramways electrical engineer for the Hull Corporation (£200). See our advertisement pages in this issue.

OUR PERSONAL COLUMN.

The Editors [illegible] ELECTRICAL REVIEW [illegible].

Central Station Officials.—A presentation of a handsome case of cutlery was made by the staff of the Middlesbrough Corporation Electricity Department to their chief clerk, MR. HENRY S. DAWSON, on the occasion of his wedding. Mr. Dawson has skippered his department for over 10 years.

MR. J. E. ALLEN has resigned his position as outside superintendent of the Ilford U.D.C. Electricity Department.

The Ealing Borough Council has advanced the salary of the assistant electrical engineer to £290. Alderman H. W. Peal, J.P., chairman of the Committee, reported that the maximum was fixed five years ago, since when the responsibilities and duties of this official had very largely increased.

Tramway Officials.—MR. DOUGLAS GRAY, tramway manager at Keighley, has resigned. The Tramways Committee has recommended that MR. H. WEBBER, borough electrical engineer, be appointed manager *pro tem.*

General.—We regret to learn from the daily Press that as the result of the recent accident to MR. MARCONI, the power of vision has diminished in the injured eye, and fears of the loss of the eye have increased.

MR. JOHN HALL, secretary to the Scarborough Electric Supply Co., whose term of office as a member of the Town Council expires at the end of this month, has intimated to his ward committee that he is unable to accept their invitation to be nominated for a seat on the Council. Mr. Hall has seen a fair amount of service on the Town Council, and was some years ago an Alderman of the Borough.

MR. C. B. GRESHAM, of the Electrical Co., Ltd., has joined the staff of Messrs. Siemens Bros. Dynamo Works, Ltd., in their meter department at Upper Thames Street, E.C. MR. W. F. BIRCH, of the meter testing room of the Electrical Co., Ltd., has been appointed assistant manager of the meter department in succession to Mr. Gresham, who, as stated above, has resigned.

MR. W. H. BOOTH, artesian and water supply engineer and oil expert, has removed to new offices at 8, Queen Street, Cheapside, E.C. Telephone No. "8305 Bank."

MR. C. JONES, electrical engineer, West Cannock Colliery Co., Ltd., Hednesford, has been appointed as lecturer in Physics and Electrical Engineering on the staff of the New Technical Institute at Hednesford, Staffs., recently opened by Sir Oliver Lodge. Mr. Jones has also been awarded the Premier Prize for the best paper read at the Association of Mining Electrical Engineers' meetings, Session 1911-12.

MR. C. A. GATE, who was local manager of the telephones at Keighley, and has been transferred to Derby, has been presented by the staff with an inscribed silver tankard.

The *Mining and Engineering Review* (Aus.) states that MR. J. W. FRASER, an engineer from the British Westinghouse Co., has gone to Tasmania to supervise the erection of the Hydro-Electric P. and M. Co.'s plant.

MR. CHARLES GRUNDY has been the principal electrician to Blackpool Tower Co. for 20 years, and he is now leaving for Australia for health and family reasons. On October 11th 100 of the company's workers met to show their appreciation of Mr. Grundy. The manager, Mr. G. H. Harrop, presided, and handed to Mr. Grundy a cheque from the company and a substantial amount of cash in a purse, to which was attached a silver plate suitably inscribed—the gift of the officials and colleagues. Mr. Grundy also received a silver cigar case from Miss Pauline Rivers, directress of the Tower ballets, as an expression of her appreciation of his artistic illumination of her ballet productions.

Obituary.—MR. BENNETT PELL.—We regret to learn of the death of Mr. Bennett Pell, which occurred on September 20th at the age of 70 years. Mr. Pell passed away suddenly at Exmouth, the cause of death being angina pectoris. The deceased gentleman was born near Canterbury in 1842, and he received his professional training in the Submarine Telegraph Co.'s London station in 1857. He was transferred to their Emden station when the first direct cable was laid from this country to Germany. He then joined the United Kingdom Telegraph Co., and was placed in charge of their Birmingham station at the unusually early age of 18. In 1863 he was appointed to the Indo-European Telegraph Department, and was in responsible positions in Persia until 1866, when he became personal clerk to Col. Robinson, at the Indian Office, whilst that gentleman was reorganising the Indian Telegraph Department. During the succeeding years Mr. Pell held important posts in connection with the Australasian and China telegraphs in Java and Singapore. To the latter place he was transferred in the year 1874 to take up the post of general manager of the Eastern Extension, Australasia and China Telegraph Co., Ltd. Whilst residing at Singapore, he established the first Telephone Exchange in the East, which was afterwards purchased by the Oriental Telephone Co. In 1882 Mr. Pell finally left the East; he joined Messrs. Johnson and Phillips in 1883, and brought out the famous Brockie-Pell arc lamp, which afterwards became the property of a limited company, with himself as managing director. Mr. Pell retired from active life in the electrical world in the year 1898. He was one of the oldest members of the Institution of Electrical Engineers, a Fellow of the Imperial Institute and a member of the London Chamber of Commerce.

We deeply regret to read of the death, which occurred on October 12th at Streatham, after a long illness, of Mr. Vaughan Pendred, M.I Mech.E., &c., at the age of 76 years. The deceased gentleman was for 42 years editor of our contemporary, the *Engineer*.

We regret to record that the death occurred recently of Dr. F. H. Low, hon. sec. of the Rontgen Society, who, according to the *Times*, had occupied the post of medical officer to the X-ray department at the London Medical Graduates' College and Polytechnic, and at King's College Hospital.

CITY NOTES.

Dick, Kerr & Co., Ltd.

The annual meeting was held on Tuesday at the Cannon Street Hotel, E.C., Mr. Claud T. Cayley presiding.

The Chairman, before moving the adoption of the report (see Elec. Rev., page 588), explained that the reason the meeting was being held later than usual, was that during the last two or three years the business of the company had so changed that it was impossible for them to get the accounts from Australia, Japan, &c., in time for the accountants to get the books made up earlier. He expected that in the future the meetings would always be held about the end of October, instead of in September as previously. Proceeding to propose the adoption of the report, the chairman said it would be seen that the company had had a poor year, indeed the poorest year since the foundation of the business. Last year the directors indulged in an extremely moderate forecast, saying that should their hopes be fulfilled the prospects of a satisfactory result were encouraging. The prospects were encouraging at that time, and the non-fulfilment of their hopes was due partly to the fact that some of the contracts which had been completed during the past year had yielded a less profit than was anticipated, and partly to delays which took place in the commencement of new contracts which at that time seemed imminent. The contracts entered into during the last five years had been taken in the face of great competition, and, as much of the company's work was necessarily accepted a long time before it could be executed, a considerable number of contracts finished last year were in fact taken when such competition was at its keenest. In the immediate past the railway and coal strikes affected more particularly their manufacturing business at Preston, because, whilst they were themselves well provided with stocks of coal, they were greatly hindered in the execution of their orders, in fact, had to stop work at one time, because of the impossibility of getting in their raw materials, and also of making delivery of their manufactured goods. The net result in this department was that with the works' order book at the maximum, their net production during the 12 months under review was, with the exception of one year, the minimum since they entered that field ten years ago. The same remarks with respect to strikes applied to the contracting department, with the addition that it was also seriously affected by the dock strike, because of the impossibility of getting that raw material which was of all importance, namely, cement. The contracts they had in hand for this year they hoped would be remunerative. The order book was healthy, the Preston works being fuller than it had ever been of that class of manufacture best suited to it, and the very greatest care was being taken by the directors and management to take no orders that would not show at least a moderate profit. Turning to the balance-sheet, it would be seen the company's works were full, the stock of materials and work in progress there having, during the year, risen from £99,621 to £142,383—over 40 per cent. With regard to the other figures in the balance-sheet, the capital expenditure had been increased by £20,156. This was after writing off for depreciation on the same scale as usual, and represented extensions at Preston works principally in connection with the completion of the lamp works, which was now producing for the market. The debtors and contracts were somewhat less than last year, but these figures were fluctuating ones, which constantly varied within considerable limits. The sundry investments remained at practically the same figure, and the cash in hand was somewhat reduced, owing to the greater amount of work in progress. In conclusion, he might say that whilst the directors were disappointed in the result of the year's trading, they were convinced that there were many grounds for hope that the result revealed by the profit and loss account was one such as only came occasionally within the experience of any trading concern, and to that concern in particular. There never was a time in its history when its organisation was more complete, or when its reputation to produce the best article stood higher. They had an experienced and excellent staff, and a management devoted heart and soul to the best interests of the company. They might say he had not promised them much for the future, but he would promise them one thing—that if they later on in the meeting re-elected him as a director, he would spare no work on his part (and he knew he had the support of all his co-directors) in endeavouring to bring about a better state of things in the near future. They would have noticed from the report that they had lost two directors during the past year, Mr. John Kerr, the late chairman, and Mr. George Richardson, who, as stated, retired from the board for private reasons. He regretted it had been thought by one or two that this might have been in connection with the poor result of the profit and loss account for the year under review. He begged to assure the shareholders that their late colleagues were not men who would retire from the company for any such reasons, but, on the contrary, would most likely have stood by their co-directors, had they had an idea at the time they retired that the results would be so unsatisfactory. It was with very great satisfaction he was able to announce that Mr. John Sampson had accepted a seat on the board.

Mr. R. H. Prestwich seconded the motion.

Mr. J. B. Concanon said he thought it was due to the chairman that, on behalf of the shareholders, he (the speaker) should express his deep sympathy with the board, as well as with themselves, for the untoward incident of their having been obliged to pass the ordinary dividend this year. He would like to point out to those shareholders who were, perhaps, not so conversant with kindred companies as he (Mr. Concanon) was, that he did not think there was one of such concerns that had paid a dividend on its ordinary shares for years, and that was the first time that Dick, Kerr & Co. had had to pass the ordinary dividend. That, he thought, in itself was a remarkable testimony to the admirable manner in which the company had been managed in the past. With regard to the appointment of Mr. Sampson, he regarded it as a distinct acquisition for the company to have such a man on the board. He was a man of the very highest position in the commercial world, and he was a man of very independent and very strong views. They might rest satisfied that nothing would be left undone on the part of the chairman and the board to get the company back into a more prosperous state. Their chairman had been connected with the company for many years, and although his (Mr. Concanon's) personal interest was not very large as an ordinary shareholder, he had always taken a deep interest in the company from its very start. He could claim to have been the first man to give an electrical contract to the company when it started on its new career 10 years ago, and it had prospered ever since until this unfortunate year, when, as they knew, the circumstances were entirely exceptional. He was aware that the reason kindred companies had not paid any ordinary dividends for some time was not so much want of orders as the taking of business that was not profitable. He applauded the remark of the chairman that it was their intention not to take any business that did not show a fair profit. He thought it was a great pity that those companies who were competing with them could not see their way to come to some sensible businesslike understanding with one another not to cut prices, for he was satisfied that if some such arrangement could be come to, it would be to the advantage of all concerned. He noticed that they had investments in the balance-sheet representing about £149,000, and he would be pleased to know if there was any serious depreciation in that figure.

The Chairman, after thanking Mr. Concanon for the complimentary nature of his remarks, said that, as to the investments, they were all added together, and they were put in the balance-sheet at what they considered to be their true value, acting on the advice of their accountants.

The report was then adopted.

On the motion of Mr. Prestwich, seconded by Mr. D. C. Ellis, the chairman was re-elected a director, and the appointment of Mr. John Sampson to a seat on the board was confirmed.

The meeting closed with a vote of thanks to the chairman, his colleagues, the staff, &c.

Oriental Telephone and Electric Co., Ltd.—The directors have declared the following interim dividends:—3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and 3 per cent. on the ordinary shares, free of income-tax. The warrants will be posted on 31st inst. The share transfer books will be closed from 17th to 30th inst.

Indo-European Telegraph Co., Ltd.—The directors have declared an interim dividend for the half-year ended June 30th last at the rate of 5 per cent. per annum, free of income-tax, payable on and after November 1st. The transfer books will be closed from 18th to the 31st inst., inclusive.

Provincial Cinematograph Theatres, Ltd.—The directors have recently declared a first interim dividend of 5 per cent.

New General Traction Co., Ltd.

The directors' report for the 16 months ended July 31st, 1912, states that the scheme of reorganisation of the company's share capital as passed by the shareholders, received the approval of the Court on July 23rd last, and for the purpose of bringing the accounts into line with such scheme they have been brought up to July 31st. The revenue received and accrued from the various sub-companies amounted to £37,521 for the period under review, against £22,657 in the previous year. The general expenses, including directors' fees and legal charges, amounted to £2,566 for the 16 months, as against £2,117 in 1910-11. The accounts for the period show a profit of £15,170. The directors recommend that this sum should be appropriated as follows: £10,480 to the payment of a 4 per cent. dividend, and that the balance of £4,690 be carried forward. The dividend received from the Coventry Electric Tramways Co. for the year ended December 31st, 1911, was increased to 9½ per cent. The Coventry Corporation has duly carried out the purchase of the Coventry tramways in accordance with the terms of the arbitration, of which particulars have already been sent to the shareholders. The accounts of the Norwich system show that there was an increase in the traffics for the year, and a decrease in the expenses. A dividend of 2 per cent. was received from that company for the year ended June 30th, 1911, as against 1¼ per cent. for the previous year. The Douglas Southern Electric Tramways, Ltd., paid 7 per cent. on its preference shares and 1½ per cent. on its ordinary shares. The income from the Philadelphia undertaking for the 16 months amounted to £20,147. The directors' reports and accounts of the Coventry, the Norwich, and the Douglas Southern Tramway Companies respectively are annexed to the report. The directors have appointed Mr. Charles Pakeman to a seat on the board.

The annual meeting is to be held on October 31st.

In respect of the reorganisation of the share capital, the new share certificates will be ready to be exchanged against the old preference and ordinary share certificates on and after October 23rd.

Prospectus.—*The Rose Automatic Tyre Co., Ltd.*—In our issue of May 24th last, we referred to a prospectus offering 19,000 shares of £1 each for subscription at par. Apparently there was then an insufficient response, for we have now received a second prospectus stating that the list was to be open from October 10th to 15th, for an issue of 21,000—thus giving the public a larger opportunity. The vendor of the patents has modified his terms, for he is now content to take only £2,000 in cash (as compared with £4,000 before), and £14,000 in fully-paid shares (as compared with £16,000 before). It is still proposed to acquire and develop the patents, and estimates of the manufacturing cost have still been prepared and carefully considered. Making their calculations of expenditure accordingly, and having regard to inquiries received, the directors are "of opinion" that there will be "satisfactory dividends." We do not now find any reference to the factory building near London that was under consideration last May, and Mr. Rose is only mentioned as technical adviser (not now as manager of the factory) at a salary of £400 per annum, the engagement being terminable after the first year at three months' notice. The company has been formed to acquire and develop the patent rights of what, as our readers know, is an excellent invention, but it is not clear what this word "develop" means, for there is no reference to any agreements as to manufacture, though it is stated that after paying for the patents, the proceeds of the issue will be devoted to "providing working capital for exploiting the invention." Our readers will not require us now to restate our criticisms of May last.

Associated Fire Alarms, Ltd.—The first report of the directors states that the accounts for the year ended June 30th, 1912, show a small profit of £112, after providing for depreciation. A considerable portion of the period was occupied in the reorganisation of the two businesses as a combined concern. The directors' expectations of economic working and reduced expenditure consequent upon the amalgamation of the businesses of the Pearson Fire Alarm, Ltd., and May-Oatway Fire Appliances, Ltd., have been fully realised; competition has been reduced and a substantial saving effected in working and other expenses, the full benefit of which will not be experienced until next year. Owing to pressure of other business, Mr. H. Cuthbert Hall, one of the original directors, has resigned his seat on the board. In the interests of economy the seat is not to be filled at present.

Ferranti, Ltd.—The directors report that for the year ended June 30th, 1912, the profit on trading was £51,759, and, after crediting discounts, interest and transfer fees, and deducting general establishment charges, repairs and renewals, legal expenses, bad debts, and directors' and trustees' fees, there remains a balance of £24,333, which has been applied as follows:—Interest on prior lien debentures, £805; interest on first mortgage debenture stock, £5,000; interest on bank and temporary loans, £1,400; depreciation reserve account, £10,000 = £17,205, leaving a balance of £7,128. The amount at credit at June 30th, 1911, was £5,327, making £12,456. The directors recommend that this amount should be carried forward to the current year. The results for the year again show an improvement over those for the previous year. Owing to the expansion of the company's business arrangements are about to be made to issue £50,000 6 per cent. five-year notes. The proceeds, after repayment of the prior lien debentures, will be available for working capital.

The annual meeting is to be held at Basildon House, Moorgate Street, E.C., on Thursday, October 24th.

Parsons Marine Steam Turbine Co., Ltd.—The report states that up to June 30th the total horse-power of marine turbines of the Parsons type completed or under construction, amounts to 8,500,000 H.P.—an increase during the year of about 2,100,000 H.P.—of which total nearly 7,200,000 H.P. is employed for propulsion of warships and 1,300,000 in the mercantile marine and yachts. The directors recommend a final dividend of 5 per cent., making 10 per cent. for the year, absorbing £21,128, also a bonus of 2½ per cent., absorbing £5,282, leaving £18,810 to be carried forward.

Brisbane Electric Tramways Investment Co., Ltd.—The directors have declared an interim dividend at the rate of 8 per cent. per annum (4s. per share) on the ordinary shares for the half-year ended June 30th.

Monte Video Telephone, Ltd.—The directors report that for the year ended July 31st last, after providing for all charges in Monte Video and London, the net profit for the period was £25,120, as against £22,145 for the previous year. The interim dividends paid on May 1st last absorbed the sum of £4,343, leaving a balance of £20,777, plus £4,381 brought forward, making an available balance of £25,158. After applying £15,000 to depreciation of the company's property and plant, and transferring £1,500 to reserve fund, bringing that account up to £60,000, the directors recommend the payment of final dividends of 2½ per cent. upon the preference shares and 3 per cent. upon the ordinary shares, making for the year 5 per cent. on the preference and 6 per cent. on the ordinary shares, leaving a balance of £4,315 to be carried forward. The number of new subscribers during the year has again shown a moderate increase.

Cape Electric Tramways, Ltd.—The directors report that for the year ended June 30th, 1912, there was a profit of £77,586, and after providing for debenture interest, redemption of debentures, and taking into account the balance brought forward from last year, there is a net credit balance of £36,662. From this sum the reserve fund has been credited with £8,000, leaving £28,662. The operations show a further satisfactory increase in earnings on the figures of the previous year in both Cape Town and Port Elizabeth, and the consequent increase of profit enables the directors to recommend the payment of a dividend of 5 per cent., free of income-tax, on the ordinary shares. This will absorb £24,561, and the balance of £4,101 is to be carried forward. During the year the tramways carried in Cape Town 13,733,656 passengers, the receipts being £135,369, as against 13,318,110 passengers, with receipts of £131,702, for the year 1910-11. In Port Elizabeth 3,747,913 passengers were carried, the receipts being £39,822, as against 3,363,099 passengers, with receipts of £35,632, for the year 1910-11.

STOCKS AND SHARES.

Tuesday Evening.

The full force of the war slump came in the Stock Exchange last Friday and Saturday. Originally started by the Balkans crisis, the financial position of the Bourses grew graver every hour, until in Berlin and Paris there was something very like panic, stocks and shares being flung overboard regardless of anything else save the necessity of selling them, and for what they would realise. The certainty of an early rise in the Bank of England rate operated as an added cause of flatness, and not until Monday in this week was there any attempt made to rally prices. By then, however, the worst part of the slump had spent itself, and the bargain-hunters made their presence felt as they went about picking up cheap stock in this market and the other. Substantial recoveries occurred all round the Stock Exchange, where members again began to smile and to talk of cheerful things.

So far as the Electrical departments are concerned, the main alterations have occurred in the Home Railway section; while some of the Latin-Canadians show heavy falls. There has not been much selling, however, of other electrical stocks and shares, and it may be said that, up to now, the latter have escaped lightly enough from the demoralisation that has been felt in wide circles. Possibly the lowest quotations have not been plumbed even yet, for it is the invariable Stock Exchange rule that the lower prices go, the further will the fall be continued until powerful support comes to the rescue: just as the converse of the proposition is true, viz., that the higher quotations rise, the more they will mount, until some accident puts the extinguisher on them and sends them down again.

Looking first at the Home Railway movements, the most marked is that of a 5 point drop in Metropolitans, though this does not by any means indicate the lowest quotation reached. On Saturday morning stock changed hands at 51, from which there was a share rebound on the next business day to 54 bid. It is argued that at anything like the latter price—some 14 points below the best recently recorded—there is plenty of scope for improvement, seeing it is practically certain that big interests are endeavouring to obtain control of the company. Districts, from 41, fell away to 37, and the subsequent recovery has taken them up to 38¾, leaving a fall of 2 on the week. The liquidation shook Central Londons, the Ordinary stock at 74 and the Deferred at 72 being 4 and 5 points down respectively. East Londons tumbled to 8 before any recovery set in, and the only stock in the market to show any resistance to the prevailing depression has been City and South London, which at 34 retains its previous advance, report being very insistent as to the company being taken over before long by one of its bigger brethren, of which the Midland is rumour's chief favourite.

London United Tramways Preference are 10s. lower, and the Debenture stock fell 1. Metropolitan Electric Trams went back to 23s. 9d., *ex* dividend, and the rumours which have recently been linking these two companies are decidedly subdued now. The Underground Electric Railway issues went down with the rest, the Income Bonds at 88, showing a drop of 3 points. British Electric Tractions gave way to a small extent. The slump, however, has not affected prior charge stocks, with the exception of Metropolitan Tramways 4½ per cent. Debenture, which is 1½ down.

The Latin-Canadian group, as already mentioned, suffered considerably in the general depression. Chief amongst the falls are those of 17 points in Sao Paulo Trams and 12 points in Rio Trams. The market is dealing now in certificates of deposit for both these Companies, but business in them has shrunk appreciably in consequence of the slump.

Montreal Light and Power shares went back 12, and Canadian Generals lost 5½ of their 7-point rise of last week. The Mexican group gave way all round, Mexico Trams losing 10 and Mexican Light and Power 6. British Columbia Electric stocks suffered severely, following upon their falls of a week ago. The satisfactory report from the Cape Electric Trams sufficed to raise the price a small fraction.

Amongst other traction issues, Anglo-Argentine Debentures weakened on the issue of the new stock. The underwriters of the latter expected to take up about 65 per cent. of their obligations. In the case of the Sao Paulo Electric 5 per cent. Debenture stock, which came out last week, the public took 22 per cent., and the underwriters were therefore left with 78 per cent., upon which the quotation fell to 2 discount; the stock looks cheap at this price, the yield working out to £5 7s. 6d. on the money. Victoria Falls Preference weakened to 18s. 9d., but the company's 5½ per cent. Debenture scrip keeps very steady at 95½. Para Electric Railways fell ⅜. Calcutta Trams at 6⅜ *ex* dividend are firm.

In the list of English Electricity Supply and Power descriptions, the principal alteration is a fall of £2 in City of London Ordinary, this, of course, being brought about by realisations on the part of the "bulls," a small speculative account still existing in the shares. Beyond this, the changes are insignificant. Brompton Ordinary and Preference enjoyed the distinction of being ¼ up in each case; and, even in the panicky markets at the end of last week, electric shares were exceptionally firm. Various rumours and reports as to something that is going to happen to make the market better continue to circulate; but in this connection we need only repeat our previous warning that too much importance must not be attached to statements which carry no official authority and which are in all probability premature.

The Telegraph market is steady, except in the few issues where anything like a "bull" account has been built up. West India and Panama shares dropped ¼, but the First Preference rose ⅛ to 10¾. Great Northern Telegraphs went back 15s., and the Anglo-American Telegraph Deferred fell ⅜. There was a sharp spurt in National Telephone Deferred the other day to 162; and though much of the rise was lost, an improvement of two points remains. The debate in the House of Commons on the Marconi contract has been studied with keen interest by the Stock Exchange; and the price of the shares, after touching 4¾, rallied to nearly 5. Monte Video Telephones gained 1/32 on the issue of a satisfactory report.

The feature in the Manufacturing market is the dulness of Castner-Kellner shares, which have fallen 3/16, although the Debenture stock is 2 points higher. British Westinghouse Preference fell ⅛, but Babcock & Wilcox are really 1/16 up, allowing for the dividend taken off last week. Dick, Kerr Preference, also *ex* dividend, have given way. Edison & Swan 4 per cent. Debenture put on a point. There are proposals in the air for a reorganisation of the company's capital account. The Brush Electrical Company has been sending round allotment letters of a new 6 per cent. Participating Debenture stock to its shareholders, some of whom evidently think that this form of issue implies a bonus, for the market has been besieged with inquiries as to what premium there is on the stock. It seems a pity that this method should have been adopted; and to those who are conversant with the condition of the market in the company's stocks and shares, it is scarcely necessary to say that there is no premium on the new issue.

Auckland Electric Tramways, Co., Ltd.—The directors report (according to an abstract in the *Times*) that the total revenue for the year ended June 30th amounted to £232,351. After providing for all expenses chargeable to revenue, including £17,322 for debenture and other interest, the rental and percentage of profits payable to the Auckland City Council amounting to £5,259, and setting aside £20,000 to the renewals and depreciating account, there is a surplus of £51,609, plus £7,147 brought forward, making £58,756. After placing £18 238 to reserve, making it £85,000, the directors recommend a further dividend on the ordinary shares at the rate of 11d. per share, tax free, for the half-year ended June 30th, making a total dividend of 1s. 6d. per share for the year, leaving £8 268 to be carried forward. It is proposed to increase the capital to £500,000 by the creation of 50,000 new preference shares of £1 each.

Bank Rate.—The Bank Rate was yesterday raised from 4 per cent. to 5 per cent.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Oct. 9	2,962	+ 153	19	30,726	+ 111	14·4	..
Ayr	" 12	493	+ 67	21	9,122	+ 210	8	..
Birmingham Corp.	" 5	22,166	+3,202	27	2 6,819	+63,063	57·17	..
Blackburn	" 9	2,369	+ 35	28½	34,323	+ 254	14·62	..
Blackpool Corp.	" 10	2,790	+ 540	..	58,287	+ 5,473	11·87	..
Blackpool-Fleetw'd	" 12	1,323	+ 136	14	22,153	— 642	8	..
Bournemouth	" 9	3,639	+ 302	27½	56,041	+ 1,726	21·95	..
Bradford	" 5	11,074	+ 340	27	152,179	— 1,708	56	..
Brighton	" 13	1,977	+ 58	23	81,837	— 1,061	9·5	..
Bristol	" 11	14,698	+ 2,140	..	285,896	+ 22,959	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	" 4	657	+ 185	40	11,961	+ 3,204	3·65	..
Barnsley	" 4	294	+ 9	"	7,139	— 252	..	..
Barrow	" 4	761	+ 98	"	15,504	+ 3,041	5·87	..
Devonport	" 4	965	— 12	"	21,693	+ 1,548	8·85	..
Gateshead	" 4	2,202	+ 24	"	41,590	— 76	11·25	..
Gravesend	" 4	465	+ 26	"	8,439	+ 8,875	6·5	..
Greenock	" 4	1,681	+ 183	"	32,649	+ 3,375	7·25	..
Kidderminster	" 4	288	+ 36	"	4,915	+ 57	..	..
‡Leamington	" 4	334	+ 10	"	7,650	+ 343	..	..
Merthyr	" 4	439	+ 26	"	8,052	— 378	2·9	..
Metropolitan	" 4	17,745	— 236	"	353,364	— 736	22	..
Middleton	" 4	692	+ 43	"	13,522	— 385	8·5	..
Mid. Joint Com'tee	" 4	6,923	+ 616	"	130,970	+ 6,395	..	..
Oldham—Ashton	" 4	1,245	+ 74	"	24,499	+ 1,462	9·13	..
Peterborough	" 4	320	+ 6	"	5,574	+ 317	5·31	..
Potteries	" 4	4,152	— 224	"	75,945	— 1,490	29	..
Rothesay	" 4	427	— 175	"	10,120	+ 436	2·75	..
Southport	" 4	693	+ 29	"	12,326	— 278	8·17	..
S. Metropolitan	" 4	1,700	— 3	"	34,313	— 1,018	..	..
Swansea	" 4	2,337	+ 51	"	46,253	+ 117	12·5	..
Tynemouth	" 4	442	+ 22	"	10,344	— 971	3·75	..
Weston-s-Mare	" 4	267	+ 10	"	6,532	— 1,298	3	..
‡Worcester	" 4	622	+ 54	"	12,010	— 97	5·75	..
Wrexham	" 4	234	+ 21	"	4,620	+ 527	..	..
Yorks. Wool. Dist.	" 4	2,173	+ 73	"	43,326	+ 1,057	17	..
Miscellaneous	" 4	479	+ 46	"	9,394	+ 143	..	..
Burnley	" 13	3,338	+ 397	..	..	.	12·44	·7
Burton-on-Trent	" 13	663	19	28	7,726	— 451	6·6	..
Bury	" 13	2,661	+ 139	28	37,200	— 420	22·5	..
Cardiff	" 5	4,992	+ 321	27	66,881	— 2,344	17·35	..
Chatham and Dist.	" 8	1,8 6	+ 130	40	34,435	- 239	14·95	..
Cork	" 10	964	+ 8	41	19,903	— 900	9·89	..
Croydon	" 4	3,626	+ 123	27	49,934	— 1,135	11·6	..
Darlington	" 12	453	+ 19	28	6,328	+ 50	4·87	..
Darwen	" 11	570	+ 29	28	7,896	+ 184	4·36	..
Dover	" 5	495	— 9	27	7,232	— 564	4·75	..
Dublin	" 11	11,655	+ 424	..	89,595	— 8,983	54·25	..
East Ham	" 12	2,064	+ 66	28	30,096	— 838	7·87	..
Exeter	..	..	..	..	..	..	..	..
Glasgow	" 12	39,144	-1,391	..	359,040	— 7,684	98	..
Hastings	" 10	1,9 9	+ 47	..	..	+ 2,809	19·3	..
Hull	" 12	6,663	- 285	28	82,188	+ 445	13·5	—1
Ilkeston	" 10	240	- 12	28	3,109	— 585	..	..
Ipswich	" 12	855	+ 45	28	13,391	- 205	10·5	..
Kilmarnock	" 12	322	+ 21	21	3,602	— 192	4·25	..
Lancashire United	" 9	2,815	+ 153	41	55,939	- 165	89	..
Leeds	" 12	15,757	+ 736	28	220 319	+ 6,908	112·7	..
Leicester	" 12	5,321	+ 180	41	104,567	+ 3,264	20	..
Leith	" 12	1,338	+ 133	21½	15,310	+ 290	8·72	..
Liverpool	" 5	24,277	+ 454	39½	478,110	+ 20,511	117	1
‡L.C.C.	" 2	82,487	— 4,156	..	1,124,836	—69,095	141·1	—·5
London United	" 12	11,893	+ 150	..	260,211	—13,475	..	..
Lowestoft	" 12	380	— 16	17	329	— 20	8·5	..
Manchester	" 12	34,092	+ 1,475	28	473 044	+16,302	105	..
Newcastle	" 12	8,920	+ 564	..	122,988	+ 1,492	31·3	..
Newport	" 5	1,413	+ 66	27	19 215	— 638	7·25	..
Oldham	" 6	4,072	+ 96	28	58,071	+ 3,033	23	..
Pontypridd	" 12	870	+ 31	28	11,054	+ 674	5·5	..
Portsmouth	..	..	..	..	..	..	16·75	..
Preston	" 2	1,605	+ 45	27	22,795	+ 1,007	10	..
Rotherham	" 9	1,535	+ 174	27½	20,264	+ 1,346	12	..
Salford	" 7	9 916	+ 292	27½	137,940	+ 3,057	41	..
Sheffield	" 15	13 947	+ 962	..	192,559	+ 7,245	40	..
Southampton	" 9	2,504	+ 146	27	35,993	— 54	11	..
Southend-on-Sea	" 9	1,418	+ 230	28	25,100	+ 2,476	7	..
South Shields	" 12	1,282	+ 119	28	18 178	+ 41	10·25	..
Tyneside	" 9	961	+ 40	15	7,413	+ 724	11	..
Wallasey	" 12	2,087	+ 1	27½	32,447	— 464	8·72	..
Walthamstow	" 12	1,342	..	28	21,514	— 887	9	..
West Ham	" 3	5 206	— 64	26½	71,119	— 2,611	16·45	1·2
Wolverhampton	" 9	2,082	+ 118	28	28,646	+ 455	13·75	..
Cen. London Rly.	" 12	10 889	+ 604	15	68,328	+ 1,201	6·78	·4
City & S. Lon. Rly.	" 13	6 119	— 335	15	43,074	— 3,311	7·26	..
Dublin-Lucan Rly.	" 11	313	+ 16	15	2,434	— 122	7	..
G.N. and City Rly.	" 12	3,053	— 11	15	20,370	— 51	3·5	..
L'pool Overh'd Rly.	" 13	3,145	+ 151	..	25,079	+ 1,952	6·6	..
Llandudno-Col. Bay	" 11	497	+ 35	45·5	15,053	+ 655	6·5	..
Lond. Elec. Ry. Co.	" 12	28,400	+ 910	15	186 075	+ 5,695	21·25	..
Mersey Railway	" 12	4 349	+ 266	15	31,226	+ 3,332	4·5	..
Metropolitan Rly.	" 13	64 718	+ 409	15	251,406	+ 5,866	25·75	..
Met. District Rly.	" 12	26,640	+ 2,601	15	181,115	+ 16,129	25	..
Anglo-Argentine	" 7	107,091	+ 8,089	..	2,032,024	+ 80,900	..	..
§Auckland	Aug. 30	18,602	+ 2 334	2	40,460	+ 8,506	24·1	..
Bombay (B.E.T.)	Sept. 20	6,340	+ 589	37	113,387	+ 5,706	..	..
§Brisbane	Sept.	22,700	+ 1,660	9	181,094	— 3,566	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 12	9,127	+ 2,553	..	..	+ 13,232	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Sept.	8,251	..	9	28,788	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	.
Madras	Sept. 30	1 587	+ 125	..	29,942	+ 3,291	14 7	2
§Montevideo	Sept.	27,711	+ 4,465	11	317,818	+ 44 299	.	..
Perth (W.A.)	Oct. 11	3 907	+ 486	..	76,323	- 10,856	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 15th.	Rise + or Fall	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9¾ — 10¼	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	4 12 1
Do. Second 6 % Pref.	10	6	6	10¼ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100	+ ½	4 10 0
Brompton & Kensington, Ord.	5	10	9†	9 — 9½	+ ½	5 [illegible]
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	[illegible] 17 [illegible]
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 — 100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4¾ — 5¼		4 1[illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4¼	..	4 11 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	[illegible] — 4½	..	5 6 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
City of London, Ord.	10	8	8†	15 — 17	[illegible]	4 [illegible] 2
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	.	[illegible]
Do. 5 % Deb.	Stock	5	5	118 — 122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	..	4 8 [illegible]
County of London, Ord.	10	6	4	11 — 12		5 0 0
Do. 6 % Pref.	10	6	6	11 — 12½	..	4 10 0
Do. 4½ % Deb.	Stock	4½	4½	106 — 108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 — 103	..	4 8 3
Edmundson's, Ord.	5	Nil		[illegible] — 1½	.	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4 — 5¼	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4 — 5¼	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 9[illegible]	..	4 14 9
Hove	5	9	8	7 — 7½ xd		5 11 [illegible]
Kensington & Knightsbridge, Ord	5	9	[illegible]	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½		1[illegible] — [illegible]		[illegible] 8
Do. 6 % Pref.	5	6	6	[illegible]	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4	[illegible]	..	4 17 [illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾		4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 — 102	..	4 8 [illegible]
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99	..	4 1[illegible]
Newcastle on Tyne 5 % Pref., Non Cum.	5	5	5	4¾ — 4[illegible]	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 1[illegible] 2
Notting Hill, 6 % Non-Cum. Pref.	10	6	[illegible]	10 — 11	..	5 9 1
Oxford	5	7½	[illegible]	[illegible]		5 1[illegible]
St. James' and Pall Mall, Ord.	5	10	10	8¾ — [illegible]	..	5 [illegible]
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	[illegible]		[illegible] 7
Smithfield Markets, Ord.	5	2	..	1⅝ — 1⅞	..	..
South London, Ord.	4	5	[illegible]	[illegible]		5 13 [illegible]
Do. 5 % First Mort. Deb.	100	5	[illegible]	98 — 101		4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1[illegible] — 1½		[illegible] 12 [illegible]
Do. 4½ % First Deb. Stock	100	4½	4½	[illegible]		4 11 0
Urban, Ord.	£3	[illegible]		[illegible]	..	..
Do. 5 % Cum. Pref.	5	2		2½ — [illegible]		..
Do. 4½ % First Mort. Deb.	100	4½	4½	[illegible]		5 1 8
Westminster, Ord.	5	10	9†	[illegible]		[illegible] 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — [illegible]	..	[illegible]

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	[illegible]	..	5 4 4
Calcutta, Ord.	5	8½	..	7 — [illegible]	— ⅛	5 [illegible]
Do. 5 % Pref.	5	5	5	[illegible]	..	[illegible]
Calgary Power, 1st Mort. Bds.	100	5	5	[illegible]	— 1½	5 4 [illegible]
Canadian Gen. El. Com.	$100	7	7	115 — 119	— 6	5 17 8
Do. 7 % Pref.	$100	7	7	118 — 122	..	5 14 [illegible]
Cordoba Lt., Power and T., Ord.	1	3	..	⅞ — 1	.	3 [illegible] 0
Do. 5 % Deb.	100	5	5	94 — 97	— 1	5 8 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	+ 2	5 16 [illegible]
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	[illegible]	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 — 106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105	.	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87 — 89	.	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	86 — 90 xd	[illegible]	4 9 0
Do. 7 % Cum. Pref.	$100	7	7	103 — 106 xd	— 1	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94 — 96	— ½	5 4 2
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	85 — 88	— 1	5 15 [illegible]
Montreal, Lt., H. and Power	$100	8	9†	[illegible]	— 12	[illegible]
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	[illegible] — 42	..	..
River Plate, Ord	Stock	10		249 — 25[illegible]	..	4 0 [illegible]
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 — 114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 — 104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	[illegible] — 10[illegible]	.	4 10 0
Shawinigan Water, Capital	$100	5	[illegible]	14[illegible] — 144	— 8	3 [illegible]
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	[illegible]		4 11 [illegible]
Do. 4½ % Per. Deb.	Stock	4½	4½	103½ — 10[illegible]	..	4 5 4
Toronto Power, 4½ % Deb.	Do.	4½	4½	[illegible]	— ¾	4 11 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	94 — 97	..	5 [illegible] 1
Victoria Falls Power, Pref.	1	11⅞d.	17⅜d.	[illegible]		..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 — 105	.	5 14 [illegible]

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7½ — 7¾	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	.	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	146 — 148	— 1	5 8 1
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph	Stock	3	3	67 — 69 xd	..	4 7 0
Do. 6 % Pref.	Do.	6	6	111½ — 112½ xd	[illegible]	5 6 8
Do. Def.	Do.	30/-	..	26 — 26½	[illegible]	5 14 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	..	4 16 2
Chili Telephone	5	7	8	7½ — 7¾	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	..	4 14 8
Cuba Telegraph	10	6	..	9½ — 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3 — 3½	..	5 14 4
Do. 10 % Cum. Pref.	5	10	10	6½ — 7	..	7 2 10
Direct United States Cable	10	5	4	7½ — 7¾	..	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 — 100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	129 — 132 xd	..	5 6 1
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79 xd	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	99½ — 101½	..	3 18 10
Eastern Extension	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	99 — 101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	12¾ — 13¼	..	4 10 7
Great Northern Telegraph	10	18	18	28 — 29	.	6 4 2
Indo-European Telegraph	25	13		57 — 59	..	5 3 5
Mackay Companies Common	$100	5	5†	86 — 89	— 1	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	+ 1½	5 9 7
Marconi's Wireless Telegraph	1	20	..	4[illegible] — 4[illegible]	[illegible]	4 1 1
Do. 7 % Cum. Partic. Pref.	1	17	..	4½ — 4¾	— ⅛	3 17 8
Monte Video Telephone, Ord.	1	6		1[illegible] — 1[illegible]	..	5 1 1
Do. 5 % Pref.	1	5	5	[illegible]	..	5 6 8
National Telephone Def.	Stock	6		157½ — 15[illegible]	— 2	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	10[illegible] — 101½		4 8 [illegible]
Oriental Telep. and Elec.	1	8		1[illegible] — 1[illegible]	..	4 5 4
Do. 6 % Cum. Pref.	1	6	6	1[illegible] — 1½	..	4 1[illegible]
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	[illegible]
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	10¾ — 11¼ xd	— [illegible]	8 17 10
Submarine Cables Trust	Cert.	6	6	126 — 1[illegible]	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 — 101½	..	4 8 8
United River Plate Telephone	5	8	..	7[illegible] — 7[illegible]	— [illegible]	5 4 [illegible]
Do. 5 % Cum. Pref.	5	5	5	5½ — 5¾	..	4 8 11
West Coast of America	2½	2½	..	1[illegible] — 1[illegible]	..	3 18 [illegible]
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 9[illegible]	..	4 0 10
West India and Panama Teleg.	10	2½		3½ — [illegible]		..
Do. 6 % Cum. 1st Pref.	10	6	6	10[illegible] — 1[illegible]	+ ⅛	5 8 1
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 — 103		4 17 1
Western Telegraph, Ltd.	10	7	7†	1[illegible] — 1[illegible]	..	5 [illegible]
Do. 4 % Deb.	Stock	4	4	9[illegible] — 9[illegible]	..	4 1 3
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	[illegible] — 10[illegible]	..	4 [illegible]

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 15th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	[illegible]	..	Nil
Do. 5 % Pref.	1	5	[illegible]	[illegible]	..	6 3 1
Do. 4½ % Deb.	100	4	4½	79 — [illegible]	..	5 [illegible]
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	1[illegible] — 1[illegible]	..	..
Do. Do. Deferred ..	100	.		[illegible]	.	..
Do. Do. 6 % Cum.Pr'f.	100	6	6	[illegible]	.	6 10 [illegible]
Do. 7 % Non-Cum. Pr'f.	100	..	..	[illegible] — 4[illegible]		..
Do. 5 % Perp. Deb. ..	100	[illegible]	5	94 — 97 [illegible]		5 [illegible]
Do. 4½ % 2nd Deb. ..	100	4½	[illegible]	7[illegible] — [illegible]	.	6 7 2
Central London Railway, Ord.	100	8	[illegible]	7[illegible] — [illegible]	—[illegible]	4 [illegible]
Do. Pref.	100	4	4	84 — [illegible]		4 1 [illegible]
Do. Def.	100	2		71 — 7[illegible]	.	2 14 10
Do. 4 % Deb.	100	4	4	1[illegible] —10[illegible]	..	3 18 5
City & South London, Ord. ..	100	1[illegible]	1[illegible]	42 — 4[illegible]	..	[illegible]
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	10[illegible] —107		4 1[illegible]
Do. Do. 1901	100	5	5	105 —107	..	4 13 6
Do. Do. 1903	100	5	5	104 —106		4 14 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 [illegible] 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1[illegible] — [illegible]	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	[illegible]	[illegible]	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	[illegible] 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2[illegible]	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 [illegible]
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	[illegible]	[illegible]	..
Do. 4 % Deb.	100	4	4	72 — 76	[illegible]	5 [illegible] 3
Metropolitan Railway Consol. ..	100	1½	1[illegible]	[illegible] — 5[illegible]	—4[illegible]	2 19 1
Do. Surplus Lands	100	2[illegible]	2[illegible]	64 — [illegible]	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — [illegible]	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86		4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	[illegible]	—[illegible]	Nil
Do. 6 % Deb.	100	6	6	141 —143		4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	—[illegible]	4 [illegible] 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 1[illegible] 3
Do. 4½ % First Pref.	100	[illegible]	4½	88 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77		4 11 0
Metropolitan Elec. Trams, Ord.	1	6	[illegible]	1[illegible] — 1½ [illegible]	—[illegible]	4 1[illegible] 0
Do. Def.	1	Nil	..	[illegible]		Nil
Do. 5 % Pref.	1	5	5	[illegible]	..	5 6 [illegible]
Do. 4½ % Deb.	100	4½	4½	96 — 98	—1½	4 11 10
Do. 5 % Deb.	100	5	5	97½—100½	.	4 19 6
Potteries, Ord.	1	[illegible]	..	1[illegible] — [illegible]	..	..
Do. 5 % Pref.	1	5	5	[illegible]	..	6 19 [illegible]
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	[illegible]	.	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 [illegible]
Underground Elec. Railways	10	..	..	3[illegible] — 4	—[illegible]	Nil
Do. "A"	10	..	..	[illegible]	—[illegible]	.
Do. 4½ % Bonds	100	4½	4½	99 —101	.	4 9 1
Do. 6 % Income	100	1½	[illegible]	87 — 89	—3	..
Yorkshire (West Riding), Ord.	5	Nil	..	[illegible]	..	Nil
Do. 6 % Pref.	5	3	..	2¾ — 3[illegible]	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	.	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 15th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	[illegible] — 5[illegible]	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4[illegible] — 5[illegible]	..	5 3 6
Do. 4 % Deb.	100	4	4	93½— 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	99 —101	—1	4 9 1
Do. 5 % Deb.	100	5	5	9[illegible] —101	—1	4 1[illegible]
Auckland Trams, 5 % Deb. ..	100	5	5	10[illegible] —105[illegible]	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾— 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97½— 9[illegible]	—[illegible]	4 10 [illegible]
Do. 5 % 2nd Deb.	100	[illegible]	5	98 — 100	..	5 [illegible] 0
Brisbane Trams Invt., Ord. ..	5	8	..	7½— 7[illegible]	..	5 3 3
Do. 5 % Pref.	5	5	5	5 — [illegible]	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½—103½	.	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	.	141 —146	[illegible]	5 9 7
Do. Pref. Ord.	100	6	6	112 —116	[illegible]	5 3 5
Do. 5 % Pref.	100	5	5	104 —107	—1	4 13 6
Do. 4½ % 1st Mort. Deb. ..	[illegible]	4½	4½	99½—102½	..	4 7 10
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —106	..	4 [illegible]
Do. 4½ % Con. Deb.	100	4½	4½	101 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	[illegible]	6[illegible] — [illegible]xd	..	5 5 8
Do. 5 % Pref.	5	5	5	4[illegible] — 5[illegible]	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	[illegible]	2½	.	[illegible]	+[illegible]	..
City Buenos Aires Trams (1904)	5	5	5	5½— [illegible]	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	[illegible]	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	[illegible]	..	..
Do. Pref.	1	6	..	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	..	1 1/16 — 1[illegible]	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 97	..	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	115 —118 xd	—1[illegible]	5 1[illegible]
Do. Gen. Con. 5 % Bonds ..	..	5	5	96 — [illegible]	—2	5 2 0
Do. 6 % Bonds	100	6	6	99 —101	—2½	5 18 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7½ — 7[illegible]	—[illegible]	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5¼	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	[illegible]	5†	1½ — 1[illegible]	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 1[illegible]
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼— 5[illegible]	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	146 —151	—12	3 6 3
Do. 1st Mort. 5 % Bonds ..	..	5	5	100 —102	—1¼	4 18 0
Do. 5 % Mort. Bonds ..	100	5	[illegible]	95½— 97½	—1½	5 2 7
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	258 —268	—17	3 14 8
Do. 5 % 1st Deb.	$500	5	[illegible]	102 —104	—2	4 14 4
Singapore Trams, 5 % Deb. ..	100	[illegible]	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	[illegible]	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅝— 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	[illegible]	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	— ½	4 7 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 15th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	6	..	½— [illegible]	..	8 0 0
Do. 6 % Pref.	1	6	6	1[illegible]— 1[illegible]	..	7 7 8
Babcock & Wilcox	1	28	14†	3½ — [illegible]xd	+[illegible]	4 2 10
Do. Pref.	1	6	6	1[illegible]— 1[illegible] xd	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	[illegible]—	..	..
Do. 6 % Cum. Pref.	1	Nil	..	[illegible]— [illegible]	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 13 8
B.I. & Helsby Cables	5	10	5†	7½— 8	..	6 [illegible]
Do. Pref.	5	6	6	[illegible]— 6[illegible]	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	— ¼	[illegible]	Nil
Do. Deb.	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10¾— 11	..	6 16 4
Do. Pref.	5	5	5	4½— 5½	..	4 17 7
Do. Deb.	100	4½	4½	99[illegible] —101½	..	4 8 8
Castner-Kellner	1	20	15†	3[illegible]— 3[illegible]	—[illegible]	5 [illegible]
Do. Deb.	100	4½	4½	105 —108	+2	4 3 4
Crompton & Co.	8	Nil	..	⅛— ⅜	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	⅛— ⅜	..	.
Do. Pref.	1	6	6	¾— [illegible]xd	—[illegible]	6 17 2
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	1[illegible]— 1⅜	..	Nil
Do. fully paid	5	Nil	..	1⅝— 2⅛	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	+1	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	¾— 1	..	7 10 0
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7⅛— 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12¼— 13	..	5 15 5
Do. Pref.	5	4½	4½	4½— 5½	..	4 7 10
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11½— 12½	..	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	34 — 36	..	6 13
Do. Deb.	100	4	4	98 —100	..	4 0
Willans & Robinson	1	Nil	..	⅛— ½	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

RECENT DEVELOPMENTS IN WIRELESS TELEGRAPHY: WITH SPECIAL REFERENCE TO SHIP INSTALLATIONS.

The following notes deal with the more important views and statements presented by Director H. Bredow in a communication of exceptional interest and value to the 1912 [illegible]. It is hardly necessary to state that the author is very strongly biased in favour of the Telefunken system of radiotelegraphy, and, indeed, it would be neither wise nor just to reproduce [illegible] some of the sections of the original dealing with general matters of policy and claims. The technical features of the article present so much valuable matter—which is, moreover, not affected by the omissions made for the above reason—that no further justification need be sought for the present abstract.

Recent development in the German radiotelegraphic field has been very rapid, and the Telefunken Co. now claims to have a greater number of stations in operation than are worked on the Marconi system. During the year 1911, 252 ship, 66 land and 72 portable stations (total, 390) were installed on the tuned-spark system, whereas, during the 10 years ending 1910, only 1,300 stations had been equipped on any system. Among the chief of the advantages attached to the tuned-spark system of working may be mentioned longer trains of purer waves, freedom from interference by "foreign" or "accidental" signals, greater range per kilowatt of radiated power and [illegible].

Whereas the old Telefunken, Marconi and Poulsen systems enabled the radiation of 15—25 per cent. of the energy fed into the primary transmitting circuit, the new Telefunken system claims a radiation efficiency varying, according to circumstances detailed below, from 50—80 per cent. Fig. 1 shows that as a result of this increased efficiency, 35 KW. now suffices for communication over 2,400 km., as against 1,000 km. with the older systems. All the Telefunken stations are rated by the amount of power *radiated* from the aerial (which amount is guaranteed in each case). Although this is the most rational rating system, stations working on other systems are generally rated by the power *input* required—a distinction which it is the more important to remember in view of the great difference in efficiency between the equipments (10-80 per cent.).[*]

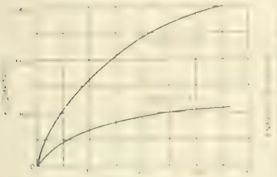


FIG. 1.

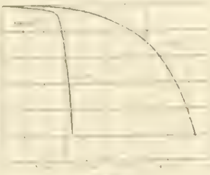


FIG. 2.

In choosing between two rival equipments, the one with the higher aerial efficiency should be selected, even though the price and the power input and nominal range be the same in the two cases. The higher radiation efficiency permits a higher margin of safety, and the loose coupling with which it is possible to work in the tuned spark system enables the obliteration of "atmospherics," while the pure tone of the telephone note is easily selected from "foreign" signals which it may be impossible to eliminate.

Range of Working.—There is no theoretical limit to the distance over which communication can be established, but the energy which can be radiated from any particular aerial, and hence the range of transmission from the latter, is limited by the capacity of the antennæ. The original Nauen aerial had a capacity area of 31,400 sq. m., and, with a maximum elevation of 100 m., averaged 80 m. above ground, yet its maximum absorption was 35-40 KW., and, on endeavouring to increase this amount, excessive brush discharge commenced, and ultimately the insulation broke down. To enable direct communication between Germany and her Colonies would require the erection of towers approximating to the dimensions of the Eiffel Tower, carrying antennæ capable of radiating 100 KW. of high frequency oscillations. The "purer" the latter the greater the effective range per kilowatt radiated. The wave form of the radiated oscillations is largely affected by the shape of the aerial, and for distances of 10,000 km. and greater distances, the magnitude and design of the aerial certainly become the controlling factor.

The wave length employed and the absorption encountered are the chief other influences affecting the range of communication. The absorption varies with the nature, and state of the earth's surface and of the atmosphere, and is especially increased by sunlight. The effective range may be two or three times as great by night as by day. For every distance, time, direction and circumstance of transmission, there is a "best" wave length which should be determined by trial and adopted as standard (as far, of course, as is practicable—the "best" wave length is continually varying and for this reason, as well as for obvious practical reasons, compromise becomes necessary). By varying the wave length the effect of absorption can, within limits, be overcome.[*]

Fig. 2 illustrates the extraordinary difference between the night and day transmission ranges under conditions otherwise identical. Telegrams were despatched every morning and afternoon from Nauen, using a 200-m. wave and constant radiated energy throughout, to a steamer leaving Hamburg. Until the steamer reached Brest, the land intervening between it and Nauen was flat; subsequently, mountains had also to be traversed and the rate of decrease of the received energy suddenly increased as a result of the additional absorption now experienced *en route*. It is remarkable, however, how very much more pronounced the effect of the mountains was by day than by night. Fig. 3 shows precisely the same phenomena in a slightly different manner. The upper curve shows the relative strength of messages received from Barcelona at various hours (the distance being 500 km., partly over high mountains, and the transmitting conditions being constant). The depressions in the curve at dusk and dawn are very striking. The difference between curves (1) and (2) is attributable to the different aerials and transmitting energy at the two stations. It should be clearly understood that these curves are relative rather than absolute. The personal equation in this matter is of such importance that it is very difficult to make absolute measurements. A good means of estimating the intensity of received signals, failing the use of a suitable thermo-galvanometer, is to connect a variable resistance in parallel with the receiving telephone; the value of the resistance when the signals just become inaudible forms a useful practical criterion of the intensity of reception, detector delicacy, and so on.

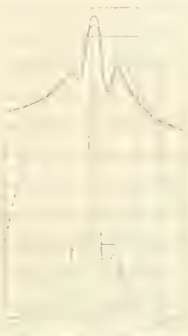


FIG. 3.

The effective range of a station being defined as the greatest distance over which commercial traffic can be safely conducted, it naturally follows that the "range" of a land station is less with regard to a ship than with regard to a land station with an aerial more nearly equal to its own. Land and coast stations have usually very large and widespread aerials, whereas those on shipboard are necessarily very limited in extent, and are often adversely affected by the surrounding metal (steel masts, &c.). This difference is specially serious when the ship is receiving from a station radiating 4,000-6,000 m. waves, and, in spite of the technical convenience of the latter for radiating large quantities of energy, a shorter wave usually extends the range of communication with ships.

Though the range of transmission is, theoretically, unlimited, mechanical considerations limit the size of aerial structure which can practically be erected. The generation of oscillating energy in suitable form and bulk, offers no great difficulty. Small stations (with a day range of, say, 50 km.) need about 100 watts oscillating energy in the aerial; the largest stations at present in operation (Nauen and the Clifden-Glace Bay stations) require 30-40 KW. each, but the Telefunken Co. has recently built a 100-KW. spark sender, and the A.E.G. has built 100-KW. and larger machines on the Goldschmidt principle.[†] The Nauen tower (the height of which was doubled last year—the tower then being 200 m. high, and, next to the Eiffel Tower (300 m.), the highest structure on earth), can now radiate over 100 KW. of high frequency oscillations, the power house being equipped with two generators, each of 100 KW. capacity and working one on the tuned spark and one on the Goldschmidt principle. The double equipment gives security of working and exceptional facilities for research, and the results which have already been obtained with the Goldschmidt alternator prove beyond doubt that the future, in this field, belongs to the dynamo-electric high-frequency generator, even for the greatest power requirements.

As shown in fig. 4, the extension of the Nauen aerial consisted in extending the main tower 100 m. vertically, and in extending the sweep of the aerial wires, which are now strained out to 18 wooden towers 30 m. high, and spaced round a circle of 400 m. radius. The length of the aerial radii has been doubled (and is now 200 m.), and the effective capacity area of the network approximates 120,000 sq. m.

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[*] For a discussion involving identical principles, but in connection with lamp ratings, see ELECTRICAL REVIEW, Vol. LXVI, page 76.

[*] For latest investigations on relation between distance and strength of received signals see ELECTRICAL REVIEW abstract, Vol. 70, p. 384, in the equations of which, however, l represents *not* the wave length but the base of Napierian logarithms.

[†] For full particulars of the theory of this generator, which supplies large quantities of energy at a frequency suitable for direct application in wireless circuits, see ELECTRICAL REVIEW November 24th, 1911, page 880, *et seq.*

The extension of the main tower is, in itself, an engineering feat, the upper 100 m. being free to rock on the under part (but, of course, under the control of the guy ropes). The flexibility of the structure is thus greatly enhanced, and even during its erection, when but imperfectly supported, the tower withstood several severe storms.* The extensions occupied about four months, and, to save time, the alterations to the main foundations and foot insulation were carried on simultaneously with the upper building. The tower was lifted hydraulically and supported by trestles for some weeks, when, the tower being already 170 m. high, it was lowered on to the newly-completed foundations.

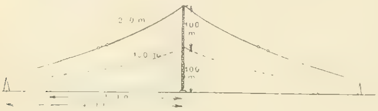

Fig. 4.

Existing and Prospective Stations.—The longest route over which regular commercial radiotelegraphic traffic is at present practised is the 3,100-km. trans-Atlantic route between Clifden and Glace Bay. The Nauen station has a greater range than either of the latter, but works over no definite route in conjunction with a sister station. Experiments conducted last year between Nauen and the Hamburg-American steamship *Bosnia*, showed that the range of the former when using about 60 per cent. of the power required by the Marconi trans-Atlantic stations, and when messages were received by the comparatively tiny aerial of the *Bosnia*, was certainly not less than 5,000 km.† by night and 1,700 km. by day. Had the station been communicating with one having a large aerial network, the daylight range of communication would have been very much greater.

TABLE I.—International Returns, July, 1911.

	Number of stations.		
	Warships.	Merchant vessels.	Land.
Austria-Hungary	37	5	3
Belgium	—	20	1
Brazil	25		11
Canada...	—	9	32
Chile	9		4
Denmark	13	4	8
France...	140	38	18
Germany	98*	156	16
Great Britain	220	296	40
Greece	13	3	
Holland	18	33	6
Italy	87	48	19
Japan	No returns	20	6
Monaco		1	
Norway	13	5	4
Portugal	5	2 (Azores)	5
Roumania	—	5	1
Russia	No returns	2	17
Sweden	27	—	2
Spain	7	26	2
Uruguay	1	—	2
Totals ...	713	673	197

Excluding torpedo-boats.

Every civilised country has now a more or less important network of land radiotelegraphic stations in operation; ‡ no new warship is without a powerful installation, and it is not too much to hope that in a few years' time, every large merchant and passenger vessel will have a receiving and transmitting equipment, and every vessel, however small, at least an equipment suitable for the reception of time signal and storm warnings.

Every important State, with the exception of the U.S.A. and Italy, has ratified the findings of the Berlin Radio Congress, and, as a result, the installation of coastal stations and the facilities for intercommunication with shipping have developed very rapidly. Ships bound for the East have no difficulty in communicating with land stations, until the Red Sea is entered (see Table IV), but thence, for a long distance, facilities are very poor, for the Italian stations are not permitted unlimited communication with all vessels,* and the English stations in this neighbourhood and on the Indian coast are few in number, and chiefly reserved for official use. The Dutch Government has been very active in the East, and, in addition to the completed station at Sabang (N. Sumatra), is now erecting stations in Java and Borneo. The Philippines and the Chinese coast offer some facilities for radio-communication with ships, and Japan is completing a very important series of coast stations on the Telefunken system. Important stations are in operation at Melbourne and Sydney, and a number of others will soon be completed in Australia.

There are no stations for commercial traffic, in the true sense of the expression, on the coast of the U.S.A. The State stations are reserved for military and naval use, and the many private stations are permitted to communicate with whom they will, and hence usually confine their traffic to ships using their own system, or with whom special contracts have been arranged. To improve these conditions, an important Telefunken station has been erected in New York. Central America is more favourably situated, and on the east coast alone of South America there are 66 coast stations, 49 of which operate on the Telefunken system. Vessels approaching Brazil from the U.S.A. communicate with Para, and those from Europe communicate chiefly with Fernando Noronha.

TABLE II.—Traffic Route and Type of German Mercantile Vessels Equipped with Wireless Apparatus.

Sailing route.	Passenger.	Passenger and cargo.	Cargo and various.
Baltic and North Sea ...	4	8	15
North America	4	57	—
Central America	—	4	—
South America (East) ...	—	18	—
South America (West) ...	—	11	6
Mediterranean	—	—	4
East and West Africa ...	—	16	—
East Asia	—	9	—
Australia	—	6	—
Miscellaneous	—	—	1
Totals	8	129	26

TABLE III.—Record Ranges; Telefunken Ship Sets.

Steamer.	Communicating with	Range; KM.	Nature of intervening land or sea.
Cap Blanco ...	*Corcorado*	2,440	Open sea.
Ditto ...	Heligoland	3.300	50 %, land; straight over Spain.
Kleist... ..	Marseilles	2.490	Open sea.
Eleonore Woermann	*Lucie Woermann*	3.700	75 % land; *via* C. Palmas-Teneriffe.
Lucie Woermann	Marseilles	3.300	50 % land; over W. African mountains.
Kaiser Wilhelm II	Norddeich	2,833	Open sea.
Neckar	Norddeich	3.234	Open sea.

Few wireless facilities are available in the South Seas and the Pacific Ocean.† New Zealand is erecting modern stations and the English and German Governments are erecting various stations on their islands in this area, but on the western mainland coasts of South and North America there are few stations conducting regular commercial traffic.

The increase in the number of mercantile ship installations is essentially dependent on the increase in the number of coast stations with which they can exchange messages. A comparatively small number of coast stations could transmit messages to ships in all the seas of the world, but the comparatively small transmission range which, at present, appears inevitable so far as ship installations are

TABLE IV.—Communication to and from "Kleist" by Night.

Position of the *Kleist*.	Intercommunication effected with	Distance between stations: km.
Off Cuxhaven	Algiers	1,970
Off Lisbon	Marseilles	1,350
Between Almeria & Mellila	N. Foreland	1,920
Off Algiers	N. Foreland	1,870
N. of Sicily	Scheveningen	1,675*
N. of Crete	Algiers	1,810
N. of Alexandria	Marseilles	2,490

* Note that this route involved transmission across the Alps,

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* Since writing the above the tower has been completely demolished (March, 1912) as the result of breakage of the guy ropes holding the upper part of the tower. A different and even larger design is to be adopted in the new tower.

† These trials were conducted with ordinary messages; not merely code signals. At 5,000 km. messages were received one night, but the next night the ship being now 5,600 km. from Nauen, no signals could be detected.

‡ It is interesting to note the extraordinary development of wireless telegraphy in Morocco. Not only is there an elaborate network of stations installed, but also these are fully engaged. During 1910 the average transmission from Moroccan stations totalled 40,000 words per month, and recently the corresponding figure has exceeded 120,000. This development is the more surprising in view of the absence of built roads, bridges, railways and wire telegraphs.

* It should be remembered that this article was written before the recent Radio Conference.

† The *Zeitschrift für Schwachstromtechnik* (1911, p. 302) reports wireless communication between San Francisco and the Japanese coastal station of Tschosi Schimosa—a distance of over 10,000 km.—by retransmission from two steamers of the Pacific Mail Co. acting as intermediate stations. The longest of the sections traversed by a single transmission was 6,000 km.

concerned, necessitates a much larger number of coast stations for effective *inter*-communication. Shipowners as a class are conservative, and though there is increasing development in the number of ship equipments voluntarily installed, it is probable that Governmental decrees will soon compel the equipment of all passenger vessels of over a certain size—indeed, action in this direction has already been taken by the U.S.A., Austria, Italy and Argentina.

International data concerning the number of stations in operation in July, 1911, may be summarised as in Table I (to the mercantile ship total of which about 1,000 should already be added). The 163 stations now in use or being installed in the German mercantile marine may be classified by traffic route and class of vessel as in Table II. Forty-six vessels in each of the Hamburg-American and Norddeutscher lines were equipped with wireless apparatus at the date of the returns. In 1911, German mercantile vessels totalled 127.000 messages (counting as one message either a reception or a transmission), *i.e.*, an average of 163 per voyage.

Hitherto, the financial results of wireless telegraph undertakings have not been very striking, owing to the enormous sums expended in experimental work and in developing new types of apparatus. Nor can high dividends be expected till the best systems of working have established their superiority and themselves attained a certain degree of standardisation of technics. Until then and until the present uncertainties of wireless work have been eliminated, full benefit cannot be derived from the low capital cost of a wireless station, as compared with a cable route, and whatever may ultimately be the case, wireless telegraphy now acts as a supplement and as a reserve to existing cable routes rather than as a fierce competitor.

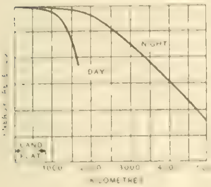
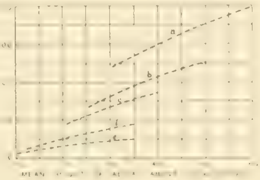


FIG. 5.



a, Large warships; *b*, Medium warships or largest merchant vessels; *c*, Large merchant ships; *d*, Medium merchant vessels or small warships; *e*, Small merchant ships.

FIG. 6.

Types of Station.—To meet various classes of service over distances ranging from 55-500 km., or more, numerous types of station have been evolved and may be grouped as follows:—

1. Land stations radiating from $\frac{1}{2}$ to 100 KW. from the antennæ.
2. Ship stations radiating from $\frac{1}{10}$ to 5 KW. from the antennæ and requiring more or less skill in operation, according to the class of user concerned.
3. Military stations for transport by men or mules.
4. Light stations for use on motor-cars, balloons, air ships and aeroplanes, &c.

Confining our attention mainly to ship stations, and in particular to those suitable for use on merchant vessels, it may at once be stated that the chief distinction between war and merchant vessel equipments is that the latter are as simple and as cheap as possible, and work at one or two international wave lengths, whereas in war vessels cheapness and simplicity are quite secondary to wide range, large reserve power, possibility of close electrical and acoustical tuning and rapid circuit changes to suit transmission and reception over a wide range of wave length.

A number of illustrations in the original article deal with special types of ship station—viz., (1) a 5-km. station operated by accumulators and a trembler coil, and suitable for tugs, aeroplanes, and so on. The accumulators weigh 5 kg., and the remainder of the equipment about 1 kg. more. (2) The largest type of sender yet adopted for merchant ships (see *b*, fig. 6), absorbing 5 to 6 KW. in the primary, and radiating 2·5 KW. (as against 1½ KW. radiated by the average mercantile sets. In a special type of this equipment the space occupied is reduced to a minimum, and vulcanite is substituted for wood, thus making the whole more suitable for use in the Tropics. (3) The main parts of a sender designed for use on small war vessels occupy only 60 × 60 cm. A special variometer allows continuous variation of the wave length up to 200, 300 m., or even higher values, and the aerial power amounts to 1 KW. (4) For large war vessels (see *a*, fig. 6) 5 KW. aerial radiation is provided. Five Leyden jars, each of 10,000-cm. capacity, provide the necessary capacity. By the manipulation of only two levers the circuits can be adjusted in a few seconds to any wave length over a wide range.

Six KW. is about the absolute limit of power radiation possible from ship antennæ, unless the latter are such as to impede the navigation of the vessel. With 5 KW. aerial radiation, the vessels *Eleonore Woermann* and *Lucie Woermann* have effected intercommunication over 3,700 km. across the mountainous part of West Africa (coast to coast), and several other notable performances of Telefunken ship sets are shown in Table III. The average day range of stations on vessels of the German mercantile marine is about 300 km.; fig. 6 shows the usual day range (over clear sea), of various types of ship sets, as a function of the aerial height. Such stations can, of course, *receive* messages from land stations at a much greater distance, and the night ranges for every class of work are two or three times the corresponding day values. Table IV shows some of the more striking results secured by the steamer *Kleist* during her first voyage equipped with wireless apparatus; *every night*, from Bremerhaven to the Red Sea, the vessel could exchange messages with some big land station, and such intercommunication was often possible by day as well. In these trials the *Kleist* worked at full aerial radiation throughout (1½ KW.), but, in ordinary practice, only such radiation is employed as is necessary to establish satisfactory communication; interference with other traffic is thus reduced to a minimum.

(To be continued.)

THE ELECTRICAL MARKET IN SOUTH AMERICA.

A VERY favourable opinion of the prospects of the countries in South America as a growing market for electrical manufactures is entertained by Mr. Ludwig W. Schmidt, who states (*Elektrotechnische Zeitschrift*, September 26th and October 4th) that one of the most conspicuous characteristics of the economic development in that part of the world in the past 10 years has been the increasing use of electrical energy for lighting and power purposes. On the one hand, coal is either of rare occurrence, or no large deposits of real importance have been discovered, while, on the other hand, the rivers both on the east and the west represent considerable sources of power which are in process of utilisation. Most of the Governments in South America have begun to convert the use of the rivers for power purposes into State monopolies, Chile being the latest example of the kind. In some cases the States have sanctioned the establishment of generating stations in connection with the rivers, but in others the State is the founder. The effect for industry remains the same. The State takes care that the abstraction of water does not unnecessarily weaken the river, and also that the prices charged by the central station are reasonable. Both the States and the cities are large consumers of power, which they partly produce themselves, and partly obtain from existing works. At present South America is only at the beginning of railway construction on a large scale. In some cases trials have been made with electric railways, but steam locomotives have hitherto had to perform the greater portion of the work. The large lighting, telegraph and telephone installations are, above all, of importance to the electrical industry in connection with the activity in railway construction, which will still be continued for a long time, as only a small portion of the continent is now provided with railways.

The newest cities make a direct change from the most primitive methods of lighting to electrical illumination without first having recourse to gas, whilst many towns almost come into existence with electric lighting, seeing that as soon as a town is large enough to possess its own system, electricity is generally adopted at once. This fact is best illustrated by the large number of public contracts which are advertised in the official newspapers every year. An excellent example of the development of electricity for lighting and power purposes exists at Buenos Ayres, of which details have already appeared in this journal in relation to the activity there of the German Transmarine Electricity Co. The conditions are similar in Rio de Janeiro, San Paulo, Monte Video, Lima and Valparaiso. It is naturally impossible to generalise in connection with a market of the extent of that in South America. Orders do not flow uniformly from all quarters. Economic relations which are beyond the control of industries play a part in the shaping of the market, and their influence must show itself in a different way in different places. South America is not as yet an industrial continent in the real meaning of the word, and industries, although rapidly developing, are limited to certain districts in the large towns, and to those places which are specially suitable for carrying them on, as, for instance, the estuary of the River Plate. The continent is preponderatingly an agricultural country, with plantation cultivation in the North. The breeding of cattle has created a large consumer of electricity in the form of the preparation and refrigeration of meat, whilst the mining industry, which is distributed over the whole continent, will also become a good customer when the railways show the way to economic progress by the opening up of new districts. Simultaneously with the development of the production of power, and the provision of new possibilities for utilising it, there is proceeding an expansion in the imports of auxiliary materials, the production of which for the greater part has to be left to European manufacturers. Germany, Great Britain and the United States participate fairly uniformly in the market, although the last-mentioned country has made great progress in recent years.

The author, in proceeding to give a comparison of the respective positions occupied by Great Britain, Germany and the United States in the trade of South America, points out that the statistics published by the countries on the latter continent are very incomplete, and that he has, therefore, been compelled to rely upon those published by the three exporting nations in question, notwithstanding differences in classification, whilst the information has been supplemented, where actual statistics are not available, from the experience of merchants domiciled in the country and by the reports of the Consulates. It is, therefore, expressly stated that the figures must not be accepted as absolutely certain. In all cases the most important classes of goods have been selected for comparison, and although the figures consequently afford no correct idea of the imports in general, they yet permit of a contrast of the influence exercised by the three countries in the most important goods. The four Republics of Brazil, Argentina, Uruguay and Paraguay, which are the best customers of the electrical industry, first receive consideration. In 1910 the imports of machinery into Sao Paulo, Brazil, for electric lighting purposes amounted to the value of 2,861,000 milreis. as compared with 1.585,000 milreis in 1909 and 842,000 milreis in 1906. The share of the United States in the trade was 1.504.000 milreis in 1910, as contrasted with 913.000 milreis in 1909; that of Germany was 1,024.000 milreis and 462.000 milreis; and that of Great Britain was 225,000 milreis and 146.000 milreis in the two years respectively. The exports from Germany to Brazil have considerably increased in recent years, and have in many cases more than doubled, as, for instance, in regard to dynamos and glow lamps. British exports have not been so fortunate, and although an advance has taken place in the past few years, it cannot be compared with that of Germany or the United States. The position of United States trade in Brazil in 1911 is particularly surprising, as the former exported to the latter almost as much as the combined exports of the other two countries concerned. This predominance is repeated in Peru, Columbia and Venezuela, whilst, at the same time, a powerful advance of the United States electrical industry in South America in general is noticeable. The accompanying table indicates the value of the exports of the three countries to Brazil in the years mentioned :—

TABLE I.—Exports to Brazil.

Germany.	**1908.**	**1910.**
Porcelain insulators...	£4.100	£9.100
Dynamos	20.400	52.650
Armatures, &c.	2.600	5.800
Storage batteries, &c. ...	2.100	3.900
Cables	22,600	46.850
Arc lamps	2.300	1.550
Arc lamp covers	250	100
Search lights	50	1,100
Glow lamps	17.000	50,950
Telegraphs and telephones ...	39,800	34,550
Materials for lighting and transmission of power	18.000	35,450
Measuring apparatus ...	2.150	5.100
Heating and cooking apparatus ...	100	150
Insulating tubes, &c.	200	600
Various	50	
Total	£131,700	£247,800
United States.	**1907.**	**1911.**
Electrical apparatus, telegraphs and telephones	£165.250	£442.450
Machinery	144,250	96,800
Total	£309,500	£539,250
Great Britain.	**1907.**	**1911.**
Electrical materials of all kinds ...	£10.900	£2,800
Telephone and telegraph wires ...	52,900	96,500
Telephone and telegraph materials	22.600	46,100
Electric lamps	1,750	5,950
Storage atteries and cells... ...	550	21,750
Machinery	58.400	90,700
Various	17,600	13.300
Total	£164,700	£277,100

The causes of the great advance made by United States electrical firms in South America are to be found in a number of circumstances which, in the opinion of Mr. Schmidt, will doubtless play a great part in the business development of the market in the future. For some time past the manufacturers in the United States have been making great endeavours to obtain a market in South America. The question is more than that of providing a new outlet for exports; it is one affecting the future of the United States industries. Canada has hitherto been a favourable channel for the latter, but the Dominion is now beginning to establish its own industries, and has no longer any room for the surplus of the United States, although the fact does not at present prevent an increase in the imports from that country. The industries in the United States suffer from frequent collapses in the home market. Sudden and unforeseen stagnation takes place, and business, which a few weeks previously was probably in the midst of a period of high prosperity, exhibits all at once indications of an economic crisis. In order to escape from the unfavourable consequences of such crises, the United States manufacturers need the safety valve of an export trade, which they had found in Canada. But Canadian and European competition in the Dominion has rendered business in Canada much more difficult than formerly, and United States firms therefore wish to assure themselves of a new market outside Canada, this being afforded by South America.

The principle having once been recognised, the manufacturers in the United States set to work with their characteristic energy in order to conquer the South American market, and the electrical firms have not remained in the background in this respect. Excellent commercial reports were the first result; then the Consuls themselves became the commercial agents of United States industries by seeking to procure orders, in which direction they have been surprisingly successful. In some countries where the Consuls were specially assisted by their representation or the circumstances, they have doubled the turnover. Simultaneously with this industrial activity is the Pan-American movement headed by the United States, which aims at a combination of the interests of the South American Republics and the establishment of closer relations between them under the leadership of the United States. It scarcely needs special emphasis that manufacturers and financiers in the United States have also availed themselves of this phase of the development of their relations. In any case this has done much to strengthen the United States in the South American market. A further factor in the situation is that the preference enjoyed in Brazil, Venezuela, &c., may be attributed to a large extent to the possibility of more rapid delivery from the United States, whose manufacturers are able to undertake delivery in a fortnight, including time for correspondence, as compared with six weeks in the case of European firms, in the event of the goods being ready for shipment.

Although admitting the activity of United States propaganda in South America, Mr. Schmidt considers that it would be a mistake to speak of an American (U.S.) danger in regard to that market as affecting the German electrical industry. Taking the respective statistics of the three countries in question, the author states that the value of the most important electrical goods exported from Germany to Brazil, Argentina, Uruguay, Paraguay, Columbia, Peru, Chile, Bolivia, and Venezuela, amounted to £1,262,500 in 1910, and that an increase of £150.000 took place in the three years ended with 1910. On the other hand, the exports of the United States to the same countries reached £775,000 in 1911, and they have advanced by one-third since 1907. If the value of the aggregate electrical imports into South America is estimated at from £3,000,000 to £3,250.000, the share of Germany is two-fifths, and that of the United States only one-fourth. The details in respect of Argentina are set forth as follows :—

TABLE II.—Exports to Argentina.

Germany.	**1908.**	**1910.**
Porcelain insulators	£4.800	£4.000
Dynamos	76,950	82,250
Armatures, &c.	11.100	15,050
Accumulators, &c.	15.100	270.950
Cables	232,950	18,300
Arc lamps	10,800	600
Arc lamp covers	1,050	10,100
Searchlights	700	145,950
Glow lamps	30.500	27,300
Telegraphs and telephones ...	19,450	112,100
Materials for lighting and transmission of power	85,400	36.550
Measuring apparatus	18.300	3,900
Galvanic cells	800	900
Cooking and heating appliances ...	250	550
Insulating tubes, &c.	350	700
Various	100	100
Total	£508,600	£729,300
United States.	**1907.**	**1911**
Electrical apparatus, telephones and telegraphs	£52.500	£72,050
Electrical machinery	30,900	37,350
Total	£83.400	£109,400
Great Britain.	**1907.**	**1911.**
Electrical goods of all kinds ...	£15,100	£9.300
Specially enumerated goods ...	11.300	29,250
Cables	25,300	39,500
Telephone and telegraph wires ...	39.900	26,500
Electrodes	1,400	1,700
Electric lamps	3,850	11,200
Searchlights...	4,700	4.100
Carbons	250	1,100
Batteries	9,050	30.450
Unenumerated	47.000	45,000
Machinery	60.650	160,100
Total	£218.500	£358.200

The author proceeds to give details in regard to the exports to other countries in South America. In the case of Uruguay, Germany exported electrical goods of the value of £102.300 in 1908, and increased the total to £130,150 in 1910; the United States were responsible for £4.650 in 1907 and £7,600 in 1911, whilst the statistics attributed to Great Britain represent £2,050 in 1907 and £650 in 1911. The figures for Paraguay, Bolivia and Venezuela, of which no record is given for Great Britain, are almost too insignificant to mention, beyond the fact that the German exports to Bolivia in 1910 reached £5.000, as against £1,000 in 1908, and those of the United States to Venezuela amounted to £20.600 in 1910, as compared with £34.800 in 1907. In the case of Columbia, the German exports increased from £1,400 in 1908 to £3,350 in 1910, and those from the United States from £9,590 in 1907 to £18,300 in 1911, but Great Britain does not publish any separate figures for this country. The Chilean market absorbed electrical goods from Germany of the value of £349.200 in 1908, as contrasted with £166,000 in 1910: £44,300 from the United States in 1907 as against £53.900 in 1911; and £66.200 and £55,300 from Great Britain in the two years respectively. The German exports to Peru in 1908 amounted to £11,200, as compared with £11,300 in 1910, but those from the United States declined from £60,400 in 1907 to £22.300 in 1911, and those from Great Britain from £40.700 in 1907 to £564 in 1911.

The opening of the Panama Canal next year is also discussed by Mr. Schmidt, who, far from thinking that the canal will strengthen foreign competition in the South American market, considers that the improvement in the means of transport by the reduction in the journey to the west coast will place European manufacturers in a more favourable relation to United States rivalry. After referring to the orders resulting to United States and British firms from the financial participation in the construction of railways in South America, the working of mining concessions, &c., the author remarks that German financiers have hitherto only taken a limited share in the industrial development of that continent, and that the German electrical industry will consequently have to rely upon its own resources in South America. This has already been done with great success, and most of the large electrical companies are interested in the South American business either by having direct agents or by selling through other establishments of a similar kind. In conclusion, it is submitted that business will develop enormously in the next few years, and that South America will become one of the most important markets with which the German electrical industry will have to reckon.

REVIEWS.

How to Manage the Dynamo. By A. R. BOTTONE. London: Whittaker & Co. Price 9d.

This book is claimed to be specially suitable for "thoroughly good engineers who . . . . . find themselves suddenly called upon to undertake the management of a dynamo." In the preface the author promises to make no attempt at explaining theoretical details; unfortunately, he has broken this promise to the extent of making some misleading statements concerning the excitation of various dynamos.

The introductory paragraphs do not read very smoothly, and it would certainly be better to say that electromotive force is induced in the armature winding than that the armature winding "generates a current." On page 11 we find the extraordinary statement that the output of a separately excited machine is independent of any variations which may take place in the outer circuit. The action of a shunt-wound dynamo, as outlined on page 13, is also very misleading; for instance, we are told that the insertion of a large external resistance compels a larger quantity of current to pass round the field-magnet coils, and this sets up higher E.M.F. to overcome the excessive resistance. The following is worth quoting in full:—"In the series dynamo, as we have seen, if a very low resistance be placed in the outer circuit, so large a current is produced and carried through the coils surrounding the field magnets and armature that the insulation is nearly sure to be burnt up; while in the case of the shunt dynamo, the lower the resistance in the outer circuit the less current passes round the field-magnet coils; and even if the outer resistance be greatly increased, the very great resistance of the field-magnet coils themselves prevents any very great amount of current passing through them, so that the shunt dynamo is much less subject to injury from sudden variation in the outer circuit than the series dynamo. Still, it is not well to allow a shunt dynamo to run for any considerable length of time with nothing or a very high resistance in the outer circuit, since, under these circumstances, the field-magnet coils would slowly but surely heat up, hence by the use of a regulating resistance inserted in the field circuit, the magnetising current can be regulated, with consequent variation in the output of the dynamo to a limited extent." There are various ways of regarding different electrical problems, but this explanation does not commend itself to us. The explanation of the action of a compound field winding is also totally incorrect. Technical inexactitudes of a less or equal importance are too frequently recurrent to be mentioned in detail. A popular hand-book need not be technically inaccurate, and the use of technically loose or inaccurate terms merely increases the difficulties met by the student when he endeavours to pass from a popular to a more advanced treatment of his subject.

On page 21 we note that "the practical engineer will understand at once that when in place the armature must ride free from the pole pieces and not bump or knock at any part"—we hope so. On page 28, it is recommended that incandescent lamps be not switched off till the dynamo has so far slackened speed that the lamps no longer glow. "This conduces greatly to their long life."

The notes on localising and remedying defects in the dynamo are better than the introductory sections, but frequently suffer from the author's very unfortunate (if no worse) method of considering the field action of dynamos. The engineer who tries to measure the actual output of a dynamo "by means of a voltmeter or ammeter directly across the terminals of the dynamo" (page 43) is likely to receive a surprise.

Figs. 10 and 11 represent positive accumulator plates by a short thick line, which is certainly contrary to general convention. In one of these diagrams, a battery is shown regulated from the positive end, while in the other, the regulating cells are at the negative end; in the text it is stated that the battery should always be regulated from the positive end. The best practice is, of course, to regulate from the negative end. On the whole, the definitions of technical terms (pages 54-64), are good, but the definition of a short circuit as:—"A short passage, opened either accidentally or intentionally, along which the current can pass instead of going along the main circuit, as usual"—might certainly be much improved. On the whole, we fear that the book is likely to lead to many theoretical and practical misapprehensions in the minds of those who read it.—R. E. N.

Electricity. By GISBERT KAPP. London: Home University Library. Williams & Norgate. Price 1s. net.

There has always existed among scientific men a strong feeling against "Popular Science," and even the appearance of such men as Faraday and Tyndall as popular lecturers failed to change the general attitude. But the scientists' dictum that to know a little is a dangerous thing has been opposed by the man in the street on the ground that half a loaf is better than no bread: and so strong has been his claim to satisfy his hunger for scientific knowledge, that he has generally contrived to carry off his half loaf in triumph. And so we have popularised editions of most of the standard scientific works, and popular lectures and pamphlets on every branch of science.

The whole case against the popular science book is based on the difficulty of reducing science to popular language without creating false impressions and conveying inaccurate information. While admitting the difficulty, there is no necessity to magnify it into an unsurmountable obstacle, and there is no obvious reason why the exercise of care and judgment should not succeed in avoiding error and ambiguity of statement, and, at the same time, produce a highly informative and interesting book on pure or applied science.

In this Prof. Kapp has succeeded to a degree. He has used a mathematical method of statement in some cases—a fact that will, perhaps, frighten away a few of the least hungry seekers after knowledge—and he has perhaps written over the heads of his readers in places, but we have not noticed any errors or obscurities, and there can be no doubt that the book is eminently interesting and readable. There are nine chapters, the last two being neat essays on alternating currents and power distribution. The order of treatment in some of the chapters appears to be unusual, but this is probably a result of the writer's popular style. The book may be recommended as a good shillingsworth to the man who wants to gain accurate ideas about electricity with the expenditure of a minimum amount of mental energy.—P. H. S. K.

The Motor-Generator: In Theory and in Practice. By J. W. BARBER. London: Ganes, Ltd. Price 1s. net.

This excellent little volume has been specially written for use by cinematograph operators; it clearly explains the reasons for and the advantages of, the use of motor-generator plant, and deals with the troubles likely to be experienced with the latter. Chapters I and II define and explain the various electrical units involved, and the author is to be complimented on the clearness and technical accuracy of his expression. The fundamental laws and phenomena of magnetism are explained in Chapter III, and the next chapter deals with the principle and construction of electromagnets. The material in these two chapters is excellent, but, in our opinion, it would have been better to have devoted less space to these chapters with a view to explaining the principles of generators (Chapter V) in rather more detail. The latter chapter is excellent so far as it goes, but we anticipate that many operators will have some little trouble in following this section. Types of generators and the broad principles of their construction are dealt with in Chapter VI. Unfortunately, fig. 19 has been printed upside down. Chapters VII and VIII deal with the electromechanical principles of the electric motor, its back E.M.F. and starting action, the evolution of motor-starters and the essential components of various types. Chapter VIII explains the economy effected by the use of motor-generators, as compared with a simple resistance in series with the arc, and illustrates this economy by actual examples. The supply conditions and classes of load for which motor-generators are economical are clearly explained; the limitations generally placed by supply companies on the size of motors connected to lighting mains and the possibility and advantages, in special cases, of running from power mains are clearly noted.

Chapter X deals with the management of motor-generators, and should prove extremely useful to operators. Chief importance is, very properly, attached to the care of the commutator, and we are glad to note that the author deprecates the use of recessed micas; "high" micas are certainly avoided by the latter method of construction, but the accumulation of foreign matter in the commutator grooves is rapid and dangerous. The notes on lubrication (Chapter XI) maintain the practical excellence of the rest of the volume, the whole of which is to be thoroughly recommended. The value of the book is greatly increased by the numerous illustrations, a few of which might, however, be drawn more neatly in later editions; it is a pity to detract from the otherwise excellent appearance of the volume by so easily remedied a defect. Operators would doubtless appreciate a section comparing, from a practical standpoint, the various types of motor-generators now available.—R. E. N.

Electrical Cooking and Heating in Canada.—At a time when so much attention is being bestowed on the development of electrical cooking and heating in this country, it is worth noticing what our Canadian friends are doing towards the same end. Quite recently, according to the *Canadian Electrical News*, the Ottawa Electric Co. replaced a standard gas stove by an electric kitchen range of the same capacity, in a house where gas had previously been used exclusively for cooking, and averaged 5,500 cb. ft. per month. The gas stove was taken out altogether, in order to ensure fair-play, and a 30-days' test undertaken. It is reported that the electric range cooked satisfactorily, except that it was found to be slower while heat regulation was not so easy. Both these difficulties were apparently due to lack of experience. A recording meter showed a breakfast load of 3—4 KW.; for the noon meal, 4—5·5 KW.; and for the evening meal, 3·5—4·5 KW.; the maximum load was 5·5 KW. Meter readings showed that 295 units were consumed, and the respective figures for gas and electricity, at $1.25 per 1,000, and 3 c. per unit respectively, with 10 per cent. discount in each case, were, for the month, $6·19 gas and $7·97 electricity. So far as mere direct cost is concerned, electricity at 2·1 c. per unit would represent equal cost, but this takes no account of the cleanliness, convenience and other advantages possible with the electric cooker. It is important to note that the above test was made by a company which controls both the gas and electric services, and therefore has no reason to favour either system. It is considered that with more experience the difference of cost would disappear.

Copper.—Messrs. Merton's statistical circular for September 30th shows that, at the end of that month, European visible supplies stood at 47,945 tons, a decrease of 2,387 from the quantity registered for August 31st. English stocks remain within 1 ton of the quantity for August 1st, the reduction being in German, Dutch and French stocks, and in the quantities afloat from Chile and Australia. In the supplies columns, we find that N. American contributions are still rather low, Spain and Portugal the same, while Chilean and Australian shipments are just under the average. The deliveries for the month are decidedly low, at 35,539 tons. The world's visible supply at the end of August was 71,181 tons, the American stocks being 20,849. This not the lowest this year, the latter being 19,793 at the end of June, but gives the impression that the U.S. demand is getting very close to supply.

Street Accidents.—Replying to a Parliamentary question asked by Mr. Kellamey of the Home Secretary, Mr. McKenna states that he is informed by the Commissioner of Police that 118 people were killed by motor-omnibuses and 21 by electric tramways in the metropolitan area from January 1st to October 8th.

COST AND CONDITIONS OF LIVING IN SOUTH AFRICA.

By A RESIDENT.

The conditions of living in Natal are, as may be supposed, somewhat different from those obtaining in the Old Country. To begin with, the climate, generally speaking, is excellent, the temperature varying from about 115° F. in the shade in the hottest coastal places in summer, at which time it is exceptionally hot, to when white frosts are on the ground in the early hours of the winter mornings; these are, however, soon dispelled by about 8 a.m. or 9 a.m. by the sun, and a lovelier climate at this time of the year cannot be imagined, the weather being bright and dry. During the summer, clouds gather, culminating in sharp and severe thunderstorms of short duration, accompanied by very heavy rains, about 5 p.m. or 6 p.m., or during the night.

The seasons are opposite to those in England, summer rains starting about August. These are usually preceded by hot winds, accompanied by dust storms, then after a short spell of fine weather, the summer sets in, and it breaks up towards the end of March, when cold rains set in, lasting from three to six or more days at a stretch.

The cost of living is, at present, somewhat over a third more than at home, though one has to pay more than this proportion for luxuries and entertainments generally. A bachelor should not undertake to come to Natal under about £200 per annum if he wishes to live comfortably. Board and lodging can be obtained in a good establishment from £5 10s. to £6 10s. per month, not including washing, the latter costing about 10s. per month, or even more. A married man cannot do much on less than £250 per annum, and I should say that £300 a year is little enough. What it costs a bachelor for board and lodging it almost costs a married man for house rent alone, before anything else is thought of. Hotel fares are from 10s. to 15s. per day.

In Pietermaritzburg a good cottage with five rooms, kitchen, pantry, boys' and out-houses, &c., also back and front verandah, with garden, can be obtained in a nice locality for from £4 10s. to £5 10s. per month, but there are also much cheaper houses, from £2 upwards in less desirable localities, among coloured people. In Durban rents are slightly higher. These prices are what obtain at present.

One requires, if married, at least one servant. This may be either an Indian coolie or a kaffir, the latter an Umfaan (young boy), from 10s. per month upwards. I pay my boy now £1 per month: he can do almost everything, including cooking and setting the table for meals, &c., and is an exception, but it all depends upon how he is trained at the outset, and a little patience without indulgence is rewarded. The language used generally in the towns between Europeans and servants is known as "kitchen kaffir"; it is a mixture of English, Dutch and the native lingo, and though a corruption of each, it suffices. One drawback to the native servants is that the boys soon get homesick and do not often stay longer than six months, so that just when they are getting used to the work a new one has to be taken on and training again begins.

The kaffir boy lives on mealy meal (this is provided by his employers, and costs about 10s. per month) and meat once a week.

The wages and salaries paid in Natal are shown below, and the list will, I think, be found to be approximately correct; the hours are eight per day :—

Skilled telegraph mechanicians ...	per annum	£180-£250
Skilled telegraph linesmen	,,	£170-£220
Cable-jointers, electric light ...	per month	£14 to £20
Stokers, electric light	,,	£13
Switchboard attendants	,,	£16 to £20
*Enginemen	,,	£13 to £14
Cabinet-makers	per day	12s. to 16s.
Carpenters	,,	12s.
Plumbers	,,	12s.
Fitters	,,	12s.
Bricklayers	,,	12s. to 14s.
Clerks, about	per annum	£150 and upwards.

* If he can do own repairs, goes to £19.

The following list of provisions and luxuries may also prove interesting :—

Boer tobacco, per lb.	2s. to 3s. 6d.
Natal cheroots (good), per 100	4s. to 6s. 6d.
Whisky per bottle, average price	6s. 6d.
Natal beer and stout, per quart, dozen	8s.
Draught beer (Natal), per glass	4d.
Cape wines per bottle, from...	9d. to 2s. 6d.
Bread, per 2lb. loaf (at present) ...	4½d.
Condensed milk, per tin	6d.
Jams, per tin	6d. to 8d
Fresh milk, per 1½ pint bottle	4d.
Potatoes, per 100 lb., vary from	5s. to 15s.
Bananas at the door, per dozen	3d.
Candles, per packet	6d. to 8d.
Paraffin oil, per case 10 gallons ...	11s
Suit of clothes, good, from ...	£5 5s. upwards.
Boots and shoes, good, from ...	£1 5s. upwards.
Rail fares per mile: See foot-note.*	
Rickshaw fares in 3d. stages.	
Meat, 7d. to 10d. per lb.	

Owing to the price of furniture, which is generally lighter than that used at home, one is disposed to do more for himself in making things than he would ever think of doing at home; and on account of the trouble of bringing furniture out, I would not recommend people to bring any. There are always plenty of sales going on, when the furniture can be obtained cheaply.

Coal costs (per ton)	£1 6 0
Firewood (per ton)	0 13 6

The former does not burn well, so has to be assisted with firewood. When leaving a house one always takes one's own stove, a custom which, I believe, prevails also in Scotland.

The prices quoted refer to the principal towns only, and for the country transport should be added.

Electric trams run in Durban and Pietermaritzburg, and there is also electric light. Speaking generally, we are not badly off for entertainments, such as concerts, theatres, bioscopes, skating rinks, travelling shows, &c. Sport is largely indulged in, especially cricket and football, and nearly everyone plays tennis.

In the country there is plenty of scope for shooting and fishing, some of the rivers being well stocked with trout. Most people ride, in town and country, bicycles being largely used.

Telephonically speaking, most places are connected, and in Durban and Pietermaritzburg there are telephone exchanges of about 2,000 and 800 subscribers respectively.

Anyone contemplating coming to Natal, should visit his tailor and lay in a fair stock of clothes, similar to those worn at home in summer; also boots and underclothing—the latter should be woollen, and of good quality. As Unions do not hold much sway in this country, a man must be prepared to adapt himself to do work other than that to which he has been confined at home, and, in conclusion, let me say that it is very inadvisable for anyone to come here on the chance of obtaining work at present. The depression, though believed to be lifting, is still felt, and there are many unemployed already in the country.

As regards the cost of living in Johannesburg, it works out at about £11 per month more than in Natal, the chief items making the difference being the higher house rents, *i.e.*, from £10 to £12 per month for a house similar to that mentioned for Natal, and the house boys £3 per month. Water is at the rate of 5s. per 1,000 gallons, and light 6d. per unit. Lodgings with board can be had for from £7 10s. to £10 per month, and washing from 12s. to 18s. per month. The climate is very dry, and it is therefore unwise to bring out furniture, as it cracks badly during the very dry part of the year. The altitude is about 6,000 ft. above sea level, and does not suit everyone, especially those subject to heart weaknesses, and very often insomnia is a great source of distress.

Entertainments are good and cheap, and good artistes are engaged at the music halls and theatres. Johannesburg is a very busy town, and several people find that they have to work harder than they were accustomed to do at home. The suburbs are excellent and well served with trams, the fares being in 1½d. stages, and living out of town one will do well to add from 15s. to £1 extra per month for tram fares. I understand that there are more motor-cars in this town per cent. of the population, than in any other town in the world, and the same remark applies to the number of motor and other bicycles. The wages for really good workmen average about £1 per day, though I fear that as the Transvaal settles down to bed-rock, these prices will not obtain.

So varied are the salaries paid up here that it is difficult to put anything down on paper, but it is safe to say that £300 per annum is not sufficient for a married man to live comfortably on, and I would suggest that no man agree to take a billet, if married, at less than £350 if he is at all comfortably off at home.

There are very many unemployed in Johannesburg. Many of them are good workers who, through retrenchment in various departments on the mines and other employing agencies, have been thrown out, and I cannot imagine a greater hardship than to be out of work in a town such as this.

The population is very largely made up of Jews, and the competition is extremely keen all round, there being much under-cutting of prices.

In winter the climate is very cold and often very windy, raising great dust storms which are decidedly unpleasant, the dust finding its way into every nook, and rendering one's clothes very shabby in a short time.

In conclusion, I would advise no one to sacrifice a certain billet to come out here, otherwise the consequences may be serious: at the same time it is well to add that the place grows on one, and the longer one stays in it the less one is inclined to leave it. The telephone exchange of Johannesburg serves about 6,500 subscribers in town, and there are very many sub-exchanges in the suburbs and on the mines.

---

*Railway Fares on the South African Railways.

These are on a scale which provides that the further you travel the cheaper it becomes (Europeans do not, as a rule, travel third here). For instance:—

Miles.		Single. 1st class.	Single. 2nd class.	Return. 1st class.	Return. 2nd class.
1	...	£0 0 3	£0 0 2	£0 0 5	£0 0 3
12	...	0 2 0	0 1 4	0 3 6	0 2 4
24	...	0 4 0	0 2 8	0 7 0	0 4 8
50	...	0 8 4	0 5 7	0 14 7	0 9 9
100	...	0 16 8	0 11 1	1 9 2	0 19 5
200	...	1 13 4	1 2 3	2 18 4	1 18 11
1,000	...	6 13 4	4 8 11	11 13 4	7 15 7

For distances exceeding 1,500 miles, first-class single is 1·35d. per mile, second ·90d., and return journeys at 75 per cent. on the single fares.

Industrial Value of French West African Rubbers.—The French Colonial Office furnishes the following information comparing the industrial value of three rubbers grown in French West Africa. The data in the following table refer to specimens of: (1) Smooth brown pancakes from Hevea-brasiliensis; 1909 crop, province of Porto-Novo: coagulation by acetic acid; (2) "Scraps" from Landolphia Heudelotii; 1910 crop in province of Kankan; natural coagulation by liana; (3) "Scraps" Ceara; 1909 crop, province of Sedhiou; coagulation by citron. The samples were treated mechanically, dried and vulcanised to 3, 5 and 10 per cent. of sulphur during three hours at 140° C. Taking fine Para hard-cure as the basis of comparison (unity coefficient in each case), the following results were obtained:—

	Hevea.	*Landolphia.*	*Ceara.*
Flexibility	1·8 %	2·4 %	1·3 %
Nerve	0·65 %	0·2 %	0·8 %
Tenacity	0·9 %	0·9 %	1·0 %
Extensibility ...	1·6 %	3·2	1·0 %
Elasticity ...	0·8 %	0·6 %	0·6 %

Compared with the Hevea from Ceylon, the Porto-Novo product has less nerve, less elasticity but greater extensibility; it has also less nerve than the Hevea from the Belland and Ong-Yem plantations in Indo-China. The Landolphia rubber is particularly flexible and extensible, but has low nerve and elasticity. Ceara rubber resembles wild Para, but has rather more nerve and less elasticity than the latter.

Electricity in the Oilfield.—According to the *Financial News*, the use of electricity in the oilfields of California is proving to be a great economy. Pumping and drilling by electricity is very much cheaper than any other method. The San Joaquin Light and Power Co. is doing a large business in this line. It is estimated that the average cost per day of pumping a well by steam is $9, while the average cost by electricity is $1·02. The majority of the wells pumped are about 1,500 ft. deep, but some of those handled by this company are 3,000 ft.

The London Chamber of Commerce.—We have received from the Chamber some literature relating to the Chamber of Commerce: "What it is; What it does; and What it offers." Particulars relating to membership, fees, &c., can be obtained on application to the secretary at the offices, Oxford Court, Cannon Street, E.C.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—The Commonwealth Customs authorities have issued the following decisions as to the duties to be levied on certain electrical goods; the duties quoted are those under the preferential tariff adopted for British goods:—

Machinery, photo-copying, continuous (electrical)	20 per cent. ad val.
Pocket lamps, electrical	10 ..
Battery cells imported with. and for, telephonic wall or table sets	10 .. ..

NORWAY.—The Norwegian Government have decided to allow the duty free admission of double tube superheaters for steam boilers, if for ships' boilers only.

DENMARK.—The Danish Customs Authorities have issued the following decisions as to the rates of duty to be levied on certain electrical and similar goods imported into Denmark:—

So-called dynamo brushes, consisting of a shaped piece of carbon, 3 cm. × 2 cm., and 9 mm. thick. On one end of the brush the carbon is coated with copper and a metal plate is soldered thereto, a piece of wire (laced copper wire) ending in a single brass contact being fastened to the metal plate	2 öre per kg.
Ignition magnets, which are intended to be attached to benzine motors in order to produce a spark to ignite the benzine when rapidly revolved by hand, and which consist of two large, powerful double magnets, between which is placed a dynamo armature enclosed in a square case consisting mainly of lacquered brass	7½ per cent. ad val.
Arc lamps, consisting of a "cap" of painted or varnished sheet-zinc, in which the machinery proper (metal rods, wire, a few iron rods and various other parts) is fixed, the lower part of this machinery being surrounded by a "case" of black varnished iron plate, less than 1 mm. thick, which is fastened to the cap with iron hooks, and on the lower part of which the globe is also to be fixed by means of iron hooks ...	20 öre per kg.

Note.—These lamps are dutiable at this rate even if they are imported in parts, though in the same consignment, provided there is no doubt that the various parts belong together and that the importer desires them to be so classed for duty.

N.B.—100 öre = 1s. 1½d.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

[illegible]. "Electric hot-air blower." F. Reiss. September 30th.

22,157. "Ignition systems for motor-vehicles." A. L. Riker. (Convention date, September 30th, 1911, United States.) September 30th. (Complete.)

22,209. "Storage and transit of incandescent electric lamps." G. Poulton. September 30th.

22,221. "Ignition devices for internal combustion engines." A. Eltsch. September 30th.

22,2[illegible]1. "Electric lamp switches." M. J. Hopcock, jun., and A. Stout. September 30th. (Complete.)

22,246. "Vapour electric apparatus." P. C. Hewitt. (Convention date, October 10th, 1911, Germany.) September 30th. (Complete.)

22,251. "Automatic controlling device for electric cut-outs." J. H. de Thierry. (Convention date, September 30th, 1911, Italy.) September 30th. (Complete.)

22,252. "Telephone receivers." British L. M. Ericsson Manufacturing Co., Ltd., and A. Brookes. September 30th. (Complete.)

22,253. "Intercommunication telephone receivers." British L.M. Ericsson Manufacturing Co., Ltd., and A. Brookes. September 30th. (Complete.)

22,258. "Electrically-heating apparatus of various kinds." E. C. R. Marks. (Landers, Frary & Clark, United States.) September 30th. (Complete.)

22,262. "Combined electric indicators and steam-flow meters." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 30th.

22,270. "Method and apparatus for commutation." C. W. Girvin. October 1st. (Complete.)

22,275. "Trolley heads." J. A. Walshaw. October 1st.

22,280. "Electrolytic decomposition." E. Higgins. October 1st.

22,308. "Apparatus for generating electricity." H. K. Boyle. October 1st.

22,311. "Oscillating spring contact for operating electric bells and such like apparatus." F. Burr, jun. October 1st.

22,328. "Electrical means for preventing the opening of doors of railway vehicles whilst in motion." G. R. Poole and E. W. Perry. October 1st.

22,339. "Indicating or meter mechanisms." G. Wall and Ferranti, Ltd. October 1st.

22,354. "Manufacture of alkali metal alloys by the electrolysis of caustic alkalis in a fused state, and in the manufacture of alkali metals, and derived products therefrom." E. A. Ashcroft. October 1st.

22,355. "Testing the waterproof covering of electric cables." C. J. Beaver and E. A. Claremont. October 1st.

22,375. "Electrical resistances." C. E. Hay and H. W. Sullivan. October 2nd.

22,381. "Electrical appliance." P. Pinckney. October 2nd.

22,387. "Sparking plugs." W. J. Charles. October 2nd.

22,412. "Means for electrical alarm signalling in connection with steam engines and machinery." T. H. Hill. October 2nd.

22,418. "Electrical regulators." O. S. Schairer. (Convention date, Otober 5th, 1911, United States.) October 2nd. (Complete.)

22,419. "Electrical regulators." A. A. Tirrill. (Convention date, October 5th, 1911, United States.) October 2nd. (Complete.)

22,423. "Starting devices for electric motors and like apparatus." G. Ellison. October 2nd.

22,446. "Means to record sounds electrically, and reproduce same by mechanical or other means." J. L. Thompson and A. S. Warne. October 2nd.

22,450. "Mine exploders." Sterling Telephone and Electric Co., Ltd. (Schaffler & Co., Austria.) (Addition to 27,318*a*/06.) October 2nd.

22,452. "Therapeutic magnetic machine." J. Cole. October 2nd.

22,470. "Locking device for keeping an electric lamp of any type, or an electric candle locked in socket and quite upright." Veritys, Ltd., and F. W. Thorpe. October 3rd.

22,477. "Switches of the tumbler kind." W. J. Charles. October 3rd.

22,491. "Electric heating apparatus." F. B. Cox. October 3rd.

22,494. "Mechanical and electrical railway fog-signalling apparatus." T. Gibson, G. A. Farmer and E. Read. October 3rd. (Complete.)

22,499. "Control of electric circuits." P. A. G. Rappis. October 3rd.

22,500. "Dynamos." J. Polkey and G. Polkey, Ltd. October 3rd.

22,505. "Diaphragm suitable for gramaphones, phonographs, telephones, and other acoustic machines and instruments." C. Ellis and G. Fox. October 3rd.

22,509. "Time lag devices for electric switches and other apparatus." M. J. Railing, J. Strachan and H. J. Coates. October 3rd.

22,520. "Variable speed dynamo-electric machines arranged in the charging circuit of accumulators." J. Peugeot. October 3rd. (Complete.)

22,521. "Electrical current generating machines with reverse compounding." J. Peugeot. October 3rd. (Complete.)

22,524. "Prevention of sparking in the control of electric circuits." W. A. Price. October 3rd.

22,530. "Sparking plugs." E. H. Deligny. (Convention date, October 5th, 1911, France.) October 3rd. (Complete.)

22,534. "Covering electric conductors with plastic material." W. S. Smith and A. D. Shuter. (Addition to 16,542, 1911.) October 3rd. (Complete.)

22,539. "Switch indicators." H. H. Berry. October 3rd.

22,542. "Conversion of electric energy." W. A. Price. October 3rd.

22,548. "Manufacture of metal filaments." Pop's Electric Lamp Co., Ltd. (C. Trenzen, Germany.) October 3rd.

22,549. "Means for suspending arc lamps." G. Schanzenbach & Co. G.m.b.H. (Convention date, May 21st, 1912, Germany.) October 3rd. (Complete.)

22,555. "Telephone fittings." Sir B. Leighton. October 3rd.

22,561. "Electric furnaces." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 3rd.

22,568. "Circles for magnetic compasses, surveying and levelling instruments." J. C. Fergusson. October 4th.

22,589. "Arc lamps." R. H. Burkitt. (Addition to 4,417, 1912.) October 4th.

22,591. "Circuit connection for electrical installations with mixed loads." Landis & Gyr. (Convention date, October 12th, 1911, Switzerland.) October 4th. (Complete.)

22,592. "Tariff electricity meter." Landis & Gyr. (Convention date, October 6th, 1911, Switzerland. Addition to 1,010, 1912.) October 4th. Complete.)

22,600. "High-tension electrical ignition devices for internal-combustion engines of the multi-cylinder type." L. A. Hindley, H. D. Hindley and W. Staniford. October 4th.

22,603. "Electrical egg tester." H. B. Garnham and A. E. Garnham. October 4th.

22,604. "Electrically controlled clocks." W. H. Burgess. (Divided application on 23,558, 1911, October 25th. October 4th. (Complete.)

22,646. "Means for controlling electrically operated mechanisms and the like." H. H. R. Green. October 4th.

22,649. "Electric signals." A. C. Brown. October 4th.

22,664. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 4th.

22,691. "Magnetic advertising machine." R. W. Suffling, P. Greig and J. Harrison. October 5th.

22,696. "Trolley pulleys of electric tramcars and the like." E. Warren, J. Warren, F. Warren, E. Warren, jun., and A. Warren. October 5th.

22,728. "Electric conductors or resistances and apparatus in which the same are employed." H. G. Dicker and S. A. Lovick. October 5th.

22,729. "Electrical instrument for use in lighting and other power circuits." J. E. Owens and H. A. Puttock. October 5th.

22,738. "Safety electric lamps more especially intended for use in mines." W. H. Hanson, H. L. Langston and Electrical Power Storage Co., Ltd. October 5th.

22,747. "Controlling devices for electric motors." A. H. Curtis, A. H. Mackley and Adams Manufacturing Co., Ltd. October 5th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford: price, post free, 9d. (in stamps).

1911.

Relays for Strengthening Weak Electric Currents. J. Schiessler. 20,320. September 13th.

Motor Feed Mechanisms for Electric Arc Lamps and Furnaces. H. J. Booker. 20,733. September 19th.

Working of Telegraph and Telephone Circuits and the like. E. S. Heurtley. 20,787. September 20th.

Speed Regulation of Electrically-Driven Ring Spinning and Twisting Frames. Siemens Bros. Dynamo Works, Ltd., and J. F. Crowley. 20,919. September 21st.

Artificial Lines used in Duplex Telegraphy. S. G. Brown. 21,000. September 22nd.

Electrical Plug and Socket Connections. A. F. Berry. 21,054. September 23rd.

Compensating Device for Telephonic Circuits. S. G. Brown. 21,069. September 23rd.

Cord Weights of Telephone Switchboards or the like. Siemens Bros. and Co. and E. A. Laidlaw. 21,165. September 25th.

Mechanism for Controlling Valves, Switches or the like at Predetermined Times. E. J. Morrison. 21,439. September 28th.

THE

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H. ALABASTER, GATEHOUSE & CO.,
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COMMERCIAL DEVELOPMENT AS IT SHOULD BE DONE.

We British have a reputation, at least amongst ourselves, for letting other nations show us how to do things; then, when the lesson has gone home, we set to work and do them better. It is not one of the traits that we should be proud of; and, happily, the saying is only partly justified. It would be easy to cite instances on either side of the argument, and it is interesting to observe that in this connection the gas and electricity supply industries in this country respectively provide us with such examples.

Some years ago, observing the admirable work done in the United States by the co-operation of a large number of electricity supply undertakings, which jointly organised an extensive campaign for the purpose of developing the business of electricity supply, we drew the attention of British central-station managers to the immense advantages to be derived from combination on these lines, and we published a series of articles on "Commercial Development," detailing the methods which should be adopted in order to emulate our American friends in their progressive and aggressive propaganda. Our example was quickly followed, and the technical Press, at least, did its duty in impressing upon our people the necessity of adopting a forward policy on sound and well-tried lines.

But little result was achieved. In America the business is almost wholly in the hands of private companies, untrammeled by statutes and regulations; here it is mainly conducted by municipalities, which not only labour under the above-mentioned disabilities, but are also hampered by the system of management in vogue, under which the recommendations of a technical or commercial expert, no matter how high his standing, are first discussed and emasculated by a Committee of laymen, and finally have to run the gauntlet of a whole Council whose members are even less conversant with the subject, to speak mildly, than the Electricity Committee. Hence it was impossible to induce the municipal authorities to take any vigorous action in the matter on co-operative lines, and, strange to say, the companies were even slower to realise its importance.

Almost the sole outcome of the movement so far has been the formation of a "Publicity Committee," which, however, is almost helpless for want of funds, and has hitherto confined its activities (save the mark!) to the emission of leaflets, posters, and similar printed matter from time to time. This, as we have pointed out, is, or ought to be, only one branch, and that not the most important, of the work that should be carried on. Lectures, demonstrations, local and travelling exhibitions, and a variety of other methods that have been discussed in our columns, ought to be provided for, and the other not neglected. The supply authorities that have not given their support to the movement ought to be unceasingly angled for, and the needs of those which have already come into the net should be examined and fully satisfied—which is not the case at present, strange as it may seem.

In brief, the movement is half-choked, struggling for life, cold-shouldered. The Committee appears to be listless and apathetic, unable to appreciate its possibilities, lacking imagination and enterprise; and the electricity supply industry, with all its vast potentialities for ameliorating the lot of the most humble worker as well as the "idle rich," is deprived of what might well be made its most effective means of development.

This is the *laissez-faire* side of the picture; the reverse is provided by our keenest rivals, the managers of the gas supply industry. Not long ago, alarmed by the growing competition of electricity—for a good thing cannot be utterly suppressed, even by its own friends—they got together and formed the British Commercial Gas Association. The objects of this organisation were precisely those which we urged on the attention of our central-station managers years ago, and have urged. It is noteworthy that the Association was incorporated under the auspices of the Institution of Gas Engineers. The first annual general meeting of the Association was held at Manchester recently, and was attended by about 400 members and visitors.

The President saw in the Association (says our contemporary, the *Gas World*) "the dawn of a fuller conviction of the unity of interest which unquestionably underlies the diversities and severances of particular gas undertakings"—was he quoting from Mr. de Ferranti, *mutatis mutandis*? It was in the cultivation of the multifarious utilities of gas that the reaction of greater prosperity would be experienced, he said, by every branch of the industry; they must employ every possible means for ascertaining the needs of every class of actual or potential user, so as to fit the service rendered or offered to the circumstances of every consumer. Three requirements presented themselves to his mind: publicity; sales organisation; service development. The President went on to explain that local publicity could be far more economically done with the aid of co-operation; the results already obtained had more than satisfied the subscribers.

The report of the General Committee stated that the list of supporters of the Association included the names of 256 undertakings, and the annual income was £12,500; this was fully utilised in promoting the objects of the Association, which wants more—and will get it. In the first year over 700,000 pamphlets, postcards, &c., had been sold, at a very low price.

We have not space here to detail the proceedings at the general meeting, but we may add that it appears to have been a most successful function. The point we wish to emphasise is that while the electrical people, with an ideal commodity for sale, are temporising with the question, the gas people, although handicapped by the peculiar qualities of their product, are proceeding to carry out with energy and success precisely that policy which we have so often urged upon the former—preaching, alas! to deaf ears.

As we have pointed out, this thriving and very much alive Association was initiated by the Publicity Committee of the Institution of Gas Engineers. We have in the Institution of Electrical Engineers an Industrial Committee, whose functions approximate, at least in spirit, to those of the aforesaid Publicity Committee. It appears to us that the duty of the Industrial Committee is plain; it is to carry into effect the policy advocated by the President, Mr. de Ferranti, and enthusiastically endorsed by the members of the Institution—to promote co-operative effort, to organise a propaganda—in fact, to follow, where it should have led, and to inaugurate just such a campaign as is being established by our rivals. Words are of no avail—action is the thing. Let our watchword be "*Organise*"! The American electrical engineers, the German gas engineers, the British gas engineers—in fact, everybody's doing it. Why don't we? Already the Association has made arrangements for a Jubilee Gas Exhibition, to be held next October at the White City. Can we not provide a necessary and salutary counterblast?

Registration of Contractors.

The announcement that the Corporation of Liverpool is about to publish a new "Current Official List of Corporation Contractors," and that contractors must pay a registration fee of 5s. for the privilege of having their names on this list, suggests a legal question of some nicety. It may be presumed that when tenders are invited, the tenders of contractors whose names are on this list will alone be considered. Any local authority which thus restricts the number of would-be tenderers runs into the danger of infringing any law which provides that tenders shall be advertised. Thus it is provided by the Public Health Act, 1875, Sec. 174 (4), that "with respect to contracts made by an urban authority under that Act, the following regulations shall be observed, namely, ... (4) Before any contract of the value or amount of one hundred pounds or upwards is entered into by an urban authority ten days' public notice at the least shall be given, expressing the nature and purpose thereof and inviting tenders for the execution of the same; and such authority shall require and take sufficient security for the due performance of the same." If to be on the list were a condition precedent to the chance of having a tender accepted, it is obvious that the object of advertising for tenders would be to a large extent frustrated, and we fancy that the Local Government Board might have something to say as to the imposition of such a condition.

Turkish Railway Schemes.

It is announced from Constantinople that notwithstanding the present critical period, the Ministerial Council has found time to settle in favour of the Deutsche Bank, on behalf of a group of German, Belgian and French financiers, the question of the concession for the construction of an underground metropolitan electric railway in Constantinople. The grant of the concession to this group, which is termed the Constantinople syndicate, would appear finally to dispose of the competitive scheme promoted by the French Omnium syndicate. The project sanctioned comprises the construction of a railway from Taxim to Bajadiz, and the undertaking is said to represent the sum of £2,800,000. It will, perhaps, be remembered that the lead in the Constantinople syndicate is taken by the Belgian Société Financière des Transports et Entreprises Industrielles, which is closely associated with the Berlin Löwe group. Among the constituents of the syndicate are the Deutsche Bank, the German Orient Bank, the Dresden Bank, the National Bank for Germany, the Schaaffhausen Bank Verein, and the Berlin Electrical Enterprises Co., several large French banks, and the Belgo-Hungarian financial group of Ganz & Co.; whilst Turkish finance is represented by the Ottoman Bank and the Banque Salonique. The syndicate already controls the Constantinople tramways, which are in process of conversion to electric traction, and which are to be extended by the construction of 13 miles of new lines; the Galata-Pera tunnel railway; the Stamboul gas works, and the Ganz electric lighting concession for Constantinople. It is intended to transform the syndicate into a Belgian company with a share and loan capital of £3,600,000, although the course of political events will probably cause delay in the completion of the transaction. This state of affairs is also expected to defer the execution of the project for the construction of the proposed Bosphorus electric railway, the concession for which was obtained some time ago by the Berlin firm of Lenz & Co., with whom the A.E.G. is believed to be associated in the matter. The firm made a deposit of £35,000 with the Turkish Treasury, and it was recently reported that the Deutsche Bank had offered to pay this amount to the firm if the latter would abandon the Bosphorus railway, which, for a section of the route, would be in competition with the proposed underground railway. The report, however, has proved to be incorrect, whilst the discussion which proceeded some time ago, aiming at the conclusion of an understanding between the syndicate and the Lenz group, is understood not to have been renewed.

ROTHERHAM TROLLEY 'BUSES.

The trolley omnibus system which has recently been inaugurated by the Corporation of Rotherham possesses several features of interest. It includes, in addition to the Rotherham-Maltby route which is now in operation, two other sections of 2¼ and 2½ miles respectively. The Corporation has obtained motor-'bus powers within the borough boundaries, and over an external route subject to the consent of the local authorities concerned. Over the Maltby route, the Corporation previously held motor-'bus powers, which automatically lapsed on the commencement of the trolley-'bus service. Other proposed trolley-'bus routes have not been sanctioned, and there has been considerable railway opposition to the granting of those powers which have been obtained. This is the first case in which a local authority has obtained powers to run trolley-vehicles outside its own boundaries.

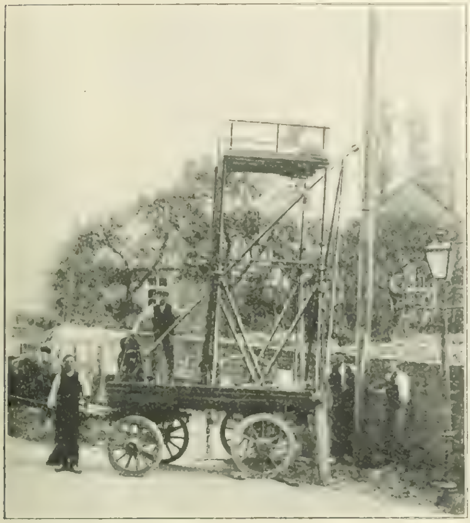

Fig. 1. Home-Made Pole-Setting Wagon.

The Rotherham-Maltby trackless trolley route will be, for a time, the longest in the country. Starting from the terminus of the tramway extension (1·7 miles from the centre of the town), it passes through the villages of Wickersley (1·8 miles from terminus), and Bramley (2·66 miles) to Maltby (4·75 miles). Until the road widening near the tramway terminus has settled, the 'buses will run 0·64 mile nearer to the town.

Though the route is very undulating, the steepest gradient is 1 in 13·7. There are many curves, and, as a result, the "rake" of almost every pole has had to be different from that of its neighbours; the line work has been further complicated by the fact that some of the poles rest in soft clay and need a cross-rail, while others have to be placed in solid rock.

The district traversed is, at present, sparsely populated, but the opening of the new collieries near Maltby is leading to a rapid growth of this village. Wickersley and Bramley have no railway service, and the only rail communication from Rotherham to Maltby is *viâ* Doncaster, so that the new service will benefit residents along the route, and, while carrying trade to Rotherham, will also benefit local tradespeople by opening out the district for residential purposes. On account of the pretty country, a considerable holiday traffic can be depended upon, and the situation of the collieries at Maltby is such that they are not likely to impair the scenery for some time to come. The populations along the Maltby route are: Wickersley, 960; Bramley, 1,340; Maltby, 1,750; total (in 1911), 4,050. For the present, three standard R.E.T. 'buses are to be employed, and there is little doubt that, in a few years, the increased population along the route will justify the laying of tramrails, thus liberating the 'buses for use on other routes.

The Thrybergh tramway extension was opened for traffic on August 23rd, 1912, and the new 'bus service and Broom tramway extension on October 3rd, 1912. Owing to the recent coal strike, it was impossible to obtain penalty contracts for the line material required, and there has, consequently, been much delay in the delivery of poles. The necessary road widenings are completed to the present 'bus terminus at Maltby, but if it is ever decided to run the 'buses right into, or through, the village, costly street widenings will probably be insisted upon.

In the course of the present extensions, Mr. Lilleker, mains superintendent, has designed and built the ingenious pole-setting wagon illustrated in fig. 1. The tower structure and the jib and struts are composed entirely of standard trolley-pole arms, brackets, tie-rods, &c., erected on an old stone dray, and completed by a simple hand-winch. The cost of this serviceable equipment, which took four days to build, was about £18 (excluding the winch): for an orthodox pole-planting wagon, manufacturers asked £70-£80, and could not deliver in less than three months! The vertical columns of the tower are bracket-arms (with the strut-bars left in place), and the semicircular clamp-ends are bolted through wooden beams and the bottom of the dray. Guard-wire and span-wire clamps and cut-down tie-rods are used, as shown, and practically the whole of the material is available for ordinary use if it should ever be decided to demolish the tower.

The height of the platform is 16 ft. from ground level, but by notching the planks of the platform and increasing the slope of the jib, a greater lifting height will be obtained. Though primarily designed for pole-setting, the structure can be used as an ordinary tower wagon, and finds innumerable applications in loading and unloading drays and shifting drums, piping, and so on. The side tube (here shown reinforced by a wooden prop), is dropped to ground level and clamped whenever it is desired to relieve the dray of a tipping load, and a pulley at the back of the wagon enables a flexible steel rope to be run laterally to any article which has to be moved transversely before being lifted. The hoisting gear has been tested to 30 cwt., and six 8-cwt. poles have been set per hour (50 poles, or 1 mile of route, per day), by its aid.

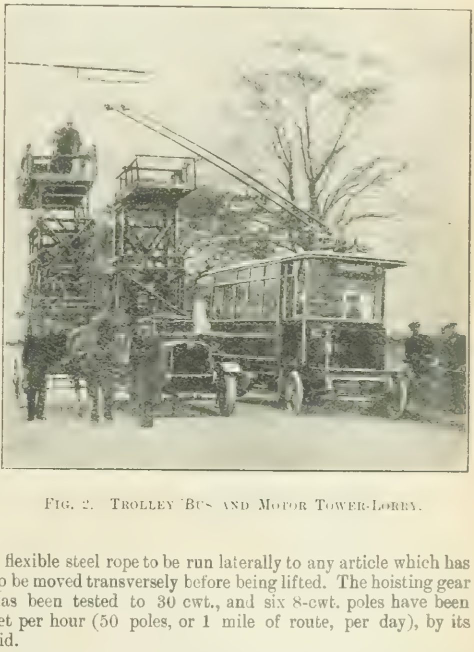

Fig. 2. Trolley 'Bus and Motor Tower-Lorry.

Four 0000 trolley-wires are erected over the 'bus route on standard tramway poles and brackets. The pitch of the poles ranges from 30 yards at bends to 37-40 yards in straight runs; the length of the bracket-arms varies from 14 to 18 ft., only a few of the longest lengths being required.

At present, the whole 5·34 miles of route is to be fed through suitable meters from a feeder carried to the tramway terminus, and, as the trolley line is double throughout, and only three 'buses are to be used, it is expected that the voltage drop at the furthest vehicle will not exceed 50 volts (except temporarily). If necessary, a positive feeder will be carried 2 or 3 miles along the route, probably in the form of a fifth overhead wire hung near the inner end of the brackets.

The 'buses are to be of the R.E.T. standard, single-deck rear-entry type, and are practically identical with those already in use at Bradford (Electrical Review, March 29th, 1912, page 492, *et seq.*). Fig. 2 shows the very roomy body employed and the covered-in driver's platform. The swivel trolley head, already described in these columns, enables the trolley boom to clear very high vehicles immediately below the overhead lines (see fig. 2, which incidentally shows the Tramways Department's powerful motor lorry provided with telescopic tower and complete testing equipment for line work). The tare weight of the vehicles will be 3 tons 12 cwt. (considerably less than that of the Leeds and Bradford vehicles), and the total weight with 28 passengers, driver and conductor will be less than 5 tons. A separate smoking compartment is provided at the rear of each 'bus accommodating 16 passengers, and 16-c.p., 105-volt traction carbon lamps with anchored filaments are used for lighting. The vehicles will turn on a radius of 12 ft. (inner rear wheel track). Shrewsbury Challoner tires are used, 32 in. diameter × 4·5 in. on the front wheels and 36 in. diameter × 8 in. (twin), on the rear wheels. The makers guarantee the tires for 10,000 miles, or grant an equivalent cash rebate.

The 'bus specification calls for a speed of 12 m.p.h., fully laden, up a 1 : 10 grade and requires the brakes to stop the vehicle fully laden, from 20 m.p.h. on a 1 : 9 down grade. Two 20-h.p., 525-volt motors are provided, and it is probable that the chain gearing hitherto standard will be abolished or a much heavier type substituted. The insulation of the motors (fully connected), between windings and case, with brushes down, is to be at least 5 megohms, and the windings must withstand 2,000 volts a.c. for 5 min. when at the maximum temperature (not higher than 75° C. above atmosphere) reached during a one-hour full-load test.

A half-hour service is to be maintained, the first 'bus leaving the Maltby terminus at 8·55 a.m. The fare will average 1d. per mile (6d. all the way, with 1d., 2d., 3d. and 5d. stages), and a revenue of about 9d. per 'bus-mile is anticipated. The motor char-à-banc lately running over the route has never had occasion to claim the subsidy promised by the Corporation, so there is little doubt that profitable operation of the new service can be secured.

The estimated capital cost of the three trolley 'bus routes is as follows :—

Feeders, overhead lines, poles, &c. (including erection and 10 per cent. contingencies)	£30,619
Trolley 'buses (14 at £750)	10,500
Proportion of Parliamentary costs	1,000
Total, excluding any allowance for road widenings	£42,119

The tramway department is to pay ⅜d. per 'bus-mile to the road authority on account of road upkeep.

Wages in the Manchester District.—There was recently held in Manchester a conference between employers and employed in the engineering trade of the district, at which consideration was given to an application for an advance of wages made on behalf of 13 Trade Unions, with a membership of more than 12,000 workmen. The *Times* states that it was decided to submit the following terms to a ballot of the societies concerned :—An advance of 1s. in day rates, and of 2½ per cent. in piece prices, the first pay at advanced rates in November. A further advance of 1s. in day rates, and 2½ per cent. in piece rates, to be paid in January. Wages to remain unaltered for three years from January next, and subsequent changes to be subject to three months' notice on either side.

HOLBORN STREET LIGHTING.

Our readers will remember that last year, after tendering against one another for the contract for the public lighting of the borough of Holborn, the rival interests joined hands and submitted a joint tender for the work, which included the supply of all the necessary plant and the maintenance of a specified candle-power for the term of 10 years, at an inclusive payment of £7,645 per annum. Having practically no alternative, the Borough Council accepted this offer, which was but little in excess of the amount paid during the previous 10 years, but provided a greatly increased candle-power and improved illumination throughout the area. The capital expenditure required in respect of new columns, lamps and fittings, &c., was estimated to amount to about £9,000; the annual payments for the extinction of this outlay were included in the contract amount above stated, and at the end of the period the new fittings, &c., were to become the property of the Council. The work was put in hand, the gas lighting being carried out by the Gas Light and Coke Co., while the electrical work was done by the Metropolitan Electric Supply Co., acting in conjunction with the Charing Cross and City Co., and the County of London Co., which are each supplying a portion of the lamps. The electrical part of the contract was put in operation on October 9th.

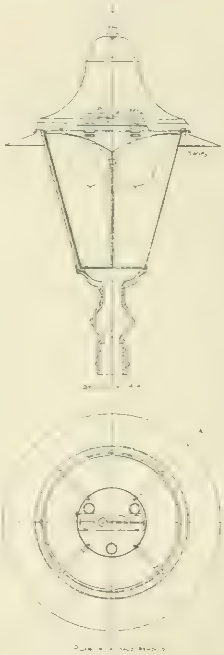

Fig. 1.—Details of Lantern.

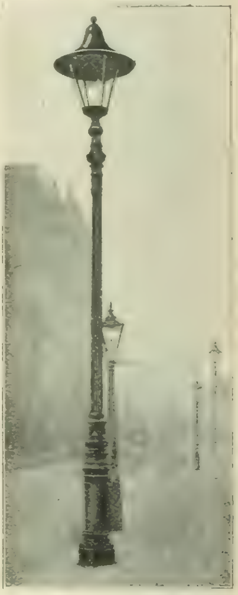

Fig. 2.—Electric Lighting Standards in Holborn.

The whole of the electric lighting has been carried out with incandescent metallic-filament lamps, of the Osram and Mazda types. These are mounted in lanterns of improved pattern, to the design of Mr. J. S. Highfield, chief engineer to the Metropolitan Co., and similar in principle to the ceiling lamps and outside lanterns which are also made under his patents.

The installation comprises an aggregate of about 186,000 c.p., distributed over 13 miles of streets, and is supplied with electrical energy at both 100 and 200 volts, partly d.c. and partly a.c. The supply is derived from the ordinary distributing mains in each locality, and the lamps are switched on and off individually by hand. Five different lighting units are employed, in accordance with the original specification, but practically the lighting is effected almost entirely with three of these; their candle-power and the number employed of each are as follows:—

C.P.	1 800	600	400	200	90
No. of standards ...	20	5	212	4	717
Distance apart, yards	30	—	15	—	25

In the principal thoroughfares, which are about 60 ft. wide, the lamps are mounted on columns at a height of about 18 ft. from the ground; in the minor streets they are about 10 or 12 ft. high. Almost all the columns are fixed on the footway, and the system of centre suspension from span wires, much favoured by the City of London Corporation, has not been employed in Holborn. Access to the lanterns is obtained by ladders.

The importance of a handsome appearance in the daytime, in addition to high illuminating efficiency at night, has been borne in mind in the design of the lanterns and columns, which are of a novel pattern. The lanterns were made by the General Electric Co., Ltd., Messrs. Veritys, Ltd., and Mr. Haydn Harrison, and are illustrated in sectional elevation and plan herewith (fig. 1). They are practically airtight, and the interior is accessible only through the top. The glass enclosure is of the form of an inverted cone, with four bars, which offer practically no obstruction to the light, and the weekly cleaning is confined to the outside of the lantern. The inside is cleaned only when new lamps are required, and thus the cost of cleaning, as well as the risk of breaking the lamps, is very much reduced. The reflectors are designed to deflect a large portion of the upward rays, so as to aid the illumination at a distance from the columns, and are carried on floating springs, as shown in the section. The switches and fuses used are those of the General Electric Co., Ltd., and Mr. Haydn Harrison, and the connections to the mains are made with rubber-insulated wires.

A general view of a column and lantern is given in fig. 2; the columns are fixed to special concrete bases, about 18 in. of their length being below the ground level. The lamps are kept burning all night. The largest size of lamp employed is of 600 C.P., the 1,800-C.P. lanterns carrying a group of three of these.

Photometric curves showing the distribution of illumination are not at present available, but the lighting, as judged by the eye, is very effective.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Trade with Australia.

Your issue of August 16th is just to hand, and I have read with interest and appreciation the articles on "Australian Trade."

There is no doubt that Mr. Hamilton-Wickes has done an immense amount of good.

At the present time there is a great tendency in favour of goods "Made in England," and it behoves manufacturers to take every advantage thereof at once.

We represent English, U.S.A. and Continental houses, and this is what we find:—

(*a*) American and Continental manufacturers keep us well posted with catalogues of every description, whilst we have to write to English advertisers to send them.

(*b*) English price lists do not contain such full details as those of their competitors.

(*c*) English houses do not seem to bother to go to the pains to give information in reply to inquiries that their foreign friends do.

(*d*) Continental suppliers appear to make it a pleasure to please and they give careful study to meeting local requirements, whereas English houses expect us to adopt their standards.

(*e*) German and U.S.A. manufacturers push for business energetically, and are real "triers"; on the other hand, we, as a rule, find it necessary to approach British companies.

(*f*) Foreign firms are always ready to cut prices and meet competition; Britishers do not seem to care what the outcome of their quotation is.

(*g*) Foreign deliveries usually appear to be more prompt.

Continental and U.S.A. firms are well represented in Australia, and, despite preferential Customs tariff, are evidently holding their own.

British firms need to wake up; we Australians are patriotic, and push forward British goods whenever we can, although there is more profit in foreign goods; but the local tendency is price first and quality next. Even so, if by paying a little more we can buy the English article, we usually do so.

To get more hold of the colonial markets, the British firms should lay themselves out to study our special requirements.

On one occasion we invited an English firm in one of the Midland counties, and a Berlin manufacturer, to tender to a certain specification, copy of which and sample could be seen at the office of the High Commissioner in London. The Berlin company sent a man to London, but the English one intimated that they did not think it worth while! The tender was worth £21,000.

We could give other instances which have disgusted us at various times.

Britain First.

Australia.

Liability of Engineers.

A matter has come to my notice which is of more than mere interest to all steam users.

I have all my steam pipework insured, and I have lately received intimation from the Insurance Co. that although they still agree to insure it as it stands, they recommend the removal of all cast-iron. Our steam pressure is 160 lb., no superheat, the pipework is steel, and the valve bodies and separators are cast-iron.

I pointed out to the company that the wording in the latest Hopkinson valve catalogue which I have is "For 160 lb. pressure cast-iron bodies and covers," "For 225 lb. pressure cast-steel bodies and covers," but they still continue their "recommendation."

Now, in the event of an accident and Board of Trade inquiry, what is my position and that of all other engineers who have received such advice? Again, how far should the recommendation be carried? Should one include boiler fittings, such as safety valves, engine stop-valves, separators, high-pressure steam chests and cylinders?

Steam engineers should realise that, even though insured, they stand to be personally fined if negligence is brought home to them at a Board of Trade inquiry.

H. M. Taylor,
Borough Electrical Engineer.

Middlesbrough, *October* 18*th*, 1912.

Fuse Formulæ.

Various formulæ have been suggested from time to time relating the minimum current necessary to fuse a wire to the diameter of the wire. The best known is, perhaps, $C = a\,d^{3/2}$, where a is a constant.

Dr. Russell, also, in a paper read before the Physical Society some time ago ("The Convection of Heat from a Body Cooled by a Stream of Fluid"), deduces a result which gives $C \propto d^{1\cdot25}$.

This formula Dr. Russell compares with experiments made by Schwartz and James, and gives a list of their results, showing that the index varied between 1·20 and 1·32 for certain wires of various substances. On referring to Schwartz and James's paper, I was somewhat surprised to find that the index varied widely for the same material. For instance, for copper, from 1 to 10 amperes, the index obtained was 1·195, whereas from 10 to 100 amperes the index was 1·403, for tin 1·13 to 1·32, and for aluminium 1·46 was obtained.

Dr. Russell, in deducing his formula, assumes, as is usual, a steady state existing between the gain and loss of heat, and also that the heat generated per second is proportional to $C^2 \rho_0/\pi a^2$, where ρ_0 is the volume resistivity (whatever that may mean), and a the radius.

The former of these assumptions is a fairly reasonable one under certain conditions, but why should $R = \rho_0/\pi a^2$? As regards many substances, R could never be arrived at in this way even approximately, and it is a huge jump to assume it so.

Again, if we adopt Dr. Russell's formula for the cooling of a strip by convection, we ought to obtain a formula the fusing current for strips. Dr. Russell does not do this for some reason, but I have, and the results obtained do not agree with Schwartz and James's experiments.

For example, I get $c \propto b^{\frac{3}{4}} t^{\frac{1}{2}}$,

whereas Schwartz and James get—

$$c = \mathrm{A}\, b\, (t + k) \text{ or } c = \mathrm{A}\, t^{\frac{3}{4}} (b + k).$$

where b and t are breadth and thickness, A and k constants.

I have come to the conclusion that convection plays only a part in the phenomena of fusion of wires, &c., and I think that Dr. Russell was rather hard on electricians when he stated, "before this paper was published, electricians making the assumption that the heat emitted per unit surface was independent of its radius deduced that n should be 1·5."

I suggest that at present these poor people are not so far wrong after all, and that the index 1·5 is for some wires just about as unsuitable as 1·25.

W. H. F. Murdoch.

Millhill, Middlesex.
October 21st, 1912.

Generating Plant for Village Lighting.

I should like the advice of some of your readers as to what power to use for generating in the following circumstances:—I have charge of the generating station in a small village, with only 500 lights connected; this number is, however, steadily increasing. A small syndicate of local people owns the affair. As it was not easy to raise money for electric lighting in a little place like this, everything has been done in the most economical manner. There is at present only one engine, and this a steam engine. I believe the general opinion is that steam is out of the question in a case like this. Well, there is this to be considered. We can get good slack at 10s. per ton delivered. Our station is in a situation where smoke is no objection, and a brook of splendid water for the boiler runs through the premises. The engine and boiler are semi-portable, undertype, single cylinder, with governor acting on expansion valve, made by a first-class firm. It was bought, in perfect condition throughout, for a quarter of its cost new. With cold feed water, my fuel cost per unit sold is at present 1·1d. per unit (please don't laugh). Pressure only 65 lb., and non-condensing.

Supposing that only one engine can be afforded, should we be wise in changing over to gas or oil? I refer, of course, to suction gas and semi-Diesel oil engine, as the power required now is only 11 H.P., and will perhaps never exceed 20 H.P. The main question is as between low capital cost, high generating cost, and reliability on the part of steam, and (comparatively, being new engines) high capital cost, low fuel cost, and reliability, or unreliability on the other hand. Whatever steam may be called, we have never had a hitch, and the bogey of banking-up losses is not such a great one as might be imagined.

I don't know whether this letter is suitable for your paper, by the side of 30,000-H.P. turbines, &c., but I know that this small subject is of interest to many people, and through the advent of the metal-filament lamps these tiny stations in rural districts are going to multiply. And there are any amount of engines of the type mentioned going at almost scrap prices, although in perfect order.

A Little Man.

The Use of Mica in Electrical Apparatus.

With reference to the article by Messrs. Fleming and Johnson on the above subject, we should like to point out that the statement regarding the annealing of mica is not at all in accordance with our experience.

We would state that "silver mica" which we have placed on the market is almost entirely the product of a special annealing process. This material has for several years proved itself, in practical use, to be of extraordinary softness; it is used in very considerable quantities, and its use will lengthen the life of a commutator to an appreciable extent. Naturally, the process is one which requires the closest attention to achieve satisfactory results.

Silver mica has the same insulating properties as natural mica, and we have never noticed any tendency to disintegration; indeed, it has almost the same solidity as natural mica.

As regards price, there is also no considerable difference as compared with natural mica, especially as "Megohmit" (Micanite), sheets are made up in exactly the same way as with natural mica, thus enabling large sizes to be used at a minimum cost. Generally speaking, the material combines the advantages of natural mica with an otherwise unobtainable softness.

Further particulars are at the disposal of any of your readers interested.

Per pro **Meirowsky & Co., A.G.**
D. H. Schultz.

Manchester, *October 21st*, 1912.

Boiling Water.

I have carried out a test with a gas ring, in order to ascertain the cost of gas boiling, and give herewith the figures obtained, which should be useful to those who are improving the efficiency of electric boiling plates. Possibly someone would furnish particulars of a similar test with electricity:—Starting all cold (14° C.); volume of water, 2 pints measured; weight of kettle, 1¼ lb.; time to boil, 7½ minutes; gas used, 2·17 cb. ft.; cost at 1s. 11d. per thousand, ·05d.

The kettle has a copper bottom and sides, and also a small tube through the middle, which tube does not, however, increase the efficiency very much.

Electrician.

NOTES FROM CANADA.

[From our Special Correspondent.]

The Hydro-Electric Power Commission, of Ontario, has just announced a substantial reduction in rates, to take effect on November 1st next. Of the more important towns, 17 are to benefit by amounts varying from about 3 per cent. to over 10 per cent.

The cheapest rate is £3 6s. 8d. for one horse-power-year, 24 hours per day, and the prices range up to £8 11s. For very small towns and villages very remote from the generating stations, the cost is higher still.

The chairman has announced that, after paying full interest charges to the Government (Provincial) amounting to some £30,000, there is still £10,000 left.

It is probable that next year further reductions will be made in the cost of energy, owing to the expected increase in the demand, which, by the end of the current month, will already have reached 30,000 H.P. This is an excellent result, considering that, with the exception of the few fairly large towns in Ontario, such as Toronto, Ottawa and Hamilton, all the rest of the towns are little larger than villages. Under the new rates Toronto's bill for power will be reduced from about £48,000 to £43,000 per annum. It was reported some time ago in these "Notes" that the Commission intended to act as a purchasing agent for the various municipalities. This work has now been actively taken up, and the Commission has been able to make contracts for large quantities of material on much better terms than would have been possible for the individual municipalities; better delivery is also secured, the Commission being a large, and, therefore, important buyer. Later on other advantages will be possible of attainment, as the Commission will have its own testing laboratory, and will be in a position to carry out suitable tests on lamps and other articles, so that, taking into consideration price, life and other factors, the municipalities will be able to buy materials of such a class as will best suit any particular requirements.

The Commission now also employs an auditor whose duty it is to investigate the financial standing of the electricity departments of the various towns. A standard system of accounting has been developed and is being widely adopted, weak spots in administration and business methods are brought to light, and the Commission recommends what it considers to be a suitable remedy.

It is evident that, particularly to the small towns and villages, such services as these are of immense benefit, as otherwise they must struggle on with inefficient plant, administration and unsatisfactory conditions generally, in many cases for years, as not a few of them have actually been doing.

Of course, as in the old country, municipalities here have a little way of overlooking such little items as depreciation and sinking fund, and go on merrily enough for a while. Now, however, the Commission is laying its finger on these matters, and it would be a bold Town Council that ignored the recommendations of the former body on such points.

Mr. Hamilton Wickes, the new Imperial Trade Commissioner, has arrived in this country, and is gathering information from all and sundry to enable him to deal with some of the problems which confront him. His task here will be somewhat different from what it was in Australia owing to the preponderating influence of the U.S.A. So far as the British manufacturer is concerned, electrical goods may be divided into two classes.

(*a*) Those in which American influence, as regards standards and patterns already ruling in the country, is very great.

(*b*) Those in which there are as yet in Canada no definitely accepted standards and patterns.

In class (*a*) come all those fittings and materials which are governed by the National Electric Code, such as conduit, small switches, fuses, insulation of wires and cables, &c. Extra-high-tension insulators, transformers, switchgear, &c., also come in this class, owing to the entire lack in Great Britain of any means of gaining practical experience of such apparatus—not until power is generated in bulk at the coal mines, and the Board of Trade permits overhead lines for 100,000 volts and more to be run across country, can the British manufacturer hope to enter the market for the latter.

In class (*b*) come central station plant, prime-movers, generators, motors, batteries, switchboards, instruments, electricity supply meters, and underground cables, especially for high voltages (say, 20,000 and upwards).

In class (*a*) it is not unlikely that American practice will always govern the situation, to a great extent, if not entirely, but in class (*b*) there is still hope for the British manufacturer, and the sooner he gets in the better, not only for himself, but also for Canada, as greater competition will be introduced and prices therefore kept down to a reasonable level.

Undoubtedly, the fact that in respect of the first-named materials in class (*a*) only Canadian and American firms are, practically speaking, in competition with each other, and that most of the former are closely affiliated with the latter, tends to keep up prices to an extent which would not be possible were other nations to enter the market.

There is a kind of double tariff wall in action here—*i.e.*, there is the ordinary Customs tariff on those materials, and on top, as it were, of that, comes the additional barrier due to the difficulty which firms outside of the American continent experience in getting their products approved by the Chicago laboratories; so far this has practically excluded competition in the lines of goods indicated from outside sources.

German Trading in Spain.—The number of dynamos, motors and transformers invoiced by the Madrid branch company of the Siemens-Schuckert Works in its first year of trading (1911) represented a total of 121,276 H.P. After defraying general expenses, interest on loans and taxes, and placing £5,000 to the depreciation account, the net profits are returned at £10,000. It is proposed to pay a dividend of 5 per cent. on the ordinary share capital of £180,000, and to carry forward the balance. The loan capital amounts to £60,000.

PROCEEDINGS OF INSTITUTIONS.

Sources of Energy Available for Power.

IN the course of a Presidential Address by DR. H. S. HELE-SHAW, F.R.S., M.Inst.C.E., before the ASSOCIATION OF ENGINEERS-IN-CHARGE, on October 9th, the author reviewed the available sources from which power can be derived. Dealing first with coal, he stated that our present annual output was about 230,000,000 tons. Assuming the present rate of output to be maintained, our coal resources would last more than 400 years.

From data collected by Dr. Beilby, it was evident that there might be a possible saving of nearly one-third of the whole amount used. To the steam turbine we owed a considerable advance towards possible limits of thermal efficiency of the steam engine. The Hon. Sir Charles Parsons stated that the upper limit of temperature to which working was possible had been nearly reached, and remarked (report of the British Science Guild):—"The highest efficiency realised by any steam engine up to the present is about 12½ lb. of steam per KW.-hour, which is equivalent to 9 lb. per shaft horse-power, or a little over 1 lb. of good coal, or about ·85 lb. of oil burnt under a good boiler. This result has been obtained with units of 10,000 H.P. working at full load, with a steam pressure of 200 lb. gauge, superheated to a temperature of 300° C., and exhausting into a vacuum of 1 in. (absolute) of mercury. It represents a conversion of about 70 per cent. of the available energy of the steam into mechanical power, or a conversion of about one-fifth of the heat in the fuel into mechanical work." . . . "In practice, a temperature is soon reached beyond which the increased deterioration of the superheater, boiler and engines more than counterbalances the saving in fuel, so *that finality in this direction is soon reached, and, in fact, has already been nearly approached.* At the lower end of the cycle, the temperature of the condenser being determined by that of the circulating water, there is not much scope for improvement in this direction. There is, however, a probability of some improvement in boiler and engine efficiencies by the reduction of petty losses, which, in the aggregate, represent a loss nearly equal to the total energy realised as mechanical work. These losses are about equally divided between the boiler and the engine, and have for many years been the subject of much careful thought and investigation. The conclusion at present appears to be that the boiler and the steam engine may be improved to some considerable extent by small economic improvements in the method of combustion, in the efficiency of heat transfer in the boiler and superheater to the working fluid, and in the engine itself, *but that no further substantial improvement is possible in the condenser.*"

Coming next to the internal-combustion engine, Dr. Dugald Clerk remarked: "With regard to the future, it is possible in a large engine, *i.e.*, gas engine, to increase the indicated thermal efficiency to about 50 per cent., but in such an engine the mechanical efficiency obtained would be about 40 per cent. The smaller gas engines do not give quite such good results, but the falling off is not great." . . . . "A very large amount of power can still be obtained from the blast-furnace gases evolved at British ironworks. Assuming 10,000,000 tons of pig-iron to be made in Britain per annum, and allowing for the free gas available after heating the blast, about 700,000 H.P. could be continuously developed in Britain *without burning any additional fuel.* Some of this gas is used for motive power, but the greater part of it is still wasted. The gases evolved in modern coking processes can be collected and used for motive power. From this source it is possible in Britain to obtain about 140,000 H.P. continuously. Engineers are busily engaged at present in attempting to utilise all sources of motive power, and at no previous time have they paid greater attention to waste gases and waste heat than at present. The waste heat carried away in the exhaust gases of gas engines is utilised in many cases for raising steam, and about 2½ lb. of steam at over 100 lb. per sq. in. pressure can be obtained per hour per B.H.P. The exhaust steam, too, from rolling mill engines and other engines using little expansion, is being largely applied to operate low-pressure steam turbines. Practically all the waste heat from gas engines, amounting to about 50 per cent. of the total heat of combustion, could be utilised in some such manner."

Considering next the available supplies of petroleum for use as motive power, Dr. Sir Boverton Redwood stated that the quantity produced per annum all over the world was approximately 38,000,000 tons. "If the whole of this crude petroleum were employed as fuel in steam raising, it would not replace, allowing for its higher thermal efficiency, much more than 5 per cent. of the world's output of coal; whilst, if used in internal combustion engines, it would be equivalent, as a source of power, to about 15 per cent. of the coal. Only a small proportion, however, of the crude petroleum could be regarded as available for use as a source of power, for by far the larger part is in demand as an illuminating agent, and as a lubricant for machinery."

It was generally assumed that the power of both wind and water cost practically nothing. Quite apart, however, from the rental of the necessary land, the up-keep of wind and water mills was by no means a negligible quantity; but the really unsatisfactory feature of such power was its uncertainty and intermittent character. A good deal might be done to conserve the water power now running to waste in this country, but we could not hope to derive power from this source with an effect such as might be witnessed in other countries. At present tidal power could not compare with steam power, even putting the cost of coal against the rental of the necessary land in this country. Dr. Louis Bell, a few years ago, taking as an illustration the possibilities of the 40-ft. tides in the Bay of Fundy, showed that for two runs of 5 hours each, more than 50,000 H.P. were available per sq. mile of reservoir, and that if the area between two head-lands 3 miles apart (an area of 400 sq. miles), could be converted into a tidal basin, more than 20,000,000 H.P. would be available: but to utilise it would require an engineering feat more tremendous than anything yet attempted by man. These figures, however, were interesting, as showing there were sources of power which, in the event of the exhaustion of our fuel supply, might at some future date have to be utilised.

Concerning the action of the wind, it took a fairly large windmill to produce any reasonable effect. For instance, a windmill with four sails, each 24 ft. long, and from 6 ft. to 9 ft. broad, making 16 R.P.M., and actuated by a fairly good wind having a velocity of 20 ft. per second, had as its highest theoretical effect only about 5 H.P.—that was to say, a windmill of this size would only produce the effect of a steam engine using from 10 to 15 lb. of coal per hour, or a total, in a week of 10 hours per day, somewhere about 5 cwt. The coal in question would only cost from 3s. to 4s., and the steam engine would have the enormous advantage of uniformity of effect, and this with a continuity of action which could not be ensured in the employment of the wind.

In countries like California, where the sunlight was continuous and rain occurred practically only at night, the direct rays of the sun might be considered to represent something like 10,000 H.P. available through at least eight hours of the day. Dr. Louis Bell gave an account of a recent type of apparatus for this purpose. The boiler gave 200 lb. pressure in full sunshine, and developed 10 H.P. The annual expense of this contrivance worked out at about £15 per horse-power per year, which was considerably below the cost of the power obtained from small steam or oil engines, and compared favourably with the price of electric power, at any rate in small units.

According to Sir William Ramsay, a ton of radium gave off energy which in the course of a year would be equivalent to the burning of 117 tons of coal. In doing this, it suffered only a minute loss of its weight. But, as far as could be reasonably conjectured, the whole world contained something like 5 cwt. of radium, so that if all the radium were available for power, and that power could be actually employed, this would only be equivalent to an annual supply of between 40 and 50 tons of coal. It was evident that our coal supply was the real source upon which we depended for mechanical power in this country, and it was a duty incumbent upon us all to economise as far as possible the stores of coal in the earth.

The Training of Engineers.

On October 12th an inaugural address was delivered to the Manchester Association of Engineers by the president, Mr. Chas. Day, Wh.Sc, from which we extract the following passages:—

In connection with the engineering trade I think it is possible so to arrange the conditions of employment for apprentices that all may have a reasonable chance of fitting themselves for advancement, and this without making the conduct of business unduly difficult. To put this into practical form I venture to outline a set of conditions under which apprentices might be employed:—

1. All apprentices to start on level terms, *i.e.*, no special privileges to be arranged in advance for any apprentice, either in regard to the number of departments he is allowed to work in, or in regard to his treatment whilst in those departments.

2. A certain proportion of the apprentices to be given a change of department, provided, of course, the conditions of trade allow of it; such apprentices to be selected from those who, by attendance at evening classes, have shown a desire to improve themselves and who, by good results at those classes, have shown satisfactory mental capacity and persistence. Satisfactory work in the shops should also be a condition.

By these means the capable and ambitious apprentices will obtain wider and more valuable training than those whose characteristics do not fit them for advancement, and the selection is almost automatically made by the apprentices themselves.

With a scheme of this kind, those who by their own want of effort limit their experience to one department of a works can, of course, only blame themselves if, at a later date they see that this narrowness of training and inattention to the theoretical side prevents them from advancing to higher positions.

It may be desirable to carry the scheme still further and provide that some of the most successful apprentices be given the full-day course at a technical school, or at least be given the opportunity to get it. In the Manchester district an intermediate step can be taken by utilising the apprentice course at the technical school, a course which is proving of distinct value. In this course apprentice engineers attend at the school each Monday during the winter session, the remaining working days being devoted to their usual employment with their evenings free for home work. The course is designed to extend over two years, but naturally employers should take care that any apprentice who does not take proper advantage of the first year, is displaced when the selection is made for the following year.

Though a high theoretical training is necessary for some positions, the number of such positions is comparatively small. What kind of education is then desirable for the employés of an engineering works?

In the case of many workmen we merely want manual skill combined with steadiness and attention to work, but in many cases, as, for instance, in the case of an erector, who is sent out to erect and set to work various kinds of machinery, a sufficient education is required to enable him to write a clear report, and in addition it is often desirable for him to have some knowledge of the basis principles connected with the machinery he is engaged upon.

For many workmen, and particularly for pattern-makers, the capacity to read drawings very thoroughly is essential.

A foreman in a machine shop does not require to be a mathematician or to have a deep knowledge of, say, the theory of heat, but he should know the elements of mechanics and a good deal about the various machine tools available, also he should have a knowledge of modern developments connected therewith.

In the case of draughtsmen, there is no doubt that technical education needs to be carried to a further degree, and in any works it is desirable that a few of the draughtsmen be men with advanced theoretical attainments so that special problems can be investigated and worked out.

The educational qualifications for managers and employers are very variable, depending largely on the class of work engaged upon, but a very sound training in first principles and in their application is a vital necessity to enable the probable effect of new developments to be gauged. Also it is very desirable for men in these positions to know what is going on in other branches of engineering, as it frequently happens that a troublesome new problem in one business has been dealt with and overcome years ago in another business; thus a fairly wide outlook on what has taken place in engineering is of special advantage.

For every different position in different works a different schedule of requirements might be made, but if this were done I feel sure that the number of positions for which high theoretical attainments are essential, or are even the principal factor, would be comparatively small, though those positions would be important ones. There is a substantial difference between a broad technical education and high theoretical attainments. An appreciation of this fact may encourage those whose circumstances do not enable them to acquire high theoretical attainments to realise that there are very many important positions open to them, for though scholastic training can help, and help greatly, it will never be so important as natural qualities.

A generation ago an apprentice in an engineering shop probably saw in that one shop a great variety of mechanical engineering work. To-day he most probably only sees one branch, or even only a sub-branch. This has the great disadvantage of narrowing the outlook of those so engaged. This narrowness can be overcome to a considerable degree by suitable training in a technical school or college which is equipped with a really good mechanical laboratory, as the student then sees and works upon a wide variety of modern machinery. Hence, a very important feature of a course of training at a well-equipped technical college lies in the wider outlook which results from seeing examples of many phases of engineering productivity, and of receiving explanations of their construction and action by teachers who are able to show how the first principles taught in the lecture-rooms are applied in practice. It is from this point of view that the extensive and varied lot of machinery in the engineering laboratories has much value.

Much which is called theoretical is really intensely practical, being the reduction to words of accumulated practical experience.

New inventions involve quite new lines of thought in their application, and men whose training has been in a narrow groove will probably be found quite unprepared (I do not say unfit) to cope with the new problems, or even to appreciate them. A good general technical training undoubtedly forms a better basis for dealing with entirely new problems than does a highly specialised one, and it makes men more disposed to watch new inventions and developments closely.

It is, then, a matter of importance for us to see that a sufficient proportion of our engineers receive a general technical training, and I would suggest that all engineering firms who do not at present assist or grant time to any of their apprentices to acquire such training, might consider the desirability of doing so to one or more of those apprentices who have already shown capacity.

From the foregoing notes it would appear that the technical education required for the different positions in engineering may be roughly graded as follows:—

(*a*) A grounding in the general basis principles underlying engineering work, combined with facility in reading drawings.

(*b*) A sound training in these same principles, together with a knowledge of their application in different branches of engineering, and a working knowledge of elementary mathematics.

(*c*) The same as "*b*," but with a more advanced knowledge of mathematics and of problems involving mathematics.

Every engineering apprentice who desires to rise at all must at least attain standard "*a*." Those who neglect to reach this standard practically decide for themselves their future positions. If attendance at evening classes can be followed by a course such as the apprentice course already mentioned, so much the better. After that, if facilities can be given for a picked few from each works to take a two or three years' full-day course, this would, I believe, be of distinct advantage not only to those apprentices, but to the trade of the country.

One point I would add, viz., that attendance at evening classes should not stop at the age of 21, and particularly so with those who have only been able to follow course "*a*," but opportunities should be taken to attend laboratories and special lectures.

Membership of this Association is the next natural step for young engineers in this district, for the work of the Association is undoubtedly of an educational character.

Another point worth remembering is that a man may have ability and still not rise if he does not let others see that he has such ability. Very many young men owe their first step upward to the fact that in discussions before such societies as this they have shown a clear insight into some engineering problem.

Most employers and managers have often to consider applications for employment from young men who have taken a course of training at a technical school or college, and who may have done exceedingly well, but who desire to get to practical work. It is by no means easy to deal with this problem, as advanced theoretical training, though of great value in the higher positions already mentioned, is not of much value in the lower positions. In most mechanical engineering shops a start must be made at the bottom of the ladder just as ordinary apprentices. A young man leaving college should apply for a "job" in a workshop rather than, as he so often writes, "for a position where his training will be of value."

The Manchester Technical School is not only intended to be used for the training of youths and young men, but also as a centre for research and investigation. In this latter direction it is possible for the school to be of great benefit to the members of the Association; I should therefore like to see some closer co-operation between the two.

An effort is to be made at the Technical School to establish a really well-equipped laboratory for dealing fully with problems connected with the internal combustion engine, also for carrying out experiments in connection with aerial flight. More people are employed round Manchester in the manufacture of internal combustion engines than around any other centre in Great Britain.

At present there are fewer difficulties to be overcome in applying Diesel engines to marine propulsion than is the case with gas engines; hence it is natural that marine propulsion by internal combustion engines should be first developed with Diesel engines. All internal combustion engines suffer in one respect as compared with steam—viz., manœuvring power. As reversing has to be done by compressed air, a large air storage, or a separate compressing engine, is necessary, if the main engine is connected direct to the propeller shaft. Long periods of running at very low speeds must also be faced, and these speeds may be below the lowest speeds at which the engine can be run on oil or gas; hence the air storage or the independent compressing plant must be large enough to supply compressed air for this long period of running at slow speed. The alternative is not to connect the main engine direct to the propeller shaft, but to drive the propeller shaft through some form of clutch, or electrically. Mechanical clutches and reversing gears present considerable difficulty in large powers, though quite satisfactory in small powers.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Arc Lamp Winch.

The London Electric Firm, of George Street, Croydon, have recently patented a winch for arc lamps and other light weights, having a ratio of one to one, *i.e.*, direct drive, which yet is self-sustaining both in raising and lowering. Where rapid lowering is desired, this can be supplied in place of their existing well-known pattern, which has a reduction gear as its base of operation. This new winch, like its predecessor, achieves its self-sustaining feature without ratchets, pawls, worm or gear wheels, springs or triggers. Fig. 1 shows the appearance of the winch.

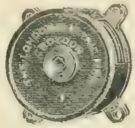

Fig. 1.—Self-sustaining Winch with Direct Drive.

Brake Solenoids and Limit Switches.

The accompanying illustration, fig. 2, shows a type of solenoid made by **Mr. George Ellison**, of Victoria Works, Warstone Lane, Birmingham, for operating mechanical brakes on cranes, hoists, &c., or for other purposes where it is desired to exert a definite pull through a limited distance. The solenoid consists of two outer parts which form the yoke, in the centre of which is fitted a brass sleeve, acting as a guide for the plunger and a base for the windings of the coil, the latter being thoroughly insulated. The plunger acts as a piston working in an air dashpot, the effect of which is adjustable by means of a screw fitted on the top of the solenoid. The magnetic circuit is such that the apparatus is compact and very powerful. The stroke and pull can be arranged to meet requirements. The solenoids are designed for connection either across the line or in series with the motor, and for either crane or continuous rating.

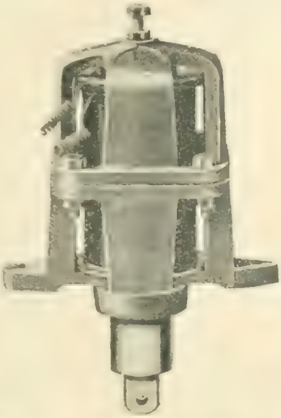

Fig. 2. Ellison Brake Solenoid.

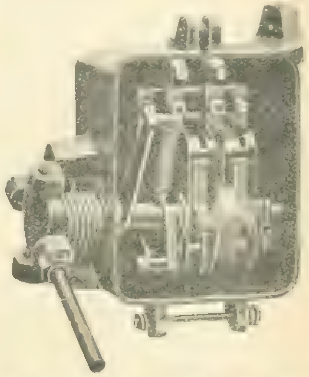

Fig. 3. Ellison Limit Switch (Cover Removed).

Fig. 3 shows a limit switch designed for automatically limiting the travelling or lifting motions of cranes, lifts, hoists, &c. These are inserted in the main circuit between the controller and the motor, and interrupt the circuit just before the end of the travel, to prevent damage to crane or motor if the operator carelessly lets the crane run too far.

The switch closes automatically when the crane or crab runs in the opposite direction. The controller must be arranged so as to be able to travel backwards with the limit switch open. The limit switches are of the barrel type, single pole, and fitted with a strong magnetic blow-out for direct current, and double pole for A.C. A powerful spring is provided to ensure quick make-and-break action, which is independent of the operating lever. They are totally enclosed in a strong cast-iron case, with feet arranged for fixing the switch horizontally or vertically. The operating lever is a round steel rod screwed into one of the four bosses in the hub. All the four bosses are tapped, to enable the customer to fix the lever in the most convenient position. Pressed mica is used in the construction of the switch; no combustible or absorbent material is used.

The "I.F." Tip Controller Finger.

Messrs. Imeson & Finch, of Alma Chambers, Stockton-on-Tees, have introduced the tip finger which is illustrated in fig. 4, having an increased amount of wearing surface. The tip is countersunk at both sides, and can be reversed four times (by unscrewing the screw, which is securely fastened by means of a lock washer), thereby obtaining a very long life from the copper tip. The only wearing part is the tip, other parts remaining fixed to the controller. A great advantage of the "I.F." tip finger is the impossibility of buckling. The longer it is worn, the better the contact becomes. The copper tips can be replaced at a very small cost, being 50 per cent. less than replacing sliding contacts.

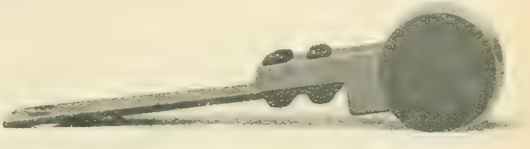

Fig. 4.—The "I.F." Tip Controller Finger.

Electric Soldering and Branding Irons.

We have recently had an opportunity of inspecting the Vulcan soldering and branding irons, which are being put on the English market by **Messrs. Scholey & Co., Ltd.**, of 151, Queen Victoria Street, E.C., and for which very high claims are made. The examples we saw are excellent with regard to workmanship, and there are many interesting details in the design which should have considerable influence on the lasting qualities and efficiency of the apparatus. Although the apparatus is new to the British market, there has been a sufficiently long experience of the Vulcan irons to warrant the claims that are made for them, and the records which have been put before us are remarkably good.

Among the drawbacks hitherto urged against electric soldering irons are that they have been clumsy in construction and the heating element after a time gives considerable trouble, and very often burns out; these objections have been guarded against in the Vulcan tools by special methods; the heating unit, which is carried in the stem, is hermetically sealed, so that flux fumes cannot destroy it, and it is claimed that the peculiar construction forces the heat to the tip. The tip is made of pure copper, hand forged and tinned. The one-piece handle unscrews and slides back on the cord, exposing convenient terminals.

A complete range of irons has been designed, which shows a very considerable knowledge of the various operations in which soldering is used. In fact, there would appear to be a sufficient variety of sizes to meet almost any industrial purpose. For instance, there is a special size for telephone and switchboard work and electrical instruments; another for motor-car repair and general use, and a larger pattern for heavy work. The weights vary from 12 to 65 ounces. Moreover, many of them are arranged in different shapes and lengths to meet various conditions. There are specially long ones for switchboard work, and specially short ones for linemen's work, and so on. The power consumption varies with the type and size of the instrument, from about 50 watts in the smaller ones up to 500 watts for the largest size. The following figures, obtained from actual test, demonstrate the advantages of electricity over gas for soldering work. Gas is taken at 2s. per 1,000 cb. ft. and electricity at 1d. per unit, and the cost of operating equivalent irons for a 10-hour day is stated to be as follows:—

Fig. 5.—Vulcan Soldering Iron.

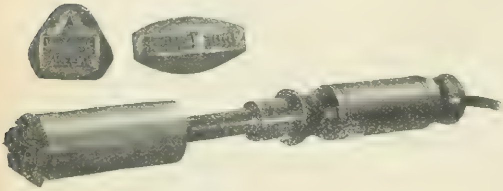

Fig. 6.—Vulcan Branding Tool.

Electricity	·7	1·2	1·5	2·5	3·5
Gas	2·82	3·1	3·53	4·8	5·65

We think there is little doubt that these irons will be of great interest to all engaged in electrical work, and soldering operations in general.

We illustrate in fig. 5 a 29-oz. iron, suitable for general manufacturing purposes, and in fig. 6 a Vulcan branding tool, capable of branding up to 2 in. square, and heated in a similar way. Various special instruments for cautery, can-capping, &c., are also made.

A "Permanent Accumulator."

The Hagen Accumulator Works, of 15, Holborn Viaduct, E.C., have brought out what is styled a new "Permanent Accumulator;" that is, one which is constructed for very slow discharge extended over a long period. The cell consists of a round glass jar containing two cylindrical electrodes, the negative a thick rod and the positive a curved plate, with an insulating separator between them. The top of the cell is hermetically sealed, a perforated ebonite screwed plug being provided for filling the cell and allowing gas to escape, and the terminals are sheathed in ebonite. The jar is of reddish brown glass, presumably to prevent injury by the action of light. These cells are designed to replace primary cells for telephone purposes, signalling and registering apparatus, and the like. The E.M.F. is 2 volts, and the accumulator can be kept for 12 months in the charged condition without deterioration. The output is half an ampere for 60 hours without intermission; the cell, which measures about 8¼ in. overall × 3½ in. diameter, is therefore very efficient for its size. It can, of course, be recharged in the usual way when run down.

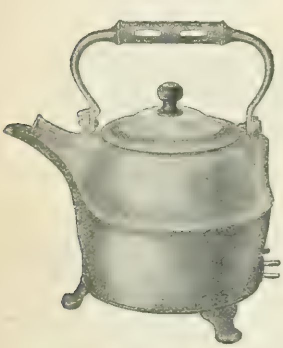

Fig. 7.—Premier" Aluminium Kettle.

Premier Electric Heating Devices.

Messrs. Premier Electric Heaters, Ltd., of Bradford Street, Birmingham, have placed on the market a cast-aluminium kettle specially designed for kitchen use, and shown in fig. 7. Although quite light, it is of considerable thickness, and suitable where rough usage is likely to be encountered. The heating elements are accommodated in the heat chamber on suitably cast surfaces, which are machined absolutely flat. Attachment is made by screws, so that replacements can very easily be effected when required. The outer bottom is also held in position by screws.

Its features are exceptional strength: no joints to leak; no solder whatever used in its construction; large rapid-pouring spout, which cannot get furred up with hard water; large lid and drop handle, allowing the interior to be easily and thoroughly cleaned out.

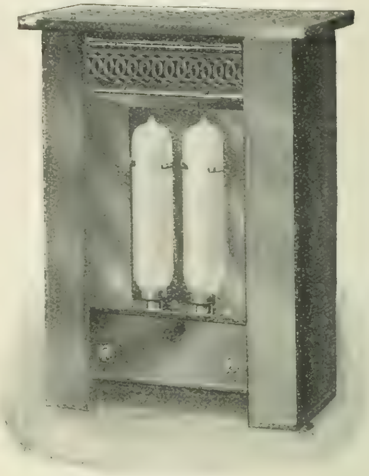

Fig. 8.—Premier Convector-Radiator.

Fig. 8 shows another of the firm's specialties—a combined-type convector-radiator, having convector elements behind and two ordinary radiator lamps in front of a polished copper reflector. The convector elements are of the usual "Premier" type, consisting of wire spirals mounted on spirally grooved porcelain tubes, each element consuming 500 watts. The effect is pleasing, there being not too much glare, as the greater part of the current is dissipated by the convector elements, and the heating efficiency is high. The switches used are of ample capacity, and all other details have been carefully worked out.

Silvertown Searchlights.

The accompanying illustration shows a number of twin searchlight projectors, forming part of a repeat order that has recently been completed by the I.R., G.P. and T. Works Co., Ltd., at their works at Silvertown. The approximate height from the base to the centre of the barrel is 5 ft., each barrel being about 2 ft. in diameter, and fitted with independent hand-training and elevating gear.

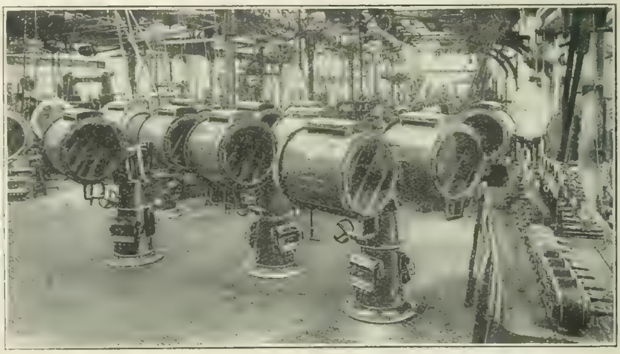

Fig. 9.—Silvertown Twin Searchlight Projectors.

The projectors are complete with double-pole switches, front glass doors and back mirror and frames, each separate part having been made at Silvertown.

The illustration also shows the automatic lamps and motors used in conjunction with these projectors, the motors being used for elevating and training the barrels of the projectors.

Similar machines of a larger size, with double the diameter of barrel, are being made in another shop.

The India-Rubber Co. has of late years made a speciality of mechanical work in which the electrical portion forms but a small section, and it has in hand such interesting machinery as that required for washing and dyeing furs, making rock drills, train lighting sets, electro-hydraulic lifts, &c., besides machinery for wireless telegraphy.

Multiple Switch Automatic Starter.

The difficulties connected with the remote control of electric motors increase with the size of the motors. Experience has shown that the motor of over 50-H.P. capacity cannot be started automatically in a satisfactory manner, except by using separate switches to short-circuit each successive resistance step. In the past, apparatus designed to effect the above purpose has generally consisted of a number of separate solenoid main switches, which in turn are controlled by a sliding contact automatic control switch. The E.A.C. new patent automatic multiple switch starter eliminates both of these features, and hence it is considerably cheaper to manufacture. Each step is provided with a separate lever of knife-switch pattern, and each lever closes with a snap, and makes a certain and definite contact. The first contact, which in switching off is the last to break, is provided with a renewable carbon arcing tip. Only one solenoid is employed, which, when energised, slowly lifts the plunger against the dashpot. The cross bar, which is attached to the base of the plunger, lifts each lever in its turn, until the lever-controlling springs are moved over their dead centre, thus causing the levers to snap into their respective contacts, one at a time, and in their proper order.

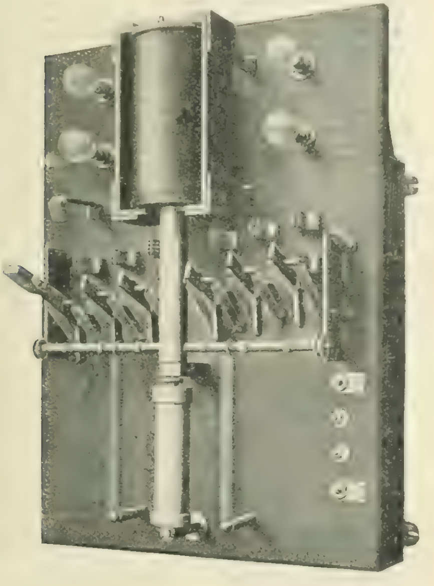

Fig. 10.—E.A.C. Multiple-Switch Automatic Starter.

When the motor has attained full speed, a high resistance is placed in series with the solenoid, to reduce the power consumption to a negligible value. The rate of cutting out resistance is adjustable, without affecting the quick make of the individual steps.

When the solenoid circuit is opened, the cross bar falls, instantaneously opening the switches in the reverse order, thus cutting the resistance in, and finally opening the motor circuit.

This starter is manufactured by the Electrical Apparatus Co., of Vauxhall Works, South Lambeth Road, S.W.

New Dimming Switch.

The "Twilight" patent reducing switch, which has been introduced by Messrs. Dimming Switches, Ltd., of Rea Street South, Birmingham, is a compact little resistance of the screw-down type, which affords a continuous variation, in the case of a lamp, from dull red to full brilliancy without sudden jumps; an electric fan or other apparatus taking a small current can be similarly regulated. A noteworthy feature is the fact that the switch has an "off" position, so that it is not an addition to, but a substitute for, the ordinary circuit switch. The construction of the device is ingenious, providing a simple means of adjustment of range to suit circumstances, and fig. 11 shows the external appearance of the switch.

LEGAL.

The National Telephone Arbitration.

(*Continued from page 613.*)

The contractors' profits were estimated by the Post Office at 1½ millions odd. Both sides agreed that the sum for material, including manufacturers' profit, freight, wages and all expenses of doing the work, should be 1¼ millions, but with the necessary additions the Post Office put the amount at £1,600,000, whereas the company said it should be £2,380,000.

Mr. J. F. C. Snell, of the firm of Preece, Cardew & Snell, consulting engineers, who, it will be remembered, gave evidence for the Post Office before the adjournment last July, was recalled for cross-examination by Sir A. Cripps.

In the course of some preliminary argument before the witness was questioned upon matters of supervision charges, &c., it appeared that the company had estimated the cost of work done under the head of conduits by contractors at £350,000, eliminating the element of profit. To this sum had to be added £150,000 for sub-contractor's supervision, making a total of £500,890. The contractor's profit under this head amounted to £50,000. The total for tools, wages, &c., paid by the contractors was put at £716,888.

Cross-examined, Witness said that the way in which the company had arrived at their figures for local engineering supervision and local administration charges was open to criticism. In some cases the charges for local administration were too high, and there was great difficulty in making a proper distinction between maintenance and capital accounts on the basis adopted by the company for preparing their figures. Another criticism he had to make was that charges for management, &c., were placed to construction, which ought properly to be considered as an element of cost in building up the business of the undertaking after the work of construction was completed.

Witness said, in answer to further questions by Sir Alfred Cripps, that assuming all the work to have been done by contract, 5 per cent. would cover the cost of engineering and management, no specific allowance being made for other management or for legal expenses. He based that figure on his own experience.

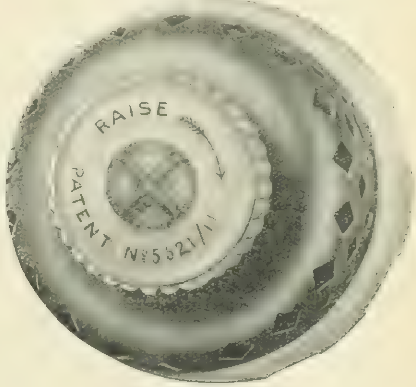

Fig. 11.—"Twilight" Dimming Switch.

Sir A. Cripps asked witness whether he meant that an undertaking costing, say, 10 millions to construct, could be carried out without the services of general management of the company apart from engineering supervision.

Witness said that the principle was the same as in smaller contracts. His company had carried out a large contract for the Government, covering dockyards all over the world, on the basis of 5 per cent., and were well paid.

Sir A. Cripps: Had the Admiralty no general management?

Sir Alfred then drew attention to several matters amounting to £440,000, on which witness, in his tables, had disallowed the usual 10 per cent. contractors' profits, on the ground that the work would have been done by the manufacturers who supplied the material, their worth being covered by the manufacturers' profits only.

Witness said it was the practice of cable manufacturers to lay cables, &c., without adding to their manufacturers' profits, and so he had disallowed the 10 per cent. on aerial cables, exchange equipment and subscribers' apparatus. He did not know how much of the work was done by the Post Office, nor did it in any way affect his tables, which were based on the experience of cable manufacturers.

Sir Alfred said that the calculations of the parties concerning the age of plant were so little apart that it might be convenient to postpone the part of the case dealing with depreciation for the present, in order that both sides might confer on the subject with a view to saving time.

Sir J. Simon agreed to this course, and remarked that any agreement reached concerning the age of the plant might have the effect of facilitating an agreement upon the further subject of the "life" of the plant.

Earthenware pipes, Witness said, were but a small element in the company's plant. The physical life given for them in the company's figures was 80 years, and his witnesses' figures were 60 years. In regard to wrought-iron pipes, he had estimated their life at 17, as against the company's 35 years. The general experience of gas companies in regard to their service pipes, were that those constructed of wrought-iron had to be renewed about every 17 years.

Sir A. Cripps: Do you really mean that? Why, the gas companies would be always taking up the pavements!

Witness: I have had a great deal of experience of wrought-iron piping in connection with electrical work, and in some cases I have known such piping to rust away in three or four years, whilst, in other cases pipes have been as good as new after having been in the ground 11 years. It largely depends on the soil. I think 17 to 20 years is a fair average to take.

Cross-examined next on the life of telephone cables, Witness said that if they put on one side the diseases to which electrical cables were liable, the physical life of the lead-covered cables was about 50 years. Taking these diseases into consideration, that life was reduced to 40 years. The company had put the physical life of the same cables at 70 years.

Sir A. Cripps: Our equated life of these cables is estimated at 47¾ years. (To Witness) It seems to me that, if you eliminate the "diseases," such as electrolytic action, chemical action, and disturbance from outside causes, there is no reason why these cables should not last for ever.

Witness: Of course, if you eliminate the sources of attack, I suppose a lead-covered cable would last for an indefinite time; but the hypothesis is stupid.

But is it not a fact that the life of the cable is determined by the lead sheathing?—No; because it would be impossible to say what might take place in regard to the disintegration of paper in which the wires are wrapped.

Do you suggest that the paper insulation could enter into the question within a period of 50 years?—No; but I would not like to say that it would not become a factor for consideration in the 70 years' limit fixed by your figures.

In arriving at your estimate of the life of these cables, have you differentiated between the effects of electrolytic action, chemical action and outside disturbance—such as a hole being knocked in the cable?—No, certainly not.

Mr. G. H. Nisbett, member of the I.E.E., &c., and 18 years manager of the British Insulated and Helsby Cable Co., was called on behalf of the Post Office. The British Insulated, he said, was one of the large companies in the United Kingdom engaged in the manufacture and supply of electric cables The amount of telephone cable manufactured and supplied by his company during the past five years aggregated 60,000 miles of circuit per annum. They were the sole contractors for the Brighton, Glasgow and Portsmouth municipalities when they established their telephone systems.

Questioned about the way in which the estimates were prepared for the supply and laying of cables, Witness said his firm took out the prices at which they would sell cable after delivery on to the site. Having brought that into their estimate, they added to it the total estimated cost of the work they had to do. To that total cost was added 20 per cent. to cover standing charges incidental to local work, and then to that their profit as contractors. They did not charge contractors' profits where they were the manufacturers of the materials. The 20 per cent. included the whole of the undertaking; local and head office engineering charges, supervision of work, clerical local charges and clerical work at the head office. About 90 per cent. of the materials would not require storage, and he thought 1 per cent was ample for contingencies. He had seen the figures agreed to between the parties in regard to fundamental cost; they included manufacturers' profits so far as materials were concerned.

Cross-examined by Sir A. Cripps, Witness said his company had never acted for the Telephone Co., but they had supplied the Post Office with large quantities of material for a number of years.

In reply to Sir James Woodhouse, Witness said that they would turn out of their factory in 2½ years the number of miles of circuit required by the National Telephone Co.'s undertaking. This only applied to conduits and cables. The number of circuit miles of "pairs" required by the National Co.'s system, both underground and aerial, would be about 469,000.

Sir Alfred Cripps said the company's figure was 465,000 miles.

Continuing, Witness said he estimated that 1,200 men could carry out the work of drawing in, jointing and laying these cables in 2½ years.

Mr. Justice Lawrence: How do you arrive at your calculation?—Witness said he had taken the maximum quantity of cable, namely, 469,000 miles of pairs, which was nearly the company's figure. He had estimated that the average size of the cable was 100 "pairs," which gave a figure of 4,690 miles. Putting the number of joints at 20 per mile, there would be 93,800 joints. He calculated that one jointer would make only one joint per day—that was a generous allowance—so that in the result 133 jointers would take 120 weeks to complete the jointing work. To these figures he added 50 per cent. allowance for cutting the cable, fitting terminals, &c., which brought the number up to 200 jointers. With regard to drawing in the cables, 25 men would draw in 5 miles of cable per week, or 260 miles per year. That figure divided into 4,690 miles meant that 20 gangs of 25 men each would have to be employed; or, in other words, 200 men would complete this work in 2½ years. To these he had added 200 men for odd and incidental labour, which, together with the 200 jointers, 200 jointers' mates, and 100 for staff, totalled 900. In order to be on the safe side, he increased that figure to 1,200.

Mr. Danckwerts: That seems to ignore all the necessary difficulties. Witness said he had based his figures upon his general and expert knowledge of the business.

Cross-examined with regard to the supply of copper for the cables, Witness said it was a common thing for his company to place an order for 500 tons of electrolytic copper on the market without such order having any appreciable effect on the latter. Electrolytic copper was copper electrically refined for use in electrical work. Of the amount of copper changing hands each day on the market, one-third was electrolytic copper.

Sir A. Cripps said, in answer to Sir James Woodhouse, that the amount of electrolytic copper changing hands was about 1,000 tons per week.

Mr. Justice Lawrence: Do you mean the amount changing hands or the actual deliveries?—Sir Alfred said he was told that 1,000 tons a week was the actual consumption.—Witness: I should say it was in excess of that; 1,200 tons.

Continuing, Witness admitted that he had said on a previous occasion that the daily turnover of the copper market averaged 3,000 tons, and that large purchases for the purposes of such a contract as replacing the company's system would, if properly carried out, not cause a rise in copper. In such a contract they would be dealing with electrolytic copper, the average sale of which he did not put higher than 1,200 tons a week. In placing such large orders for copper on the market as would be necessary under such a contract, his firm would obtain warrants for ordinary commercial copper, and change them for electrolytic copper as they required it. That was a method commonly adopted in cases of large contracts.

Mr. Justice Lawrence: But the two kinds of copper are different prices?—Witness said that was so, but there was a fixed premium between the two.

Mr. Buckmaster: Are you prepared on behalf of your company to make a tender involving an obligation on your part to obtain 2,500 tons of electrolytic copper within a short period?

Sir A. Cripps objected to this question on the ground that the witness had already stated in the course of his evidence in reply to a similar question, that he could not answer it; it was a policy which his firm would have to consider.

Mr. Buckmaster (to witness): Would you have any difficulty in obtaining through the market the necessary amount of electrolytic copper for supplying and laying this quantity of cables within 2½ years?—I am sure we should not have the slightest difficulty.

Mr. Justice Lawrence: You mean it would not affect the market?—I could not answer that. I do not say it would not affect the market if we placed the order for the whole of the quantity required in one day, but I could cover my company against risk of rise in the price of the metal and subsequently obtain the necessary electrolytic copper.

In answer to further questions, Witness said the process of refining copper, or, in other words, of making electrolytic copper, was becoming more universal as time went on. There were at present two works in England engaged in the production of this material, but their combined output was relatively small compared with the total American output. He could not say what the total amount turned out in the United States came to.

Cross-examined with regard to his figures for scrap material, Witness said he ascertained the amount of material in the 68 centres of the company's system, and had calculated the value of the scrap copper at £68 a ton, and of the lead at £14 per ton. Having calculated the total value of the materials on the site, he deducted from that the cost of drawing out the cable from the conduits, which he put at 35 per cent. of the original cost of drawing it in. He had also deducted the cost of abstracting the metal from the scrap cable at 20s. per ton on the total weight of the cable, and another 25s. per ton had to be taken off to cover freight charges, &c.

Questioned next on the subject of corrosion of the lead sheathing of the cables, Witness said the length of new cable required to repair such a defect would depend entirely on how the cables were laid. If they were laid in a conduit, a fault caused by corrosion would entail the laying of a new piece of cable from one manhole to the next; but in the case of a cable simply laid underground, it would only be necessary to cut out the piece affected and renew it. He had had a considerable experience of the repairs necessary to electric cables after they had been laid, and he had found that such repairs certainly did not remain constant throughout the life of the cable.

Mr. Buckmaster: Do the difficulties with electric cables come from within or from without?

Witness: In electric power cables the difficulties may come both from within and from without.

Mr. Justice Lawrence: We have quite enough to do in this case to deal with telephone cables without going into questions affecting power cables.

Mr. Wm. Slingo, engineer-in-chief at the G.P.O., was next called, and gave evidence with regard to the plant possessed by the P.O. and the N.T. Co. Including both telegraph and telephone lines, he stated that the underground plant, single duct, belonging to the G.P.O. amounted to 5,728 miles, and that of the N.T.C. was 3,435 miles. The amount of underground cables, single wires, of the G.P.O. was 847,000 miles, and that of the N.T. Co., 827,000 miles. The G.P.O. owned 10,000 miles of submarine cables, and the N.T.C. 515 miles; the miles of pole routes of the G.P.O. were 53,105, and that of the N.T.C. 17,831. The total mileage of bare wires and aerial cables of the Post Office was 458,600, and that of the N.T.C. 368,623. Witness next contrasted the expenditure at the engineering department in 1911-12 with the estimated expenditure for the current year, including the transfer of the N.T. Co.'s system as follows: 1911-12, £2,428,000; 1912-13, £4,233,000. The normal expenditure on telegraphs and telephones was £2,500,000. The supervision of the telephone engineering department was just as costly as that of the telegraph department.

(To be continued.)

WEBER & CO., LTD.

A PETITION presented by the County of London Electric Supply Co., Ltd., for the compulsory winding up of Weber & Co., Ltd., was before Mr. Justice Neville, in the Companies' Court, on Tuesday last.

COUNSEL stated that the petitioners were creditors. The company was in voluntary liquidation, and a meeting of creditors had been summoned for Saturday next. Under these circumstances, he suggested that the petition should stand over for a fortnight, to see what was done at the meeting.

The company assented, and his LORDSHIP directed an adjournment accordingly.

MOONEY *v.* MIDDLETON ELECTRIC TRACTION CO.

ON the 10th inst., at Oldham County Court, a case of importance to tramway employés was heard, in which James Mooney, a tramcar guard of Manchester New Road, Middleton, applied for compensation from the Middleton Electric Traction Co.

MR. CLARKE, solicitor, who represented the applicant, said Mooney was a guard employed by the company at a weekly wage of £1 4s. 6d. On May 6th he was acting as guard on a car running from Sudden to Middleton when something struck him in the eye. He continued working that day, and in the evening saw the company's medical adviser, Dr. Whitestone. The doctor advised him to go to the Manchester Eye Hospital. He went, and was asked to go into the hospital, but said he could not do so, as he had to support two sisters and a brother. Dr. Whitestone treated him for some time, and later he was treated by Dr. Harry, of Rochdale, but he had lost the sight of the eye. Mr. Clarke submitted that Mooney was exposed to an increased risk owing to the position in which he worked, the back of the car being exposed to dust and dirt, which flew around the car.

MOONEY stated that he had been in the company's employ for 6½ years, and he thought a piece of grit struck him in the eye.

In the course of cross-examination by MR. ACTON, DR. HARRY said it was extremely likely that the eye could have been saved if Mooney had gone into the Eye Hospital on May 10th.

For the respondents, MR. ACTON submitted that the statutory notice was not served as soon as practicable under the Act.

His HONOUR agreed with this view, and, in giving judgment for the respondents, said he was always loath to decide a compensation case on that point, but he was bound to do so.

FRAUDULENTLY ABSTRACTING ELECTRICITY.

MRS. LOUISA BRINCKWORTH, of 17, Herbert Street, Taunton, was charged at Taunton Police Court on the 16th inst. with having wilfully or fraudulently abstracted electricity from the mains of the Taunton Town Council, on September 17th and 18th.

The TOWN CLERK said defendant's house was supplied with electric light some years ago, and for some time past the defendant's winter consumption was about half that of the summer. The meter inspector visited the house a week earlier than the usual time, and he found that the electric light main had been so tampered with that the current was scarcely going through the meter at all. By the method adopted, electricity could be used without any payment.

MR. A. J. HOWARD, Corporation electrical engineer, said the effect of the contrivance of the defendant would be that practically all the current would go through the "bridge" and not through the meter. The defendant's statement, on oath, was that she recently had her house redecorated, and as the painters complained that the loose electric light wires were in the way, and would scratch the paint of the door, she fastened them back with a bit of wire, which her little girl found. She did not use the electric light much, as she had oil lamps. She did not know anything about electricity, and did not understand how to make a contact.

The MAGISTRATES, after hearing evidence on behalf of the defendant, told her she had wronged the owners of the light, and people must understand that they could not tamper with these things. She would be fined 10s. and costs.

BRITISH WESTINGHOUSE ELECTRIC CO. *v.* THE UNDERGROUND ELECTRIC RAILWAYS, LTD.

A DIVISIONAL Court of the King's Bench Division, consisting of the Lord Chief Justice and Justices Channell and Avory, on Tuesday heard a motion in connection with this litigation, which was recently before the House of Lords.

Sir Alfred Cripps, K.C., and Mr. Disturnal appeared for the British Westinghouse Co., while Mr. Fitzgerald, K.C., was for the defendants.

MR. DISTURNAL informed the Court that the first part of the motion would not be objected to, and that was that their Lordships should make as an order of the Court the finding of the House of Lords recently delivered. The other part of the motion would be opposed, and that was that an order should be made for the repayment to his clients of certain sums amounting to about £26,000, which they had paid to the Underground Electric Co. by order of the Court.

The LORD CHIEF JUSTICE: Are you asking for the payment out of that money now?

MR. DISTURNAL: Yes. Their Lordships would remember that the Westinghouse Co. claimed £87,000 for machinery supplied to the Underground Railways Co., while the latter counter-claimed for £78,000, alleging that the machines were not up to contract. The matter had been before an arbitrator, the Divisional Court, the Court of Appeal, and the House of Lords. The arbitrator made an award by which the Underground Co. were to receive £15,000 from the Westinghouse people, and that was paid together with a large amount of costs. Since then the Law Lords had decided that that matter should go back to the Arbitrator with a fresh direction, and he applied that having regard to that finding of the House of Lords, the applicants should be repaid the sums they had paid out.

MR. FITZGERALD objected on behalf of the Underground Railways. He said his contention was that the Court had no jurisdiction to order the repayment of the money, seeing that the matter was not at an end, and the Arbitrator might not alter his award by sixpence.

MR. FITZGERALD was continuing his argument on Wednesday morning, when the Lord Chief Justice said he now understood that there had been an order of the Court with regard to the matter, and therefore they had jurisdiction to deal with the whole of the motion.

MR. FITZGERALD said that was simply an order which enabled execution to be issued to enforce the award if necessary. It was not a judgment or order for the payment of the amount awarded. At the same time, his clients would be willing to pay out the amount if the solicitors for the other side would give an undertaking to pay it back again if the award was not altered.

MR. DISTURNAL said he agreed that they could not claim interest on the amount to date, but directly the Court made the order they could claim interest, and that would amount to a good sum.

The Court granted the application, making the judgment of the House of Lords an order of the High Court, and ordering the repayment to the Westinghouse Co. of sums amounting to £16,500 by the Underground Railways, Ltd.

ATTORNEY-GENERAL *v.* LONDON ELECTRIC RAILWAYS CO.

THE motion in this action, which was before the Judge in the Vacation, and by which it was sought to restrain pumping at the defendants' Embankment Station in alleged contravention of the Act of Parliament was, on Friday last, with the consent of all parties, fixed to come before Mr. Justice Neville in the Chancery Division to-day, 25th inst.

Electric Steel Works on Tyneside.—A new industry, that of steel melting by electricity, is about to be started at Dunston-on-Tyne by the Stobie Steel Co., of Sheffield. The chief reason why the works are to be established in that neighbourhood is that any quantity of electricity can be obtained at a price which can be quoted by few generating companies. Dunston, although situated on the upper reaches of the Tyne, is admirably situated, for there is an immense shipping trade, and there are several engineering works in close proximity. The site obtained by the Stobie Co. is very favourably situated; it is near the Dunston generating station of the Newcastle Electric Supply Co., whence the current will be derived, and but a short distance from both river and railway. The installation which at present it is intended to put down consists of a 15-ton three-phase steel-melting furnace and a 5-ton two-phase furnace for special steels, and a 3-cwt. alloy-melting furnace. It is stated that the Dunston works will be the first in Great Britain solely engaged in the manufacture of tool steel, alloy steels, &c., by electricity. Our correspondent understands that the establishment of armour-plate works on Teeside is being considered by a south-country syndicate.

The site of the new works covers an area of three acres, and the laying out of the ground and erection of furnaces and buildings will occupy about six months; it is expected to begin actual operations next spring. Mr. Victor Stobie first introduced the present process into Sheffield, and a feature of the Dunston installation is that every part of it is of his design. The output is expected to be 33,000 tons per year. The steel ingots which the company will manufacture at Dunston will be sent to Sheffield to work into bars and forgings, but it is expected that the cost of transit will be more than balanced by the low rates and the cheap charges for electrical energy.

Fair Wages Clauses.—The Edinburgh Building Trades' Federation and the Electrical Contractors' Association complain that the Corporation fair wages clause in contracts is inquisitorial and oppressive, as a contractor is held to have given assurance that for a period of three months prior to the contract he has paid the standard rate of wages, and the Corporation has power to examine the books of a contractor in the event of a dispute arising as to wages paid. A Sub-Committee of the Town Council recommends the Council to adhere to the present form of the clause.

NEW FITTINGS SHOWROOMS.

A year or two ago we referred here to the series of new showrooms that had been opened by Messrs. Falk, Stadelmann & Co., Ltd., at their premises at 83-87, Farringdon Road, London, E.C., for the display, amid suitable surroundings, of various designs of electric light fittings. We have this week inspected a further, and equally extensive, suite of apartments, decorated and furnished in styles characteristic of the Louis and contemporary English periods, that have just been made in the same buildings. These consist of Jacobean and French rooms. The former is fitted out in oak and, among other features, contains a magnificent fireplace with luminous radiator. It is illustrated in fig. 2, from which the reader will observe that there is a fine selection of excellent models of the Georgian period, in the centre of which is a good example of Flemish candle electrolier fitting. In the brackets, pendants, standard and other fittings shown here, there is included every kind of finish. The other apartment, which is about twice the size of that just mentioned, creates an excellent impression as the visitor enters (fig. 1). The scheme of decoration is Louis XVI with grey panelling throughout. The fittings which are so well displayed amid beautiful and appropriate furnishings, are of the French and crystal classes, of the 14th, 15th and 16th periods. Here again some of the best models have been drawn upon by the designer. Messrs. Falk, Stadelmann have for some years shown what importance they attach to having well-appointed showrooms for the use of the trade, architects, consultants and their clients, by their repeated efforts to increase the effectiveness of their premises, and by the selection of a very fine collection of fittings for display therein, but it is needless for us to add more here, for the pictures are better able to speak for themselves. Those who have fittings requirements would certainly not find a visit to Farringdon Road to be time thrown away.

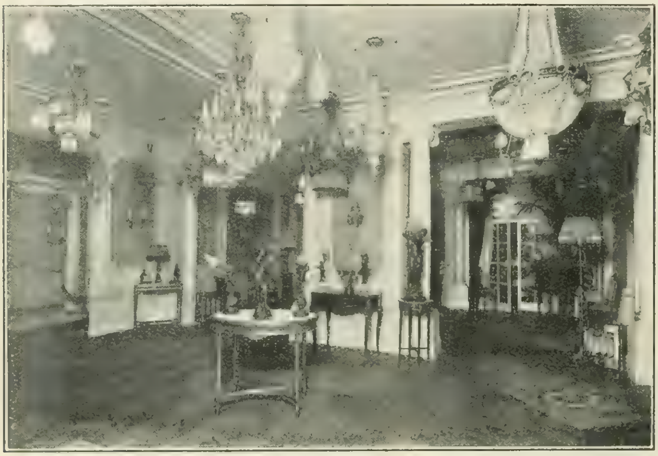

Fig. 1.—The French Room at, Falk, Stadelmann's

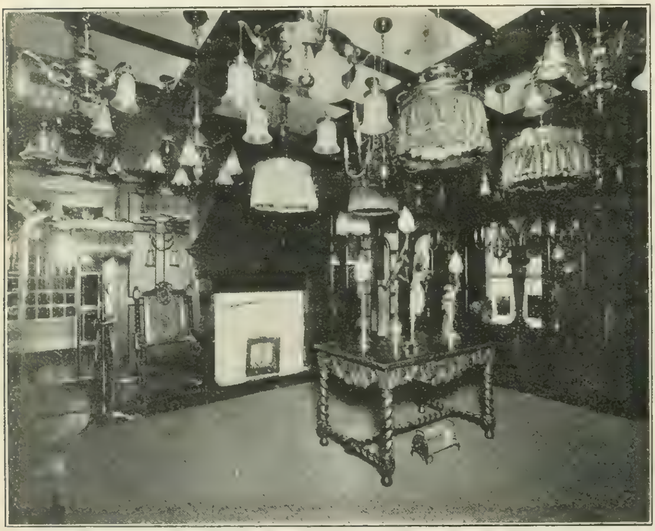

Fig. 2.—Messrs. Falk, Stadelmann's New Jacobean Showroom.

BUSINESS NOTES.

Book Notices.—*The German Export Guide.* 1912.—This is a volume of between 500 and 600 pages, issued by the Hanseatischer Export-Verlag, G.m.b.H., of Hamburg. It contains a great deal of informing matter in English relating to German export trade, and is to appear annually, information respecting other branches, beyond those now covered, being promised for future editions. The various industries are reviewed in separate sections each of which is followed by a number of advertisements of firms concerned with those trades. German shipping, German export trade (export sample exhibition and commercial policy), mining industry, iron and steel, German machine industry (including steam engines and turbines, internal combustion engines, water-power plant, transmission plant, &c.), industrial machines, machine tools, motor-car industry, textile industry, scientific instruments—these and other subjects all have separate chapters devoted to them. There is, of course, a special section devoted to German electrical engineering industry, and its great developments, from which we gather that it is estimated that the number of workmen and staff now engaged in that industry is 170,000 (85,000 to 95,000 employed by the big companies manufacturing electrical material, and 80,000 by special branch firms). The money value of its yearly output is said to amount to at least 1,000 million marks, three-quarters being absorbed by the home markets, while a quarter finds its way to foreign countries. The exports for 1911 were 248 million marks. At the beginning of 1911 there were 2,700 public electric power stations in Germany with a total output of 1½ millions KW., a capacity of 2·6 millions KW., and an annual output of 2,150 million B. of T. units. From these some 11,000 towns and villages were supplied. Adding the isolated plants, it is estimated that there are 50,000 electric generating stations, with an output of 6·5 million KW., and an annual output of 7,000 million units. The following remark is made: "Although the German electrical engineering industry enjoys next to no protection at home, it nevertheless completely commands the German market . . . . . and there is a steady increase of its exports to all parts of the world." This section is contributed by the "Verein zur Wahrung gemeinsamer Wirtschaftsinteressen der deutschen Elektrotechnik," of Berlin, and there is also a briefer section on "Various Lighting Systems," relating mainly to electric lamps and electric lighting.

Electricity in India, edited by Mr. S. M. Rutnagur, joint editor of the *Indian Textile Journal*. Bombay: Proprietors of the *Indian Textile Journal*. Price Rs. 2-8, post free, paper cover Rs. 1-12.—This is a pamphlet of about 80 pages in which the author deals principally with the Tata hydro-electric project and its inaugural ceremony, also with the progress made in electric power transmission since Messrs. Crompton & Co., Ltd., put up the first hydro-electric installation for the Darjeeling municipality in 1896. Information is given regarding the mill industry in Bombay and the relative cost of steam and electricity, material being also included descriptive of mill electrification work carried out in Lancashire. Toward the end of this interesting publication there is a useful directory of engineers interested in electrical work in India, and of manufacturers (with their agencies) who have been supplying installation machinery and plant there; another feature is a list of electrical power stations and plants in India.

"*Journal* of the Franklin Institute." Vol. CLXXIV, No. 4 October, 1912. Philadelphia: The Institute. Price 50 cents.

"*Proceedings* of the American Institute of Electrical Engineers," Vol. XXXI, No. 10. October, 1912. Price $1.

Careers in the Crucible. By Christopher L. Town. This 24 page pamphlet contains an address delivered by Mr. Town recently before the Incorporated Phonographic Society at the Cripplegate Institute London. The author is the assistant secretary of the London Chamber of Commerce, and secretary of its Commercial Education Department, and he has handled his subject in, to our mind, a masterly manner. The address must have been listened to with profound attention, for it combines a fund of interesting illustration with sage counsel accumulated in the course of practical experience rubbing shoulders with the world. He shows, among other things, how both the young hopeful's fancies and the fond parent's schemes are often frustrated, but he brings together a group of most useful ideas, which cannot fail to be instructive to the young mind and valuable to the guardian or parent in stimulating thought at such a period of life as to prevent a youth being content with having "a jolly good time," while he drifts along oblivious of such matters as the trade or profession that he ought to follow.

The Gas Works Directory and Statistics for 1912-13. London: Hazell, Watson & Viney, Ltd. 10s. 6d. net.—This is the thirty-fifth edition of a useful directory containing very full information respecting gas works, their areas, finance, personnel, and so forth, in England and Wales, Scotland, and Ireland. There is a brief section relating to foreign and colonial gas works having London offices. The particulars given are revised up to August last.

We have received a copy of the *Engineering Gazette and House Journal*, which is issued monthly by Messrs. Marryat & Place, of 28, Hatton Garden, London, E.C. It contains a great deal of entertaining and useful matter, and is a credit to its producers.

"*Journal* and List of Officers and Members of the Institution of Electrical Engineers." No. 215, Vol. 49. London: E. and F. N. Spon, Ltd. Price 5s.—The issue for September contains the following papers:—"On the Power Factor and Conductivity of Dielectrics," by Dr. J. A. Fleming and G. B. Dyke; "The Work of Lord Kelvin in Electricity and Magnetism," by Prof. H. du Bois; "Direct-current Watt-hour Meters," by S. W. Melsom and W. H. Eastland; "Electrical Meters on Variable Loads," by Prof. D. Robertson; "The Corrugation of Rails," by A. Schwartz and R. G. Cunliffe; Chairman's Address, Cape Town Local Section, by W. F. Long; "The Diesel Engine, from the User's Standpoint," by W. J. U. Sowter; "Weight Efficiency of Electric Motors and of Prime Movers," by W. B. Hird; "Induction Motor Design," by J. K. Catterson-Smith.

"*Transactions* of the University of Toronto Engineering Society." September, 1912. Toronto: The Society.

"*Journal* of the American Society of Mechanical Engineers." October, 1912. New York: The Society. Price 35 cents.

"Science Abstracts." Vol. 15, part 9. September 25th, 1912. Sections A and B. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Bulletin* of the Association des Ingenieurs Electriciens." June, 1912. Liége: The Association. Price 7 fr.

"Electricity made Plain." By G. R. Peers. 1912. London: John Heywood, Ltd. Price 1s. net.

"Post Office Electrical Engineers' Journal," Vol. 5, Part 3. October, 1912. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Report on The Equitable Building Fire, New York." By F. J. T. Stewart. London: The British Fire Prevention Committee. Price 3s. 6d.

"*Journal* of the United States Artillery," with "Index to Current Military Literature." Vol. 38, No. 2. September, 1912. Fort Monroe, Va.: The Coast Artillery School Press.

"Annales des Postes, Télégraphes et Téléphones." September, 1912. Price 6 fr. "La Service Postal de Chèques et Virements." By Léon Cazes. Paris: A. Dumas.

"The Measurement of Induction Shocks." By Ernest G. Martin. New York: John Wiley & Sons.

"*Engineering* Directory." October, 1912. London: *Engineering*, Ltd. Gratis.

Heavy Oil Engines.—The Aster Engineering Co., Ltd., of Wembley, Middlesex, who are well known in connection with the internal-combustion engine as employed in motor-vehicles and for other purposes, inform us that they have arranged with the Westinghouse Brake Co., Ltd., to undertake the manufacture of heavy oil engines of the semi-Diesel type, under the Westinghouse Cross Patents. The outstanding advantages of this type of engine, which has been described in our pages, include simplicity, substantial construction, high efficiency and economy in working. There are no complicated parts in the engine, which runs at a moderate speed, and the first cost of the engine is very small. The Aster Co. will produce a range of models—from one to four cylinders developing at normal engine speeds from 5 to 100 h.p.

The Shops' Act.—Pudsey T.C. has made an order under the provisions of the Shops' Act for the closing of retail electricians' establishments at 1 p.m. on Wednesdays.

Supper.—On Friday night last at Probyn's Restaurant, Dalston Junction, the annual supper and concert of Siemens Dalston Works Fire Brigade was held, Mr. A. M. Hicks being in the chair. An interesting programme was arranged by the supper committee, of which Mr. C. Lucken acted as hon. secretary, and a most enjoyable evening was spent.

Liquidation.—Fleetwood and District Electric Light and Power Syndicate, Ltd.—This company is winding up voluntarily, with Mr. W. Cash, 90, Cannon Street, E.C., as liquidator. A meeting of creditors is called for November 4th.

Colliery Installations.—Messrs. Sandycroft, Ltd., of Cheshire, have completed a double-drum haulage gear, electrically-driven, at 2,000 volts, three-phase, to the order of an Indian colliery, near Hyderabad; also a 400-h.p., 2,200-volt motor, to be used for driving an air compressor for one of the largest collieries in South Wales.

Trade Announcements.—Messrs. W. A. Davis & Co., of 13, Kinghorn Street, London, E.C., have been appointed sole agents for Great Britain by Mr. A. Kussmann, of Coln-Rhein, Germany, for cast and engraved metal name-plates; also sole agents for Messrs. Kaeser, Moilliet & Co., of Bern-Zollikofen, Switzerland, for advertising novelties in celluloid.

Mr. C. M. Simpson has opened offices in Canada House, Baldwin Street, Bristol, as agent and factor, and he desires to receive catalogues of electrical and mechanical apparatus, &c.

The Eastern Electric and Trading Co., who have changed their head office from Sukkur to Karachi, India, are in the market for all kinds of electrical goods, and want export lists and terms.

The Splitdorf Electrical Co., of New York, have opened an English branch at 6, City Road, Finsbury, London, E.C., for the sale of the Splitdorf magnetos and other electrical specialities.

The Windsor and Ascot Engineering Co., Ltd., electrical engineers, have opened new works at South Ascot.

The business of Mr. J. A. Brockett, electrician, &c., 13, Victoria Square, Whitby, and Robin Hood's Bay, has been purchased by Mr. T. H. Beecroft.

Mr. Amos Brook, late of the firm of H. Jaggar & Co., electrical engineers, Commercial Street, Batley, and 2, Halifax Road, Halifax, has commenced business at Hanover Street, Batley, under the style of A. Brook & Co.

Messrs. Victor H. Coates & Co. announce that from to-morrow (Saturday) their address will be 121, Victoria Street, Westminster, S.W., where they have taken more extensive premises.

According to *Commercial Intelligence*, the Automatic Wind Motor Co., Ltd., has been formed in Sydney to manufacture wind motors for generating electricity. A trial order has been given to the company by the New South Wales Railway Department.

Messrs. T. M. Johns & Co., of 41, George Street, Plymouth, have recently acquired additional stock rooms and facilities for dealing with plant and accessories and for rewinding and repair work to a.c. and d.c. motors.

Patent Applications.—Applications have been made for the restoration of the following patents:—

No. 25,217 of 1902, "An Improved Ore Roasting Furnace"; T. D. Merton.

No. 22,968 of 1904, "Improvements in Centrifugal Machines," W. E. and H. W. Lake.

No. 7,471 of 1900, "Improvements in Electric Telegraphy," S. G. Brown.

Application is to be made to Mr. Justice Parker in the Chancery Division on December 3rd respecting a petition for extension of Patent No. 8,961 of 1899, granted to Valdemar Poulsen, Copenhagen, for "Method of and apparatus for effecting and storing up of speech or signals by magnetically influencing magnetisable bodies."

Catalogues and Lists.—The Electrical Engineering and Equipment Co., Ltd., 109-11, New Oxford Street, London, W.C.—List (C. 1) of four pages, giving prices and particulars of their flame carbons, with and without metal core, also a special line of carbons for cinematograph projector work, which are claimed to show low current consumption, and to be run at high current density so that smaller diameters can be used. With c.c. the negative carbon has a copper-coated core, which prevents hissing and keeps the arc in the centre of the carbons. The carbons are impregnated with flame salts.

The Brimsdown Lamp Works, Ltd., Kingsway House, London, W.C.—We have received two attractively-coloured advertising novelties for the current lighting season—one is a gauze-mounted cut-out of John Bull holding a Brimsdown Wirum lamp of British manufacture, with the well-known wording, "See things in a better light," and the other is a hand and lamp cut-out with strut. These novelties are for general distribution to the trade; the gauze cut-out is printed in seven colours, and the hand and lamp cut-out in four.

The Langdon-Davies Motor Co., 110, Cannon Street, London, E.C.—16-page catalogue containing a specification of the firm's standard a.c. motors of short-circuited rotor and slip-ring types, and illustrating several applications of these motors. The company contradict a rumour that their organisation has entailed a change of staff and employés. The only alterations are in the management and in prices of motors, which have been considerably reduced. All the old workmen, the works staff, and the works manager who has been responsible for the design and manufacture of the motors for the last 16 years, are retained.

The D.S. Pulley Block and Crane Manufacturing Co., 78, Southwark Street, London, S.E.—32-page illustrated and priced pamphlet, particularising their various electric and other pulley blocks, travelling cranes and other lifting appliances, also electric runways.

The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Aston, Birmingham.—New season's catalogue (32 pages), giving descriptions and numerous neat small illustrations, with prices, of various types of "Eclipse" electric convectors and luminous radiators, also the "Eclipse" electric cooker, water boilers, and other cooking appliances.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London' W.C.—We have received a pamphlet (No. 21, of 16 pages) entitled "Electrical Advertising," which has been issued for the use of contractors and others interested in the advertising sign business. A special discount offer, which is open only until the end of October, accompanies it, being intended as a special inducement to contractors and others to help to make a bigger showing in connection with this department of electrical business. The list contains illustrations of new designs of zinc case letters, zinc block letters, glass reflector letters, universal advertising and live signs, kaleidoscopes, number indicators for music halls, &c. Prices are given fully in nearly all cases. Twelve distinct types are included, with prices in seven sizes. All the letters listed, except the glass reflector letter, are English made. The company will forward particulars on application. They hold that more business of this kind could be done if only it were properly pushed.

Mr. H. M. Budgett, Crown Works, Chelmsford.—New 12-page catalogue, containing excellent illustrations, description and prices of magnetic chucks, flat, for holding work on surface grinders, planers, &c., and rotary, for holding work on cylindrical grinders, lathes, &c.; also demagnetisers, countershafts, small generators and motor-generators, for supplying current for magnetic chucks and demagnetisers.

From Messrs. Cryselco, Ltd., we have received a couple of counter advertising cards of attractive coloured design, relating to the "Cryselco" metal-filament lamp. One carries a model of the lamp in card.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Two new illustrated leaflets relating to aluminium wire for winding every kind of coil, and aluminium relay coils.

The "Chicago Rawhide" Co., Ltd., Hythe Road, Willesden, London, N.W.—Four-page price list of belting, lacing, packing, hammers, mallets and other "Chicago Rawhide" specialities.

The Sun Electrical Co., Ltd, 118-120, Charing Cross Road, London, W.C.—24-page illustrated price list of electric cooking and domestic electrical appliances; a variety of kettles, cooking outfits, hot-water jugs, boiling and warming plates, toasters, grills, restaurant apparatus, hot cupboards, electric ovens and irons, towel rails, suction cleaners, the "Belenus" boiler and other similar lines are included. Copies of the catalogue will be sent on application.

The Kramax Manufacturing Co., 12, Cambridge Lane, Glasgow.—Small priced pamphlet and cards relating to the "Ellco" invisible lamp lock.

Bankruptcy Proceedings.—Augustus Wm. Byron, described as of Park View Hotel, Hyde Park Corner, formerly of Chesterfield.—An application was made last week to Mr. Registrar Linklater at the Bankruptcy Court for an order of discharge. Mr. Walter Bayle, Official Receiver, reported that the applicant failed in April, with liabilities £65,029, and it was unlikely that any considerable amount would be realised from the estate. He attributed his failure to a loss of £70,000, incurred chiefly in connection with companies formed to acquire the British patents of a process for the manufacture of weldless steel tubes, and to ill health, which prevented him from earning an income during the past two or three years. In 1899, the debtor borrowed between £4,000 and £5,000, and, as a speculation, purchased at a premium upwards of 3,000 £1 shares in an electric battery company. The company was not a success, and the shares became valueless. The debtor estimated his loss over the transaction at about £6,000. The Official Receiver opposed the application on the grounds (1) that the assets were insufficient in value to equal 10s. in the £ on the amount of the unsecured liabilities, and (2) that the debtor had brought on his failure by rash and hazardous speculations. After hearing Mr. Albert Osborn in support of the application, the learned Registrar imposed a suspension of three years, observing that the general financial career of the debtor had been reckless in the extreme. He disclosed no assets, and filed his petition simply for the purpose of being whitewashed.—Order entered accordingly.

John Tizzard, electrical engineer, Abbey Road, Torquay.—First and final dividend, 2s. 5½d. in the £, payable October 29th at Official Receiver's offices, 9, Bedford Circus, Exeter.

Fred Shaw, electrical contractor, Hessle Road, Hull.—November 4th is the last day for the receipt of proofs for dividend by the trustee, Mr. G. H. Acheson, York City Bank Chambers, Lowgate, Hull.

Mexico.—The present moment is favourable, says *Elektrotechnik und Maschinenbau*, for the export of electrical goods of all kinds to Mexico, and especially to the State of Durango. A whole series of electric installation schemes are in hand. Particular attention is being given to utilising the numerous waterfalls of the country which have hitherto attracted little attention. Among the installations foreshadowed are those of the Mexican Candelaria Co., which already owns a generating station, and is building two other hydro-electric works. The equipment contemplated consists of six turbine aggregates of 160 up to 6,000 KW. The Topia Mining Co. at Topia is building a power house, with a view to electrifying the working of its mine. Lastly, the lately-formed Durango Hydro-Electric Light and Power Co. is building 60 km. west of Durango, at El Salto, a generating station for the City of Durango.

Japan.—In Japan, according to the *Deutsche Electrische Rundschau*, there is observable an increasing demand for electro-technical specialities. This demand is attributable mainly to the creation of a number of hydro-electric stations, through the activity of local agents of foreign firms, a movement for which there is a great future. The use of electricity in Japan has made fairly rapid progress, and, besides a number of electric tramways, Japan possesses big power stations, which distribute light and power over considerable areas. There is a certain amount, but small, of competition with imported electrical goods from native manufacturing firms; but the Japanese industry suffers from a lack of skilled electrical workers, and must rely for a lengthened period on foreign imports, and, as the use of electricity is growing, a sustained demand for electrical articles may be safely reckoned upon.

Stoker Contracts.—Among important orders for stokers recently received by the Underfeed Stoker Co., Ltd., are the following:—

Usine Electrica de Monte Video, eight class "E"; Madras Electricity Supply Corporation, three class "E"; Newport Corporation Tramways, one class "E"; Mines de Houille du Grand Hornu, four class "A"; Sulzer Bros., for Japan, six class "A"; Sulzer Bros., for Riga, two class "A."

Fire.—Considerable damage was done by fire at the works of Elliott's Metal Co., at Selly Oak, Birmingham, last Saturday night.

Cable Works in Finland.—The first works in Finland for the manufacture of electric cables are about to be established in Helsingfors by a company which has just been formed with the title of the Finska Flatfabriken. The works will be under the management of Herr A. Wikstrom, who is stated to have studied electric cable manufacture in England and Germany.

LIGHTING and POWER NOTES.

Alloa.—Damage estimated at £70,000 was done by fire last week at the Devonbank Pit, Alloa. Much of the machinery and fittings was destroyed, including washing, picking and conveying plant, and electric cables.

Asiatic Turkey.—According to the German Consul at Beirout, since a Belgian Tramway Co. established there began to supply current for light and power, there has become apparent a demand for motors. Those already utilised, to the number of 100, are of ¼ to 2 H.P., and are employed for the watering of gardens, while some of larger power are used in the weaving industry and in the wood and metal trades. Damascus is the seat of an extensive flour-milling industry; nine flour mills are at work, whose motive power is derived from turbines, principally of French manufacture.

Atherton.—At a meeting of the U.D.C. last week the electrical engineer mentioned that after the winter load is over, it will be necessary to renew the H.T. switchboard at the sub-station. It was decided to invite tenders for new transformers, and a sub-committee was appointed to inspect the switchboard at the sub-station.

Australia.—The N.S.W. Minister of Works states that a Melbourne syndicate is willing to spend £500,000 in a scheme to dam the Buddong Falls, and generate power to run an electric railway and a carbide plant. The Minister intimated that the Government might take the matter up itself.

The Sydney City Council has decided to expend £52,500 in installing an underground storage battery, to be brought into use in April, 1914. The City electrical engineer's report as to the extension of electric street lighting through all streets at present lighted by gas has been adopted.

The Melbourne Electrical Supply Committee has withdrawn its proposal to obtain powers to hire and sell electrical fittings to consumers, and the matter now stands in abeyance.

It was proposed by the Port Melbourne T.C. to install an electrical plant at a cost of about £8,000, but, having consulted Mr. H. R. Harper, the electrical engineer of the Melbourne City Council, it has been decided to adopt the three-phase system in order to secure a better supply. Fresh tenders are being called for cables and poles.—*Australian Mining Standard.*

Barrow-in-Furness.—The T.C. has received from the L.G.B. sanction to a loan of £21,484 for electricity purposes.

Basingstoke.—A prov. order for E.L. is being applied for by Messrs. Edwards & Armstrong, of Bristol, and the matter is to be considered by the T.C. at a special meeting.

Bridport.—The T.C. has retained Mr. E. M. Lacey to report on a proposed electricity scheme, at a fee of 100 guineas.

Canada.—A general reduction in power rates benefiting over half of the municipalities in the Niagara Power zone has been decided upon by the Ontario Hydro-Electric Commission. The reduced rates are based upon an expected increase in the consumption of 30,000 H.P. at the end of the current month. The new rates, which are a 3 to 15 per cent. reduction, will come into effect on November 1st.

Carlisle.—An interesting exhibition of electrical appliances was held last week at the Church Hall, which adjoins the Corporation electricity works. Included in the exhibits were domestic apparatus for heating, cooking, vacuum cleaning and ironing. It is claimed that the special new tariff for electricity in the city allows consumers to light and heat their houses, and cook their meals, at a lower price than by any other means, and to have, at the same time, all the advantages which electricity affords. The opening ceremony was performed by the Mayor, in the presence of a large gathering, the chair being occupied by Dr. Overton, chairman of the Electricity Committee.

Cromer.—The U.D.C. has decided, subject to the approval of the L.G.B., to transfer its electric light undertaking, for which £30,000 had been raised on loan during the past 10 years, to Messrs. Edmundsons, Ltd., who will have to pay the Council £18,000 in extinction of outstanding loan liabilities.

Dalkey.—The question of electric light supply was considered in connection with a letter from the town clerk of Kingstown in reply to a request that the Kingstown Council should defer coming to a decision on the electric lighting question until Dalkey had an opportunity to discuss the matter. The town clerk read the resolution of the Kingstown Urban Council. The resolution granted permission to a solvent public or private company to open up streets for the purpose of supplying electric light, &c., "always provided that this permission will be granted only on the condition that the Councils of Blackrock and Dalkey shall also approve of said undertaking, and shall join with this Council in entering into an agreement safeguarding the rights of the several parties." Mr. Booth submitted a report of an interview of a deputation of the Dalkey Council with the promoters of the electric lighting company for Kingstown, Blackrock and Dalkey, and it was agreed to favourably consider the granting of permission to any company which proposes to supply the district. Mr. Conan said that the company's proposal was to run a main as far as Castle Street, and after that further mains to the extent of one mile. Bearing in mind that the distance from Castle Street to Sorrento Point was practically seven-eighths of a mile, it left very little possibility of extension to any other part of Dalkey. Any scheme to which they could give their approval should be sufficiently elastic to, at least, give a hope that in the near future every main road in Dalkey would be supplied with electric light. The promoters met that objection by saying that they would be prepared to extend their system by running another mile of main, which, they said, would cost £1,300 a mile, if they got a guarantee of an annual income of 20 per cent. of the cost of the main, or, in other words, £260 for a mile of main. It was decided to appoint a Sub-Committee.

Ealing.—At the Ealing Chamber of Commerce last week, Mr. Timpson drew attention to the municipal trading carried on by the Electric Lighting Committee. That Committee, he said, was taking orders for the supply of outside lamps and the hire of electric fans, and he had also heard it stated that it was supplying Osram lamps, although this had been denied. He understood that in the Town Hall extension scheme it was proposed to have a large showroom for the electricity undertaking to show improved methods of using electricity for heating, cooking, and so on. He had no objection to such a showroom, provided it did not attempt to sell against contractors and tradesmen. The Chamber unanimously decided that a letter of protest be sent to the T.C. against any municipal trading by its Electric Lighting Committee that in any way competed with local private enterprise.

Glasgow.—Owing to the great demand for electricity the T.C. some time ago acquired ground in the Dalmarnock district for the purpose of erecting another power station. An exhaustive report on the whole position was submitted by the engineer at the last meeting of the T.C. He points out that when the new station at Dalmarnock has been properly equipped, Port Dundas and St. Andrew's Cross would be used principally as peak load stations—*i.e.*, in meeting the great demand from October to March for lighting. At other periods—*i.e.*, during the summer months—H T. energy would be transmitted to those two stations from the Dalmarnock works for transformation and distribution in their immediate areas. Govan and Partick Electricity Works would not be extended as generating stations, but for the increasing demand in the areas of these stations extra H.T. energy would be transmitted to them, and transforming plant installed there. As soon as convenient the steam plant in these works would be shut down, as a saving of between £4,000 and £5,000 per annum could be effected by the use of energy generated at Dalmarnock station and transformed for distribution in the Partick and Govan areas. The general manager has been instructed to prepare rough ground plans showing a general arrangement for a generating station, and to submit a statement of the cost of a section of the station.

Great Harwood.—The U.D.C. has approached the Accrington Corporation with a view to obtaining the terms upon which it will supply current to the township. This is an alternative scheme to the one drawn up by the consulting electrical engineer for the establishment of a local generating station. The cheaper scheme will probably be accepted.

Greenock.—In regard to the understanding arrived at between the T.C.'s of Greenock and Port Glasgow with respect to the latter obtaining a supply of electricity for power and lighting purposes, at a meeting of the Greenock Corporation it was agreed to give an immediate supply to power users, and arrange for low-pressure lighting mains being laid in the principal streets in Port-Glasgow. The Council of the latter town is to at once apply to Parliament for an electric lighting order, the transfer of which will be accepted by the Greenock Corporation. The rates to be charged for lighting purposes are not to exceed by more than 5 per cent. those charged to Greenock consumers.

Mr. Robertson, the T.C. electrical engineer, has reported that the estimated cost of laying a low-pressure lighting main in the streets scheduled under the draft order would be £2,850, and for the additional streets specified in the Port Glasgow resolution, £750, exclusive of consumers' services and meters, estimated at £1,450, or a sum of £5,000 to be added to the expense of providing the supply to the power users.

Harwich.—The E.L. has been installed at the station, quay and pier, current being supplied from the G.E.R. Co.'s plant at Parkeston.

Hastings.—The T.C. on October 18th decided to apply to the L.G.B. for loans of £3,000 for mains, £500 for meters, £1,500 for house services, and £500 for transformers. A loan of £423 for mains extensions in the old London Road, by which 18 gas lamps will be converted to electricity, has also been applied for.

Heckmondwike.—The U.D.C. has given formal notice to the Bradford Dyers' Association to determine the agreement for the supply of electricity.

Keighley.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £7,000 for the provision of a new 2,000-KW. turbo-alternator, complete with condensing plant and foundation, at the electricity works.

Ledbury (Herefordshire).—At a meeting of the U.D.C. it was reported that Messrs. Brown & Parsons, Ltd., Leamington, were applying for Parliamentary powers which would enable them to tender for the public lighting of Ledbury by electricity.

Leeds.—At a special meeting of the City Council on the 17th inst., consideration was given to a report of the manager of the Corporation Electricity Department on the provision for future requirements of electrical energy, the proposal being to request the Parliamentary Committee to include in the next Bill in Parliament promoted by the Corporation, the necessary powers for the acquisition of a site in South Accommodation Road for the purposes of an electricity generating station. Mr. R. Armitage, chairman of the Electricity Sub-Committee, outlined the scheme, and said in the Accommodation Road proposal there was put down for land, £6,000 per acre for 10 acres, and in an alternative scheme a site for £30,000. After an hour's discussion it was decided to request the Parliamentary Committee to seek powers for the acquisition of a site for the purpose of a new station.

Limehurst.—With reference to the supply of current to Crossbank by Oldham T.C., the latter body has asked the Limehurst U.D.C. to place in the agreement a clause providing that if at any time the U.D.C. decides to supply current itself, it will take over the plant to be provided at Crossbank, as, under such circumstances, it would be useless to the Corporation. The Council has agreed to insert the clause mentioned.

Littleborough.—At the Greenvale Mill, owned by Messrs. Fothergill & Harvey, Littleborough, near Rochdale, the whole of the ring frames are now operated by motors on the individual drive system, the A.E.G. Electric Co., Ltd., of Manchester, being responsible for the installation.

Liverpool.—During the past 12 months over 8,000,000 units have been generated from refuse at the destructors of the Corporation.

London.—A proposed agreement between the Central Electric Supply Co. and the Chelsea Electricity Supply Co., to enable the former to give a bulk supply of energy to the latter, has been submitted to the L.C.C., and certain amendments have been suggested in conjunction with the Special Committee on London Electricity Supply.

ISLINGTON.—With reference to the letter received from the County of London Co., suggesting that the Council should take a bulk supply from the company's mains, a reply is to be sent, stating that the Council is satisfied that the damage would not have been less, or the supply resumed earlier, if the Council's station had been connected with any other generating station, inasmuch as the spare generating plant was more than sufficient to deal with the load.

FULHAM.—As an indication of the progress and development of the electricity undertaking during the past five years, the following statements of units sold and of consumers connected has been issued :—1907-8, (*a*) units sold, 2,840,626 : (*b*) consumers, 2,440 ; 1908-9, (*a*) 3,165,734 ; (*b*) 2,722 : 1909-10, (*a*) 3,202,208 : (*b*), 3,058 ; 1910-11, (*a*) 3,331,497 ; (*b*) 3,409 : 1911-12, (*a*) 3,512,266 ; (*b*) 3,843.

WESTMINSTER.—The Works Committee reports that it has considered the Council's option to give six months' notice to determine the contract of September 18th, 1899, with the Charing Cross Electric Supply Co. for public electric lighting in the parish of St. Martin-in-the-Fields and a portion of the Strand district, at the end of the fourteenth year of the contract, viz., September 17th, 1913. To exercise the option, notice would have to be given to the company on or before March 17th, 1913, but if the option is not exercised the contract will run for the full period of 21 years. Having regard to the conditions attaching to the termination of the contract before the full term of 21 years, the Committee says it would appear to be inadvisable to consider as to the curtailing the term of the contract, unless the Council contemplated taking over the undertaking to the extent referred to in Clause 14 of the contract, The Committee also reports having considered the possibility of effecting an improvement in the light provided under the contract. Clause 5 requires the company to supply the lamps with electricity of an energy of not less than 500 watts per hour, giving an actual minimum and continuous candle-power of at least 1,000 per lamp. 124 lamps are lighted. and maintained by the company under the contract. In the case of about 50 of these, the company have, with the concurrence of the Council, provided modern flame arc lamps of the Johnson and Phillips type. These lamps give illumination greatly superior to that of the old open-type arc lamps, and the Committee is of opinion that if suitable terms could be arranged, it would be of great advantage if more powerful modern lamps could be substituted for the remaining open-type arc lamps. The company is, therefore, to be asked upon what terms it would be prepared to improve the public lighting under the contract, and to guarantee a standard of light to be agreed upon. The Contracts Special Committee reports that the Council's contract with the Westminster Electric Supply Corporation, for the supply of electrical energy to the Council's premises will expire on December 31st next, and that it has decided to continue the contract for a further period of one year from January 1st next.

Marylebone.—In consequence of fumes arising from the gas-heating apparatus at St. John's Wood Road and Marylebone Road conveniences and the overheating and bad ventilation thereof, the substitution of electric radiators for the gas-heating apparatus has been decided on, and the offer of the electricity department to provide electric radiators, including the necessary wiring. &c., at these conveniences for the sum of £17 has been accepted.

Greenwich.—The South Metropolitan E.L. and Power Co. is to enter into an agreement with the L.C.C. for a supply of electricity for lighting Blackwall Tunnel and working the pumps. The agreement provides for not less than 100,000 units per annum, and up to 50 kw., the normal being 25 kw., at a price of ·96d. per unit, and is to cover a period of five years, subject to reduction of the charges to correspond with any reduction made by the company to other consumers.

New Zealand.—The Whangarei B.C. has appointed a special committee to consider the desirability of installing an electric lighting plant for the borough at a cost of about £12,000. The original proposition was to utilise the water-power of the Wairua Falls for the development of electrical power, but that scheme has been indefinitely postponed.—*Australian Mining Standard.*

Rawtenstall.—The borough electrical engineer has been empowered to obtain a light tower wagon to be used in connection with the cleaning of electric street lamps, &c. On his recommendation it has been decided to obtain an additional boiler for the electricity works, together with the necessary superheater, mechanical stoker, feed pump, &c.

Romford.—Mr. W. T. Pressland has written to the U.D.C. asking that body to provisionally approve of his E.L. scheme for the town. As there are two other schemes proposed, the clerk has replied that the Council cannot give preference to any one of them.

Sevenoaks.—Having received evidence of sufficient support, Sevenoaks and District Electricity Co., being formed by Messrs. Crompton & Co., has been registered, and the requisite sum of money deposited. The U.D.C. holds its own prov. order, and that body has decided to interview the B. of T. respecting Crompton and Co.'s scheme, which the Council is supporting, and the dealing with the prov. order.

Sheffield.—Sanction has been received from the L.G.B. to the borrowing of £57,000 for mains (repayable in 25 years), £9,000 for services (repayable in 15 years), and £40,000 for substations, transformers and power factor rectifiers (repayable in 15 years). The Electric Light Committee considers that the period of repayment for the latter sum is very short, and the L.G.B. is to be urged to extend the period to 25 years.

Shipston-on-Stour.—Messrs. Brown & Parsons, of Leamington, who are carrying out an E.L. scheme at Shipston, have approached the B. of G. as to supplying current for the workhouse, which is at present lit by oil lamps. The Guardians have decided to wait and see how the electric light answers in the town before deciding upon the matter.

South Africa.—The Durban borough electrical engineer has suggested that the T.C. should arrange to hire out electric heating stoves to small consumers. He proposes, in the first instance, to call for tenders from local contractors for the supply of low-priced electric heating stoves suitable for small households. He also stated that if experiments which are being made locally to produce a cheap and simple stove should prove successful, tenders will be invited for the supply of stoves of the improved pattern.

Taunton.—The T.C. has altered the charge for current for heating purposes from 2d. per unit to 2d. for the first 50 units per quarter, and 1d. beyond.

Treharris.—The public supply of current to Treharris, Merthyr Vale, and Aberfan, provided by the Merthyr Tydfil Electric Traction and Lighting Co., Ltd., was switched on at the Penydarren generating station on October 17th, by the Mayor of Merthyr, Alderman J. N. Berry, J.P.

West Kilbride (near Ardrossan).—A suggestion has been made that a scheme be brought forward for lighting the village by electricity. Several persons are contemplating the adoption of private installations, power for which will be derived from small turbines driven by the gravitation water. It is said that there is a possibility of the local authorities taking up the matter.

Windsor.—An offer made by the Windsor Electrical Installation Co. to do the pumping at the sewage farm has been accepted by the T.C. The company agrees to do the work for 12 months, and not charge more than the pumping has cost before. In the event of the electrical plant failing, the company will recompense the Council for the use of the steam plant, and at the end of the period stated, the Council will have the option of adopting the new method permanently, or of not doing so.

Worsley.—The U.D.C. has approved of the scheme of the Lancashire Electric Power Co. for electric lighting in the district, subject to all cables being laid underground, &c.

TRAMWAY and RAILWAY NOTES.

Australia.—Parliamentary sanction is being sought for the substitution of electric for steam traction on the railway between Adelaide and Glenelg, a distance of 6¾ miles, at an estimated cost of about £115,000. It is probable that the Act authorising the expenditure will be passed this Session, but work is not likely to be commenced before 1913.

Bournemouth.—A public meeting was recently held to protest against the proposed running of Sunday cars in the town. Apparently over 2,000 people attended, and the proceedings were not wholly in favour of the protest. Although a resolution to that effect was "declared" carried, we note that a call from the audience to move an amendment was not responded to, and that the discontenteds voiced their disapproval in the usual way.

Bradford.—A heavily-signed petition has been presented to the Corporation in favour of the proposed extension of the tramway system from Thornton terminus to Keelham Hill.

Colwyn Bay.—The Light Railway Commissioners have issued an order, which has been confirmed by the B. of T., authorising the construction of tramways in Colwyn Bay, Colwyn and Conway, being an extension of the undertaking authorised by the Llandudno and Colwyn Bay Light Railway Orders, 1898 to 1907.

Glasgow.—The proposal by the Sub-Committee on Tramways to appeal against the municipal assessments for 1912-13 was discussed by the T.C. last week. It was pointed out that assessments had been imposed on the full valuation of the tramway lines, notwithstanding that it had been decided this year in the King's Bench Division of the English Courts, that a system there was liable to be assessed on only one-fourth of the valuation of the lines. The town clerk gave the opinion that the English case did not help Glasgow at all. It was made clear, in the case referred to, that the decision was due to the fact that it was a one-connected system, viz., a tramway and a light railway. Bailie Pratt was dissatisfied with the ruling, pointing out that he did not see why they should go on paying full rates when they should only be charged one-fourth. If they wanted the tramways department to subsidise the rates, they should not do so in this hole-and-corner fashion. Mr. James Stewart argued that by means of the present method of taxation, the tramways were made to contribute something like £17,000 per annum. Mr. Robert Graham explained that an appeal on the lines suggested by Mr. Pratt had been made to the Sheriff. and had been dismissed. The *status quo* was maintained on a division.

The general manager reported to the T.C.'s Committee on Tramways that the Glasgow Corporation Tramways Friendly Society, as at present constituted, would, in consequence of the National Insurance Act, 1911, be discontinued as at December 31st next; that over 1,700 employés in the department had expressed their willingness to continue the present society in supplement of the benefits under the National Insurance Act; and that they would be prepared to contribute weekly 3d. per member towards the funds of the society. The Committee, after careful consideration, agreed to recommend (1) that the Corporation should contribute weekly the sum of 1d. per member to the said funds, and (2) that its representation on the Committee of Management of the society be proportionate to its contribution.

Huddersfield.—The Corporation has confirmed a resolution of the Tramways Committee (1) approving of the plans and estimates of cost submitted by the borough engineer, in respect of the proposed tramways extensions, viz.:—Brighouse, Elland, Marsden, Longwood (Dod Lea), Crosland Hill, Kirkheaton, Beaumont Street, Gasworks Street and St. Andrew's Road; and (2) instructing the borough engineer to take the necessary steps to prepare the same for Parliamentary deposit.

Irlam.—Several employers of labour in the district having petitioned the Council, urging it again to approach the Salford Corporation with a view to extending the tramways from Peel Green to Irlam and Cadishead, a resolution was proposed and seconded at the meeting of the U.D.C. that the clerk be instructed to enter into negotiations with the Corporation. An amendment was then moved that the matter be referred to the General Purposes Committee. Eventually both the resolution and the amendment were withdrawn, and it was decided to discuss the matter in private.

Japan.—The Musashi Electric Railway Co. proposes to construct an electric railway between Tengenji, Azabu, Tokio and Takashimacho, Yokohama, with a branch from Chofumuna to Kamata and another from Himonza and Shinzuku.

Llandudno.—The U.D.C. at its meeting on Friday, October 18th, received a report from the deputation appointed by the Council respecting the interview it had with Mr. Balfour, the director in charge of the electric tramway undertaking, respecting the proposed extension of the Llandudno and Colwyn Bay Light Railway Co.'s line. As a result of the interview terms have been arranged for doubling the track, and this will be carried out during the coming winter. The tramway company will contribute £200 towards the cost of road widening; the company will also supply fittings for lighting the overhead standards in Bodaton Road, on the understanding that the Council will undertake the future maintenance of the lamps. Mr. Balfour stated, in a letter received subsequently to the interview, that subject to the interests of the company being safeguarded, he would assist the Council in reducing the number of standards in the streets by allowing the Council to make use of the tramway poles for public lighting purposes. The report of the deputation was unanimously approved.

North-Eastern Railway Electrification.—The North-Eastern Railway Co. has under consideration a proposed extension of electrification to a portion of its system in County Durham; the section of railway under consideration is the mineral line from Sheldon to Newport, near Middlesbrough, the distance being about 20 miles, and forming one of the busiest lengths of mineral railway on the North-Eastern system.

U.S.A.—A proposal is on foot for providing passenger subways in Chicago at an approximate cost of £19,260,000. The cost of the equipment is placed at £6,970,000, and includes a power system with generating and sub-stations, &c., and third-rail equipment.

Wharfedale.—There seems to be considerable difference of opinion existing between Menston, Otley, Burley and Ilkley District Councils concerning a proposal of the Leeds Corporation to run railless cars from the tramway terminus at Guiseley to these places. The three former Councils view the proposal with favour, but at Ilkley—which is a residential town serving the cities of Leeds and Bradford, and a noted health resort—a cautious attitude is being adopted, because the town would be differently affected from the other places. No decision for or against the suggestion has yet been arrived at by the Ilkley Council.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The offer of the Marconi Wireless Co. and the Australian Wireless (using the Telefunken system) of their respective patents in Australia to the Federal Government, which the Postmaster-General has declined to entertain, says a Melbourne telegram to the Perth *West Australian*, was that the Commonwealth should pay £40,000 down and give the companies a contract for £60,000 to erect the proposed high-power station at Port Darwin, together with an agreement to give them 10 per cent. of the gross takings from that station for 28 years. The £60,000 was to be exclusive of site, foundations for machinery and buildings, and the cost of the buildings themselves. Thus, for an outlay of more than £100,000 at the outset, Australia was to get one station, and was to have the privilege of erecting others at its own cost, and using the companies' patents. The Postmaster-General has decided to go on with the scheme of the Department's expert. Under this, for less than £100,000, not only the Port Darwin high-power station, but nine others will be erected round Australia. The patents of the companies will not be used, the Federal Government contending that the Balsillie system does not infringe them in any way.—*Financier.*

Austria.—The wireless station which has been erected on the roof of the Ministry of War at Vienna consists of two lofty masts, equipped with antennæ similar to those used on board ship. Its range will be only about 500 km., reaching as far as Budapest, Prague, Krakow and Passau. The Austrian naval ports of Pola and Sebenico lie, however, outside its range.—*Zeit. des Oest. Ing. u. Arkt. Vereins.*

Belgium.—A powerful wireless telegraph station is under construction at Laeken, near Brussels, to permit communication with Boma, in the Congo, either directly or by way of Dakar. According to anticipation, it will be possible to communicate between Brussels and Boma about the beginning of next year. There are at present 10 stations in the Belgian Congo.—*The Times.*

Imperial Wireless System.—The Government have appointed Sir Albert Spicer chairman of the Select Committee on the Marconi Agreement, which will commence its sittings to-day.

Switzerland.—An understanding has been reached between the German and Swiss Governments as regards the building of a wireless station on Mount Säntis. This station, when completed, will be able, by means of the recently opened station on the Zugspitze, to effect communication right across the Alps.—*Elektrotechnische Zeitschrift.*

Wireless Rescue.—Owing to a violent outbreak of fire on board the *Berkshire*, carrying cotton, the lives of 100 passengers were endangered. Help, however, was summoned by wireless, and the passengers were taken off while the ship was still 50 miles from land, off the shore of North Carolina.

Wireless Telegraphy.—According to the [illegible] *Telegraph*, M. Valdemar Poulsen intends to establish wireless communication between Scandinavia and America, *viâ* an intermediate station in South Greenland.

The Admiralty are arranging for periodical practices in wireless communication between warships and ships of the British mercantile marine, for the purpose of ensuring efficient and reliable communication when required under the regulations.—[illegible]

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 5th. Balancer for the U.D.C. See "Official Notices" October 18th.

Atherton.—November 6th. One 250-K.V.A. single-phase transformer, for the U.D.C. See "Official Notices" to-day.

Australia. — South Australia. — November 27th. 18 miles paper-insulated cable, 155,000 jointing sleeves, also switchboard cable (Schedule 248). See "Official Notices" October 18th.

December 11th.—Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" to-day.

December 17th. Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—November 12th. Deputy P.M.G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 8th and 12th. (*a*) 340 A.C. and 800 D.C. electricity recording meters; and (*b*) insulated copper cables, for the Melbourne City Council. See "Official Notices" to-day.

November 19th.—One mercury vapour converter, for the P.M.G.'s Department. See "Official Notices" Oct. 11th. Also two batteries and a 4-K.V.A. single-phase transformer. High Commissioner in London.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" October 11th.

"The Postmaster-General will shortly invite tenders for the construction of a tunnel for the conveyance of mails between the G.P.O., Melbourne, and Spencer Street. The load will be suspended from a rail at the top of the tunnel and electrically propelled."—*Mining and Engineering Review Tenders.*

New South Wales.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

Austria.—Vienna.—November 1st. Tenders are invited for the supply of 657 red larch telegraph poles of various sizes for the Austrian post and telegraph service. Particulars, with printed tender forms, from the K.k. Post und Telegraph Direction, Hetzgasse II, Wien III.

Zenica, October 30th.—The authorities of Zenica are prepared to receive offers for the establishment of an electric light service in the town. Particulars of the Gemeindeamt in Zenica.

Barrow-in-Furness.—November 5th. Electrical and steam plant, &c., in connection with the electricity works extensions, for the Corporation. See "Official Notices" October 18th.

Belgium.—November 7th. La Société de l'Exposition Universelle et Internationale de Gand 1913, of Rue des Moineaux, Ghent, is inviting tenders for—(1) An installation of electric lighting in the Palais des Fêtes; (2) ditto in two restaurants connected with the Palais de l'Horticulture; and (3) ditto in the Palais de l'Horticulture.

Brighton.—Private telephone service and electric fire alarms, Warren Farm Schools, for the B. of G. Mr. P. Coote, consulting electrical engineer, 3, North Street Quadrant, Brighton.

Canada.—October 31st. One 500-B.H.P. Diesel engine, alternator, exciter, switchboard, tungsten street lighting apparatus, for the town of Yorkton, Sask. Apply Board of Trade Commercial Intelligence Department in London.

Dublin.—November 4th. General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" October 18th.

November 5th.—3,000-KW. steam turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" October 18th.

Christchurch.—November 1st. Electric light installation at the Workhouse and Cottage Homes, for the B. of G. Mr. T. A. Digby, consulting engineer, 32, Shaftesbury Avenue, London, W. Returnable deposit of £5.

Glasgow.—October 28th. The Caledonian Railway Co. invite tenders for various stores for the year, including telegraph appliances, telephones, &c., electric lighting material and fittings. J. Blackburn, secretary, company's offices, 302, Buchanan Street.

Keighley.—November 11th. One 2,000-KW. steam turbo-alternator, for the Corporation. See "Official Notices" to-day.

Leigh (Lancs.).—October 30th. About 4,000 tons of steam slack, for the Corporation Electricity Works. Electrical Engineer, Albion Street.

London.—L.C.C.—November 4th. Carbons, fittings, insulating materials and lamps, for a year. See "Official Notices" October 18th.

BATTERSEA.—October 25th. Twelve internal telephone instruments and lines, for the B.C. See "Official Notices" Oct. 18th.

PORT OF LONDON AUTHORITY.—November 1st. Stores and materials, including carbons for electric arc lamps, carbon filament lamps, glass and glassware, india-rubber and gutta-percha goods, steam and other fittings, &c. Stores Superintendent, 106, Fenchurch Street, E.C.

L.C.C.—November 6th. Electric lighting installation at Mantua Street School, Battersea. See "Official Notices" to-day.

Neath.—October 31st. Coal (through-and-through, or small steam) for the R.D.C. generating station, Court Sart, for six or twelve months. Mr. G. H. Thomson, electrical engineer and manager, 12, Green Street, Neath.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

Rawtenstall.—The T.C. has decided to purchase an additional boiler, with superheater, mechanical stoker, feed pump, &c., for the electricity works, and a light tower wagon for use in cleaning the street electric lamps.

Rio de Janeiro.—November 11th. Tenders to the Directoira Geral de Correios, Telegraphos e Illuminacão, Ministerio da Viação e Obras Publicas, Rio de Janeiro, for the construction and working of an overhead or underground telephone system designed to join up the cities of Rio de Janeiro and São Paulo. The *Diario*, containing further particulars, may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

Salford.—October 28th. One hundred tramway poles and fittings. General Manager, 32, Blackfriars Street, Salford.

South Africa.—November 18th. The Municipal Corporation of Cradock, Cape Province, is calling for tenders for two 50-KW. Diesel oil engines and dynamos complete, also supply mains and public lighting. Specifications from Mr. B. A. Paterson, town clerk, on deposit of £2 2s.

Switzerland.—KÖLLICKEN.—The authorities of Köllicken, near Aarau, are open to receive tenders for the installation of an electric service, consisting of a high-pressure network 2 km. in extent, a generating station, four transformer stations, and the secondary network with street lighting. Particulars from Ingenieur Matter, Kantonal Waterbaubureau, Aarau.

Tonbridge.—October 28th. One 100-KW. Diesel engine and generator, and alterations and additions to switchboard, for the U.D.C. See "Official Notices" October 11th.

York.—November 16th. Construction of about $1\frac{1}{4}$ miles of light railways, for the T.C. Mr. H. Craven, Town Clerk. Returnable deposit of £5.

CLOSED.

Argentina.—According to *Commercial Intelligence* the only tender for the concession to construct an electric tramway in Santiago del Estero, Argentina, was submitted by Messrs. Roberts, Perona & Co., of that town.

Australia. — According to the *Australian Mining Standard* the following contracts have recently been placed :—

Victorian Railways.—
Automatic telephone switchboard (£2,439) and supply of wall and table sets.—Automatic Telephones (Australasia), Ltd.

Sydney Municipal Council.—
Metal-filament lamps, £212.—Australian Metal Co.
Fibre conduit, £958.—Noyes Bros. Propty., Ltd.
A.C. and D.C. panels, £310.—Australian G.E. Co.

Tenders (*Mining and Engineering Review*) states that the W.A. Tender Board has ordered electric train lighting material (£331) from the Hart Accumulator Co., Ltd.

Bradford.—The Tramways Committee of the T.C. has accepted the tender of Messrs. Hurst, Nelson & Co., Ltd., for 48 car trucks, at £81 each.

Brighton.—The B. of G. has accepted the tender of Messrs. A. E. Dean & Co., of London, for an X-ray apparatus, at £133.

Epsom.—The U.D.C. has accepted the tender of Messrs. Perch & Co. for 200 tons of anthracite washed nuts for the electricity works, at 30s. 6d. per ton, and for 300 tons of Welsh through-and-through coal, at 19s. $11\frac{1}{2}$d. per ton.

Faversham.—The T.C. has accepted the tender of Mr. Davis, of Faversham, for 250 tons of anthracite coal for the electricity works, at £1 15s. 9d per ton.

Glasgow.—The following offers have been recommended for acceptance by the T.C.'s Tramways Committee :—

Lighting fittings.—Siemens Bros. & Co., Ltd.
Scrap—(*a*) Cable, (*b*) copper, (*c*) zinc.—R. M. Easdale & Co.
Copper strip.—Leslie & Hall.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

WAR OFFICE.

Electric cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. and Co., Ltd.; Western Electric Co., Ltd.
Conduit fittings.—Accles & Pollock, Ltd.; Barton & Sons, Ltd.; Brotherton Tubes and Conduits, Ltd.; Credenda Conduits Co.; Eureka Conduits and Fittings Co.; Nettlefold & Sons, Ltd.; Walsall Hardware Manufacturing Co.
Electric light fittings.—Bulpitt & Sons, Ltd.; Edison & Swan United Electric Light Co., Ltd., General Electric Co., Ltd.; S. Heath & Sons, Ltd.; D. Hulett & Co., Ltd.; Simplex Conduits, Ltd.
Erection of electric power station, Tidworth.—W. P. Goose & Sons.
Overhead conductors and supports for electric light installation, Tidworth and Bulford.—G. E. Taylor & Co.

INDIA OFFICE, STORE DEPARTMENT.

Accumulators.—D.P. Battery Co.
Cable.—London Electric Wire Co., and Smiths, Ltd.; Siemens Bros. & Co.
Cells.—Siemens Bros. & Co.; Tudor Accumulator Co.
Switchgear.—British Thomson-Houston Co.
Switches, &c.—Isca Foundry Co.
Switchboard, &c.—Peel-Conner Telephone Works.

CROWN AGENTS FOR THE COLONIES.

Telephone cable.—Henley's Telegraph Works Co., Ltd.
Electric capstan and accessories.—Clarke, Chapman & Co., Ltd.
Diesel engine and generator.—Willans & Robinson.
Telegraph poles.—Siemens Bros. & Co., Ltd.
Switchboard, &c.—Siemens Bros. & Co., Ltd.
Telephone apparatus.—Siemens Bros. & Co., Ltd.

OFFICE OF WORKS.

Electric wire and cable (1912-13).—Liverpool Electric Cable Co.; Siemens Bros. & Co., Ltd.; Callender's Cable and Construction Co., Ltd.
Engineering work, Pekin Legation.—Siemens Bros. & Co., Ltd.
Electric crane at Stationery Office, Shepherdess Walk.—R. Waygood & Co., Ltd.
Electric goods lift at ditto.—Easton Lift Co., Ltd.

GENERAL POST OFFICE.

Two electric lifts at Post Office Telegraph Stores, Birmingham.—R. Waygood and Co., Ltd.
Telephone Exchange equipment at Hammersmith, East Ham and New Cross, S.E.—The Western Electric Co., Ltd.
Protective apparatus.—Gambrell Bros., Ltd.; International Electric Co.; Spagnoletti, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co.; Western Electric Co., Ltd.
Telephonic cable.—W. T. Henley's Telegraph Works Co., Ltd.; Western Electric Co., Ltd.
Wood arms.—Millar's Timber and Trading Co., Ltd.; Western Electric Co., Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliff and Co., Ltd.
Telegraphic ironwork.—Baldwin's, Ltd.; F. W. Cotterill, Ltd.; Phœnix Bolt and Nut Co.; Portland Bolt and Nut Co., Ltd.; C. Richards & Sons.
Telegraphic wire.—Johnson & Nephew, Ltd.; Rylands Bros., Ltd.; F. Smith and Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.); Whitecross Co., Ltd.
Telephonic wire.—T. Bolton & Co., Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).

G.P.O.—Messrs. Clough, Smith & Co., Ltd., have secured from the G.P.O. the London-Weybridge—Guildford Section 1 Contract, for the laying of about six route-miles of conduits.

Newcastle-on-Tyne.—The City Council, on 17th inst., sealed the following contracts :—

Titan Trackwork Co.—Tramway junctions, £970.
Lorain Steel Co.—Tramway junctions, £1,328.

New Zealand.—The Te Kuiti (N.Z.) Borough Council has accepted the tender of Messrs. A. & T. Burt, of Dunedin and Auckland, for the installation of an electric light and power plant with a capacity of 100 H.P., to meet the requirements of 7 miles of streets, the contract price being £5,495. "A special condition of the specifications was that aluminium cables should be used instead of the usual copper cables, the price of the latter having risen considerably during the last few months. Although there were four tenderers, only two quoted for aluminium cables."—*Australian Mining Standard.*

Rawtenstall.—The T.C. has accepted the tender of Messrs. S. S. Stott & Co., Ltd., for an elevator for the sand drying apparatus at the tramway depôt.

Southend-on-Sea.—The T.C. has accepted the tender of Belliss & Morcom, Ltd., of Birmingham, for a 500-KW. steam generating set.

(*Continued on page* 666.)

ELECTRICITY SUPPLY DEVELOPMENTS AT BRADFORD.

(Concluded from page 622.)

Turning to the switchgear in the No. 2 station, it is interesting to note that this has practically all been built up by the department itself in the well-equipped workshop attached to the station. The direct-current gear is distributed on the ground floor and two galleries facing the original No. 2 engine room, and probably the most attractive feature here is the direct-current remote-control benchboard, fig. 6, for the 1,000-KW. units in the adjacent station.

Each of the bench panels is fitted with two controllers operating the main circuit-breakers, positive and negative, on the upper gallery, and indicating lamps showing the positions respectively of the inter-connector switch (lighting or traction) and circuit-breakers; there is also a voltmeter, a controller for regulating the motor-driven face plates of the field rheostats, which are adjacent to the machines in the No. 3 station, and five solenoid-controlled push buttons—two for signalling the hand control of the rheostat if the power control fails, and the others for engine signals. In each case the driver's return signal is provided by the push button springing out again.

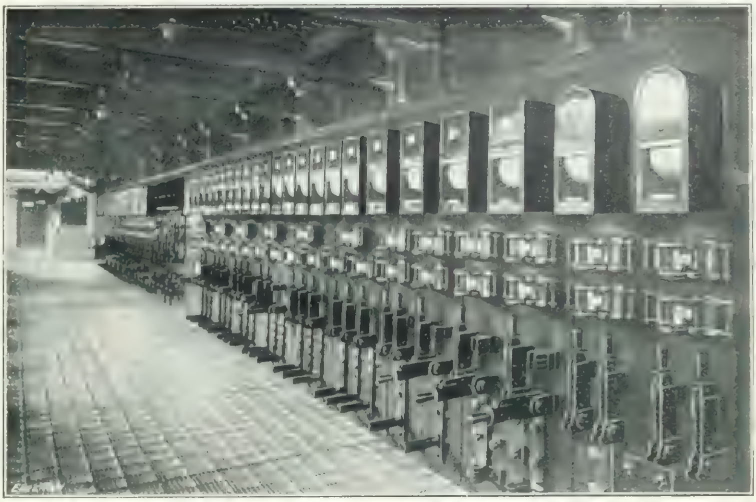

Fig. 10.—Direct-current Feeder Panels for General Supply.

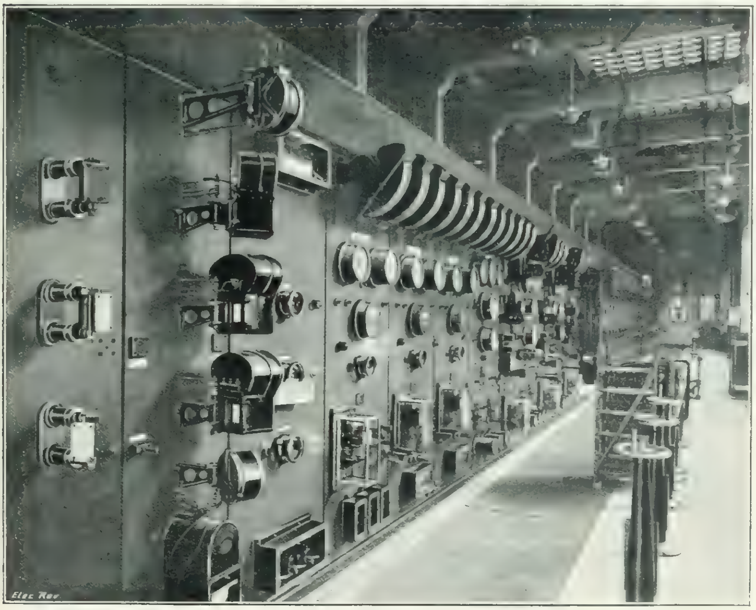

Fig. 11.—Extra-H.T. Machine Panels, with Direct-current Switchgear beyond.

The signal lights are run off a small battery, while the control circuits are operated by 240-volt current from the station bus-bars.

On the upper gallery four positive and four negative 3,000-amp. Westinghouse circuit-breakers are installed in slate cubicles, and behind them panels carrying Thomson wattmeters and circuit-breaker relays, set for instantaneous operation on reverse and allowing an 8 sec. lag on overload. The large circuit-breakers are coupled to the generators through 1·6 sq. in. concentric cables and change-over switches.

The switch panels on the ground floor include 12 machine panels for the Willans sets, also 12 traction feeder panels of normal type; a panel containing paralleling switches, and another containing three master traction meters in series and Kelvin feeder logs. An Aron meter is also provided in the traction negative as a check on the above three meters.

Nine traction negatives enter the station, and are coupled to a main vertical bus-bar; shunts are provided to each of the former, coupled through a sliding contact to an ammeter, also a main shunt for the Aron meter, so that return current readings can be readily obtained.

The first gallery contains the general direct-current supply panels, including 21 positive and 21 negative feeder panels, also interconnecting panels (lighting and traction) and positive and negative switch panels for turbo-alternator field excitation. Fig. 10 shows the extent of this gallery which continues into the A.C. annexe, where it carries certain extra-H.T. switchgear.

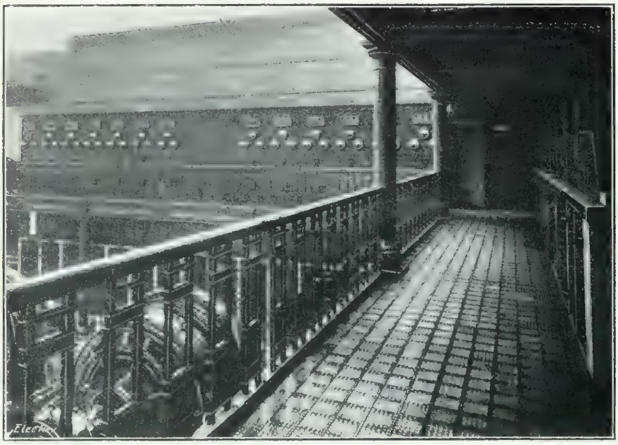

Fig. 12.—Extra-H.T. Switch Galleries in the Annexe.

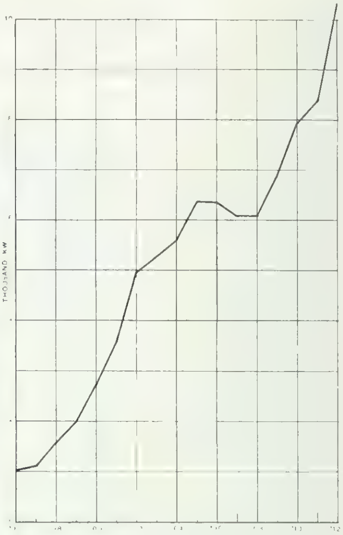

Fig. 13.—Maximum Load Curve.

The panels are arranged for two or three feeders, which are controlled through knife switches and Peard fuses, the latter arranged either singly or two in parallel, so that one can be disconnected during light load; a Kelvin feeder log for recording pressure and current is fitted at the top of the panel for each feeder, and in the lower portion sockets and plugs for coupling to either of three bus-bars behind the board. The feeder logs are all driven electrically from a master clock on the ground floor. The design and construction of this extensive array of switchgear—both mechanically and electrically—is a credit to the electricity department, which carried out the work; the galleries are spacious and tiled with glass, and the greatest care has been bestowed on the detail constructional work behind the panels.

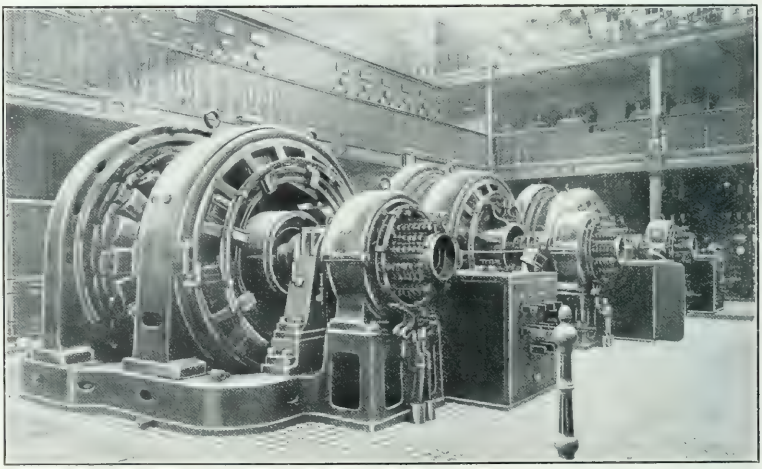

Fig. 14.—Interior of the A.C. Annexe, Showing Motor-Generators and Switch Galleries.

As regards the alternating current plant, the annexe already referred to contains three 500-KW. Westinghouse motor-generators (fig. 14), linking up the A.C. and D.C. supplies; each consists of a 750-H.P., 460-560 volts, compound-wound motor, driving a 500-KW., 6,000-6,500 volts, three-phase, 50-period, generator, at 300 R.P.M. Each motor-generator set has a D.C. compound-wound exciter for energising the fine wire coils of the motor, and a D.C. booster for traction purposes. The generators are separately excited from the lighting bus-bars. A starting rheostat is provided for each motor-generator set, also a field rheostat for each motor-generator, exciter and booster. A large addition to this plant will shortly be made in the shape of a 1,500-KW. rotary converter with an A.C. booster, which is on order. The switchgear for controlling these machines, the three turbo-alternators in the No. 3 station, and 13 outgoing A.C. feeders, is installed along two sides of the building.

The control panels for the machines are arranged at floor level, with Ferranti oil switches on the gallery above, coupled through isolating links, in cells behind, to bus-bars on the top gallery.

The motor-generator and turbo-alternator panels are equipped with both KW. and power-factor meters, while the latter also contain in addition, the main switch controller, three single-phase ammeters, an Aron meter, the handle for adjusting the motor in connection with the turbine governor, a Merz-Price relay and four-signalling solenoid press buttons communicating with the turbines, which, of course, are a considerable distance away. For this reason the Merz-Price protective gear has been fitted in connection with the leads running to these machines.

The remaining panels are for synchronising and section switches.

The remote control circuits for these panels are energised from the station direct-current bus-bars; we may mention incidentally, that a stand-by battery will shortly be installed in an adjacent building which has been prepared for that purpose, and which will be arranged to automatically supply the alternator excitation and auxiliary direct-current circuits in the event of failure of the normal direct-current supply.

The feeder switchgear is somewhat different from the foregoing, the control panels being arranged on the gallery, fig. 12, with the bus-bars in cubicles behind, and mechanically-operated G.E.C. oil switches in cubicles at floor level below.

Ferranti overload relays are fitted on each feeder panel with indicating lamps to show which of the relays operate, attention being forcibly drawn to this by a loud sounding bell operated through a relay on the panel. All the H.T. cells are provided with red and green indicating lamps inside, which show at any time whether the cells are in use or not.

A feature of the station is the fine cable basement into which the bare conductors from the switchboards above pass, and are coupled through sealing boxes to the main feeders; the latter are lead covered six-core cables, three pilot cores being included. The cables are arranged in tiers, and supported on racks, with a view to accessibility.

As previously indicated, the department possesses well-equipped fitting and joiners' shops at Valley Road capable of dealing with the bulk of the repair work; a works chemist is regularly engaged in the testing of coal, oil, feed-water, &c., and comprehensive records are kept of everything which may tend towards the efficient working of the department.

The running load factor on the direct-current plant averaged 87·3 per cent., and on the alternating-current plant 61·48 per cent. for the last year, the station load factor being 24 per cent., although load factors of 40 per cent. and over are obtained during winter weeks. The fuel cost for the year averaged ·15d. per unit sold, with coal costing about 10s. per ton.

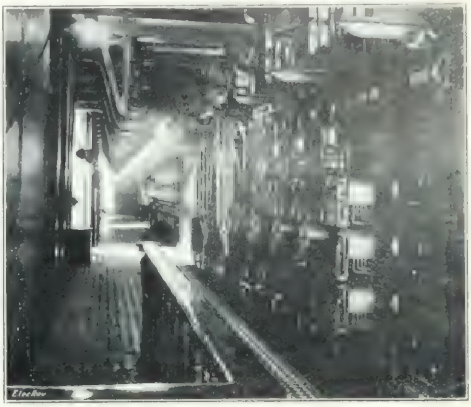

Fig. 15.—View Behind Switchboards.

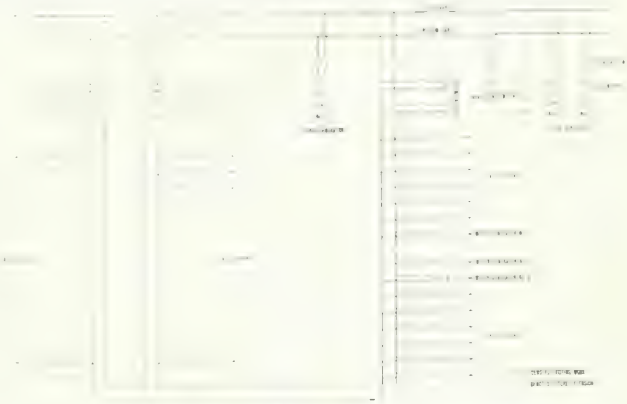

Fig. 16. Skeleton Diagram of E.H.T. Connections, Valley Road Station.

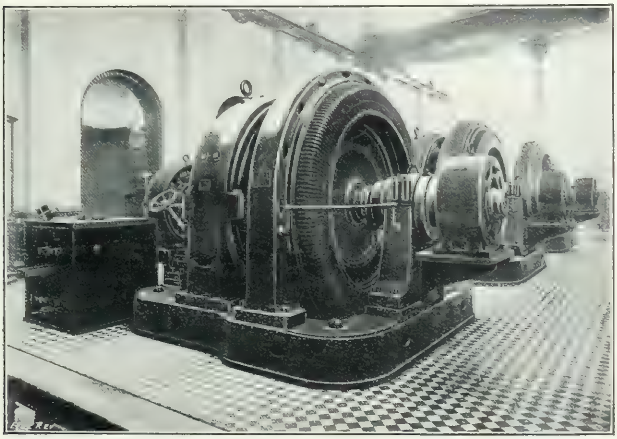

Fig. 17.—500-kw. Motor-Generators, Valley Road Station.

The Valley Road plant operates in conjunction with a 3,000-ampere-hour battery, with balancing and booster plant, which represents the present equipment of the Bolton Road (No. 1) station, and with a small plant at the Sunbridge Road Destructor Works, where a 300-kw. generating set with a battery and a 250-kw. rotary converter are installed for tramway supply—the total capacity of plant installed at the Corporation stations amounting to 16,830 kw.

Some 230 miles of cables, mostly armoured and laid direct, are in use, including 48 miles of 6,600-volt three-phase mains, which supply 20 substations and transformer chambers in the area.

All the larger power consumers are supplied through the three-phase system, and the department is gradually transferring all the outer areas, more than 1½ miles from the centre of the city, to the alternating system (230 volts, single-phase, for lighting, and 400 volts, three-phase for motors).

Altogether some 4,000 kw. of Westinghouse and Brush transformers of the oil-cooled type have been installed in sizes varying from 50 to 312 k.v.a., the usual arrangement being a single transformer for commercial supply and duplicate transformers in the case of a district network. We illustrate in fig. 18 a typical sub-station equipped with duplicate 145-K.V.A. transformers fed through two three-core ·05 feeders. The equipment includes on the E.H.T. side Westinghouse oil switches and isolating links for the feeders, and A.E.G. oil fuses or oil switches with a series trip and isolating links for the transformers, while the L.T. distributors are controlled by Reyrolle switch-fuses, a Reason demand indicator being fitted.

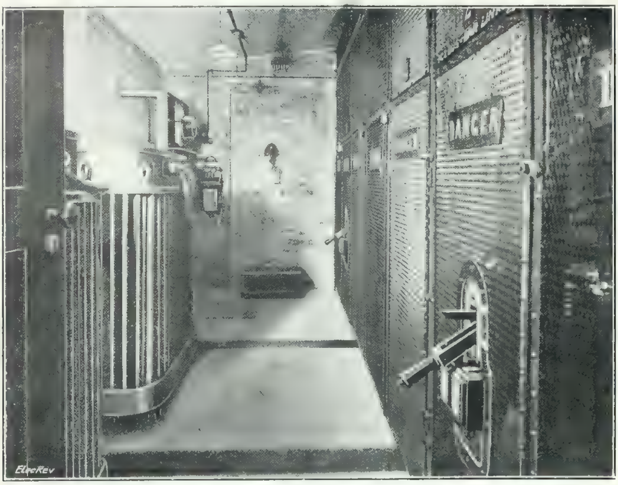

Fig. 18. Typical Transformer Chamber, Bradford.

The E.H.T. switchgear is installed in cubicles, one of the latter containing bus-bar sectioning switches, so that one-half of the switchgear can be laid off for inspection. A telephone is provided in each chamber, also a maximum thermometer, and the latest chambers have a ventilating chimney.

Supply Developments.—No account of the Bradford electricity undertaking would be complete without some reference to the energetic development of the supply for all purposes which has been such an important feature of its administration under Mr. Thos. Roles, the present chief engineer. The enterprise which was responsible for the inauguration of the first municipal electricity supply in Britain in 1889, has a counterpart in the skilful organisation which is to-day attacking the greatly extended supply problems of the present time.

The progress of the department is exemplified by the load curve, fig. 13, the upward tendency of which is more pronounced than ever, due to the greater willingness of large power users to avail themselves of municipal power.

It is interesting to note that the temporary falling off in 1906-8 is traceable to the price of power units for small users, being increased from 1d. to 1¼d., a proceeding which led to the introduction of small gas engines by various consumers, but which were discarded when the normal charges were resumed. Some striking figures connected with the supply, from 1908, the year when "bulk supply" was commenced to the present year, are given in tabular form (p. 665), from which the popularity of this class of supply can be seen. Any consumer having not less than 100 KW. maximum demand is classed under the above heading and allowed to use current for any purpose, including lighting, at power rates.

Under "domestic supply" it will be noticed that the special private residence rate of 15 per cent. on the rateable value plus ½d. per unit, is attracting numerous consumers—some 365 being connected at March, 1912, with an actual average consumption for the year of about 1,000 units each. These figures indicate the popularity of this system in Bradford, but Mr. Roles points out that they refer as yet to only lighting and heating (electrical cooking, for reasons mentioned later, contributing, as yet, insignificantly to the total) and show that such consumers use electricity throughout their houses for the purposes mentioned. In fact, we gather that it is easy to distinguish a consumer on this system by the extent of his illumination at night.

Electric heating has been facilitated by the Corporation offering cheap convectors and radiators, simply and plainly constructed, to the design of the electricity department, and some idea of the scope of this business is gathered from the fact that in a recent week, 75 KW. of such apparatus was supplied.

Although both the special bulk and domestic supply rates, no doubt, temporarily influenced the figures under "private lighting," as shown in the table, yet the indications are that private lighting is going ahead as rapidly as before their introduction, and there can be no doubt that the consumer greatly appreciates any departure from the hard-and-fast tariff. The adoption of electric cooking in Bradford and West Yorkshire generally has been hindered owing to the local custom of baking bread at home, a purpose for which the average electric stove has not been designed. We gather, however, that Mr. Roles has succeeded in inducing one or two makers to meet the demand for a suitable stove for the purpose, and that these will shortly be introduced. An extempore electric stove is used at the mess room at the works, and although a gas stove is installed and equally available, the caterer uses the former exclusively, because it pays him

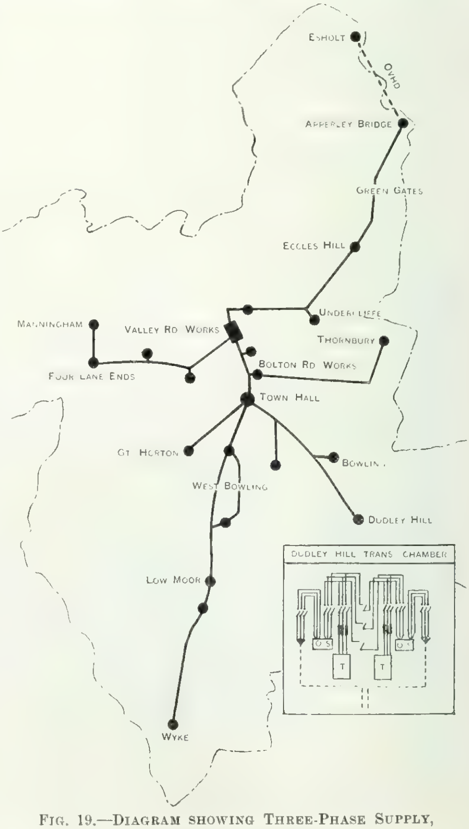

Fig. 19.—Diagram showing Three-Phase Supply, Transformer Chambers, &c.

better. The electricity department runs a well-equipped showroom for the convenience of consumers, in connection with its offices at the Town Hall; the client's contractor, however, receives the trade discount in the case of all apparatus sold through the department.

But it is in the direction of "bulk" supply for power purposes, in connection with the textile and other local industries, that the greatest progress is being made at the present time.

To bring conviction to the mind of this class of consumer has required some years of strenuous effort, which, however, is now resulting in good business. The following list of installations is some indication of the trend of events :—

Bradford Dyers' Association, Ltd., dyers, Thornton Road	1,600 H.P.
*Roby, Clifford & Co., worsted spinners, Wyke ...	500 H.P.
Ed. Ripley & Son, Ltd., dyers, Bowling	500 H.P.
Mitchell Bros. (Bfd.), Ltd., worsted spinners, combers, &c., Manchester Road	450 H.P.
*H. & J. Gaunt, woolcombers, Valley Road	250 H.P.
*Conditioning House, conditioning, Canal Road ...	130 H.P.
*John Emsley & Co., worsted manufacturers, Parkside Road	200 H.P.
*Arthur Robertshaw, worsted manufacturers, Bullroyd Lane, Four Lane Ends	100 H.P.
F. Ripley & Co., Ltd., worsted spinners, combers, &c., Thornbury	100 H.P.
*Charles Sykes & Co., manufacturers, Willowfield Mills	70 H.P.
*Ward & Henry Holroyd, silk and worsted manufacturers, Bankfoot	60 H.P.
*Woodhouse Carter, Ltd., silk manufacturers, Low Moor	50 H.P.
Total	4,010 H.P.

* These premises it is interesting to note have no main chimney stacks.

Messrs. Ward & Holroyd have adopted the individual drive, about 100 looms being equipped with Siemens motors; at Messrs. Emsley's mill 350 looms are group driven from seven motors with chain drives on to shafting running at 200 R.P.M.—an increase on the usual speed of 140 to 160 R.P.M.

In this case the looms, each fitted with electric "knock-off" motions, are driven by pairs through half-turn belts, and exactly half the shafting originally proposed, has been dispensed with. Ventilation is provided by 14 24-in. reversible fans; electric cookers and water boilers are provided in connection with the catering for the workpeople, and some 800 lights are installed. Messrs. Emsley expect to obtain a considerably increased output as the result of the electric drive; another "electric driver" on the list, recently declared in public that he had obtained both improved quality and increased output as the result of his venture.

At one of the mills supplied, some 10,000 spindles are driven from shafting running at 750 R.P.M., the drive being through half-crossed belts.

In West Yorkshire, on the average, three silk or worsted looms, or one heavy loom and shafting, require a horse-power for driving purposes, and the usual load factors for such textile establishments vary from 30 per cent. in worsted spinning, 22 per cent. in a woollen mill, and 15 to 18 per cent. in weaving, to 50 per cent. in a wool-combing establishment when running, which is usually during only a period of the year.

Units sold for the year:	1908.	1909.	1910.	1911.	1912.
Bulk supply	405,134	2,186,008	3,578,171	4,229,338	4,908,997
Private lighting	2,887,969	2,777,386	2,717,315	2,748,392	2,843,163
Domestic supply		—		106,376	338,590
Public lighting	143,542	132,911	134,410	117,254	97,980
Motive power and heating	2,657,664	2,401,482	2,725,858	3,321,545	3,822,385
Tramways Day supply...	8,905,270	9,421,368	9,440,394	9,604,736	9,927,237
" Night supply	117,680	143,300	141,709	137,530	164,660
Total	15,117,259	17,062,455	18,737,857	20,265,171	22,103,012
Number of consumers	2,344	2,439	2,570	2 967	3,295
Number of motors connected	1,445	1,510	1,545 {	222 B. supply 1,683	378 1,862
B.H.P. of same	6,817	7,209	9,582 {	7,438 2,806 B. supply	8,158 4,571
Route miles of cable laid at end of year.—					
General supply feeders, D.C.	24¼	26	26¼	27¼	24·5
General supply distributors, D.C.	105	107¼	110	114½	63
Tramway feeders, D.C.	72¾	72¼	72¾	72½	18
A.C. feeders and distributors	—	—	—	—	118
Total	202	205½	209	214¼	223·5
Maximum combined load in KW.	6,087	6,884	7,922	8,371	10,314

One of the difficulties in connection with the introduction of mill driving in this area is the practice of letting off "room and power" in the mills, which frequently have numerous tenants dependent for power on one main engine. It may be mentioned that the power rates in Bradford are based on £3 per KW. of maximum demand plus ½d. per unit used, but discounts varying from 2½ per cent. to 50 per cent.—the latter for over 350 KW.—reduce this price to a figure which appears very attractive to the large user. Unfortunately the maximum demand restriction, though technically fair, is inadequate to meet the conditions existing in some trades, and possibly, from the users' point of view, also inequitable; a corporation is, moreover, unable to quote a "lump sum" contract price, although there is no doubt that many consumers would prefer this method of doing business, even though it actually cost them more.

In conclusion, we are indebted to Mr. Thos. Roles, the city electrical engineer, and to his several assistants, for affording us the fullest information on the occasion of a very interesting visit to the "woollen" city.

Alternating-Current Trolley 'Buses. — The first trolley 'buses to employ alternating current were recently placed in operation at the Leipzig Exhibition. Each 'bus is equipped with a 10-KW., 110-volt, 50-cycle motor of the repulsion type, which type has the great advantage of starting and speed control by simple variation of the brush setting. The motor is connected through an elastic coupling to a 10 : 1 gear reduction driving the rear axle of the 'bus. The original paving of the route being very uneven, a strip of macadam 40 ft. in width was laid, and the interstices filled in with tar. It will be interesting to observe how the new 'buses compare with the direct-current types now in use in this country and on the Continent, as regards convenience of operation, running efficiency and maintenance costs.

•**A German Patent Action.**—An action which has been pending for some years past between the A.E.G. and the Swiss firm of Brown, Boveri & Co. has now been finally decided by the Imperial Court at Leipzig in favour of the latter. The case refers to the arrangement of the winding in the inductors of high-speed machines. The A.E.G. obtained a licence for this arrangement from the Swiss company, but during the course of manufacture, the former made certain alterations, which were patented, and came to the conclusion that the machines did not fall under the Brown, Boveri patents. With a view, however, to settling the question, the A.E.G. instituted a patent action, which has resulted as already mentioned. It is now stated that the A.E.G. intends to alter the turbo-generators so that they will not come under the Swiss company's patents, whilst at the same time retaining the characteristic properties of the A.E.G. types. It is calculated that the arrears in licence royalties extending over eight years, and which will have to be paid, amount to over £50,000.

CONTRACTS CLOSED.

(*Continued from page 660.*)

London.—HAMMERSMITH.—The B.C. Electricity Committee has accepted the tender of Messrs. W. Cory & Son, for Seven Sisters Hard dry coal, at 13s. 9d. per ton for 12 months, and that of the Main Colliery Co., for "Graigola and Victoria" free-burning coal at 16s. 6d. per ton for six months.

FULHAM.—The B.C. has accepted the tender of Messrs. Cory Bros. & Co., and Messrs. Phillips & Co., for 3,000 tons of Gedling nutty slack, at 12s. per ton, and 2,000 tons of Kirkby ditto, at 11s. 11d. per ton, respectively, for use at the electricity works.

The Metropolitan Water Board has accepted the tender of Messrs. Veritys, Ltd., for tape, cable, &c.

The tenders of the General Electric Co., Ltd., and Messrs. Falk, Stadelmann & Co., Ltd., have also been accepted for supplies of a quantity of electrolier wire and fittings accessories, the former at £129 for the fittings, and the latter at £27.

Taunton.—The T.C. has accepted the tender of Messrs. C. Goodland & Sons, of Taunton, for main colliery through-and-through steam coal for the electricity works, at 17s. 3d. per ton.

York.—The tender of the Electrical Apparatus Co., Ltd., for the supply of meters up to and including 5 amperes capacity for the Corporation, has been accepted for the year ending September 30th, 1913.

Car meters supplied by Messrs. Venner & Co. are now being installed on the tramways here.

FORTHCOMING EVENTS.

Physical Society.—Friday, October 25th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Constitution of Mercury Lines Examined by an Echelon Grating and a Lummer-Gehrcke Plate," by Prof. H. Nagaoka and T. Takamine; "Note on the Mutual Inductance of Two Co-axial Circular Currents," by Prof. H. Nagaoka; and "The Absorption of Gas in Vacuum Tubes," by Mr. S. E. Hill.

Institution of Mechanical Engineers.—Friday, October 25th. At 8 p.m. Paper on "Characteristic Dynamical Diagrams for the Motion of a Train during the Accelerating and Retarding Periods," by Prof. W. E. Dalby; and paper for discussion, in writing only, on "Theory and Experiment in the Flow of Steam through Nozzles," by Prof. J. B. Henderson.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, October 25th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-on-Tyne. Annual general meeting. Inaugural address by the Hon. Sir C. A. Parsons, president.

(**Graduate Section**).—Saturday, October 26th. At 7.15 p.m. At Bolbec Hall, Newcastle. Address by Mr. L. E. Champness, chairman.

Association of Engineers-in-Charge.—Saturday, October 26th. At the Holborn Hall. Whist drive and dance.

Great Central Debating Society.—Saturday, October 26th. At 6 p.m. At the Grand Hotel, Leicester. Lecture on "The Economics and Advantages to be Obtained by the Institution of Goods Clearing Houses, Suitably Designed, and Adequately Equipped and Approached," by Mr. A. W. Gattie.

Junior Institution of Engineers.—Saturday, October 26th to Monday, October 28th. Week-end visit to the works of Messrs. T. Firth & Son, Ltd., and Messrs. Cammell, Laird & Co., Ltd., Sheffield.

Institution of Electrical Engineers (Manchester Local Section).—Friday, November 1st. At 7.30 p.m. At the Midland Hotel, Manchester. First meeting of the session. Address by Mr. A. A. Day, to be delivered by Prof. E. W. Marchant, vice-chairman.

NOTES.

London Traffic.—In the Parliamentary Papers recently Capt. Jessel asked the Home Secretary whether the Government would bring in a Bill to set up a traffic board in accordance with the recommendation of the Royal Commission of 1905.—Mr. McKenna, in reply, said that he would consult his colleagues at the Board of Trade and the Local Government Board in the matter, but he did not at present see much prospect of Parliament having time to discuss legislation on the subject.

Protection from X-rays.—In a communication to the Academy of Sciences of France, M. Droit describes a new device for the protection of X-ray operators from radiodermatitis, consisting of silk tissues impregnated with phosphoric acid 8 per cent., tin oxide 44 per cent., and lead oxide 34 per cent.; gauntlets made of this material six layers in thickness afford effective protection.

Concert.—On Wednesday night last week, at their clubhouse, Howe Bridge, Atherton, a concert was given by employés of the South Lancashire Tramways Co., under the presidency of Mr. E. H. Edwardes, general manager, who was supported by Mr. H. B. Conibear, secretary, and Mr. W. Lancaster, traffic superintendent.

Swedish Trade in Spain.—Two of the leading members of the Allmänna Svenska Elektriska A.-B. have set out for Spain in order to form a branch to promote that firm's considerable interests both there and in Portugal.—*Affärsvärlden.*

Copper.—Stocks in France and England and afloat are shown by Messrs. Merton's statistical circular to be 809 tons less at the half month, *i.e.*, October 15th than at the end of September. Of this, England has reduced stocks by 534 tons, while France has increased by a larger amount, the reduction on the whole quantity being made by the reduced consignments afloat. The total European visible supply, including Rotterdam and Hamburg, was 1,171 tons less on October 15th than on September 30th. Deliveries for the half-month were normal from North America, very low from Spain and Portugal to England and France, the quantity to other countries being above the average: Chile shipments were well up, and Australian high. The total European deliveries, at 20,972 tons for the half-month, show a normal amount of business, if repeated in the remaining half-month. The stock in American producers' hands at the end of September was 28,155 tons, an increase over the stock for the end of August of 7,306 tons, which puts this quantity higher than for any month since last April. The total visible supply from all known sources for the end of September was 76,100 tons, showing an increase, over the end of August, of 4,919 tons.

Tungsten Lamp Contracts.—The following letter came to hand too late for inclusion in our "Correspondence" columns:—

"Having seen Form F.T.C., relating to trade contracts for tungsten lamps, and observed its several conditions, which are binding upon the buyer, who, in most cases, will be the electrical contractor, it appears a most unjust clause, prohibiting the buyer to advertise, stock or solicit orders for tungsten lamps other than those manufactured by the companies in the Tungsten Lamp Association, whose names are given on Form M.L., dated September 30th last.

"There are other manufacturers of tungsten lamps in this country who have considerable interests at stake, and whose lamps have secured a reputation for efficiency and reliability, and it seems unfair that buyers should be precluded from dealing with such firms, whose lamps have been proved by experience and trial to be equal in every respect to the so-called Association lamps.

"Contractors should be in a position to supply any make of tungsten lamp which would give satisfaction to their client, without any restriction, and in view of the small additional advantage offered by the Association to buyers signing the contract form, surely contractors should prefer to have liberty in purchasing where they think fit, by the non-acceptance of the conditions set out in the form of contract. JUSTICE.

"*October 21st*, 1912."

The Electrical Trades Benevolent Institution: A Dramatic Performance.—On Saturday, November 16th, at 8 p.m., the Garrick Dramatic Society will give a performance of the "Second Mrs. Tanqueray," at the Royal Court Theatre, Sloane Square, S.W., in aid of the funds of the above Institution. This will be the first production by an amateur company of Sir Arthur Pinero's play. It will be under the stage direction of Mr. T. Ireby Cape, and the society's orchestra will be under the direction of Mr. Robert S. Kerr. The prices of admission will be as follow:—Orchestra stalls, 10s. 6d.; dress circle, 7s. 6d.; upper circle, 4s.; pit stalls, 3s.; gallery, 1s.; and private boxes by arrangement. It is hoped that there will be many demands from among our readers for tickets, as it is desired that the Benevolent Fund shall benefit largely by the event. Tickets can be obtained on application to the Secretary, Mr. F. B. O. Hawes, 18, Park Mansions, Vauxhall Park, South Lambeth Road, London, S.W., or to Mr. Leonard G. Tate, Secretary of the Electrical Contractors' Association, 20, Bucklersbury, London, E.C. If every one of our readers were to 'phone or write one of these gentlemen ordering tickets they would have very real evidence of the interest which electrical men take in an effort to swell the funds of a very deserving institution. "Do it now!"

Bradford Wiremen on Strike.—The Bradford wiremen are on strike for an increase of pay. They maintain that they are paid less than similar workers in other towns, and demand an increase from 8d. to 9d. an hour. The employers do not admit the correctness of the statement that the pay in Bradford is unusually low. Mr. Kinneburgh, the organising secretary of the Electrical Trade Union, is in Bradford in control of affairs on the men's side. A conference between representatives of the Union and of the Bradford Electrical Contractors' Association took place on Wednesday evening last week with a view to the possibility of coming to an amicable agreement, and the employers agreed to consider the case as presented by the men, and give their decision in due course. On Thursday the employers notified the men that, after careful consideration, they regretted that they could not accede to the demands, but they would be quite willing to submit the matter to the arbitration of the Board of Trade. The men, after a long discussion, rejected the offer. In the meantime, the wiremen employed by the Corporation, the Bradford Dyers' Association and one or two private firms, in which cases the pay is regarded as satisfactory, are to be allowed to continue work.

Fatalities.—An inquest was held on Saturday into the cause of death of two labourers (Creaser, aged 32, and Goddard, aged 31), who were killed at the Devonshire works of the Staveley Coal and Iron Co., on the previous Thursday. It appeared from the evidence that they were painting some standards, when they came into contact with a 6,500-volt live wire, and both died as the result of extreme burns and shock. There were notices some 30 yards from where the deceased were working, warning of danger, and Creaser had been personally warned, and told that the work had better be done on Sunday when the current was off. The jury in returning a verdict of "Accidental Death," recommended that the Staveley Co. should be asked to fix warnings on the standards, and that the painting of the pillars should be done on Sundays.

Tide Utilisation.—As was reported some time ago, a scheme has been prepared by a Hamburg engineer (E. Pein) for the utilisation for power purposes of the ebb and flow of the tide at Husum, in the North Sea. As doubts have been entertained in various quarters as to the practicability and economy of the project, a water-power installation company has been formed at Hamburg to erect an experimental plant at Husum, of 10 H.P., to test the system.

A Large Air Pump.—Messrs. Richardsons, Westgarth and Co. recently gave, at their Hartlepool works, a demonstration of a large kinetic air pump designed for use with a 12,000-KW. steam turbine. With ejection water at 72° F. and barometer 30 in., a vacuum of 29·8 in. was obtained when air was admitted by a 4-mm. hole and a vacuum of 28·3 in. when air was admitted by a 14-mm. hole, equivalent to approximately 66 cb. ft. of free air per minute at 60° F. It is believed that this establishes a record.

Organisation of Employers.—The movement for better organisation of employers to meet the increased efficiency in the organisation of Labour, is spreading. The Employers' Parliamentary Association is at present carrying on a campaign in this connection. Nottingham employers were addressed by the president of the Association (Sir Chas. Macara) last week, and they gave their support to the movement.

Institution and Lecture Notes.—Institution of Electrical Engineers (Yorkshire Local Section).—The first general meeting of this Section will be held at the Hotel Metropole, Leeds, on Wednesday, November 6th, when Mr. S. D. Schofield, the chairman, will deliver his inaugural address. A smoking concert will follow. Subsequent meetings of the session will take place on the following dates: At Leeds: December 4th, January 15th, February 12th, March 12th, April 16th and May 14th. At Sheffield January 29th, March 26th and April 23rd. This arrangement (seven meetings in Leeds and three in Sheffield) has been adopted as the result of careful consideration of various schemes devised with the object of securing larger attendances at the meetings.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—The following are the events announced for the 1912-13 session:—

Nov. 11th.—"A.C. Measurement, with Special Reference to Telephone Cables, Loading Coils and the Construction of non reactive Resistances," by C. E. Hay.
Dec. 9th.—"Trunk Telephone Communication, Transmission Schemes and the Design of the Circuits," by A. B. Hart and W. J. Hilver.
Jan. 13th, 1913.—"The Electrophone Service," by J. H. Pattman.
Feb. 10th.—"Loading Coils," by S. A. Pollock.
March 10th.—"Wireless," by F. Addey.

The meetings are held in the I.E.E. Lecture Hall, Victoria Embankment, W.C., at 6 p.m.

Rugby Engineering Society.—The syllabus of meetings for this Society includes the following:—

Nov. 19th.—"Chain Gearing," by H. T. Hildage.
Dec. 17th.—"The New Diesel-Driven Pumping Plant at Rugby Waterworks," by B. A. Fleiderer.
Jan. 7th, 1913.—"Large Steam Turbo Units," by J. P. Chittenden.
Feb. 4th.—"High-Speed Bearings," by J. C. K. Balfry.
March 4th.—"Power Transmission by Modern Gearing," by H. H. Thorne.

Institution of Municipal Engineers.—At the annual meeting on October 11th, Mr. Frank Latham was elected president. Amongst the vice-presidents are Mr. H. C. Adams and Mr. H. L. P. Boot. The annual report of the Council shows that the roll at June 30th last numbered 882 members. The excess of revenue over expenditure for the year was £47, and the accumulated balance £234. Examinations were inaugurated in November last.

Institute of Marine Engineers.—Mr. Summers Hunter delivered his Presidential Address at a meeting of the Institute, held on Monday, October 14th, afterwards presenting the Denny Gold Medal, awarded to Mr. John McLaren for his paper on "Wireless Telegraphy," read December 11th, 1911.

American Institute of Electrical Engineers.—As the result of negotiations with other societies, reciprocal arrangements have been made between the Institute and the Institution of Electrical Engineers, as well as the German, French, Italian, Swiss and Dutch electrical societies, which enable members of the A.I.E.E. whilst abroad to enjoy the privileges of members of those societies for a period of three months, and *vice versa*.

Barrow and District Association of Engineers.—The first meeting of the autumn session in connection with this Association was held on October 11th, when Mr. H. R. Burnett, borough electrical engineer, Barrow, delivered his presidential address. A collection of electric heating and cooking appliances was afterwards open to the inspection of the members in the large lecture hall of the Barrow Technical School. This exhibition of the latest developments in electrical apparatus for all domestic purposes was utilised by the Barrow Corporation on the following Saturday afternoon, the general public being invited to attend.

Mining Electrical Engineers (West of Scotland Branch).—In the annual report of this Branch just issued, the list of meetings for the new Session is announced. On Friday, 18th inst., Mr. Matthew Brown delivered his presidential address, and presented certificates to successful candidates. Mr. A. B. Muirhead followed with a paper on "Notes on Electricity Rule No. 7." The later meetings will take place on November 16th, December 21st, January 18th, 1913, February 15th, March 20th, April 17th, and May 15th. The papers will include "Notes on the Electrification of a Group of Small Collieries," by Mr. A. Campbell King; "Variable Speed A.C. Motors," by Mr. S. A. Simon; "Power Transmission," by Mr. W. H. Telfer.

Institution of Electrical Engineers (South Africa).—At a meeting held towards the end of September Mr. E. T. Ewing read a paper on "Some Practical Aspects of Electric Winding," and a paper by Mr. J. Askew on "Practical Operation of the three-phase Hoists at the Bantjes Consolidated Mines, Ltd.," followed. Mr. J. H. Rider presided. At a meeting of the students' section a few days later a discussion on electric traction was continued.

Institution of Electrical Engineers (Scottish Local Section).—The eleventh annual dinner will be held on Tuesday, December 17th, in the Banqueting Hall of the Grosvenor Restaurant, Glasgow. The meetings during the session will be held in the Lecture Hall, 207, Bath Street, Glasgow (four), and at Princes Street Station Hotel, Edinburgh (two). The first meeting will take place at Glasgow on November 12th, when the chairman (Mr. W. M'Whirter) will deliver his inaugural address.

London Association of Foremen Engineers and Draughtsmen.—On Saturday last, the members and friends of this Association inaugurated the winter session of the sixtieth year of the Association with a grand Bohemian concert at the Cannon Street Hotel, E.C. The president (Mr. C. Eggleston) occupied the chair, and some five hundred members and guests greatly appreciated the excellent programme that had been prepared. The syllabus for the ensuing term covers a very wide range, and foremen and others holding positions of responsibility connected with engineering are invited to the Association's meeting on Saturday, November 2nd, at 8 o'clock, at the Cannon Street Hotel, when Mr. William Bell will read a paper on "Refrigeration."

Co-partnership.—"The Human Side of Co-partnership," and "Co-partnership and Efficiency," are subjects upon which Lord Robert Cecil and Sir W. H. Lever will address the Labour Co-partnership Association at Birmingham early next month.

Appointments Vacant.—Chief assistant engineer for the Edinburgh Electricity Department (£400); Charge engineer, for the Ilford U.D.C. Electricity Works (£120); Teacher of practical electric wiring at the L.C.C. School of Engineering and Navigation, Poplar, E. (10s. 6d. per evening); Switchboard attendant, for the Corporation Electricity Works, Lancaster (25s.); Head of the Electrical Engineering and Physics Department, L.C.C. Hackney Institute, London, N.E. (£300); Electrical fitters and armature winders, for H.M. Dockyard, Devonport (36s.); Switchboard attendant and man to take charge of and repair motors and fans, for the Blackpool Tower Co., Ltd. See our advertisement pages in this issue.

Concrete Institute.—A course of six weekly lectures on "Concrete" will be delivered by Mr. H. Kempton Dyson, commencing on Tuesday, November 12th. Particulars and tickets (free) may be obtained from the Secretary of the Institute, 296, Vauxhall Bridge Road, Westminster, S.W.

Charge against a Councillor.—At Liverpool on Saturday last, according to the *Times*, a member of the Wallasey Borough Council was committed for trial (bail £50) on a charge of soliciting a fee of 100 guineas from Mr. J. B. Hutchins as an inducement to do something in respect of the proposed purchase of land from Mr. Hutchins by the Wallasey Council.

Carbide of Calcium.—The report for 1911-12 of the Usines Electrochimiques de Hafslund, of Geneva, which carry on works in Norway for the manufacture of carbide of calcium, states that the market for carbide became steadier during the year, thus favourably influencing the results. The effects of the carbide syndicate formed in the previous year had not been specially manifested, so that the trade still suffered from a certain amount of over-production. The company, which had resumed the manufacture of ferro-silicon, had a turnover of £221,000, and earned gross profits of £45,000, as compared with £25,000 in 1910-11. After allocating £10,000 to depreciation, the accounts showed net profits of £35,000, as against £16,000 in 1910-11, and it is intended to distribute 10 per cent. on the share capital of £90,000. The balance has been partly placed to the reserve fund and partly applied to extra depreciation, leaving £3,900 to be carried forward.

Progress of the Commercial Electric Vehicle.—P. D. Wagoner, president of the General Vehicle Co., Long Island City, N.Y., discussing conditions in the electric commercial vehicle industry, recently said:—"The development of the electric commercial vehicle industry has shown some particularly interesting phases in the past 12 months. Among these may be mentioned the following:—(1) The increase in orders received this year over those in 1911; (2) The wonderful percentage of repeat orders, which in our case in 1911 was 69·4 per cent., and thus far in 1912 is well over 65 per cent.; (3) The encouraging increase in 'small wagon' business, as compared with the situation in previous years when the use of heavy trucks greatly predominated and department stores and retailers favoured non-electrics; (4) The increase in sales to retailers who own from two to six horses and to whom the purchase of even our smallest wagon often meant a heavy initial investment. We have won their confidence, and have shown them that they can make electrics pay as well as the big firms do; (5) The fairer attitude of the public toward the electric; (6) The recognition by business men of the respective fields of the electric and the gasoline vehicle and of the importance of buying the proper vehicle for each class of work; (7) The increase in battery efficiency and the encouraging decrease in the cost of energy to off-peak users. I look for the electric truck and wagon to improve still more in operating efficiency as actual service under varied conditions yields its secrets, with the result that electric vehicles will be handled more intelligently."—*Electrical World.*

Brazilian Government and State Cables.—A correspondent of the *Times* states that the Brazilian Government does not recognise in any way the project submitted to the Chamber authorising the Government to lay coast cables. The Government possesses full knowledge of the rights embodied in existing concessions, which would be infringed by such a scheme, and it intends to maintain them. Therefore, the project will not be carried.

Correction.—In a leaderette in our last issue, entitled "An Important Case as to the Measure of Damages," we summarised from the October "Law Reports" the decision of the Court of Appeal in the case of the British Westinghouse Electric and Manufacturing Co., *v.* the Underground Electric Railways, Ltd. Our readers will, however, in some cases have remembered that in our issue of July 26th last it was reported that this decision had been reversed by the House of Lords. The matter receives further attention in our "Legal" columns to-day. The points of reference were very clearly quoted in our issue of January 20th, 1911, page 89. We are anxious to remove any erroneous impression that our comment of last week may have created.

Electrical Workers' Wages.—At a meeting of the Nottingham Guardians on Tuesday, the House Committee reported that a letter had been received from the Electrical Trades Union asking for an increase of 2s. per week in the wages of the men employed in the electrical department of the workhouse. The Committee had, however, resolved to consult the men and, if they wished it, to place them on a trade union basis in all respects. The acceptance of this would involve loss of holiday, sick leave, and other benefits now granted to them.

Bankruptcy.—The adjourned public examination of Henry Hallifield Oxley (otherwise known as Oliver Huxley), consulting engineer, 22, Uxbridge Road, Hanwell, Middlesex, was fixed to take place at the Court House, Half Acre, Brentford, on October 22nd, but the debtor did not appear. The Official Receiver said that the debtor had said he was in the employ of the British and Foreign Investments Corporation, at a salary. At the last Court the debtor consented to an order setting aside £100 a year for the benefit of his creditors, but the officials of that company informed him that he was not now employed by them. His engagement terminated last July, so that the order made by the Court was not worth the paper it was written upon. Debtor had said that he was employed by the company at £6 per week at the time the order was made; that was incorrect, so he should ask that the case should be adjourned, and the debtor would be invited to explain, and, if possible, complete his examination. The application was granted.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Thomas Harding, collector, has been presented by Mr. Francis Teague, the city electrical engineer, and his colleagues on the office staff of the Bath Corporation electricity department, with a silver teapot, on the occasion of his approaching marriage.

The Liverpool Corporation Electricity and Tramways Committee received 65 applications from gentlemen of high standing in the electrical engineering world, for the position of Corporation electrical engineer, at a commencing salary of £1,000, increasing to £1,500. Out of that number, nine were selected to appear before the Special Sub-Committee on Monday, when the following were chosen to appear before the full Committee on Tuesday last for final selection:—Mr. John Christie, chief electrical engineer, Brighton; Mr. Harold Dickinson, chief electrical engineer, Leeds; and Mr. Thos. Roles, chief electrical engineer, Bradford. The result of Tuesday's proceedings was that Mr. Dickinson was appointed.

Owing to the amalgamation with Glasgow of the burghs of Govan and Partick, arrangements have been made with the various heads of departments in the service of the local T.C.'s. It is recommended that Mr. T. C. Parsons, the electrical engineer to Govan T.C. should be retained in the service of Glasgow at a salary of his present rate of £500 until Whit Sunday, and given a lump sum of £2,000 as compensation. With regard to Mr. Wm. Sillery, electrical engineer to Partick T.C., his services are also to be retained till Whit Sunday at a salary of £450 per annum, and he is to receive a lump sum of £1,500.

Tramway Officials.—Mr. Hartley, who was for many years inspector on the Sonth Lancashire Tramway Co.'s system at Atherton, has been appointed an Inspector under the Insurance Act.

General.—The *Daily Telegraph* states that at St. Bartholomew's Hospital the vacant post of director of the department for electrical treatment has been filled by the appointment of Dr. E. P. Cumberbatch, M.B., M.R C.P., to be medical officer in charge. The X-ray department is now managed separately from the department for general electrical treatment, under its own medical officer, Dr. Hugh Walsham having lately been elected to this position.

Mr. John E. Gibbs, motor and electrical engineer, of York, has accepted an invitation from the Conservatives of the Walmgate Ward to contest that area at the forthcoming municipal elections.

Mr. Thos. O. H. Bates, chief electrical engineer at the Rotherham Main Colliery, and formerly of the Morley electricity staff, has accepted the position of electrical engineer to the Tata Iron and Steel Co., of Sakchi, near Jubbulpore, India.

Mr. H. Bettley has resigned the position of electrician to the Ammonia Soda Co., Ltd., at their Cheshire works, to take up the position of resident electrical engineer to the Weaverham and District Electricity Co., Ltd., under the jurisdiction of Mr. A. J. Leigh, of Northwich, consultant and secretary, who has considerable extensions in negotiation.

In order to prevent injury to Mr. Marconi's left eye, it was found necessary to remove the right eye, and this operation was successfully performed on Thursday last week. We are glad to add that the patient is making satisfactory progress towards recovery.

We are officially informed that Mr. John Christopher Mitchell has resigned his position as secretary of the London General Omnibus Co., Ltd, and has been appointed comptroller of the Underground Electric Railways Co. of London, Ltd., and that Mr. William E. Mandelick has been appointed to succeed him.

Mr. H. Bloodworth, formerly of Siemens Bros. Dynamo Works, Ltd., has recently taken up an appointment with the Armorduct Manufacturing Co., Ltd., as country sales manager.

Obituary.—Mr. George Lowdon.—We regret to learn of the death, which occurred on October 17th, at Dundee, at the advanced age of 88 years, of Mr. George Lowdon, scientific instrument maker for 56 years, and a pioneer in Scotland of many scientific discoveries and inventions. He was associated with Faraday, who, it is said, frequently visited his shop, with J. Bowman Lindsay, in his wireless telegraphy experiments, and with Sir David Brewster in making and improving the stereoscope. With Lindsay he was in business association. Among other matters attributed to him are the invention of electrical means for establishing communication between the driver and guard on a train, the first introduction of electric light into Dundee and the first Bell telephone into Scotland, also it is said that, in 1878, he brought forward the first saleable and workable dynamo and lamp in Glasgow, Edinburgh and Dundee. When the electric telegraph came into use, Mr. Lowdon erected the first wires on the Dundee and Perth, Dundee and Arbroath, and Dundee and Newtyle Railways, and he also made the instruments, and instructed the station-masters in the use of them.

Sir J. Irving Courtenay.—We are sure that large numbers of our readers will join with us in regretting the death, which occurred on Tuesday last at St. James's Court, Buckingham Gate, of Sir John Irving Courtenay. Sir Irving's association with the electrical industry began many years ago in association with others interested in pioneering electrical enterprises, and his activities of this kind had been continuous ever since, both at home and abroad. Notwithstanding that he had reached the age of 75 years at the time of his death, his practical interest in the undertakings with which he was connected had led him to visit the River Plate comparatively recently. He was chairman of a large number of companies—electrical manufacturing, electric supply, telephone and tramway—as follows:—Chelsea Electricity Supply Co., Ltd., Electric Construction Co., Ltd., Electrical Power Storage Co., Ltd., Oxford Electric Co., Ltd., United River Plate Telephone Co., Ltd., Cordoba Light, Power and Traction Co., Ltd., and the Cordoba (Argentine) Electric Tramways Construction Co., Ltd., and his experienced grasp of the affairs of these concerns, and the courtesy and freedom with which he always imparted information will be familiar to his shareholders, by whom he will be greatly missed at the meetings of the companies. The deceased gentleman was a member of the I.E.E., and a Fellow of the Royal Geographical Society. He was called to the Bar in 1861, and was made a Knight five years ago.

Mr. Wm. Bottomley.—It is with regret that we learn of the death of Mr. William Bottomley, B.E., a nephew of the late Lord Kelvin, who for many years aided him in the bringing-out of his mariners' compass and nautical sounding machine. Mr. Bottomley's death took place at his residence, 15, University Gardens, Glasgow, on Friday morning, the 18th inst., after a prolonged illness. Mr. Bottomley was a son of the late William Bottomley, Esq., J.P., and was born in 1850 at Fortbreda, Co. Down, Ireland. He was educated as an engineer at Queen's College, Belfast, under the late Dr. James Thomson, F.R.S., who was then Professor of Engineering in the Queen's University of Ireland. His first engineering post was under the late Mr. Alexander Tate, County Surveyor for the County of Antrim, with whom he worked for some years as a civil engineer; and he left this work to take service with Lord Kelvin (then Sir William Thomson) and the late Prof. Fleeming Jenkin in the early seventies, when they were engaged in preparing the Western and Brazilian and the Platino-Braziliera Cables. These cables were constructed at Hooper's Telegraph Works, and at Messrs. Siemens's Works at Old Charlton, where a large staff of young men, some of whom afterwards became well known as telegraph engineers, worked under and along with Mr. William Bottomley in the supervision and testing of the cables. Mr. Bottomley afterwards took part in the cable laying expeditions; and, when the work was completed, he was offered an important permanent post as one of the resident engineers. He preferred, however, to return home, and take part, under Lord Kelvin, in the experimental work connected with the development and perfecting of Lord Kelvin's mariners' compass and nautical sounding machine; and he took entire charge of the not unimportant commercial side of the bringing-out of these inventions. Lord Kelvin's compass and sounding machine were at first constructed in the workshops of the late Mr. James White, and when, in 1900, the business of Mr. White was converted into Kelvin & James White, Ltd., Mr. William Bottomley was one of the first directors of the Limited Company. He continued to manage the nautical part of the business until Lord Kelvin's death in 1907, when he resigned. Since that time he has been engaged in private work. In 1883 Mr. Bottomley married a daughter of the late Mr. W. H. Barlow, F.R.S., the well-known architect of the Tay Bridge, and he is survived by his wife and two sons and three daughters. Mr. William Bottomley's genial disposition made him a favourite with all those with whom he came in contact.

Mr. C. D. Phillips.—We regret to announce the death of Mr. C. D. Phillips, of Emlyn Engineering Works, Newport, Mon., which occurred on 21st inst., at the age of 67 years.

Last Friday an unknown visitor died suddenly at the Palatine Hotel, Blackpool, and on Wednesday the body was identified as that of Arthur Stewart Laing, 42, an electrician, who has been travelling the country for the past 12 months in the pursuit of his duties. A verdict of "Death from natural causes" was returned.

NEW COMPANIES REGISTERED.

Commercial Cable Co., Ltd. (124,712) This company was registered on October 11th, with a capital of £[illegible],000 in £5 shares, to take over the whole or any part of so much of the undertaking of the Commercial Cable Co. (incorporated under Laws of State of New York, U.S.A., in December, 1883, and now carrying on business in the United Kingdom), as is situate or is carried on within the United Kingdom or other part of Europe, or in any Colony or Dependency of the United Kingdom, to generally acquire and assume, wholly or in part, any of the undertaking, property, business, rights, assets and liabilities of the said company or of any other company or association having among its objects the carrying on the business of a telegraph, telephone or cable company, to construct, establish, lay, maintain, repair, renew, and work submarine cables, and land, wireless or other telegraphs or telephones between and in Great Britain and Ireland and any other part of Europe and any Colony or Dependency of the United Kingdom, and America (North and South), and between and in any places or points forming or intended to form part or parts of any kind of telegraphic or telephonic communication or submarine cable route in or between those places or any intermediate places or in any part of the world, to manufacture, for use or sale, and deal in submarine or other telegraph cables, wires and wireless telegraph installations, instruments and other apparatus, to enter into and carry into effect working, traffic or other agreements with Governments, Government Departments, railway, postal, steamboat, telegraph and other companies and authorities, &c. The subscribers (with one share each) are:—Geo. G. Ward, 253, Broadway, New York City, U.S.A., vice-president of the Commercial Cable Co., New York; F. Ward, 63-4, Gracechurch Street, E.C., manager in England of the Commercial Cable Co., New York. Private company. The number of directors is not to be less than five or more than 15; the first are C. H. Mackay, G. G. Ward, E. C. Platt, G. Capperton, and F. Ward; no qualification necessary. Registered by Budd, Johnson & Jecks, 24, Austin Friars, E.C.

G. W. T. T. Syndicate, Ltd. (124,618).—Registered October 5th, with capital £600 in 1s. shares, to carry on the business of a general and wireless telegraph and telephone and electric light, heat and power supply company, &c. The subscribers (with one share each) are:—C. C. Macklin, Guildhall Annexe, 23, King Street, E.C., solicitor; G. Van Zwanenberg Phillips, Guildhall Annexe, 23, King Street, E.C., solicitor. Private company. The number of directors is not to be less than three or more than five; the first are G. Van Zwanenberg Phillips, C. C. Macklin and F. W. Baker; qualification, 20 shares; remuneration as fixed by the company; secretary, B. Simons. Registered office, Guildall Annexe, 23, King Street, E.C.

Joint Standard Union, Ltd. (124,724).—This company was registered on October 11th, with a capital of £3,000 in £1 shares, to acquire inventions relating to joints for pipes, tubes, wires, cables, tubular fittings and the like, and to adopt an agreement with A. G. France. The subscribers (with one share each) are:—H. S. Parlett, 7, Aubrey Road, Hornsey, N., law stationer; T. Dawson, Lennox House, Norfolk Street, W.C. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Kenneth Brown & Co., Lennox House, Norfolk Street, W.C.

Northern Wireless Schools, Ltd. (124,753).—This company was registered on October 12th, with a capital of £500 in £1 shares, to carry on the business of instructors of wireless telegraphy, manufacturers of and dealers in wireless telegraph, apparatus and accessories, &c. The subscribers (with one share each) are:—Norman Rostron, Heath Howes, Ainsdale, motor expert; J. McKeever, Dower House, Euxton, near Chorley, secretary. Private company. Norman Rostron is the first director. Secretary, J. McKeever. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Hydro-Electric Concessions, Ltd. (124,748).—This company was registered on October 12th, with a capital of £21,000, in 20,000 7 per cent. cumulative preference shares of £1 each, and 20,000 ordinary shares of 1s. each, to seek and secure openings for the employment of capital in any part of the world, especially in connection with hydro-electric propositions, undertakings and works, to enter into any arrangements with any governments or authorities to work, develop and control hydraulic, electric or hydro-electric works or stations for generating power, &c. The subscribers (with one share each) are:—E. Hammond, 16, Alexandra Park Road, Muswell Hill, N., accountant; G. Solhurst, Clevedon, High Road, Lee, S.E., gentleman; H. F. Wesson, 541, Salisbury House, E.C., incorporated accountant; H. A. Back, 28, Pall Mall, S.W., solicitor; F. Birch, 94, Salusbury Road, Brondesbury Park, N.W., solicitor; J. T. Arnold, 3, Montolieu Gardens, Putney, S.W., clerk; G. L. Devisse, 17, Pembroke Street, N., clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, £100. Registered by Surtees, Phillpotts & Co., 6, St. Helen's Place, E.C.

Sevenoaks and District Electricity Co., Ltd. (124,811).—This company was registered on October 16th, with a capital of £40,000 in £1 shares, to carry on the business of producers and suppliers of electricity or electrical currents and force, to acquire from the Urban District Council of Sevenoaks the transfer of, and all benefit and rights under, the Sevenoaks Electric Lighting Order, 1911. The subscribers (with one share each) are:—C. E. Currie, St. Helens, Nursery Road, Sunbury-on-Thames, solicitor; J. A. Russell, 30, Moorgate Street, E.C., accountant; W. E. Baldwin, 12, Carter Street, S.E., clerk; G. F. Wallace, 10, Eastcheap, E.C., mining agent; P. Connolly, 37, Wallbrook, E.C., financier; F. Robinson, Royal Oak Hotel, Sevenoaks, hotel proprietor; R. F. Holland, Lime Tree Hotel, Sevenoaks, hotel proprietor. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than six; the first are F. Swanzy, J.P., Major H. Fulton and H. W. Handcock; qualification, £500 shares; remuneration, £100 each per annum (chairman, £150), and 5 per cent. of the net profits after 7 per cent. dividend is paid, divisible. Registered by R. Brooks, 24, Lawrence Lane, Cheapside, E.C.

Fallot Incandescent Light Co., Ltd. (124,715).—This company was [illegible] acquire, deal [illegible] relating to the [illegible] gas [illegible] for lighting, heating, and otherwise, and to adopt [illegible] W. S. Searle and L. Girodo. The subscribers (with one share each) are:—W. S. Searle, 27, Noel Street, W., merchant; W. H. Lowe, 35, Mowbray Road, Brondesbury, N.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are W. S. Searle and W. H. Lowe; qualification, £100; remuneration, £150 each per annum (chairman £175). Registered office, 27, Noel Street, Wardour Street, W.

Brabbins Fuelless Engine Syndicate, Ltd. ([illegible]).—This company was registered on October 10th, with a capital of £500 in £1 shares, to carry on the business of engineers, cycle and motor manufacturers, electricians, &c. The subscribers (with one share each) are:—A. G. Jeffs, 6, Cranford Street, Wolverhampton, merchant; B. Brabbins, Rosedale, Calf Heath, Shareshill, near Wolverhampton, engineer; W. Sammons, 41, Victor Street, Walsall, gentleman; A. E. Edwards, Bushbury, Wolverhampton, baker and grocer. Private company. The number of directors is not to be less than two or more than seven; the first are A. G. Jeffs, B. Brabbins, W. Sammons and A. E. Edwards. Solicitor, J. Ore, Old Square, Birmingham. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Ennig Electric Light and Power Co., Ltd. (124,822).—This company was registered on October 17th, with a capital of £1,000 in £1 shares, to carry on the business indicated by the title, and to adopt agreements with G. J. Lewis and Elizabeth M. George. The subscribers are:—W. F. Burton, Pontvaen, Hay, *via* Hereford, electrical engineer, 50 shares; H. Williams, J.P., The Cottage, Talgarth, medical practitioner, 10 shares; J. Parry, Phœnix House, Talgarth chemist, 25 shares; W. Jones, Pendre, Talgarth, farmer, 25 shares; W. V. Pugh, Radnor Arms, Talgarth, licensed victualler, 25 shares; T. B. Walker, Masons Arms, Talgarth, licensed victualler, 10 shares; H. Rouse Armstrong, Hay, solicitor, 1 share. Minimum cash subscription, 250 shares. The first directors are W. F. Burton, H. Williams, J.P., J. Parry, W. Jones, W. V. Pugh and T. B. Walker. Secretary, J. Parry; solicitors, Cheese and Armstrong, Hay, *via* Hereford. Registered office, 11, St. Mary's Place, Hay, *via* Hereford.

Metal Plates, Ltd. (124,8[illegible]).—This company was registered on October 15th, with a capital [illegible] "A" and 5,000 "B"), to carry on the business of smelters, refiners, rollers, assayers and manufacturers of and dealers in minerals, metals, ores, precious stones and metallurgical and mineral substances of all kinds, electricians, electrical engineers, &c., and to adopt an agreement with S. O. Cowper-Coles. The subscribers (with one "A" share each) are:—S. O. Cowper-Coles, 1 and 2, Old Pye Street, Westminster, electro-metallurgist; W. Craddock, 1 and 2, Old Pye Street, Westminster, secretary. Private company. The number of directors is not to be less than three or more than six; the first are Colonel J. R. Wright, J. G. Gordon and S. O. Cowper-Coles. The last-named has the right to nominate two directors; qualification, 100 shares; remuneration as fixed by the company. Registered office, 1 and 2, Old Pye Street, Westminster.

Mickelwright, Ltd. (124,82[illegible]).—This company was registered on October 17th, with a capital of £1,000 in £1 shares, to take over the business of electrical engineers, manufacturers of and dealers in electrical apparatus carried on at Sicilian House, Southampton Row, W.C., and to adopt an agreement with W. R. Mickelwright. The subscribers (with one share each) are:—W. R. Mickelwright, 5, Brandenbury Road, Gunnersbury, W., electrical engineer; W. W. Peck, 63, Meadvale Road, Brentham, Ealing, W., chemical engineer. Private company. The number of directors is not to be less than two or more than three; the first are W. R. Mickelwright and W. W. Peck. Registered by W. A. Warren, 25, Ironmonger Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Stearn Electric Lamp Co., Ltd. (95,340).—Return dated July 23rd, 1912 (filed July 24th). Capital £4,070 in £10 shares; 407 shares taken up; £10 per share called up on seven; £70 paid; £4,000 considered as paid on 400 shares. Mortgages and charges: Nil.

United River Plate Telephone Co., Ltd. (23,654).—Return dated August 6th, 1912. Original capital £500,000 in £5 shares. Present capital £2,000,000 in £5 shares (230,000 ord., 40,000 pref. and 130,000 unissued); 230,000 ord. and 40,000 pref. taken up; £[illegible] per share called up on 2[illegible] ord. and 40,000 pref.; £1,270,000 paid; £80,000 considered as paid on 16,000 ord. Mortgages and charges: £[illegible].

Tubes, Ltd. (91,224).—Return dated July 25th, 1912 (filed September 20th). Capital £100,000 in £1 shares; all shares taken up; £82,859 paid; £17,141 considered as paid. Mortgages and charges: £59,500.

United Electric Tramways of Monte Video, Ltd. (80,456).—Return filed July 23rd, 1912. Capital £1,000,000 in £5 shares (100,000 pref. and 100,000 ord.); 90,000 pref. and 80,000 ord. taken up; £5 per share called up on 16,221 pref. and 12,800 ord.; £14[illegible] paid; £704,8[illegible] considered as paid on 73,77[illegible] pref. and 67,2[illegible]0 ord. Mortgages and charges: £[illegible].

Buenos Ayres City and Suburban Tramways, Ltd. (114,031).—Agreement for further advances and holding over requirement of issue of bonds, dated September 4th, 1912, to secure not more than £20,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. Holders: Buenos Ayres Port and City Tramways, Ltd., 2, Broad Street Place, E.C.

South American Cable Co., Ltd.—Return dated August 6th, 1912. Capital £500,000 in £10 shares; 24,707 shares taken up; £147,070 paid; £100,000 considered as paid. Mortgages and charges: Nil.

British and Continental Electricity Co., Ltd. (57,088).—Return dated September 13th, 1912. Capital £20,000 in £1 shares (10,000 pref.); 1,000 pref. and 997 ord. shares taken up; £16,370 paid on 790 pref. and 847 ord.; £3,600 considered as paid on 210 pref. and 150 ord. Mortgages and charges: Nil.

Pontelec Welding Patents, Ltd.—Issue on September 27th, 1912, of £300 debentures, part of a series of which particulars have already been filed.

G. H. Cox & Co., Ltd.—Issue on September 10th of £1,000, and on September 11th, 1912, of £500 debentures, parts of a series of which particulars have already been filed.

South London Electric Supply Corporation, Ltd.—Issue on July 1st of £10,000, and on July 30th, 19[illegible], of £[illegible] debentures, part of a series of which particulars have already been filed.

North Wales Power and Traction Co., Ltd. (78,193).—Particulars of £7,000 "B" debentures, created January [illegible], 1912, filed pursuant to Section 93 (3) of the Companies' Consolidation Act, [illegible] amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to certain prior charges but ranking in priority to second mortgage debentures. No trustees.

"Z" Electric Lamp Manufacturing Co., Ltd. (96,594).—Memorandum dated September 20th, 1912, endorsed on £25,000 debentures, c[illegible] rate [illegible] interest from 6 per cent. to 8 per cent.

Creed, Bille & Co., Ltd.—Two debentures, dated October 3rd, 1912, to secure £1,175 and £2,350 respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. A. Coulson, 156, St. Vincent Street, Glasgow, and F. G. Creed, 266, Selsdon Road, Croydon.

Mann, Egerton & Co., Ltd.—Debenture, charged on company's undertaking and property, present and future, including any issued or uncalled capital (but not unissued capital, or calls already in arrears), dated October 3rd, 1912, to secure all moneys due, or to become due, from the company to Barclay and Co., Ltd., 54, Lombard Street, E.C., not exceeding £10,000.

Brush Electrical Engineering Co., Ltd.—Issue on September 29th, 1912, of £20,000 debentures, part of a series of which particulars have already been filed.

Hong Kong Tramway Co., Ltd.—A memorandum of satisfaction, to the extent of £2,000, on September 3rd, 1912, of trust-deed dated July 1st, 1903, securing £195,000, has been filed.

Edmundson's Electricity Corporation, Ltd.—Return dated August 8th (filed September 14th), 1912. Capital £800,000, in 80,000 ordinary and 80,000 preference shares of £5 each. All shares taken up. £734,000 paid on 66,800 ordinary and 80,000 preference. £ 6,000 considered as paid on 13,200 ordinary. Mortgages and charges: £472,000.

Clarke, Steavenson & Co., Ltd. (57,821).—Return dated September 5th, 1912. Capital, £3,000 in £1 shares. All shares taken up. £1 per share called up on 1,400, and 15s. per share on 1,603. £2,600 paid. Mortgages and charges: £300.

General Accessories Co., Ltd. (104,464). Return dated August 5th, 1912. Capital £3,000 in 1,580 6 per cent. pref., 920 5 per cent. pref., and 500 ord. shares, all of £1 each; 1,552 pref. (class of pref. not stated) and 500 ord. shares taken up; £632 paid; £1,420 considered as paid. Mortgages and charges: Nil.

Blackburn, Starling & Co., Ltd. (61,302).—Return dated August 1st (filed August 17th), 1912. Capital £12,000 in £1 shares; 11,168 shares taken up; £7,268 paid; £3,900 considered as paid. Mortgages on freehold property and workshops: £4,600.

Ackroyd & Best, Ltd. (54,600).—Return dated August 22nd, 1912. Capital £25,000 in 3,200 pref. and 1,800 def. shares of £5 each; all shares taken up; £5 per share called up on 3,100 pref.; £15,500 paid; £9,500 considered as paid on 100 pref. and 1,800 def. Mortgages and charges: £55,850 sealed debs.; £7,550 floating debs. sealed to cover overdraft at bank and guarantors.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Return dated September 19th, 1912. Capital £50,000 in £5 shares; all shares taken up; £50,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Uxbridge and District Electric Supply Co., Ltd.

The directors report that the accounts for the year ended December 31st, 1911, show a gross profit of £4,355, out of which interest on debenture stock absorbs £3,287, leaving £1,068, plus £751 brought forward, making £1,819 available. Out of this there is to be placed to bad debts reserve £255, to write off from preliminary expenses and discount on debentures £793, to write off advance to wiring department £76, carrying forward £695. The troubles through which the company has passed during the preceding two years can now be looked upon as ended, and the directors have every confidence in the future success of the undertaking. The business continues to grow in a satisfactory manner, and applications for lighting and power are coming in daily at prices which are satisfactory, and which it is anticipated will produce a considerable addition to the balance at the credit of profit and loss when this year's accounts come to be made up. The total output for 1911 was 815,995 units. In the balance-sheet several items still remain from the old accounts. These are having the attention of the directors, who will deal with them in due course. Since the end of last year, the directors have been successful in placing £15,000 of the 6 per cent. cumulative preference shares, and they are negotiating at the present moment for the placing of the remaining £10,000, which will be required in the immediate future for remunerative extensions. It is the intention of the board during the current year to commence the supply of electricity in the Beaconsfield area, and to duplicate and extend the existing mains and network in Gerrard's Cross.

At the twelfth ordinary general meeting held on Thursday last week at Hamilton House, Victoria Embankment, Mr. Chas. H. McEuen, in moving the adoption of the above report, said that the gross profit for the year under review had amounted to £4,354, and that the troubles through which the company had passed during the past two years could now be looked upon as ended, and the directors had every confidence in the future success of the undertaking.

Mr. T. Petersen seconded the motion, and the report was adopted.

Drake & Gorham, Ltd.

At the annual meeting held on the 16th inst., Mr. B. M. Drake (the chairman), in moving the adoption of the report (see Electrical Review, p. 589), said that the profit of £9,021 for the year was £1,537 better than for 1911, which showed an increase of £1,427 on 1910. They were adopting a conservative policy in proposing to keep the dividend the same as last year, for their available working capital was none too large for the important developments that they had in hand. Experience showed them that their policy of employing the best engineers and workmen was sound, for with work going on in every part of the country, it was essential that managers, foremen, and men, should all be equally interested in securing the good name of the firm. Colonel Holden, late R.A., F.R.S., M.I.E.E., &c., had consented to give the firm the benefit of his long experience as superintendent of the Arsenal in connection with certain new developments which the company had in hand. The chairman proceeded to give a lengthy list of the names of some of the year's *clientèle.* The impetus given to electric lighting by the introduction of the metal lamp still continued, for not only were they enabled to bring electricity within the means of many who could not formerly have afforded the luxury, but it had also decreased the bills for energy from supply stations to such an extent that it was now actually cheaper than gas. The policy of conducting their wholesale business as an entirely separate organisation had been justified. The turnover had considerably increased, and a still further improvement was apparent on the few months of this year's trading. All trade orders were now received at 1, Felix Street, Westminster Bridge Road, which was adjacent to their stores, and this had facilitated the handling of goods and resulted in improved delivery. The business of the Metallic-Filament Lamp Co. trading in Liverpool had been acquired during the year, the consideration for goodwill being met out of part profits, so that for a time the benefit of this business would not be apparent in the balance-sheet, but the results so far had fulfilled expectations. Their manufacturing profits had increased considerably, and the factory was at present busy. The use of electricity as a means of transmitting power was rapidly extending, and during the year they had done work of this class for the Droylesden Foundry Co., Ltd., T. Littlewood & Sons, Ltd., Porritt Bros. & Austin, Deakins, Ltd., Black & Brownlow, and others. Trade had been particularly brisk in the North, and the Manchester branch was to be congratulated on the greatly improved results. Judging by the numerous inquiries received, he had every hope that if the present wave of good trade continued, and the political horizon cleared, their progress might continue.

The report was adopted, and the dividend declaration of 4½ per cent. on the ordinary shares was approved.

Auckland Electric Tramways Co., Ltd.

The annual meeting was held on Monday at the Electrical Federation Offices, Kingsway, W.C., Mr. C. G. Tegetmeier presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 630), once again congratulated the shareholders upon the results of a successful year's working. The progressive expansion in their business which they had experienced in every successive year of the company's operations since they started electrical running in 1902 had been continued during the past year, and although there was no increase in the route-mileage worked, the traffic receipts showed an increase of £18,975, and amounted to £229,142, which was nearly £10,000 per route-mile of line. The number of passengers increased from 33 millions to 36 millions. The population of Auckland served by the tramways was about 100,000, so they carried that population 360 times in the course of the year; in other words, they carried daily an average number of passengers equal to the whole of the population, and, of course, on many days they carried a number very largely in excess. The working expenses showed a considerable increase, the larger portion of which was in the item of power and running expenses, which amounted to £85,607, or £12,509 more than in the previous year. A considerable portion of this increase was the natural result of the largely increased car-mileage, and another portion was due to the large increase in wages to the men. The expenditure on repairs and maintenance—£34,187—was £6,040 less than in the previous year, but, in addition, they spent upon the important item of renewals £7,570, which was charged to the renewals and depreciation account. The expenditure upon renewals, more particularly upon renewals and reconstruction of the permanent way, was likely to be an increasing amount for some years to come, and during the next few years they would probably make very considerable inroads upon the renewals and depreciation fund. The necessity of making provision for expenditure of this nature could not be questioned. Out of last year's revenue they had set aside £20,000 to the renewals account, which was the same amount as in the previous year. The account would then amount to £71,007, or a net increase of £12,429 during the year, and they believed they were providing adequately for the future in that respect. Debenture and other interests had absorbed £17,321, and the rental and percentage of profits payable to the Auckland City Council required £5,258. Since the last meeting he had paid a visit to Auckland, and had had the advantage of discussing with the local directors and the management many matters of importance in connection with the company's business. It was three years since he had been in Auckland previously, and he was much struck with the developments that had taken place, and the progress that had been made in the interval. The most noticeable feature was the growth of the suburban districts, which, owing to rapid and efficient tramway communication, were becoming more and more the residential area of the city. The crush of people and tramcars at their city terminus at five o'clock, and for some time after, every day, compared in intensity with the most crowded centres of London, and in Auckland, as well as in London, the difficult question of providing tramway facilities for large bodies of people wanting to leave the same spot at the same time had to be dealt with. The matter had the most serious consideration of the management, and also of the Auckland City

Council, whose co-operation they most gladly welcomed. In every direction Auckland had made exceptional progress during recent years, and the present evidences of prosperity were very marked. The expenditure of a community upon tramway travelling might be regarded as a fairly reliable barometer as to its prosperity, and if they adopted that test they might be well satisfied to note that their traffic receipts equalled considerably over £2 per head of the whole population per annum, as compared with the 10s. per head, which would be regarded as a fairly satisfactory figure in a prosperous community in this country. He saw no reason to doubt that this progress would be continued in the future. The one thing needed, and that might be said of New Zealand generally, was a more rapid increase in the population. An important matter that came up for settlement during his visit to Auckland was the revision of the terms and conditions of employment in the company's service; a matter which had been discussed by the board before he left this country. The labour legislation of New Zealand provided machinery by means of a Conciliation and Arbitration Act for dealing with industrial disputes and for settling the relations between employer and employed, but it had this somewhat extraordinary feature—that it permitted any industrial union by cancelling its registration under the Act to free itself from its operations and from the jurisdiction of the Arbitration Court. The Auckland Tramways Industrial Union adopted that course, and previous to his arrival in the city had formulated rather extravagant demands for increased wages and improved conditions of service, and the question had to be settled between the company and the Union direct. The company had always been desirous of meeting its employés in a fair and equitable manner, and they were prepared to go to the fullest extent, which they considered reasonable and practicable. At one time a strike seemed imminent, but he was glad to say that after many conversations and discussions their proposals were accepted and an agreement was arrived at which represented a very material increase in the scale of wages, besides providing concessions in other directions. The agreement involved an increase in their wages bill of not less than £12,000 a year, which was, he thought, a very liberal sharing with labour of the profits of the company. It came into force at the beginning of the year, so that the present accounts only showed the effect of the increased expenses for six months. Under the new scale their motor men, after three years' service, got 1s. 2½d. per hour, and conductors 1s. 1d. per hour, which was probably double what men in similar positions received in this country. All time worked over 8½ hours in any one day was paid for at time and a half rates, and they guaranteed all traffic men a minimum of eight hours' wage per day. They were able to pay those high wages, because of the high scale that prevailed in all industries in New Zealand, and the correspondingly high purchasing powers of the people gave them their high traffic receipts. During his two months' stay in Auckland, he had opportunities of meeting the Mayor and members of the City Council and other local bodies, and he was glad to say that their relations with them continued cordial and harmonious. The history of the company had been one of continuous expansion and continuous capital expenditure. Ten years ago they started with 43 cars and 900 KW. of plant, which at that time was considered an extravagant scale for remunerative employment, with the result that the promoters of the company were left to carry the whole of the financial burden of the undertaking. In successive years as requirements had increased, large sums had been spent in providing increased facilities, and to-day they had 136 cars and generating plant of 4,900-KW. capacity. Their capital expenditure last year amounted to £85,351, of which £38,000 was spent on cars, £21,000 upon power station plant and machinery, £7,000 upon developments of the permanent way, £12,000 upon a new car-shed, and the remainder upon various capital purposes. They had also spent £5,567 on the purchase of the freehold of their power station site, which under their lease they had the option of buying at a price which was very much less than its present market value. Their stores and materials on hand were £11,000 more than on June 30th, 1911, their sundry debtors were £7,500 more, and cash was £16,000 more. To provide the necessary funds for that expenditure, they issued during the year £50,000 of preference shares, and £50,000 of debenture-stock, and for some time past they had been using their reserve funds for the purpose of capital outlay, instead of issuing fresh capital. The capital outlay of the company was very largely in excess of the share and debenture capital. They had considerable further capital expenditure in view, and to meet the needs of developing suburbs, they had agreed to construct several short extensions, and were increasing their rolling stock by 25 more cars, all of which they hoped to have available before this time next year. That would make a total of 161 cars, or an addition of 61 cars, costing about £70,000 in two years. That large increase necessitated the provision of still further car-shed accommodation, and also an extension of their car repair works and equipment, and altogether a good deal of expenditure would have to be incurred. They proposed to make an issue of £50,000 in preference shares, and although their preference shares at the present time were at a considerable premium, they proposed to give shareholders the full benefit of the shares, and to adopt the same course as on the last occasion by offering the new shares *pro rata*, to existing ordinary and preference shareholders at par. The issue of those shares would enable them to issue another £100,000 of debenture stock when the need arose, which would place them in a very strong position with regard to further capital requirements. In conclusion, the chairman said that the company was well served on the spot by an excellent staff, and he saw every reason to anticipate continued prosperity

MR. C. SHIRREFF HILTON seconded the motion

MR. LEO MYERS, as one who had recently returned from Auckland, endorsed the remarks of the chairman as to the present prosperity and future possibilities of the city, and expressed his confident opinion in the future of the company under its present able management both in London and New Zealand.

The CHAIRMAN, in reply to a shareholder, said that the agreement with the men's union was for one year, and it was to remain in force thereafter until one side or the other gave notice to terminate it.

The report was adopted.

Subsequently, at an extraordinary meeting, a resolution was unanimously passed increasing the capital from £450,000 to £500,000 by the creation of 50,000 new preference shares of £1 each, ranking, *pari passu*, with the existing preference shares.

Ottawa Electric Co.—This company has resolved to increase its capital from $2.000,000 to $5.000,000. Large extensions and improvements are contemplated. The president of the company is Mr. Thomas Ahearn, Ottawa.

Continental. Belgium.—La Société de la Manufacture de Cables, Accumulateurs et Appareils Electriques, of Seneffe, is declaring a dividend of 3 per cent. for the last financial year.

Kaministiquia Power Co.—The directors announce a dividend at the rate of 4 per cent. per annum, for the quarter ending October 31st.

Montreal Light, Heat and Power Co. – The directors have declared a dividend of 2¼ per cent. on the paid-up capital stock, being at the rate of 9 per cent. per annum, for the quarter ended October 31st.

Clyde Valley Electrical Power Co.—Mr. F. C. Gardiner, who presided at the half-yearly meeting of this company in Glasgow, moved the adoption of the report, and said that the adverse effect of the coal strike on the company's output and revenue had not been so great as might have been expected, that the company continued to show substantial progress, and that there was a steady demand on the part of manufacturers of all classes for the company's supply. The contracts for supply showed an increase of 4,000 H.P. during the half-year. The prov. order authorising the company to issue cumulative preference shares and for other purposes had been passed, and the confirming Act has received the Royal Assent. The report and accounts were adopted. Resolutions were passed authorising an issue of preference shares and the creation of a special reserve fund.

STOCKS AND SHARES.

Tuesday Evening.

OF the panicky feeling which demoralised markets about ten days ago there has been no recurrence, but it cannot be said that the Stock Exchange is at all happy. The aftermath of the slump is to be seen in severe liquidation, though of a quiet kind, and confidence continues very coy about returning to the Stock Exchange markets. The chief seat of the uneasiness is in Paris, while some of the Belgian operators are known to have been speculating beyond their means. The only effect, however, upon the markets with which we are concerned is to bring about a little depression in the prices of Latin-Canadian issues, to which the state of affairs in Mexico adds emphasis.

The principal feature in the Home Railway markets, so far as the price movements are concerned, is a jump of 12s. 6d. in Great Northern and City Railway Preferred Ordinary, the shares to which reference has been made here a good many times as worth the attention of the long-sighted capitalist prepared to take up his interest and wait for developments in the future. Rumour is busy with the idea that the Great Northern and City may be linked up with the other tubes, while it is also said that the Great Northern Railway is at last going to endeavour to get control. This latter was the basis upon which many of the original subscribers founded their applications for shares, but it was destined to be rudely upset almost from the start. Its revival may be due in some measure to the expectation—or hope—that the Midland intends to obtain a controlling interest in the City and South London, though this particular anticipation is a little damped this week by a fall of 2 in the price of City and South London Ordinary stock.

On the other hand, Central London Ordinary and Deferred have each regained a small part of their last week's falls, though the Preferred at 84 is a point down. It is worth remembering, in connection with Home Railways, that the second half-year is that in which the "fat" dividends are paid upon most of the stocks. Central London Deferred, for example, carries the full year's distribution in its price up to the end of the twelvemonth. Metropolitans, after touching 56, came back to 54, and Districts rose to nearly 40 before they reverted to 38¼.

London United Tramways Preference shares recovered the 10s. which they shed last week, but there is no particular change in Metropolitan Electric Tramways issues. British Electric Traction 5 per cent. Debenture stock fell away 3½, and the 6 per cent. Preferred is ¼ down at 12½.

In the English Electric Lighting market the changes are fairly well distributed between rises and falls. While there are advances in Brompton Preference, Charing Cross Preference, and St. James's Ordinary, there are small falls in Bournemouth and Poole Ordinary and Second Preference, County of London Ordinary, and Westminster Preference. A rise of £1 in City of London Ordinary restores the quotation to its level of last week, and there has been a disposition to buy the shares speculatively again. The market, as a whole, is very quiet, and the recent little buying movement has been somewhat checked by the consideration that the final dividends for the year are certainly not likely to be improved by the incidence of the Insurance Act, and the increased cost of fuel, &c., due to the labour troubles this year.

Mexico has the ever-present thorn of revolution to trouble the country's securities once more this week. The rebels have certainly done their work well up to now, and few people on this side will be astonished if they succeed in planting General Felix Diaz in the Presidency and turning out the present occupant of the office, President Madero. If this can be accomplished without much bloodshed, the general Stock Exchange opinion seems to be that it will be a step in the direction of something like a real settlement of Mexican affairs upon a more permanent basis than has been enjoyed for the last half decade or so.

Mexican Light and Power, after its 6 points fall, is another 1½ down, and Mexican Electric Lighting bonds and Vera Cruz bonds are lower by a point each. Mexican Tramway Common shares shed 2½, and the 5 per cent. bonds lost 1. There is no movement in Monterey Debentures. Montreal Light, Heat and Power recovered half of its 12 points fall, and Shawinigan Water rallied to the extent of 3, while Canadian General Electrics are 1 to the good. Calcutta Electric Supply Ordinary are ½ down; the interim dividend at the rate of 7 per cent. per annum has just been announced. Calcutta Trams are also easier, falling ⅛ to 6¼. Rio Trams have regained 9, and Sao Paulo Trams 7, of their previous big falls, and the First Mortgage Bonds rallied ½. Anglo-Argentine 4 per cent. Debentures eased off ½. The amount which the underwriters of the recent new 5 per cent. Debenture issue had to take up came to about 80 per cent. The company's first Preference shares, however, recovered $\frac{1}{16}$. British Columbia Electric stocks are firmer. Part of the many falls last week were due, of course, to the expectation—or to the anticipation, rather—of sellers coming along to realise investments in order to raise money required to pay differences; but not much real stock came out, and upon the appearance of bargain-hunters, quotations were quickly readjusted to a level approaching that which prevailed before the slump.

The Telegraph market has been undergoing violent excitement in connection with Marconis. After falling to 4¾, the price jumped to 5⅜ with scarcely a break, reverting later on to $5\frac{1}{16}$, leaving a rise of $\frac{3}{16}$ on the week. The Preference moved in sympathy. All the friends of the celebrated inventor are thankful that he has escaped from his motor accident with the loss of one eye only, much as they have regretted that there should have been this result. At first, it was greatly feared that Mr. Marconi might lose his sight altogether. The somewhat grim jest in the Stock Exchange is that the name of the great scientist ought now to be spelt without the final letter, having regard to the result of his operation.

National Telephone Deferred is again a point lower, and West India and Panama Telegraphs rallied $\frac{3}{16}$, to lose it later. Movements in all speculative stocks and shares are extremely erratic, and, as the Stock Exchange says, markets cannot be trusted very far, in view of the unsettled conditions of financial affairs, more especially on the Continental Bourses. Indo-European Telegraphs rose ½, but Great Northerns have not yet recovered from their weakness. Direct United States eased off to 7½; the Anglo-American group as a whole is a little lower. Amazon Telegraphs are ⅛ up, while Globes moved down to 11 middle.

There are several changes of consequence amongst Manufacturing shares. Edison & Swan partly-paid shares have been marked down $\frac{5}{16}$—shares changed hands at 5s. 3d. the other day—and the fully-paid were put down ¼. These falls may possibly be the outcome of the suggestion to reorganise the capital, of which mention was made here last week. Brush 4½ per cent. Debenture dropped 3, from which it might appear that the attempt to place the new 6 per cent. participating Debenture, by the process of allotment, were not a great success so far. Castner-Kellners and Dick, Kerrs are both $\frac{1}{16}$ better, while India-Rubber shares have begun to go back again. Babcock & Wilcox lost their previous improvement, though British Aluminium Debenture continues to creep up. The Rubber Share Market is dull and depressed, the dwindling in the price of the raw stuff causing a certain amount of exasperation to rubber shareholders whose guides and counsellers had been promising them that the day of improvement in the produce was near at hand.

Metallic Seamless Tube Co., Ltd.—According to the *Financier*, the report states that the net profits for the past year were £3,580, plus £5,034 brought forward. A dividend of 10 per cent. is proposed, adding £5,000 to the reserve, and carrying forward £1,740.

Calcutta Electric Supply Corporation, Ltd.—The directors have declared an interim dividend, at the rate of 7 per cent. per annum, on the ordinary shares for the six months ended June 30th last, payable on November 15th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, October 23rd.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	„ Nitric	„	22/-	..
a	„ Oxalic	per lb.	2¾d.	..
a	„ Sulphuric	per cwt.	5/6	..
a	Ammoniac Sal	„	42/-	..
a	Ammonia, Muriate (large crystal)	per ton	£29 10	..
a	Bleaching powder	„	£5 10	..
a	Bisulphide of Carbon	„	£18	..
a	Borax	„	£16 10	..
a	Copper Sulphate	„	£26	..
a	Lead, Nitrate	„	£26 10	..
a	„ White Sugar	„	£25 10	..
a	„ Peroxide	„	£32	..
e	Methylated Spirit	per gal.	2/6	..
a	Potassium, Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (88/90 %)	per ton	£22 10	..
a	„ Chlorate	per lb.	3½d.	..
a	„ Perchlorate	„	4½d.	..
a	Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a	Shellac	per cwt.	70/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers	„	£6 10	..
a	„ Recovered	„	£5 10	..
a	„ Lump	„	£5 5	..
a	Soda, Caustic (white 70/72 %)	„	£10 5	..
a	„ Chlorate	per lb.	3⅝d.	..
a	„ Crystals	per ton	£3 5	..
a	Sodium Bichromate, casks	per lb.	3d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots	per ton	£85	£3 inc.
b	„ Wire, in ton lots	„	£112	£10 inc.
b	„ Sheet, in ton lots	„	£120	..
p	Babbitt's metal ingots	„	£38 to £145	..
c	Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	..
c	„ Tube (brazed)	„	11¼d.	¼d. dec.
c	„ „ (solid drawn)	„	9¾d.	¼d. dec.
c	„ Wire, basis	„	9⅛d.	..
c	Copper Tubes (brazed)	„	1/0⅛d.	½d. dec.
c	„ „ (solid drawn)	„	11½d.	¼d. dec.
g	„ Bars (best selected)	per ton	£91	£4 dec.
g	„ Sheet	„	£91	£4 dec.
g	„ Rod	„	£91	£4 dec.
d	„ (Electrolytic) Bars	„	£82	10s. dec.
d	„ „ Sheets	„	£99	£1 10s. dec.
d	„ „ Rods	„	£87	£2 dec.
d	„ „ H.C. Wire	per lb.	$10\frac{3}{16}$d.	$\frac{1}{16}$d. inc.
f	Ebonite Rod	„	5/8	..
f	„ Sheet	„	4/9	..
n	German Silver Wire	„	1/10	..
h	Gutta-percha, fine	„	..	..
h	India-rubber, Para fine	„	4/6½	¾d. dec.
j	Iron Pig (Cleveland warrants)	per ton	66/2	6d. dec.
l	„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g	Lead, English Pig	„	£19 12 6	£2 5s. dec.
m	Manganin Wire No. 28	per lb.	6/6	..
g	Mercury	per bot.	£8	..
e	Mica (in original cases) small	per lb.	6d. to 8s.	..
e	„ „ „ medium	„	3/6 to 6/-	..
e	„ „ „ large	„	7/6 to 11/-	..
p	Phosphor Bronze, plain castings	„	11d.	..
p	„ „ rolled bars & rods	„	1/0½	..
p	„ „ rolled strip & sheet	„	1/1	..
o	Platinum	per oz.	185/-	..
d	Silicium Bronze Wire	per lb.	11½d.	½d. inc.
	Steel, Magnet, in bars	per ton	£55	..
g	Tin, Block (English)	„	£231 to £233	inc.
n	„ Wire, Nos. 1 to 16	per lb.	2/7	..
p	White Anti-friction Metals	per ton	£45 to £150	..
k	Zinc, Sh't (Vieille Montagne bnd.)	„	£31 12 6	..

Quotations supplied by—

a	G. Boor & Co.	*j*	Bolling & Lowe.
b	The British Aluminium Co., Ltd.	*k*	Morris Ashby, Ltd.
c	Thos. Bolton & Sons, Ltd.	*l*	Richard Johnson & Nephew, Ltd.
d	Frederick Smith & Co.	*m*	W. T. Glover & Co., Ltd.
e	F. Wiggins & Sons.	*n*	P. Ormiston & Sons
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o*	Johnson, Matthey & Co., Ltd.
g	James & Shakspeare.	*p*	
h	Edward Till & Co.	*r*	W. F. Dennis & Co.

Ferranti, Ltd.—The annual meeting of this company was held yesterday, Thursday. Our report will appear next week.

Monte Video Telephone Co., Ltd.—Our report of this company's meeting, which was held on Wednesday, will appear next week.

West India and Panama Telegraph Co., Ltd.—The directors announce a dividend of 1s. 6d. per share on the ordinary shares.

Cuba Submarine Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 6 per cent. per annum for the half-year ended at June last.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9¾ — 10¼	½	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 13 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	— ½	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord...	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	+ ½	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	+ ½	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 8 4
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	+ 1	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	.	4 8 3
County of London, Ord... ..	10	6	4†	11½ — 11¾	— ¼	5 2 2
Do. 6 % Pref.	10	6	6	11⅞ — 12¼	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	..	7/16 — 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7⅝ — 7⅞ xd	..	5 14 3

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½		1⅝ — 2⅛		3 15 8
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅞ — 4⅛	..	4 17 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ —101½ xd	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	9 — 10	+ ½	5 0 0
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88		3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅝	..	..
South London, Ord.	4	5	..	3 — 3½	.	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛ — 1¼	..	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord...	£3	Nil		¼ — ½	..	..
Do. 6 % Cum. Pref.	5	2		2⅝ — 3⅛	..	..
Do. 4½ % First Mort. Deb...	100	4½	4½	84½ — 88½	.	5 1 8
Westminster, Ord, ...	5	10	9†	8¾ — 9¼		5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾ — 5¼	— ⅛	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5¼ — 5¾	..	5 4 4
Calcutta, Ord.	5	8½	..	7⅛ — 7⅝	— ¼	5 11 6
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	93½ — 95½	.	5 4 9
Canadian Gen. El. Com. ..	$100	7	7	116 —120	+1	5 16 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	¾ — 1	..	8 0 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 8 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	9/16 — 11/16 xd	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 8
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	—1	5 13 8
Mexican Lt. & Power, Common	$100	4	4†	85 — 88 xd	—1½	4 11 0
Do. 7 % Cum. Pref.	$100	7	7	103 —106 xd	..	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	93½ — 95½	—½	5 4 9

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c.
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	85 — 88	..	5 13 8
Montreal, Lt., H. and Power ..	$100	8	9†	238 —243	+ 6	3 14 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	39 — 42	..	..
River Plate, Ord.	Stock	10	.	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	143 —147	+ 3	3 8 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	— ½	4 5 9
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	96½ — 98½ xd	— ¾	4 11 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	—1	5 4 2
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅞d.	15/16 — 1	+ 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4	..	7⅜ — 7⅞	+ ⅛	5 1 7
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	145½ —147½	— ½	5 8 6
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	3	3	67 — 69 xd	..	4 7 0
Do. 6 % Pref.	Do.	6	6	111 —112 xd	— ½	5 7 2
Do. Def...	Do.	30/-	..	25¾ — 26	— ¼	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	[illegible]	7⅝ — 7⅞	..	4 8 11
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	82 — 84	— ½	4 15 3
Cuba Telegraph	10	[illegible]	..	9½ — 10½	..	5 14 8
Do. 10 % Pref...	10	10	10	16½ — 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3¾	+ ¼	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	6½ — 7	..	7 2 10
Direct United States Cable ..	10	5	4	7¼ — 7¾	— ⅛	6 9 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	129 —132 xd	..	5 6 1
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79 xd	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	99½ —101½	..	3 18 10
Eastern Extension	10	7	7†	12¾ — 13¼ xd	— ¼	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	— ¼	5 7 7
Do. 6 % Pref.	10	6	6	12¾ — 13¼	..	4 10 7
Great Northern Telegraph ..	10	18	18	28 — 29	..	6 4 2
Indo-European Telegraph ..	25	13	..	57½ — 59½	+ ½	5 9 3
Mackay Companies Common ..	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 — 5⅛	+ 3/16	3 18 2
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅜ — 4⅝	+ ¼	3 14 0

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c.
Monte Video Telephone, Ord...	1	6	..	1 1/16 — 1 3/16	..	5 1 1
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
National Telephone Def. ..	Stock	6	..	156½ —158½	—1	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101	— ½	4 9 1
Oriental Telep. and Elec. ..	1	8	..	1¾ — 1⅞	..	4 5 4
Do. 6 % Cum. Pref.	1	6	6	1 3/32 — 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	11⅞ — 11⅜ xd	+ ⅜	8 16 2
Submarine Cables Trust .	Cert.	6	6	126 —129 xd	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ —101½	..	4 8 8
United River Plate Telephone	5	8	..	7 7/16 — 7 11/16	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32 — 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3⅛ — 3⅝	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅝ — 11⅛	+ ⅛	5 7 10
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13⅜ — 13⅞	..	5 1 0
Do. 4 % Deb.	Stock	4	4	96½ — 98½	..	4 1 3
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98½ —101½ xd	..	4 8 3

* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½ — 13½	— ½	..
Do. Do. Deferred ..	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	..	..
Do. 5 % Perp. Deb. ..	100	5	5	90 — 94	—3½	5 6 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 83	..	5 7 2
Central London Railway, Ord.	100	8	8†	74 — 76	+1	3 19 0
Do. Pref.	100	4	4	83 — 85	—1	4 14 2
Do. Def.	100	2	..	73 — 75	+2	2 13 4
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1¾	1¼†	40½ — 41½	—2	3 6 3
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	105 —107	..	4 13 6
Do. Do. 1901	100	5	5	105 —107	..	4 13 6
Do. Do. 1903	100	5	5	104 —106	..	4 14 4
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2¾	+ ⅛	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	11/16 — 23/32 xd	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2 5/16	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5¼ — 6	+ ½	..
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3

NAME.	Stock or Share.	Dividends for 1911.	1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Metropolitan Railway Consol. ..	100	1⅞	1½†	53¾ — 54¼	— ⅜	3 0 0
Do. Surplus Lands	100	2⅞	2¾†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	38 — 38½	— ½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	88 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅛ — 1¼ xd	..	4 16 0
Do. Def.	1	Nil	..	¼ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	95 — 97	—1	4 12 9
Do. 5 % Deb.	100	5	5	97½ —100½	..	4 19 6
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	3¾ — 4	..	Nil
Do. "A"	1/-	..	..	19/32 — 21/32	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	87 — 89	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1911.	1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16 — 5 3/16	+ 1/16	5 6 0
Do. 2nd Pref.	5	5½	5½	4 13/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	93 — 94½	½	4 4 8
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Auckland Trams, 5 % Deb. ..	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	+ ½	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	..	7¼ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	142 —147	+1	5 8 10
Do. Pref. Ord.	100	6	6	115 —119	+3	5 0 10
Do. 5 % Pref.	100	5	5	104½ —107½	+ ½	4 13 0
Do. 4½ % 1st Mort. Deb. ..	100	4½	4½	98 —101 xd	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	101 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	6 — 6½ xd	— ⅛	5 7 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	11/16 — 13/16	+ 1/32	..
City Buenos Aires Trams (1904)	5	5	5†	5½ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

NAME.	Stock or Share.	Dividends for 1911.	1912.	Closing Quotations Oct. 22nd.	Rise + or Fall —	Present Yield p.c. £ s. d.
La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	..	31/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	..	1 1/16 — 1 5/16	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	92 — 95	..	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	112 —116	—2½	6 0 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	95 — 97	- 1	5 3 1
Do. 6 % Bonds	100	6	6	99 —101	..	5 18 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7 3/16 — 7 9/16	..	6 12 5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½ —102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	155 —160	+9	3 2 6
Do. 1st Mort. 5 % Bonds ..	..	5	5	100½ —102½	+ ½	4 17 7
Do. 5 % Mort. Bonds ..	100	5	5	95½ — 97½	..	5 2 7
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	265 —275	+7	3 12 9
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 14 4
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	+ ⅛	5 9 1
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	½ — ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼ xd	⅛	4 6 2
Do. Pref.	1	6	6	1 7/16 — 1 9/16 xd	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	⅛ — ⅜	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝ — ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	86 — 89	+1	5 12 4
B.I. & Helsby Cables	5	10	8†	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	3	Nil	Nil	½ — ¾	..	Nil
Do. Deb...	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	—3	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10¾ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	3 11/16 — 3 13/16	+ 1/16	5 4 9
Do. Deb...	100	4½	4½	105 —108	..	4 3 4

Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	6	5	65 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16 — 13/16	+ 1/16	..
Do. Pref.	1	6	6	¾ — ⅞ xd	..	6 17 2
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	¼ — ½	— 5/16	Nil
Do. fully paid	5	Nil	..	1¼ — 2	— ¼	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12¼ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11 — 12	— ½	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	34 — 36	..	6 13 4
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

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* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING SEPTEMBER, 1912.

We publish herewith statistics of the exports and imports of electrical material during September, from which it will be seen that the former—totalling £634,879—were considerably higher than in the previous month, due to the inclusion of a large submarine cable export to New South Wales.

Apart from the telegraphic exports, which were valued at £232,592 for the month, the returns disclose a decided falling off in machinery and telephonic exports, with, however, increased cable exports as a saving feature. The latter reached £129,943 in value, and thus eclipsed the previous month's record value.

The import section also witnessed a considerable increase as compared with the August returns, the figures being £194,090 and £205,656 respectively, although in this case the only considerable increase occurred in lamp importations, which, as a whole, amounted to over £34,000 in value, other items, such as machinery, cables, telegraphic and telephonic material, showing only slight improvement over the August figures.

In the re-export section, the total of £20,115 shows a falling away from the £23,741 recorded in the preceding month.

While New South Wales was our best customer during the month, owing to circumstances mentioned above, our business with Japan and Canada also reached a high level.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cables and apparatus and electric bells.	Telegraphic cables and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	714	14	83	15	139	368	6,859	70	198	40	564	911	9,975
Germany	2,606	7,212	27	...	427	140	1,400	615	6	252	255	425	13,365
Netherlands, Java & Dutch Indies & Borneo	609	1,720	170	24	93	11	1,144	...	22	...	33	736	4,562
Belgium	162	473	94	15	50	12	2,231	974	3	10	299	139	4,762
France and French Indo-China, &c. ...	448	...	3,313	...	...	10	6,942	73	636	...	42	760	12,224
Portugal	233	260	...	20	...	5	617	...	21	3	196	63	1,418
Spain, Canary Isles and Spanish N. Africa...	955	4,743	160	...	...	88	5,749	920	13	...	744	50	13,422
Switzerland, Italy and Austria-Hungary ...	727	75	134	...	95	...	3,003	22	70	61	85	1,634	5,906
Greece, Roumania and Turkey	293	490	...	...	71	...	605	5	2	...	115	1,927	3,508
Channel Isles, Gibraltar, Malta and Cyprus...	93	216	...	...	24	34	162	7	18	...	7	289	880
U.S.A., Philippines and Cuba	1,149	55	78	76	...	11	841	...	164	22	...	172	2,568
Canada and Newfoundland	1,533	19,522	1,160	2,215	...	3,072	7,941	...	287	...	1,895	12,300	49,925
British West Indies and British Guiana ...	...	35	56	224	...	...	220	13	19	2	123	45	737
Mexico and Central America	19	3,435	5	...	...	...	119	...	2	...	168	219	3,967
Peru and Uruguay	151	886	40	55	...	16	869	15	...	...	...	2,471	4,503
Chile	458	764	152	156	...	28	4,847	...	204	...	...	254	6,863
Brazil	773	1,533	354	1,194	...	155	6,556	2,271	666	38	13	4,299	17,852
Argentina	2,881	9,961	257	572	462	897	9,584	349	2,113	83	4,459	3,397	35,015
Colombia and Venezuela	101	...	...	...	...	...	...	...	...	...	150	264	515
Egypt, Tunis, Morocco and Persia	784	94	166	26	15	37	532	49	194	...	35	610	2,542
British West Africa	28	71	253	86	...	...	838	3,096	17	6	222	273	4,887
Rhodesia, O.R.C. and Transvaal	2,908	837	485	1,192	31	181	2,375	1,287	364	108	369	1,415	11,552
Cape of Good Hope	1,456	897	214	188	48	400	1,682	259	61	14	128	230	5,577
Natal	969	6,278	767	250	...	12	3,962	170	402	...	42	752	13,604
Zanzibar, Brit. E. Africa, Mauritius and Aden	295	43	61	176	10	79	597	84	81	...	453	52	1,931
Azores, Madeira and Portuguese Africa ...	211	2,744	25	83	...	69	1,161	6	106	...	...	10	4,415
China and Siam	1,401	462	152	1,484	92	1,101	3,180	36	544	222	15	515	9,204
Japan and Korea	282	23,067	5	...	...	3,087	21,462	4,968	2,505	46	4,155	146	59,723
India	3,841	9,143	2,566	2,201	121	927	9,376	2,446	2,813	316	1,603	1,337	36,690
Ceylon	393	239	117	185	...	53	33	338	78	13	68	111	1,628
Straits Settlements, Federated Malay States and Sarawak	307	813	147	101	115	135	760	69	53	325	67	4,033	6,925
Hong Kong	805	2,520	97	100	64	248	518	443	593	17	54	47	5,506
West Australia	476	36	64	286	...	...	684	...	14	11	140	453	2,164
South Australia	2,592	1,072	286	304	21	40	402	27	113	...	236	1,065	6,158
Victoria	4,489	8,915	645	913	...	394	3,221	373	700	39	4,625	11,169	35,483
New South Wales	3,658	10,713	958	1,205	...	148	11,706	1,014	2,719	24	263	171,102	203,510
Queensland	260	2,035	12	281	...	39	1,066	...	209	...	...	69	3,971
Tasmania	168	2,602	...	...	...	...	...	...	...	...	61	...	2,831
New Zealand and Fiji Islands	835	5,967	911	285	...	541	6,205	286	245	42	446	8,848	24,611
Total, £	40,363	129,943	14,014	13,906	1,878	12,338	129,479	20,285	16,285	1,694	22,102	232,592	634,879

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cables and apparatus and electric bells.	Telegraphic cables and apparatus.	Total.
Norway, Sweden and Denmark	21	...	23	132	...	...	7,526	120	405	4	7,561		15,792
Germany	6,674	7,540	601	18,612	8,773	1,945	55,651	2,883	5,225	7,327	18,518		133,749
Holland	...	...	...	654	779	...	1,985	...	...	...	...		3,418
Belgium	243	1,733	14	157	112	129	3,931	...	280	22	6,814		13,435
France	420	78	215	1,698	267	326	1,725	82	1,016	2,919	629		9,405
Switzerland	128	1,069	36	51	4	61	1,308	...	...	10	940		3,607
Italy	20	714	...	...	...	...	...	...	...	...	2,517		3,251
Austria-Hungary	...	1,300	3	664	89	...	290	...	6	153	...		2,505
United States	1,812	371	565	135	2,090	12	6,580	7,915	144	5	339		19,998
Canada	125	...	...	40	...	...	...	250	...	...	6		421
Total, £	9,443	12,805	1,457	22,143	12,114	2,503	78,996	11,250	7,076	10,470	37,324		205,581

Additional imports: Spain, carbons, £75.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephone cables and apparatus and electric bells.	Telegraphic cables and apparatus.	Total.
Various countries, mainly as above ...	9,765	789	...	1,253	475	...	7,133	...	124	470	106		23,741

Total Exports: £634,879. Total Re-Exports: £20,115. Total Imports: £205,656.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

A LIBRARY SCHEME FOR CATALOGUES AND PRICE LISTS.

[COMMUNICATED.]

Many attempts have been made to find a really efficient and satisfactory solution to the catalogue and price list difficulty, but judging by the fact that in most offices it is still the usual rule to find all sorts and conditions of this class of literature just dumped in untidy and dust-covered heaps, sometimes on shelves, but more often in odd corners on the floor, with no attempt or pretence at classification or arrangement, one is forced to the conclusion that no very satisfactory solution has as yet been found, or, if it has been found, is confined to the fortunate few.

That the draughtsman, cost clerk, or estimator, who has to make frequent recourse to catalogues and price lists, would welcome some system of classification is certain. It is most annoying and absolutely ruinous to the best temper to have to make periodic searches for a particular list, which may extend over five minutes, or possibly may last for half-an-hour or more, and having obtained the desired article, to find that one's hands are covered with dust, and that probably in pulling down heaps of lists, one has received a generous shower bath of dust. Before work can be resumed a thorough wash and brush up have to be indulged in. Even if success rewards the searcher in the end, it is a most unsatisfactory state of affairs; but it is often the case that the list required is not forthcoming, and it is only after a general hunt that it is discovered, say, in the drawer of some more enterprising young gentleman who has had occasion to use it a month or so ago, and either forgot to return it, or else having had a similar experience in obtaining it, has kept it by him with an eye to further requirements.

As has been said, such an experience is, to say the least of it, annoying to the individual, but it is also a most serious thing looked at from an economical point of view. In an office of this description (and, alas, only a very slight exaggeration has been made of the conditions existing in the majority of offices) the amount of time wasted in this way is enormous, and it is almost always the time of a highly-paid man, because it is practically useless to send a junior on a search of this kind. Consequently the finding of catalogues becomes a most serious item in the establishment charges.

Again, it is simply marvellous what an amount of space can be occupied by lists stored in the way described; partly because no attempt is made to eliminate "out of dates," and also because there is no check on the multiplication of the same lists. On close examination, it is sometimes possible to discover that at some remote period an attempt had been made at classification; but, in most cases, this leads to confusion worse confounded. One finds a ticket stuck on the front of the shelf "Dynamos and motors," let us say, and requiring a little information concerning squirrel-cage machines, one searches through the heaps over this ticket only to find lists of iron and steel, a few lathes, pattern-shop requirements, and, in fact, everything and anything except dynamos and motors. Someone, for greater ease of search, had at some time removed the correct pile to his desk and either forgot or did not think it worth while to return it. Someone came along with a new consignment of lists, hailed the empty space with delight, and promptly filled it. Result: chaos.

The harrowing story might be continued *ad lib.*, but since the experience is pretty general, it is hardly necessary to dwell upon it. The question is, can a simple library scheme be devised, and one which can not only be applied to the formation of a new library, but also to the reformation of an existing dust and rubbish heap? It must be as simple as possible and, at the same time, elastic. It must enable the least-called-for list to be found at a moment's notice. It must be so appointed as to give the fullest information to manager, draughtsman, estimator, stores buyer and cost clerk. It must be as cheap in first cost and maintenance as possible, since the deviser can hardly hope to be credited with a reduction in the establishment charge, although such will follow naturally, but he will undoubtedly have to answer or any outlay entailed.

In describing the following scheme, every proposal has purposely been made in its very simplest form, and in some cases the writer may be accused of crudeness. The reason is that it is always easy to amplify a simple system and give an opportunity for exercising one's individual tastes, but it is a most difficult matter to simplify a complicated system.

A.

Subject.	*File No.*
Accessories, drawing office	12
,, gas and oil engines	10
,, pattern shops	24
,, steam engine	3
Advertising	1
Alloys	5
Aluminium	7
Angle iron	30
Appliances, gas	15

FIG. 1.

Then, again, every different kind of factory will require to make certain modifications to suit its own requirements. Hence, it is only waste of time and space to elaborate in every detail a fixed scheme. The present library scheme is offered with the certainty that it will be found to be a great time saver and a real addition to the efficient equipment of any factory or office. That there are difficulties in the way goes without saying, the present state of chaos is sufficient proof of this. Perhaps the greatest of these is the great variety which exists in the size, shape, and method of binding. Uniformity in size has been advocated again and again, but the realisation is still more or less a dream, and, it is feared, likely to remain so. Consequently, it becomes necessary to group the catalogues in some way.

To commence with, let us differentiate between bound and unbound lists. It will be found that the unbound lists, which are the class which gives most trouble, are hardly ever of such large dimensions that they cannot be accommodated in an ordinary box file. Extra large ones are few in number, and may be folded to fit in. It is therefore decided to use box files, since these are compact and will hold at the same time a good number of lists, and, above all, exclude dust.

In dealing with collections of lists already in stock, it is best to commence by dividing them into groups under general headings, denoting the subjects, as "shafting and shaft fittings," "steam engines," "boilers," "switchgear," "dynamos and motors," and so on. These groups of papers will in all probability be found too large for convenient handling, and must therefore be sub-divided. It is obviously better to err on the side of too full division than the reverse, because the process of finding a required list is thereby rendered easier. The degree of sub-division is therefore left to individual discretion and taste.

Once the groups are arranged in the desired manner, the next proceeding is to make an index of the groups, which will be called the "subject index." Each subject is then given a distinctive number, which is included in the index. The subjects should be arranged alphabetically for ease of reference, and all that is necessary is to type the lists under each initial, and file them in a box file with thumb index. Additions and alterations may then be made when required with a minimum of expense. Each subject will, in all probability, cover several sub-divisions, so that it might be found convenient to amplify the index by a finer sub-division that is made in filing.

D.

Name of firm.	*Initial in thumb-index.*	*File No.*
Dawson, John, Ltd.	D.	1. 17
Dearing, Alfred Smith, and	S.	30
Dickson, Samuel, & Co.	D.	2. 5. 9
Dombey, Willis and	W.	15
Durnford, Atkinson, Mills, & Ltd.	A.	24

FIG. 2.

Thus, in the case of "shafting and shaft fittings" indexing, it would be an assistance if in the index there appeared "pulleys," "plummer blocks," "hangers," "wall boxes," and so on, each under its own initial, and with reference to the same file number. This is, however, a matter which may be conveniently left to the judgment of the librarian.

A sample extract from the subject index is given in fig. 1. A box file is next provided for each subject number, which is marked distinctly on the back, or if the number of lists is too great for accommodation in one file, more must be added. These must bear the subject number, and in addition the letters *a*, *b*, *c*, &c., as a suffix according to the number of files required. For instance, if three files are required for Subject 5, they must be numbered 5, 5*a*, 5*b*. Each file is to be provided with a thumb index, and the lists are then filed under the advertiser's initial in groups as already arranged. It is, therefore, seen that by referring to the subject index, we may with the greatest ease find all lists relating to that subject, and then by means of the thumb index in the file discover any particular advertisement under the advertiser's initial. Sometimes it is required to find a certain well-known advertiser's list without reference to the subject, and therefore for the purpose, an alphabetical list of advertisers is arranged and called the "advertiser's index." For this purpose a file similar to that used for the "subject index" is founded.

In the case of compound names, the advertiser should be indexed under the initial of each separate name, thus:—Smith, Jones & Brown, Ltd., should be indexed under S, J and B, since the full name may not be remembered when required. In this index the first column should contain the full name of the firm, the second column the initial under which he is indexed in the thumb index in the files, and the third column the numbers of the files in which he appears. A sample extract from such an index is given in fig. 2. Where a firm describes several articles which come under different headings in the subject index, if the advertiser does not issue loose sheets, the whole list may itself be filed under the principal subject, dummy sheets being filed under the other subjects covered, on which is stated the subject heading or the file number under which the list is to be found. For instance, supposing Messrs. Clarke, Thompson are makers of steam engines, boiler fittings and superheaters; steam engines being the principal subject, and one list only being issued, this list will be filed under "Steam engines" in, say, file No. 21. In the files for each of the other subjects under C will appear a dummy sheet, as shown in fig. 3.

FOR FILING UNDER SUBJECT No. 11.

Name of Firm.	*Full list in file No.*
Clarke & Thompson	21

FIG. 3.

Catalogues which are too bulky for the files will, in all probability, be found sufficiently well bound to arrange on shelves. They should be grouped together alphabetically under the advertiser's initial. The catalogues under each initial should, if possible, be kept separate, and since it is easy to estimate the amount of space required for each group, the shelves may be partitioned off by uprights, leaving a liberal allowance in each pigeon-hole for additions. Another plan would be to devise some plan of movable partitions, which could be slid along as required. In the case of fixed partitions, each pigeon-hole should be plainly marked with the initial it is provided for. A separate index is not necessary for the bound catalogues. All that is required will be dummy sheets in the files under the advertiser's name, as shown in fig. 4. There must be a dummy sheet in all files covering subjects dealt with in the bound catalogues referred to. Discount sheets are to be filed separately in a file marked "discount." The filing should be done alphabetically under the advertiser's name. These should be kept as far as possible in the library itself, and should on no account be issued to any but responsible hands. In cases where printed discount sheets are not issued, but discount is quoted by letter, the letter or a copy should be filed in the discount file. So much for the organisation of the library. A set of shelves will, of course, be required for its accommodation, but these will in many cases be already to hand, or may be very easily and cheaply erected.

Now, to come to the maintenance. It is most important that one person, and only one person, should be responsible for the library. If anyone is allowed to take any list at any time, the whole system will break down in a week, and, in course of time, things will get back to where they were before the initiation of the scheme. A very suitable person to act as librarian is a junior clerk or a draughtsman. He should be big enough to exercise authority, and, as far as the library is concerned, should be responsible to no one but the manager. It is not necessary that he should be actually located in the library itself, though he should be near enough to prevent raids. When a list is required, a slip inscribed with the name of the list or lists should be presented to the librarian, who files them, and, before issue, obtains the receiver's signature to the requisition slip. These slips may be merely odd pieces of paper or printed forms, according to taste. They should be filed pending the return of the list, after which they may be destroyed. At the end of the week—say, at noon on Saturday—the librarian, armed with the slips still remaining on his file, goes the round of the offices and collects all lists out, which he refiles in their proper places. In this way a constant check is kept on the lists and their whereabouts.

FOR FILING UNDER SUBJECT No. [illegible]

Name of Firm.	*Full list in file No.*
Robinson & Weekes Ltd.	Bound catalogue.

FIG. 4.

All new lists, immediately on receipt, should be taken charge of by the librarian, and brought before the notice of the management as soon as possible. Those decided on as being worth keeping are filed away at once.

In case of new lists being requisitioned, the librarian should set about obtaining these, but he should not do so without proper authority. Such is the idea of the library. It is, of course, open to amplification, and it is worth while investigating a few of the lines upon which it is advisable to proceed.

Catalogues get out of date, and require either replacement or confirmation. Obviously a large proportion of the total library is seldom referred to; consequently, to avoid a great deal of useless labour and expense in replacement, it becomes necessary to discover which lists are in most frequent use. For this purpose the requisition slips after the return of the lists should not be destroyed, but should be filed away for reference, and will form an index to the lists most often required. At the end of fixed periods, say six months, all lists found mentioned on the requisition file should be either replaced or confirmed. In the case of replacement the old list should not be destroyed, but filed away in separate files initialled for the advertiser's name. No thumb index will be required in these files, which will be known as "reference files." Into these files also go all lists of more than 12 months' standing. In the place of confirmation instead of replacement, a copy of the confirming letter should be pasted securely to the list, the letter itself being attached to the discount sheet if any is provided.

Lists two or more years old should be destroyed, but not on the authority of the librarian alone. Some responsible official should inspect the discarded lists and decide what is to be done with them. Lists passed for destruction should be burnt, and the librarian should be held responsible in this respect. Care should be taken to see that lists do not fall into irresponsible hands. In a large library it would be advisable to refile the lists most frequently requisitioned in a separate group of files known as the "current library." These files should bear the usual subject numbers, but with the prefix C, thus: C6, C30, and so on. Such a sub-division would be of great advantage to newcomers as an indication of the firms generally dealt with. Further, it is most likely that on reference to the requisition slips it would be found that certain officials regularly required certain catalogues, in which case these lists should be obtained in duplicate or triplicate as required, the spare copies being lodged permanently with the most frequent users.

A very useful addition to a library of this description may be formed in this way. In many of the technical journals of the day will be found a classified index of trades, or buyers' guide. A study of these will keep one in touch with new firms advertising. These lists should be cut out and filed in a separate file and marked "buyers' guide," and the sheets should be arranged alphabetically in a thumb index under the name of the journal from which they were taken. These sheets should be filed week by week regularly, the old sheets being destroyed when, say, a month old.

If the library is sufficiently large to warrant the appoint ment of a librarian who shall give his whole time to it, his spare time may be very usefully employed in compiling and keeping up to date tables showing the comparative prices of various vendors for such articles as are most frequently in requisition in the factory or office concerned. For instance, in an electrical engineering works, tables might be prepared for such subjects as iron, steel and copper bars, tool steel, bolts and nuts, oils, and so on. The table might take some such form as that shown in fig. 5, and be kept up to date by frequent quotations. Notes as to the quality and general remarks should be added, and the firm usually dealt with may be underlined in red ink. For trial purposes the blank tables might be very conveniently drawn out in the drawing office, and traced, blue prints being taken and used in the library, but if finally adopted, printed forms would probably be found cheaper.

Prices of:—

Name of firm.	Price per					Remarks
	Date.	In lots of.	Carriage.	D.y.	Price.	

Fig. 5.

Such is the system in its simplest form. Modifications and improvements will, no doubt, suggest themselves to the user. For small and medium-sized offices, no simpler and more satisfactory system can be devised. The first cost is confined to the outlay on files, which is insignificant. The labour involved in the organisation is not a large item, and that for the upkeep is practically negligible. In large offices the system will bear a good deal of expansion, which will take the form chiefly of much greater detail in the sub-division and indexing, but this must be left to the discretion of the users.

If managers will only realise that their present dust heap is a most costly item in their running expense, it is certain that some such system as that suggested will be welcomed, and it is hoped not only that the present article will serve to impress upon them the advantages of a library, but also that although they may not follow precisely on the lines laid down, the suggestions made may form a sound basis for their own private scheme.

CO-PARTNERSHIP OR TRADE UNIONISM —WHICH?

By FRANK BROADBENT, M.I.E.E.

"Co-partnership forms the most effective method of breaking down the hard line of division between Capital and Labour, which more and more induces conflict disastrous to the country." Such was the concluding sentence in the letter addressed to the Prime Minister last year covering the memorial signed by nearly 300 Members of Parliament, asking for the appointment of a Royal Commission to inquire into the practicability of applying the principles of co-partnership to the industries of this country. The report of the Royal Commission will, it is hoped, shortly be issued. It is significant that the letter from which the foregoing quotation is taken was signed by Members of Parliament representative of practically every section of the House of Commons *except* the Labour Party.

At the annual meeting of the Labour Co-partnership Association in 1911, a resolution was unanimously carried, expressing the belief that "the adoption of co-partnership would tend to harmonise the interests of Capital and Labour; increase industrial and commercial efficiency, and widen the ownership of property." The mover, Mr. Lleufer Williams, said that, coming as he did from the Rhondda Valley, he was convinced that a plan for harmonising the interests of Capital and Labour in coal-mining was absolutely essential, since 80 per cent. of the cost of coal was due to labour.

Similar expressions of opinion from men whose views command respect might be multiplied, and yet it would be difficult to find an accredited representative of organised labour, that is to say, a representative of Trade Unionism, who has ever said a good word for co-partnership. When Sir Christopher Furness four years ago offered to sell to the Trade Unions the shipyards owned by his company, or, alternatively, to make the workmen limited partners, practically everybody but the Trade Union leaders hailed the proposal as a serious and well-meant attempt to reconcile the interests of Capital and Labour, and to bring about a spirit of co-operation between employer and employed, in place of the existing spirit of antagonism.

But how was the proposal received by the leaders of the Labour Party, the party representative of the Trade Unionism of the country? Said Mr. J. Ramsay Macdonald, the then secretary of the Labour Party, "If this is another South Metropolitan Gas Works' scheme—and it seems to me a little worse than that—it is bad, and ought to be opposed. The limited co-partnership appears to be just the old idea that the late Sir George Livesey developed, and its purpose is to smash up Trade Unionism and to detach the workers from each other." It will be remembered that Sir Christopher Furness emphasised the fact that he had no feeling of antagonism towards the Trade Unions, and was quite willing to co-operate with them to bring about more harmonious relations between Capital and Labour.

Mr. Will Steadman, M.P., speaking for the Trade Union Congress Parliamentary Committee, said "Sir Christopher Furness sees labour no longer in the position it was, and he would alter the position at any cost to save his own skin. Thus it is he comes forward like the good fairy in the pantomime, with proposals not worth the paper they are written on."

Mr. Lee, the Secretary of the Social Democratic Federation, said that his party could not approve the proposition of Sir Christopher Furness, because they were dead against anything in the nature of profit-sharing between employer and employed. He considered that under such a system the men would sweat themselves to increase their bonus, and by over-production would bring about a crisis which would involve in disaster those who were working under similar conditions.

The opinions quoted above, and many more were expressed to the same effect, are in line with the report issued in 1904, signed by the officials of about 20 Unions, in which it is said that the premium system—a species of profit-sharing, "has absolutely nothing to recommend it; it is an adaptation of the most pernicious and degrading condition of employment in modern industrial history—the taskwork system . . It has been the cause of more men being discharged than any strike which has ever taken place in the history of the engineering or shipbuilding trades, and it will have the effect of keeping men whose waning physical powers unfit them for the closest and hardest labour, from obtaining employment, even when trade is at its busiest."

The premium system, which, as stated above, is a species of profit-sharing, is not co-partnership, but the above report not unfairly represents the spirit in which all profit-sharing and co-partnership proposals are regarded by the leaders of the Trade Unionist movement.

That there is no objection to profit-sharing among the rank and file of Trade Unionists is sufficiently obvious from the fact that most, if not all, the members of the Workmen's Co-partnership Societies are Trade Unionists. There are now 110 Workmen's Productive Co-partnership Societies, embracing a wide range of trades, in which a capital of about £2,000,000 is invested by the workers, who are both the employers and the employed.

That all these societies pay full Trade Union wages, and most, if not all, have adopted the eight-hour day, and that there is no such thing as a strike, or lack of employment among them form a sufficient refutation of the opinions expressed in the report just referred to.

In addition to paying the full Union rates of wages, the workers last year shared a profit of £228,000, which is 11 per cent. on the invested capital, £29,847 of the profits being distributed as dividend on wages.

These workmen's co-partnership societies do not, of course, include the gas companies in which profit-sharing has been adopted with such satisfactory results. "If this is another South Metropolitan Gas Works' scheme, it is bad, and ought to be opposed," said Mr. Ramsay Macdonald, in referring to the Furness scheme of co-partnery, yet about 40 gas companies have now followed the example of the "Metrogas," and have adopted the scheme of profit-sharing initiated by Sir George Livesey. The share capital invested in these profit-sharing gas companies is over £50,000,000. The number of employés in 1911 was about 22,300, and the amount of their shares and deposits now reaches a total value of £672,500, or about £30 per employé. Last year, in addition to interest on deposits, a sum of £103,418 was paid to the workers as dividend on wages; that is an average of about £5 each over and above the usual Trade Union wages. Since the gas companies took up profit-sharing, and, with the exception of the "Metrogas," only four of the 36 have had the system in operation for over three years, over three-quarters of a million—viz., £792,000—has been paid to labour as a dividend on wages. Everybody concerned—shareholders, consumers and workers—is satisfied, everybody except those Trade Union officials who fail to see in profit-sharing anything but an attempt "to smash Trade Unionism and to detach the workers from each other."

A short time ago the writer was discussing the subject of profit-sharing with an employer of labour who is firmly convinced that in one of his machine-rooms alone over £1,000 a year extra might be earned if the unions would allow the men to do their best, instead of deliberately restricting their output. And he would be quite willing to share this £1,000 with the men, in addition to paying full Trade Union rates. As an experiment, he tried profit-sharing for a short time in one department of his works, and the men received their proportion of the extra profit made. But they brought the money back in a week or two by order of the Trade Union officials, who would not allow them to keep it.

Profit sharing is now practised in many large company-owned works, each company having its own method of sharing. There is as yet no uniformity as regards the proportion of profits paid respectively to capital and labour. The fairest method would appear to be that adopted by Godin in the co-partnership system which he established at Guise, a system which has had such a wonderful record of success during the past 30 years. He treated capital as a wage-earner, the interest at, say, 5 per cent. per annum being reckoned as the wages of capital. It then receives *its* share of the profits over and above its wages of 5 per cent. at exactly the same rate as is paid to the workers on *their* wages. Thus, if the workers' wages amount to the same sum as the interest on capital, then capital and labour share and share alike. If wages are more or less than interest, the profits are divided in proportion to the respective amounts, each individual worker or shareholder receiving a sum directly proportional to his annual wages, and interest, if any, on shares. As the whole of the capital has now passed into the hands of the workers—an inevitable result of the system—the workers share the whole of the profits in proportion to their combined wages and interest on shares.

The Guise system is, moreover, a true co-partnership system, which simple profit-sharing is not. In a co-partnership system the workers share not only in the profits, but also, to a limited extent, in the management of the undertaking, and it is in this latter connection that one of the chief difficulties occurs in formulating an acceptable system.

It is easy to *talk* about co-partnership, and to those who have considered it only in the abstract it seems to be perfectly simple to apply it to almost any branch of industry. Those, however, who have tried to formulate a definite scheme for adoption in a particular case know that it is by no means so simple in practice as it appeared in theory. Experience in this, as in most other matters, should be the best guide, and those who are contemplating the adoption of a scheme of co-partnership will find much valuable information in the very detailed description of the methods by which Godin established and developed his unique system at Guise, published in a book under the title of "Twenty-five Years of Co-partnership at Guise."

There can be little doubt that the principles of co-partnership are gaining ground, and it has been said by one whose opinions were based upon exceptional experience that, by means of co-partnership, the working classes in the next generation will make as big a step forward in material prosperity as the middle classes did in the last.

We may believe this or not, as we like, but one thing is highly probable, and it is what the labour leaders fear, viz., that co-partnership will eventually supplant Trade Unionism; this will depend to some extent on the future attitude of official unionism, and, instead of bitterly opposing the inevitable, the best policy of the leaders of Trade Unionism would appear to be to take the path of least resistance and endeavour to formulate a working scheme in which the principles of co-partnership and those of Trade Unionism are harmoniously combined.

RECENT DEVELOPMENTS IN WIRELESS TELEGRAPHY: WITH SPECIAL REFERENCE TO SHIP INSTALLATIONS.

(*Continued from page* 635.)

Location of Ship Stations.—In old vessels existing conditions often fix the position of the wireless equipment irrevocably, but, wherever possible, the spark-room should be amidships and on the upper deck, so as to make possible a direct vertical connection to the aerial. On passenger boats the wireless station should be easily accessible from the promenade deck; on cargo vessels the station should be as near the bridge as possible, and may conveniently be in, or adjoining, the chart-house; its location must not interfere with the look-out or steering arrangements. On men-of-war and armoured cruisers the station should be below decks, but on unarmoured vessels and torpedo-boats it should be placed above decks. If the station is placed below deck a clear tunnel, at least 1 m. sq., must be provided, so that the H.T. connections to the aerial may be at least ½ m. from the metal sides of the tunnel. The walls of the operating chamber should be "sound-proof," and good telephone connection should be provided to the bridge, engine room, and so on. The wireless room should have a floor area of 6 × 6 ft., if this can be arranged but in a certain German torpedo-boat the whole wireless equipment, excluding the transformers, which are placed in the engine-room, occupies only 1·2 × 1·8 m. On cargo steamers, where the wireless chamber is combined with the chart room, about 2 7 m. square is a sufficient allowance for the former. On passenger vessels, a more liberal allowance is necessary and can easily be spared. The D.C.-A.C. converter being located outside the operating chamber, under a weatherproof shield on deck, the apparatus room, living room for a staff of two men, and a small office for passengers, may be arranged within a total floor area of about 4½ × 3½ m. Plenty of fresh air and direct lighting are imperative in the operating room.

Type and Arrangement of Aerial.—The antennæ should be suspended at as great a height as possible*, and the distance between the masts should be not less than twice the height of suspension of the aerial. The usual flag stays, spanned from top to top, must be replaced by stays running down to the funnel or spanned across the masts about half way up the latter. These stays should preferably be of hemp; if steel is used, insulators should be placed in the rope about 3 m. from each end. The exact importance of the metal structures adjacent to the aerial on steel ships has been much disputed. Undoubtedly a certain amount of the energy is absorbed and wasted by such structures, but it is doubtful whether the loss is sufficient to justify the means necessary to reduce it appreciably. It is obviously impracticable to sectionalise the masts by insulators, and though stay wires are easily fitted with insulators, saline moisture and tropical climates soon destroy the efficacy of the latter, hence the wisdom of their installation is very doubtful. The aerial network is, of course, insulated as perfectly as possible from the ship's frame and metal connected thereto, and deteriorated insulators must be replaced as often as necessary—fortunately a comparatively easy process.

The precise arrangement of the aerial network in any particular case is determined by the class of vessel concerned, the rigging arrangements and the range of transmission to be provided. The simplest disposition is secured by placing the aerial amidships. Fig. 7 shows the standard T aerial, connected to the operating chamber by vertical leads from the centre of its span; fig. 8 shows the L arrangement, only differing from the T in the point of connection of the downtakes. Fig. 9 shows an aerial arrangement suitable for lightships, and fig. 10 represents the antennæ of a large warship where, to get a long wave length, the aerial has been extended to the bow and stern and, to get large capacity, twin networks are mounted side by side and interconnected. A special arrangement in use on the Lloyddampfer *Bremen* is shown in fig. 11; the large T aerial is used for ordinary traffic and the small aerial forward, carried from a single mast, serves for emergency duty (over a much reduced range, of course). The availability of such an auxiliary aerial—permanently erected or ready for instant rigging—is of great importance to war vessels.

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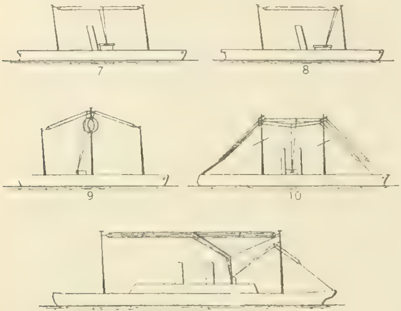
* Thus increasing the range of transmission and reception: see fig. 6 and Austen's formulæ, *loc. cit.*

Materials and Insulators.—Antenna wires must combine strength with lightness and small exposed area for given mechanical strength; they must resist corrosion by sea air, and be capable of easy stowage and easy erection and repair at sea. Trial has been made of stranded copper cable with stranded steel core; electrically the combination is satisfactory, but the steel soon rusts, and the cable then breaks by its own weight. A bronze alloy combining maximum strength with minimum resistance is found to give the best results; special clamps are used to make aerial connections.



Figs. 7, 8, 9, 10 and 11.

The insulators used to isolate the antennæ (electrically) from direct earth connections or leakages must combine electrical and mechanical strength with lightness and capability to withstand the conditions encountered in tropical seas. Figs. 12-14 inclusive illustrate a number of types which have been employed by the Telefunken Co. during the past few years. The chief advantages and limitations of each pattern will be gathered from the following notes:—

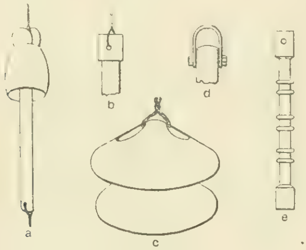


Fig. 12.

Fig. 12a.—This represents an ordinary insulator with a long, screwed vulcanite pin; the whole is deficient in mechanical strength.

Fig. 12b.—A simple vulcanite construction of considerable strength, but ill-adapted for use in hot, moist climates.

Fig. 12c.—A cheap form of ordinary high-tension insulator; electrically good, but of too great weight and exposed area to suit aerial work.

Fig. 12d.—A glass block bored for cross bolts carrying stirrups at either end; a number of blocks generally used in series. The construction is cheap and suitable for moderate voltages; the blocks are easily broken, and yield rather a heavy construction.

Fig. 12e.—The leakage surface of a glass rod is increased by circumferential ridges, but such insulators are brittle and very easily broken.

Fig. 13a.—In this, the simplest of a number of "egg" types, porcelain blocks of elliptical section are provided with crossed grooves for the accommodation of the steel suspension links. Unfortunately, the latter are easily displaced, and the leakage surface of the blocks is small.

Fig. 13b.—An improved form of 13a, in which perforations are provided for the wires; this has been in constant use since 1907.

Fig. 13c.—This represents an intended improvement of the "egg" type. Long blocks increase the length of the leakage path, but the thinness of the walls between the grooves makes the resistance to earth very low.

Fig. 13d.—Bobbin-type glass insulators are held between vulcanite side plates, the mechanical pull being taken by iron strap plates outside the latter. The weakness of the design lies in the too severe stressing of the brittle glass blocks.

Fig. 13e.—An attempt is here made to provide strength and insulation by two independent elements. The pull on the insulator is transmitted through a fine silk-hemp rope, over which a porcelain tube is drawn, the interstices being run full of paraffin wax—to improve the insulation and exclude damp. The bell cover prevents sparking. This type of insulator is satisfactory when first placed in service, but heat from the flue gases, and from the sun in tropical latitudes, melts the paraffin, and the insulation then deteriorates.

Fig. 13f.—An improved form of fig. 13e, the rope and porcelain tube being now replaced by a vulcanite rod.

Fig. 14a.—The stout glass tube here employed is much less liable to breakage than most other types depending essentially on glass.

Fig. 14b.—This is the type most generally used on German ships (Rendahl type). The pull is taken by a wooden rod surrounded by a porcelain tube, the intervening space being filled with oil Sleeves are placed on the end of the wood for connecting purposes, and the end-shields prevent spark discharges across the insulators.

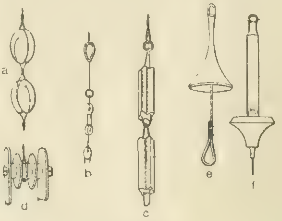


Fig. 13.

Fig. 14c-f.—Show other types of insulator in more or less general use; the constructions are obvious from the sketches.

Where H.T. aerial connections have to be carried through walls, excellent insulation must be provided, and by such means that negligible capacity leakage to earth can occur at the penetration point. Fig. 15 shows various types of insulators specially designed to meet the needs of such cases. A simple bushed vulcanite tube with glass bell rain shields is shown in 15a; figs. 15b and c illustrate commercial types of "lead-through" porcelain insulators, complete with the necessary copper through conductor; fig. 15d represents a somewhat similar type specially designed for submarines, and therefore provided with waterproof flanges and joints. One of the latest types of through-insulators (fig. 15e) consists of a porcelain tube carrying the conductor and surrounded by a porcelain cylinder. The whole is fixed to the wall by a metal flange which simultaneously provides for earthing the aerial. Ample insulation and minimum capacity effect are secured.

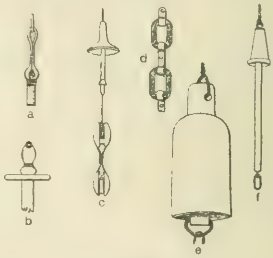


Fig. 14.

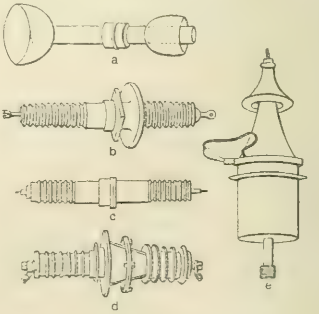


Fig. 15.

(*To be concluded.*)

Correspondence Stolen.—The letter box of the British Central Electrical Co. was again broken open on 17th inst., and correspondence was stolen. Will writers of such letters send copies?

GHENT INTERNATIONAL EXHIBITION, 1913.

Following up our recent comments, we are now able to give some further information with respect to the above event, also regarding an importance to British manufacturers in connection with their export trade.

One of the most interesting features in the British sections will be an admirable display of machine tools made by British manufacturers. Their fine show at Olympia we have already referred to in our pages. From among this wide range of exhibitors a representative number have already decided to take part at Ghent in order to place before Continental buyers an adequate idea of the pre-eminence in excellence of British tools for every purpose. Belgium itself, with its low tariff, furnishes an excellent market, and the neighbouring countries of Holland and Denmark are valuable customers.

The exhibition of foreign tools in the South African market which has been on view in London, Birmingham and Sheffield, illustrates only too well what is going on in this great Colonial field. While the percentage of tools supplied by British firms has fallen from 49 to 38, the German makers have increased their sales from 5 per cent. to 10 per cent., and Sweden has also gained 3 per cent. the United States being virtually stationary.

It is anticipated that the British display at Ghent will include machine tools, radial drills, pneumatic and electric tools, air compressors, pumping machinery, saw-sharpening machinery, bolt-screwing and nut-tapping machines, ball bearings, feed-water heaters, water-power plants, pumps, power hammers, drilling machines, shafting and power transmissions, double helical and reduction gears, magnetic clutches, lathes, planing and shaping machines, driving chains, drop forgings, engines, electric lighting and pumping plants, crushing, grinding, screen separating, dust collecting and ventilating machinery, wood-working machinery, welding apparatus, belting, &c.

The practical help given by the Government to British sections of International Exhibitions is planned on good business lines, and there is now a continuous instead of spasmodic policy, and, as our readers know, it is under permanent expert management. Broadly speaking, it may be said that the policy of the Board of Trade is to encourage good representative displays of the British manufactures most in demand in the countries concerned. In past years a few big manufacturers have made fine individual displays, but the British sections have been belittled by the speculative nobody. For instance, at Milan a number of so-called "British firms" were engaged in selling "diamond" brooches and scarf pins at 1s. and 6d. Thanks to Government supervision this sort of thing has been put an end to.

To come to practical points, the Board of Trade now secure for the British exhibitor the most favourable rates of carriage, arrange cartage (at Ghent this average 6s. per ton daily), send an erecting staff, undertake all decorations, provide show-cases and window dressers and signs. All these items, which have been found a costly business for the exhibitor, are now dealt with by the Board of Trade and are included in the space charges, which are virtually lower than those charged at trade exhibitions at home. Another valuable help is given by the Government's expert engineer, who sees that suitable concrete foundations of sufficient strength are provided where necessary. Another item is the translations necessary for the exhibition catalogue. The exhibitor is thus able to figure out fairly accurately the cost of his exhibit, an item which he has never been able to calculate previously.

In dealing with a Government vote, it is of course essential that the expenditure should be for the benefit of a community and not for any individual firm or group. By securing representative collective exhibits the benefits resulting are not merely for the firms contributing to the exhibit, but indirectly for the advancement of the entire industry and every one connected with it. Continental exhibitors have worked successfully on these lines for many years. For instance, at Dusseldorf a complete picture was given to the Rhenish iron industry, with the result that a tremendous impetus was given to the entire field of enterprise. Brussels and Turin each furnished successive examples of the policy when applied to a leading British industry. At the former, Bradford made a splendid display of the woollen trade. The collective setting is believed to be the best not only from a business but from a public point of view. Comparison with other countries is more readily made and a stimulus is given to improvements. Alkali and Redditch manufacturers have also found satisfactory results by working on these lines, and at the Belgium International Exhibition at Ghent next year the special display of the textile trades and machine tools should be found to have even more satisfactory results.

It is hoped, as we mentioned a fortnight ago, that something tangible may be done along the same lines by British electrical machinery and apparatus manufacturers.

A popular delusion in regard to Belgium is that, being of small size, it is only of small account, but Belgians, like Britishers, have won their laurels as administrators in pretty well every country of the world, and have "many irons in the fire" in Russia, China, Egypt, Persia, and other countries, to say nothing of their valuable Colonial rights in the Congo. In the Russian Empire alone, it is estimated that there is $140,000,000 of Belgian capital sunk in developing Russian mines and other industries. There are over a hundred big concerns of Belgian origin in the Muscovite Empire, about half of them consisting of coal and iron mines, petroleum wells, metal and glass works, while no fewer than 16 tramway systems are owned by Belgium. This alone will give some idea of the value to manufacturers of machinery and machine tools of meeting Belgian capitalists at the Ghent Exhibition next year. Our Continental rivals are making bold bids to capture their orders, and it will be impolitic in the extreme not to show British supremacy in manufacture wherever possible.

Still another opening for big business will present itself in the Far East, as the King of Siam has placed the development of his country's vast resources in Belgian expert hands. Egypt again is a striking example of Belgian enterprise, the service of trams in Cairo being owned by a Belgian syndicate. The Congo, however, offers an even wider field of possibility.

All these points are proof of the interests acquired by Belgium in every quarter of the globe, which are certain to control valuable industrial expansion in a short time, and which should direct the attention of the British manufacturer to their national enterprise in planning another exhibition which will surpass in many respects any previous effort, and which will have profited considerably by the experience that was gained at Brussels and Liége.

Belgium itself is the home of industrial activities very much like our own and very near—coal mines, smelting furnaces, iron foundries, glass works, machine factories. The recent discovery of extended coalfields improves the future outlook of Belgian manufacturers, adding many years of life to their fuel supply. Flanders has been famous for centuries for its skill in the textile arts—its countrymen were indeed the pioneers of some of them in England and Scotland—and there is so great and growing an interchange of business between the two countries that the more we know of each other the better for the further exchange of business relations. It is likely that there will be many visitors from other countries. From our own shores, too, the journey can be easily accomplished in, say, half-a-dozen hours—and we understand that every facility will be arranged to add to the comfort and enjoyment of a popular business trip.

We have before us a copy of a "Memorandum of Information for British Exhibitors" at Ghent Exhibition, issued by the Board of Trade Exhibitions Branch (Queen Anne's Chambers, 28, Broadway, Westminster, S.W.), and copies of this, as well as any other required particulars, can be obtained either on application to that address or to the London offices of the Exhibition. In the "Memorandum" referred to the terms are given for space, as well as for motive power, lighting, and water supply. The conditions of installation include the following:—"Exhibitors will be required to carry out their own installations of water and gas pipes and electric wiring and accessories, in accordance with the regulations of the Belgian authorities." Copies of these regulations will be supplied on application.

For the purpose of supplying continuous current in the British section, one British manufacturer has offered to supply on loan a 300-kw. six-pole horizontal-divided six-phase rotary converter running at 1,000 r.p.m., suitable for converting from 50 periods, approximately 310 volts, to 440 volts on the continuous-current side, complete with field rheostat; also one squirrel-cage induction starting motor for the above rotary, mounted on the end of the shaft. There will also be lent a transformer reducing the pressure of the three-phase supply from 6,000 volts to the voltage of the rotary converter. Another British manufacturer is lending a switchboard with the necessary switches, fuses and instruments.

THE ENGINEERING EXHIBITION AT OLYMPIA.

(*Concluded from page* 615.)

Mr. A. F. Davis, 2, Enfield Road, London, N.—An improved design of firebar is shown, which, it is claimed, is unlike anything previously known to exist for furnace work in general without mechanical appliances of any kind such as forced draught, steam jets, or induced draught. Air apertures are provided through and between the bars, which cause preliminary heating of the air before it passes through the fuel, thus improving combustion in the furnace, and bringing about economy of fuel and increased efficiency. Waste is reduced to a minimum, as a thin perforated clinker is found in small pieces only, in addition to the fine ash falling into the ashpit. Fuel of the lowest grade has been used with these bars to great advantage recently, and smoke trouble ceases where the bars are used, as the combustible gases are dealt with in the furnace almost entirely. Clinker does not adhere to the bars, owing to the increased air pressure at the rear end of the grate caused by the chimney draught.

Messrs. Andre Citroen & Co., 27, Queen Victoria Street, E.C.—This firm's exhibit consists of their well-known double helical gears, some of them of very heavy construction; one set of three rolling-mill pinions, for instance, is shown, each of which weighs 3 tons. Some of the gears are shown in operation. A set of double-reduction gear, consisting of spur and bevel gears contained in a gear box, is included in the exhibit.

Messrs. Lassen & Hjort, 52, Queen Victoria Street, E.C.—The exhibit of this firm comprises their well-known water-softening apparatus, which are shown in operation on the stand, softening London water from 17° to 2°. The special feature of the system is the provision for exact measurement of the water and the chemicals to ensure the desired result. The measuring and mixing apparatus of a large softener having a capacity of 20,000 gallons per hour is shown on the stand, together with other interesting details of the mechanism.

Messrs. Compayne, Ltd., 64, Victoria Street, S.W.—This firm has a very interesting exhibit of power transmission by oil, under the patents of Dr. H. S. Hele-Shaw. The principal feature of this system is the use of a rotary pump with variable stroke, which was described in connection with the Hele-Shaw-Martineau steering gear in our issue of August 9th, 1912, page 209. Fig. 12 shows sections of this pump as actually constructed; the stroke is varied by moving the floating guide ring F F along the line A B, which not only alters the stroke, but if the motion is continued past the central point of zero action, reverses it. The tube D is fixed, and conveys oil to the centre of the pump, whence it flows through ports into the cylinders; when the cylinder body C revolves the ring F moves with it, running freely on the ball bearings R R, which are carried in guide blocks. As C rotates, the pistons in the seven cylinders successively recede from and approach the central tube, receiving oil from one set of ports and discharging it through another set. The pump runs with very little friction, all working parts being copiously lubricated, and wear is practically *nil*; the ordinary maximum working pressure is 1,000 lb. per sq. in., though the pumps will stand 2,000 lb., and the speed is from 750 to 1,400 R.P.M. The efficiency at full load is very high, 90 per cent. being attained.

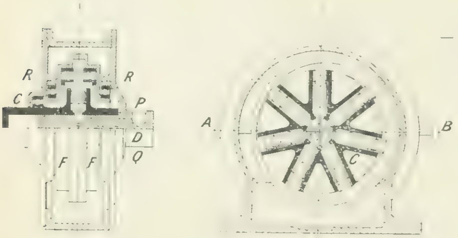


FIG. 12.—SECTIONS OF HELE-SHAW PUMP.

In transmitting power by this means, a hydraulic motor is used, which is shown in section in fig. 13. Like the pump, this is a rotary machine, and has a double-cam track K for rollers on the piston crossheads L. Thus perfect balance is attained, and the motor runs without vibration, with an efficiency which has exceeded 95 per cent. The motor can be made with various modifications according to circumstances; we need here only consider one important application of the system, which is illustrated in fig. 14. This shows an electric motor E, coupled to a Hele-Shaw pump P, which in turn drives a Compayne double-cam motor M. With this device the motor can be started under zero load, and when running at constant speed is enabled to drive the main shaft at any speed from zero to the maximum, in either direction of rotation. At low speed the oil motor will exert a large torque, as in starting a motor vehicle, and the efficiency in such an application reaches over 75 per cent. (engine to road wheels), while higher efficiencies can be attained. The electrical engineer will at once see that this system enables the inherent advantages of the A.C. motor to be combined with those of the D.C. motor, as lathes, lifts, &c., can be driven at any desired speed, while the motor runs at constant speed, and the motor can be started on light load, reversal of direction can be accomplished without reversing the motor, and so on. Messrs. Waygood have obtained a licence for the use of the system in connection with their electric elevators, and other applications can readily be perceived.

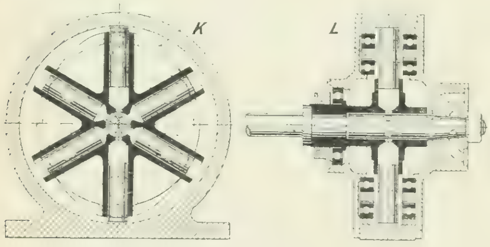


FIG. 13.—SECTIONS OF COMPAYNE DOUBLE-CAM MOTOR.

Messrs. John Stirk & Sons, Ltd., Halifax.—One of the largest lathes in the Exhibition is shown by this firm, fitted with their patent motor control and quick-traverse arrangement for the saddle. The lathe is driven by an E.C.C. motor mounted on the headstock, and the special controlling device is attached to the saddle; the motor is started and stopped by push-buttons, and the speed is also raised or lowered in the same manner. The quick traverse is effected by means of a second motor fixed near the end of the lathe bed, and driving a side shaft; this enables the saddle to be traversed from end to end in either direction with rapidity.

Cambridge Scientific Instrument Co., Ltd., Cambridge.—The instruments shown on this stand are mainly those for which the company is so well known in connection with temperature measurement. Resistance and thermoelectric pyrometers, the Whipple temperature indicator (shown in operation, measuring the temperature of a tool-hardening furnace), the thread recorder, &c., are all exhibited, as well as the Féry radiation pyrometers and mercurial thermometers. A base-metal thermoelectric pyrometer, in which an iron-constantan couple is used instead of the rare metals, is a notable feature of the exhibit; it is suitable for use up to 800° C. Rosenhain's fuel calorimeter, the bi-meter CO_2 recorder, and other specialities of the firm are also shown.

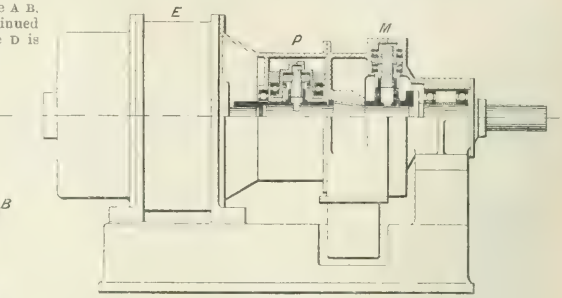


FIG. 14.—ELECTRIC MOTOR WITH COMPAYNE TRANSMISSION GEAR.

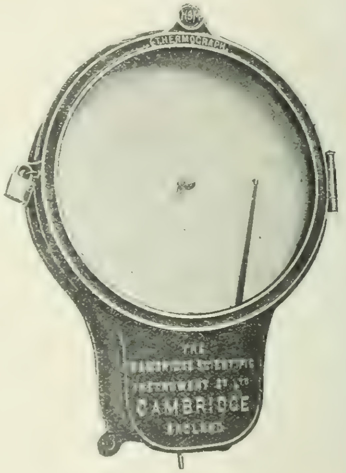


FIG. 15.—H. & M. THERMOGRAPH.

A feature new to this country is the H. & M. thermograph—a recording thermometer for temperatures up to about 700° F.—which has been largely used abroad for recording the temperatures of feed-water, superheated steam, flue gases, &c. The primary object in its design has been to manufacture a simple, cheap, robust, and reliable instrument for everyday use. It gives a record on a circular chart, as shown in fig. 15. The principle made use of is the expansion of mercury, which is contained in a very strong steel bulb. This is connected by steel capillary tubing to the recorder itself. A special feature of the instrument is the character of the capillary tubing, which is such as to render the readings of the instrument practically independent of temperature changes round the tubing. Most recorders of this type have hitherto been seriously limited in their accuracy by the fact that changes in temperature of the tubing affect the readings.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, E.C. —This firm exhibits a variety of motor-starting gear, the Hopkins electric speedometer, and the "Tool Steel" gear and pinions; the latter are new to this country, and are made of very hard steel, endowing them with exceptional resistance to wear and tear. The E.M.B. grid resistances and various tools such as electric soldering irons, wax melters, branding irons, &c., are shown.

One of the special features of the exhibit is the "Britannia" metallic-filament lamp, which has only recently been introduced to the market. It is of British manufacture, and is made at what is stated to be the largest and most modern factory in the kingdom, in all the usual sizes and shapes, and for the customary voltages.

Mr. Charles Taylor, Bartholomew Street, Birmingham.—An entirely new machine is exhibited by this firm for cutting off bars or tubes up to a diameter of 3 in. The cutter is rotary, the stock being held stationary, and 3-in. round steel is cut off in 45 seconds.

Messrs. Stuart Turner, Ltd., Henley-on-Thames.—Several small "Stuart" petrol-electric sets are shown on this stand for lighting yachts, country houses, &c. We illustrate one of these, of 300 w. output; the engine is of the vertical two-stroke type and drives the dynamo through a flexible coupling at a speed of 900 or 1,000 R.P.M. Larger sizes are made, as well as sets having as small an output as 150 watts, and motors and switchboards are also shown.

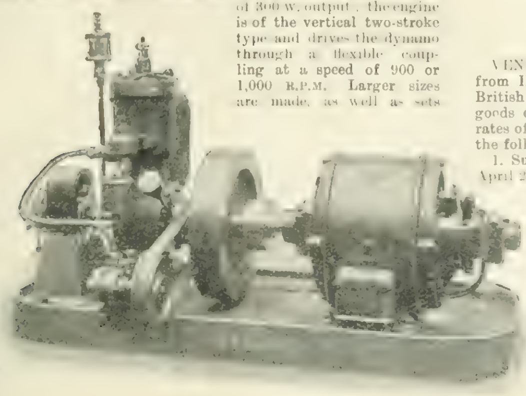


Fig. 16.—"Stuart" Petrol-Electric Yacht-Lighting Set.

Crown Works, Chelmsford.—A variety of magnetic chucks—flat, rotary, and with different formations of holding-face corresponding to the class of work to be handled—is shown at this stand. A demagnetiser is also exhibited, which is used to remove all traces of magnetisation from articles that have been held on the chucks. Generators and motor-generators to supply current to the chucks and demagnetiser are also shown, as well as surface plates and gauges.

The L. S. Starrett Co., 36 and 37, Upper Thames Street, E.C.—This company shows a wide range of tools and micrometer gauges. Amongst the latter the newest is the "Hub" micrometer, the frame of which is specially narrow, so as to pass through a ⅜-in. hole in the hub of a cutter. Another novelty is a quickly adjustable micrometer; on pressing the finger against the end of the screw plunger, the nut is released, and the micrometer can at once be opened or closed to any extent within its range. On releasing the plunger, the nut engages the screw, and the fine adjustment is then made in the usual way. Not only is time saved, but continual wear on the screw is thus avoided.

Messrs. Kynoch, Ltd., Lion Works, Witton.—A gas engine of 100 B.H.P. is shown working on this stand, with a patent suction gas plant.

Mr. William Boby, Salisbury House, London Wall, E.C.—Two water softeners are shown by Mr. Boby—the "Simplex" type, in which the reagents are used in the form of a cream of lime and soda, and the type "K" machine, a new softener, in which the reagents are in the form of dry powder. The latter is designed to deal with from 200 gallons per 24 hours to 4,000 gallons per hour, and requires, it is claimed, less attention than any other type.

Mr. John Thompson, Ettingshall Works, Wolverhampton.—The special feature of this stand is a model of the Thompson dish-ended Lancashire boiler, with corrugated flues. There are no internal stays, and the seats for the feed valves and steam gauge are pressed from the solid plate. There are no rivets on the ends except those connecting the flues to the shell, and these are in shear. The "Thompson Mars" bent-tube superheater, with 30 tubes, is also shown, and the "Thompson Mars" economiser with 96 tubes. Another prominent feature of the stand is the Kennicott water softener, having a capacity of 1,250 gallons per hour.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford.—This firm has an interesting display of pumps, air compressors and steam and water fittings, including the "Davidson" feed pump, "Köster's" patent two-stage air compressor, &c.

The Korfund Co., 47, Victoria Street, S.W.—The floor of Stand No. 74 is entirely covered with Korfund anti-vibration material, showing its utility in connection with machine tools.

Unbreakable Pulley and Mill Gearing Co., Ltd., West Gorton, Manchester.—This firm is showing the Cooper all-hard steel roller-bearing at Stands Nos. 12, 60 and 325.

In the foregoing references we have by no means exhausted the features of interest to electrical engineers, especially those engaged in manufacturing processes. For the latter, indeed, there is a wealth of information to be derived from a visit to the Exhibition. To deal with the exhibits of machine tools in detail is not possible in our pages, owing to the pressure on our space; we can only say that the collection at Olympia is probably unique of its kind.

Disclaimer.—Mr. W. W. Martin, electrical engineer, 84, Trinity Road, Birchfield, Birmingham, asks us to say that he is in no way connected with Albert Edward Martin (Midland Electrical Supply Co.) whose bankruptcy proceedings have recently been recorded in our pages.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

VENEZUELA.—The Board of Trade have received a despatch from H.M. Minister at Caracas, suggesting that the attention of British exporters to Venezuela should be drawn to the fact that goods on importation into Venezuela are subject not only to the rates of duty specified in the official Venezuelan Tariff, but also to the following surtaxes:—

1. Surtax of 25 per cent. of the Customs duties payable (decree of April 25th, 1901).

Note.—This surtax is made up of two surtaxes of 12½ per cent. each, called respectively, "*Impuesto* [illegible] and [illegible]."

2. Surtax of 30 per cent. of the Customs duties payable (decrees of February 16th, 1903, and June 4th, 1912);

3. Health tax (decree of December 29th, 1910) of 1 per cent. of the Customs duties payable + the two surtaxes (*i.e.*, 1·55 per cent. of the Customs duties payable).

Goods proceeding from the Antilles are, on importation into Venezuela, subject to a special surtax of 30 per cent. of the Customs duties payable. The expression "Antilles," as at present interpreted by the Venezuelan authorities, includes not only the British, Dutch, Danish and French West Indian Islands, and Porto Rico, but also Cuba, Haiti and San Domingo. This surtax of 30 per cent. is to be added to the Customs duties, and on the sum thus obtained the surtaxes of 25 per cent. and 30 per cent. mentioned in the preceding paragraph are calculated; the 1 per cent. "health tax" is calculated on the total amount.

The Venezuelan Government has informed H.M. Minister at Caracas, in reply to an inquiry, that goods despatched from Europe or the United States of America, the Consular invoices of which state that they are to be transhipped in the Antilles, are not subject to the special surtax of 30 per cent. levied on goods proceeding from the Antilles; nor is this surtax levied on such goods if they are landed or warehoused in the Antilles for want of ships to effect the transhipment, provided that this circumstance is certified to by the Consul.

NEW ZEALAND.—The New Zealand Customs Authorities have decided that as electric-welded fencing made of metal wire not exceeding three-sixteenths of an inch in diameter can be used for purposes similar to those for which metal-wove wire is used, this wire shall be admitted free of duty if the manufacture of some part of the British Dominions. If of foreign origin the duty will be 10 per cent. *ad valorem.*

CUBA.—With reference to a previous notice in the Electrical Review regarding a Cuban proposal to revise the tariff of import duties on goods imported into the Island by increasing the duties on goods from countries which have not concluded reciprocity treaties with Cuba, it is now notified that this proposal has been dropped.

SIERRA LEONE.—The Government, by Order in Council of June 17th, have decided to include the following in the list of goods admitted free of duty into the Colony:—

Motor vehicles and engines used for industrial or commercial purposes, and all accessories thereto, and (if imported at the same time) tools and implements for use in connection therewith when admitted as such by the Collector of Customs.

Oils, greases, petrol and other non-portable spirits for use as motor power or lubrication for motor vehicles and engines, used for industrial or commercial purposes, and imported by or on behalf of the owners of motor vehicles and engines, when admitted as such by the Collector of Customs.

NORWAY.—The Norwegian Customs Authorities have decided that the exemption from duty recently granted for electrical circuit-breakers shall only apply to such circuit-breakers as are used in electric light installations in houses, &c.

BELGIUM.—The Belgian Government have arranged for the temporary free importation of goods imported for exhibition in the International Exhibition to be held at Ghent in 1913, provided they are subsequently re-exported, and the Customs formalities are duly complied with.

ITALY.—The Italian Customs authorities have decided that electrodes for industrial use made of a combination of ferric oxide (ossido ferroso-ferrico fuso) shall be dutiable as "carbons for use as electrodes for industrial purposes," at the rate of 3 lire per 100 kg. gross weight (1s. 2½d. per cwt.).

Negative Plates of Accumulators.—In an article in *La Revue Electrique*, Messrs. Askenasy and von Putnsky describe experiments on the effect of adding a small quantity of inert matter to the paste in making negative plates. The effect at first is inappreciable, but after 500 discharges, with 1 per cent. of inert matter present in the paste, the ampere-hour capacity of the plates is materially greater than that of plates without this addition.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

22,784. "Electric incandescent globes." A. J. Laird. October 7th.

22,786. "Device to ensure that the isolating trip cock and the trip cock on electric trains shall be properly set for operation whenever a train is in motion." A. G. T. Wilding. October 7th.

22,788. "Lifeguard for mechanical road and street vehicles, driven by any kind of power, as steam, gas, petrol, hydraulic power, compressed air, electricity, and so on." H. Conradi. October 7th.

22,805. "Antennæ used for transmitting and receiving radio-electric waves for telegraphic messages or electric energy." C. T. A. Hanssen. (A. J. T. Hanssen, Germany.) October 7th.

22,807. "Portable device for use in connection with an ordinary bath for the application of electricity to the human body." H. S. Turner. October 7th.

22,833. "Electric signalling systems." C. W. Ward. October 7th. (Complete.)

22,851. "Electric animal and insect exterminators." C. C. Tuch. (Convention date, October 17th, 1911, United States.) October 7th. (Complete.)

22,852. "Electrical mixing machines." P. Young. October 7th. Complete.)

22,875. "Method of producing high-frequency oscillations." K. Rottgardt. (Convention date, October 7th, 1911, Germany.) October 7th. (Complete.)

22,882. "Wireless light control switch." W. H. Whiteside. October 8th.

22,885. "Electric-light fittings." J. Lutley. October 8th.

22,893. "Sunk switch boxes, plug and socket boxes, bell-push boxes for electric lighting and electric bell work." J. B. Meiklejohn. October 8th.

22,947. "Perforating slip to be employed in the transmission of telegraphic messages." R. St. J. Canney and W. J. Richards. October 8th.

22,952. "Electric lamps." F. B. Cannock. October 8th. (Complete.)

22,959. "Controllers for electric motors and like apparatus." G. Ellison and M. R. H. Mueller. October 8th.

22,972. "Production of light and other radiations." S. O. Hoffmann. October 8th. (Complete.)

22,976. "Automatic device for the protection of electrical circuits." P. M. Levy, H. T. George and C. G. E. Milne. October 8th.

22,985. "Brush-holders for dynamo-electric machines." J. H. Holmes. October 8th. (Complete.)

22,995. "Sparking plug for internal combustion engines." J. Collins. October 9th.

23,004. "Electric leakage indicators." R. McFarlane-Marshall. October 9th.

23,014. "Electric distribution fuseboard." H. B. Prentice and H. Atlay. October 9th.

23,024. "Electric discharge apparatus." Q. Majorana. October 9th. (Complete.)

23,037. "Devices for supporting overhead trolley wires for electric railways, tramways and the like." H. W. H. Richards. October 9th.

23,046. "Driving mechanism of magneto-ignition machines having oscillating armatures." R. Bosch (firm of). (Convention date, May 3rd, 1912, Germany.) October 9th. (Complete.)

23,050. "Process for the manufacture of heat refractory articles from tantalum." Siemens & Halske Akt-Ges. (Convention date, October 21st, 1911, Germany.) October 9th. (Complete.)

23,082. "Electric heating and cooking apparatus." R. F. Venner. October 9th.

23,086. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 9th.

23,096. "Method of and means for electrolytically depositing metal upon the interior of tubes and other hollow articles or the like." G. P. M. Lee and W. A. Brame. October 10th.

23,110. "Apparatus for the measurement of gases liberated by electrolysis." T. Rooke. October 10th.

23,150. "Electromagnetic clutches in machines with reversal of motion." E. C. R. Marks. ("Vulkan" Maschinen-Fabriks Akt-Ges. Austria.) October 10th. (Complete.)

23,155. "Arc lamps." L. Kamm. (Divided application on 24,333/11, November 2nd.)

23,169. "Process and devices for producing in a continuous manner Röntgen rays having any desired degree of hardness which can be adjusted at a moment's notice." J. E. Lilienfeld. (Convention date, October 10th, 1911, Germany.) October 10th. (Complete.)

23,207. "Self-regulating electric generators or motor-generators." E. L. Frenot. October 10th. (Complete.)

23,208. "Electric transformers." British Thomson-Houston Co., Ltd., E. B. Wedmore and J. M. Wallace. October 10th.

23,240. "Telephone receivers." A. Marr. October 11th.

23,251. "Electric controllers." J. McCallum. October 11th.

23,258. "Sanitary attachment for the mouthpiece of a telephone transmitter." J. P. Vinall. October 11th.

23,273. "Variable speed dynamos for use in starting internal combustion engines and the like." H. Leitner. October 11th.

23,279. "Electrical apparatus for moving railway points or the like, or controlling an electric motor to run a predetermined number of revolutions in either direction alternately." J. H. Gath. October 11th.

23,285. "Arrangements for obtaining sparkless commutation in rotary converters coupled to alternating-current booster." Siemens-Schuckertwerke G.m.b.H. (Convention date, November 14th, 1911, Germany.) October 11th. (Complete.)

23,341. "Regulation of the speed of electric motors." Siemens-Schuckertwerke G.m.b.H. (Convention date, October 13th, 1911, Germany.) October 12th. (Complete.)

23,344. "Method of and means for preventing explosions in mines by damaged electric lamps and motors." F. Palmer. October 12th.

23,372. "Regulation of dynamo-electric machines." Allgemeine Elektricitats-Ges. (Convention date, October 13th, 1911, Germany.) October 12th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Telephonic Apparatus. F. L. Muirhead. 21,639. October 2nd.

Vapour-Electric Apparatus. P. C. Hewitt. 21,828. October 3rd.

Electrical Measuring Instruments having Movable Coils. J. W. Record. 22,656. October 14th.

Method of Producing Ferro-Silicon. C. Bingham. 22,755. October 16th.

Intercommunication Telephone Systems. British Insulated and Helsby Cables, Ltd., W. A. Aitken, H. Cooper and C. Remington. 22,983. October 18th.

Electric Light Fittings. Simplex Conduits, Ltd., and T. Birkett. 22,988. October 18th.

Electrical Heating Devices. J. F. Monnot. 22,992. October 18th. (November 12th, 1910.)

Electrical Switches or Contact Make-and-Break Devices. R. R. Smith and F. B. Cox. 23,162. October 20th. (April 22nd, 1912.)

Electric Clutch for Controlling Railway Signals. A. H. Johnson and W. J. Thorrowgood. 26,111. November 22nd.

Burglar and like Alarms. A. Richon. 27,697. December 9th.

Electric Safety Lamps suitable for use in Mines. W. H. Lowe. 28,749. December 20th.

Electric Resistance Material. British Thomson-Houston Co. (General Electric Co.) 28,869. December 21st.

Production of Periodically-Varying Currents of High Frequency. E. Weintraub. 14,504. June 18th. (June 18th, 1910.)

Electrical Switches. H. W. Cox. 21,037. September 23rd.

Power and Electrical Installation of Power-Propelled Vehicles. F. W. Lanchester. 21,322. September 27th.

Dynamo-Electric Machines. Hon. Sir C. A. Parsons and A. H. Law. 21,496. September 29th.

Automatic Electric Switching Apparatus. A. J. Howard and A. C. Allen. 21,649. October 2nd.

Means of Enclosing Electrical Apparatus. A. H. Curtis and Adams Manufacturing Co. 22,372. October 11th.

Joining or Bonding the Junctions of Metallic Sheathing or Armouring of Electric Conductors. L. Sunderland. 22,550. October 12th.

Calling Apparatus for Telephones and the like. P. W. Wall. 23,122 October 19th.

Electric Furnace. G. Mettler. 25,890. November 20th.

Method of Storing Wired Detonators. N. Field. 26,044. November 21st. (Patent of addition not granted.)

1912.

Electric Connecting Plugs. British Thomson-Houston Co. (General Electric Co.) 285. January 3rd.

Electricity Meters. Firm of Landis & Gyr. 1,010. January 12th. (August 19th, 1911.)

Electric Railway Systems. J. J. Deschamps. 2,825. January 29th. (January 30th, 1911.)

Intercommunication Telephone Systems. E. R. Corwin. 3,097. February 7th.

Lead Storage Battery Electrodes and Processes of Making Them. W. Morrison. 7,253. March 25th.

Refillable Cartridge-Fuse for Electrical Purposes. E. B. Mallory. 8,110. April 3rd. (April 3rd, 1911.)

Electric Refining Crucibles. E. C. R. Marks. (Patents Purchasing Co.) 8,790. April 13th.

Electric Fuses. S. D. Sprong and W. E. McCoy. 12,701. May 29th.

Multiple Carbon Arc Lamps. Korting & Mathiesen Akt.-Ges. 14,872. June 25th. (June 30th, 1911. Patent of addition not granted.)

Fuses for use in Electrical Circuits. Siemens Schuckertwerke Ges. 19,980. September 2nd. (September 2nd, 1911.)

Electrically-Heated Stoves. British Thomson-Houston Co. (General Electric Co.) 723. January 9th.

Electric Lifts of the Alternating Type and the like. H. J. Moysey. 3,144. February 7th.

Means of Making Contact or Operating Electric Signals for use Principally in Mines. M. Fryar. 5,919. March 9th.

Electric Time Switches. F. Schmid. 6,078. March 11th. (August 10th, 1911.)

Apparatus for the Generation of Electricity from the Motion or Currents of Water. A. Visser, de Goede and de Veen. 6,962. March 21st.

Apparatus for Indicating Speeds at a Distance. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 6,977. March 21st.

Anode Supports for use in Electroplating. Spirella Co. of Great Britain. (Spirella Co.) 9,148. April 18th.

Electric Traps for Rats and the like. S. Takacs. 9,263. April 19th.

Devices for Adjustably Suspending Electric and other Lamps, Electroliers, Gas Pendants and the like. W. H. Sturge. 9,900. April 26th.

Telephone Receivers. J. Parr. 10,616. May 4th

Alternating-Current Distribution Systems. S. D. Sprong and W. E. McCoy. 12,682. May 29th.

Earthing Arrangements for Electrical Systems. Siemens Schuckertwerke G.m.b.H. 12,738. May 30th. (May 30th, 1911.)

Arc Lamps. H. E. Moul. (Korting & Mathieson Akt.-Ges.) 14,516. June 21st.

Electrical Junction Boxes. T. E. Murray. 19,534. August 26th. (September 11th, 1911.)

Electrical Motor-Vehicles in America.—A meeting of the Electric Vehicle Association of America was held in Boston on the 8th and 9th inst., when among the papers read was one on "Street and Traffic Conditions as Applied to the Use of Electrical Vehicles," by Mr. R. McAllister Lloyd, of New York, another entitled "Some Recent Developments in the Lead Battery," by Mr. Bruce Ford, of Philadelphia, and one on "Electrical Vehicle Charging Apparatus," by Mr. R. E. Russell, of the General Electric Co., Schenectady, New York.

Hampton Court Fire Protection.—The Gamewell system of fire protection has been completed at the Palace by Mr. G. L. Beasley, of 10, Warwick Court, W.C. There are 64 alarm boxes, the operation of any one of which punches a time recorder in the fire station and at the same time rings a gong and displays a numbered disk in each of the 27 firemen's houses. Telephonic messages can be sent from any box. The storage batteries, in duplicate, are supplied automatically from the local lighting mains.

The Lighting of the House of Commons.—Answering a Parliamentary question by Mr. King, Mr. W. Benn says that the First Commissioner of Works has now substituted electric light for gas in the Chamber of the House, and the result is satisfactory

THE ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

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WASTE LABOUR.

It is impossible to withhold one's sympathy from the moving appeal set forth in our "Correspondence" columns by the Secretary of the B.E.A.M.A. to-day; the abuse to which he draws attention is as notorious as it is onerous. Not only in connection with drawings and prints is it experienced, but also in the more costly items of complete tenders for sections of the plant which is to be placed on order. As we have pointed out on previous occasions, it is not unusual for the maker of a dynamo to submit a number of alternative tenders incorporating the engines of different makers in his offer for the combined set, and sometimes the engine builders also tender separately, with various dynamos. The consequence is, of course, that innumerable drawings and specifications are required, the aggregate cost of which constitutes a very heavy burden upon an industry already sufficiently laden with costs and taxes and crushed by excessive competition. In the long run the purchaser has to pay the bill for the whole, and the consulting engineer is distracted by the multiplicity of tenders, differing but little in essentials, and therefore all the more difficult to appraise in order of merit.

Never was it more necessary to cut down unproductive expenses and to minimise the waste of labour than it has been during recent years; it is true that we are just now passing through a phase of exceptional prosperity, but that is no excuse for extravagance on the part of the industry, any more than it would be in the case of an individual. Now is the time when reasonable profits should be made to compensate for all those lean years that we have experienced, and that may possibly recur. The methods of shop management have undergone a revolution; the output of each workman can now be measured and checked to decimal fractions, and the utmost care is exercised in up-to-date workshops to abolish loss of time and waste of labour in every department; it is no less important that the demands of external sources shall be similarly scrutinised and whittled down to the lowest possible degree consistent with efficient salesmanship and satisfaction to the purchaser. The particular type of oppression cited by Mr. Dunlop affords a flagrant instance of thoughtlessness and futility. The practice may be due, as he says, to the bad habits contracted by engineers' assistants, to whom the asking for a superfluity of information comes easily, without regard to the cost of supplying it; but even if this be the case, the principals are wholly responsible for its continuance. There is no mystery or complexity about ordinary switchgear to justify the provision of detailed drawings in the preliminary stages: any competent junior draughtsman can prepare the designs, but that is no reason for setting an army of junior draughtsmen and photographers at work, all doing the same thing, and all but one of them doing it to no purpose. Such staff might be more profitably employed in preparing photographs and drawings of completed work for publication in the technical Press—a direction in which our firms are sadly wanting in enterprise in comparison with their Continental rivals.

Apart from the fact that the purchaser is the loser in the end, there is another consideration which cannot fail to appeal to every patriotic engineer—the welfare of the industry in which he is himself engaged—and we hope that the widespread attention that is now being given to the subject will induce him to take prompt action to put an end to the waste of other people's time and money. The Association has done well in taking this step, and we trust that it will be no less earnest in removing the many other obstacles with which the manufacturing engineer is confronted in this country.

The Manchester Street Lighting Reports.

So the cat is out of the bag; the great fiction which has resulted in Manchester being a city of outer darkness—a by-word in the matter of street lighting—is at last exposed. Even the Gas Committee, on which rests the responsibility for the gloomy Manchester that we all know, cannot very well cavil at a report which is jointly signed by a recognised enthusiast in the cause of street lighting by gas.

To be confronted with a discrediting report, which cannot but reflect on the part played for so many years by those responsible for inefficiently lighted streets, is bad enough, but to know that that report is subscribed to by a zealous admirer—even though with transparent unwillingness—is infinitely worse. Yet such is the plight of the Manchester Gas Committee, now happily superseded by, let us hope, an impartial Street Lighting Committee, so far as street illumination is concerned.

In the early summer the City Council, in order to decide what had become a burning question in more senses than one, arranged for a joint investigation, by Messrs. Haydn Harrison and Jacques Abady, of the rival systems of flame-arc lighting and high-pressure gas lighting, a typical installation of each kind having been arranged for the purpose in Portland and Princess Streets respectively. The joint and individual reports of these gentlemen are dealt with elsewhere in our pages, and it is sufficient here to say that both of them agree that the illumination in the two cases is approximately the same, but that the cost of the electric lighting is considerably less than that of the high-pressure gas lighting.

Mr. Harrison goes further in his separate report, stating "that had the gas lamps been working at double the efficiency, or the cost of electrical energy been double what it is, the electric arc lamps would still have proved to be the more economical for equal illumination."

But we can safely leave Mr. Harrison's own report to the judgment of our readers; it deals concisely with ascertained facts, and is unobscured by generalities.

Mr. Abady's separate report is much more extensive, and, indeed, he appears to have expanded the reference to cover matters far removed from the relative merits of the rival installations in Portland and Princess Streets, a proceeding which, we are compelled to assume, arises from the necessity for making the most of the very poor case for high-pressure gas lighting. Mr. Harrison accepts the figures of costs given by the Manchester electricity and gas departments, and draws a straightforward comparison between the two installations; not so, however, Mr. Abady, who interprets the reference to include an invitation to criticise not only the electricity and gas department's costs "if necessary," but also the respective installations.

The words "if necessary" are significant; never was it more necessary to juggle with obstinate facts and figures, to gloss over the fatal deficiencies of gas lighting, and to damn by the faintest of praise the excellences of its great rival electricity, and Mr. Abady's gas friends must needs admit that he has left no stone unturned in their cause.

The all-important fact remains, however, that he himself considers "that, based upon the figures of cost given by the electricity and gas departments . . . . the Manchester Corporation gas department cannot supply for public lighting purposes three-burner high-pressure lamps at as low a cost as can the electricity department supply for public lighting purposes 11-amp. flame arc lamps."

However, as the drowning man will clutch even at a straw, so Mr. Abady, with the gas instinct uppermost, grasps at anything which may keep his reputation as a gas enthusiast afloat. And the straws in this case are even more intangible than usual.

It is, however, needless to enter into the various excuses and specious arguments advanced by him in the cause of gas; even he must realise the utter hopelessness of a case which compels him to advance such a statement as the following:—"It is also a fact that light given by a . . . gas mantle contains a larger percentage of this useful light than does the light given by an arc lamp. That is one of the reasons why a street lighted by high-pressure gas lamps is so noticeably brilliant, a fact which, because it cannot be measured, cannot be expressed in £ s. d.," or to urge in its favour the preponderating subsidies of the gas department to the rates—subsidies which are due in part, at least, to that department having given such poor value for money in street illumination in the past.

Moreover, Mr. Abady goes out of his way to criticise matters of which he cannot expect to be regarded as a competent judge, *i.e.*, the fixed and running charges of the Manchester Electricity Supply. As these have been discussed from time to time, our readers will be aware that at Manchester the fixed charges for traction are based on plant which has been practically reserved for traction purposes, and are, therefore, somewhat higher than the fixed charges due to the large turbine plant installed solely to meet the rapidly developing power supply business.

The traction charges, however, benefit in the general reduction in running charges from year to year: this arrangement is probably as equitable as dividing up the whole of the capital expenditure *pro rata* to the maximum demands for power, lighting and traction, and basing the fixed charges thereon.

However, in such case a brief calculation will show Mr. Abady that even lower values are obtained, viz., £7·6 per KW. of M.D., plus ·223d. per unit running costs, as compared with the £7·5 per KW. and ·232d. per unit adopted by Mr. Abady in calculating the cost of electric lighting in the report.

The pill, despite Mr. Abady's attempted gilding, is the bitterest by far that our gas friends have had to swallow; pill?—we might almost say emetic.

Motor-Hiring at Leeds.

The controversy on municipal motor hiring, which appears to be claiming the close attention of a section of the industrial community of Leeds, revives once more one aspect of the old question of municipal *versus* private trading. In this case a proposal was brought forward by the Electricity Committee that the Corporation should borrow the sum of £10,000 with a view to financing and establishing a department for the hiring of electric motors—a method of development which has brought much grist to the mill in other towns similarly situated.

Officially the Leeds traders will, however, have none of this, and in view of the active opposition aroused, particularly on the part of the electrical fraternity in the city, the Council, after considerable discussion, referred the matter back for further consideration by the Committee, so that the issue is still undecided.

Quite apart from the Committee's proposal, and its real or imagined effect, it is worthy of examination whether the electrical trade opposition to this particular phase of development of a municipal department which is *un fait accompli*, is not short-sighted. Neither from a commercial nor a municipal point of view can it be contended that the Leeds electricity department has failed in its objects, but it is quite arguable that these objects would be more fully attained if prospective users of electric power were able to test the soundness of electric driving without, as they may think now, having a possibly useless motor left on their hands.

If in a city like Leeds electric driving is to be confined to the people who can afford to purchase their installations outright, it must be obvious that a large proportion of the small and, no doubt, some large power users—potential consumers who are hesitating on the score of first cost—will be indefinitely lost to the supply undertaking and to the local electrical firms as well, if they would only see it, for they forfeit the prospective wiring under the Electricity Committee's scheme, and, with one exception, are apparently unable or unwilling to offer any facilities for motor hiring comparable with those under the scheme.

As we understand the matter, electrical contractors, speaking generally, are quite willing to give in on this point of motor-hiring, which, obviously, would mean in most cases a larger lock-up of capital than they can stand, if electrical wiring and installation work be left to them. This being so, it is difficult to understand why Leeds firms are anxious to hinder a policy which, we believe, would make for a better development of the city's own undertaking. We recognise the importance of the principle involved, but there are some things which a public authority is by nature better fitted to handle, and one of these, as it appears to us, is motor-hiring.

It is undeniable that a great field exists for the hire of motors and other apparatus by electricity supply undertakings, and one need only turn to the rival gas undertakings for proof of this. What proportion, for instance, of the 20,000 gas cookers, which the people of Norwich are credited with using, would have found users if some hiring scheme had not been in operation, and how could local firms have financed the huge business which has actually been built up?

Again, the neighbouring city of Bradford had 1,732 motors on its mains at June, 1911, and of these the larger proportion, viz., 919, were hired by their users, and, no doubt, maintained in efficient order by the Corporation, a factor of no small importance to the small power user.

The problem of the small power user who cannot afford to purchase apparatus outright, and of others who prefer for various reasons to hire rather than purchase, has to be faced in some way, and it is quite evident that co-operative, and not obstructive, tactics will lead to the most profitable all-round solution of the matter.

The Powers of Directors.

Anyone who holds the position of director of a public company must sometimes wonder what is the extent of his powers. This is especially the case when he sees the affairs of the concern practically run by the managing director or the chairman, and he feels that he has little or no power. So far as the direction of policy is concerned, it may be a one-man company. A correspondence has recently appeared in the *Times* with reference to the powers of directors. It was initiated by a gentleman who wrote to complain of the present state of company law. It appears that he had obtained the opinion of an "eminent counsel" to the effect that a director has no right of access to the books of a company unless he is specially authorised in that behalf by a resolution of the board of directors. This opinion has evoked a storm of disapproval, and having regard to the authorities cited by those who disapprove, it may be regarded as erroneous. Although directors can, *primâ facie*, only act by resolution passed at a duly convened board meeting at which a quorum is present, and no director has individual powers unless delegated to him, yet the directors of a company are the managing partners of the concern, and as such are entitled to the same right of access to the books of the company as the members of an ordinary partnership. In Burn *v.* L. and S. Wales Coal Co. (W.N. 1890, 209) it was expressly held that a director has a right to inspect and take notes of all documents held for the company *virtute officii*. Lord Justice Buckley, in his work on companies, appears to hold the same view, when he says :—

> It is the duty of the directors (a duty which they have undertaken to perform in becoming directors) to be acquainted with the proceedings of the board of which they are members. A director cannot, therefore, semble, escape liability by professing ignorance of a state of affairs which he might have learned from the books of the company. But knowledge of all the entries in the books will not be imputed to him.

English law is sometimes vague and uncertain, and it must be admitted that in that lengthy Act which consolidated the law relating to public companies in 1906, there is no special provision dealing with the question in hand. It would, however, certainly be surprising if the position of director, which involves very great responsibility, did not carry with it the right to make the most minute inquiry into the affairs of a company.

The "Point Fives."

The announcement which reached us last week that another borough electrical engineer—Mr. Allen, of Carlisle—had been elected to the select assembly known as the "point fives," reminds us that these—shall we say economical?—gentlemen are now ten in number.

That they have been able conscientiously to adopt what are, by comparison, extremely advanced views in the matter of domestic electricity supply is all to their credit, and undoubtedly very gratifying and satisfactory to their consumers. It is no secret, however, that some engineers, men whom we and they respect for their sound views, look with some misgivings at the ½d. unit when it is unaccompanied by a fixed charge based on the connected load.

One cannot blame them for this. It is not so much a question of the normal consumer's peak load as of the abnormal consumer's possible peak load, assuming that such consumers take every possible advantage of the temptation which is purposely held out to them to adopt electric lighting, heating, cooking, &c., throughout. There is no doubt that consumers on a rateable value assessment tariff will, if they fulfil expectations, tend as a whole to become abnormal consumers in the matter of lighting and heating, whatever they may be as regards cooking, and, so far, nothing definite appears to be known as to the net effect of their increasing connections on the peak load.

Our remarks do not refer particularly to cooking loads, which, one might judge, from statements made at the Harrogate Convention in June last, are as likely as not to be "off-peak" loads—at any rate, this is the experience of such divergent localities as Marylebone and Luton. The whole question is admittedly an involved one, but probably the engineer who adopts the ½d. rate risks far less than other people suppose, and plays for far higher stakes than he is himself aware of. The engineer has a great ally in the steadily falling fixed charge, and an even greater in the mysterious diversity of habit of his consumers.

In conclusion, one might suggest that there is still scope for the "point five," who feels inclined to become fractionally smaller still, to consider some scheme of heating at "so much per room" during the winter months. Small heaters suitably placed and automatically controlled by a thermostat placed, say, on the ceiling, and adjusted so as to maintain a temperature of about 60° F., might meet the case; but, of course, it needs a really simple and reliable method of temperature control and a relatively low charge per unit, neither of which may materialise just yet.

Country House Installations.

The article printed elsewhere in this issue, describing the electrical installation at Stoneleigh Abbey, may be regarded as illustrating the best modern practice in country-house equipment. It is not often, perhaps, that the engineer has so free a hand to carry out an installation as he considers it ought to be carried out. Usually, he is more or less bound by competition to effect a compromise between what is best and what is expedient, frequently with a considerable bias towards the latter, but in this case, we believe, the best has been demanded and supplied.

The fire-fighting installation is particularly interesting, being designed on novel lines, and marking a great advance even upon the up-to-date system previously in use at the Abbey. Taken in conjunction with the article on private house water supply, recently published in our pages, which attracted much attention, it indicates a useful opening for electricity supply in country houses, and in other connections also.

Electric cooking is another direction in which country houses offer a wide scope for development. Here it is free from all competition except that of the coal range, and, once tried, cannot fail to score a triumph.

It is regrettable that the uses of electricity in agriculture are still but little appreciated in this country; we have endeavoured to bring them home to our readers by inserting descriptive accounts of work that has been accomplished abroad, and we fully believe that eventually, when the British agriculturist realises the extreme convenience, economy and elasticity of electric power, he will be glad to avail himself of its advantages.

AUTOMATIC CURRENT REGULATION DURING EXHAUSTION OF INCANDESCENT LAMPS.

[COMMUNICATED.]

In any process, such as the manufacture of incandescent electric lamps, which involves passing work through a number of departments, it is often difficult to trace defects in the final product to the department primarily responsible. A certain percentage of incandescent lamps have to be rejected as "outfalls" when tested on the photometer, owing to incorrect treatment either in the filament mounting or globe exhausting stage of manufacture. This leads to special annoyance and loss when fulfilling urgent orders. Not only may delivery be delayed beyond the promised date, but also, especially if the order is for lamps of unusual candle-power or voltage, the maker gradually accumulates a stock of "outfalls" for which there is very little demand.

The two most delicate operations in the construction of an incandescent lamp are the mounting of the filament, and the exhaustion of the bulb. Up to the present a very considerable number of lamps have been seriously injured by the incandescing of the filaments at too early a stage in the exhaustion of the bulbs, and by delay in opening the supply circuit in case of failure of the vacuum.

The apparatus described and illustrated in the following paragraphs is due to A. Stifter, and provides for the automatic switching-in of lamps when such a vacuum has been attained that the filament may be safely incandesced, and also for automatic opening of the supply circuit in the event of the explosion of a bulb or serious deterioration of vacuum by leakage in a bulb or its connections. The attendant's duty is limited to mounting and sealing-off lamps; hence, a reduced staff can deal with an increased output, while, by the action of the automatic circuit breaker, the number of the spoiled and "outfall" lamps is greatly reduced.

Referring to fig. 1, the mercury vacuum meter *a* controls a local circuit containing the switch solenoid *d*; the resistances b_1—b_7 are of any convenient resistance material, and are provided with intermediate platinum contacts fused through the wall of the vacuum gauge. When the mercury has risen to a height corresponding to that vacuum at which the lamp can safely be incandesced, the contact *c* is closed, and current flows from the local battery through the whole of *b*, and the coil *d*. The core *e* is then raised so far that the conducting part of the U-bar *f* (see also fig. 2), is drawn into the mercury cups *g*, thus closing the lamp circuit. If the filaments have been mounted properly, they now become duly incandescent, and the isolating switch *h* in the alarm bell circuit is closed.

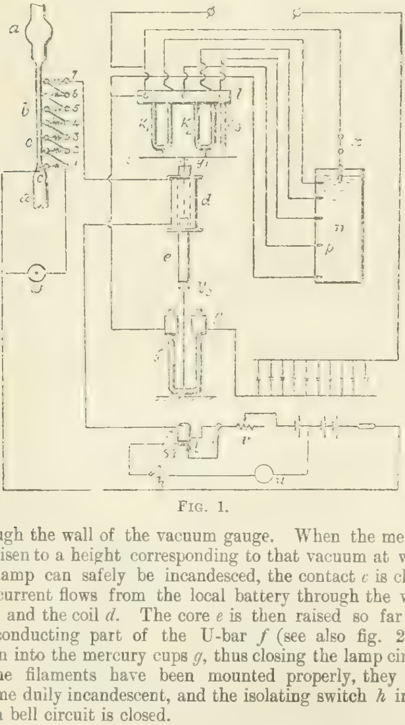


Fig. 1.

Above the coil *d* is an insulating plate *i* carrying contact bars k_1, k_2, the construction of which is shown in fig. 3, which imagines the ring of bars developed into one plane. The actual arrangement is shown in plan in fig. 4. At the moment when *f* closes the lamp circuit, these contact bars make no connection between sections m_1, m_2, &c., of the ring *l*, hence, for the time being, the lamp current traverses the whole of the liquid resistance column *n*.

Meanwhile the lamp vacuum is increasing, and when the mercury level in the vacuum gauge reaches *o*, the section b_1 of *b* is short-circuited, and the current through *d* being thus increased, the core *e* is raised further and the conducting limbs of *k* make contact between m_1, m_2, thus short-circuiting part of the resistance *n*, with the result that the lamps burn more brightly than before. The same cycle is repeated till, by the time the mercury in the vacuum gauge reaches *b*, the whole of *n* is short-circuited and the lamps are supplied at 10 per cent. over-voltage.

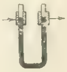


Fig. 2.

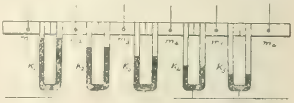


Fig. 3.

Suppose now that a lamp explodes, or a leakage occurs during the exhaustion, the mercury level in *a* at once sinks below *c*, the coil *d* is cut out of circuit and the lamp current is rapidly reduced, as k_1, k_2, &c., descend, and finally the switch *f* is opened. The core *e* descends under its own weight and that of the contact gear; no control spring is used. The opening of the control circuit permits the armature of *r* to fall, with the result that the alarm bell *u* at once commences to ring and attracts the notice of the attendant, who opens *h*, remedies the defective condition and recommences the exhaustion. At the most one lamp is lost. Should the switch *h* not be closed after the lamps have been switched in circuit, the automatic action of the main switchgear is unaffected, but the attendant may for some time fail to notice that the vacuum has been lost and the lamp circuit opened.

Should the vacuum fail temporarily after the switching-in of the lamps (owing to a sudden emission of occluded gases, or the drying-out of moist joints), the push *w* may be compressed, thus keeping the local control circuit closed until the mercury level in the vacuum gauge again rises above *c*. Temporary loss of vacuum by the above causes is easily distinguished from the sudden large and permanent loss of vacuum due to in-leakage. To avoid oscillation of the core *e* occurring when temporary vacuum variations are set up during exhaustion (thus leading to a temporary uncovering of one or more contacts *b*), a cylindrical damping capsule is provided.

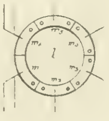


Fig. 4.

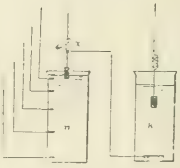


Fig. 5.

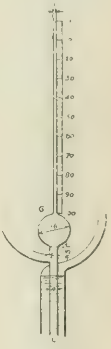


Fig. 6.

When dealing with lamps of abnormal voltage or candle-power, a second liquid resistance may be connected in series or parallel with *n*, as shown in fig. 5, after opening the isolating switch *x*. The effective value of the supplementary resistance may be varied by raising or lowering K, or varying the water level, or by the addition of a few drops of acid or alkali. Every type of lamp can thus be handled simply and rapidly, and to avoid risk of injury, the whole apparatus is so enclosed that only the vacuum gauge is visible, and the switch *h* and push *w* are accessible to the workman.

In order to make the contact loops *k* as light as possible, the conducting length may be made up of aluminium 1 — 5, but it is then impossible to use mercury at m_1, m_2, &c., and some other means of effecting efficient contact must be employed. As compared with copper and the noble metals, aluminium has high conductivity, while possessing very low specific gravity.

If aluminium be used, the weight of each contact loop need not exceed 12 gm., and it is possible, by using glass (specific gravity, 2·65), or quartz (specific gravity, 2·5—2·8) for the upper insulating part of the U bars, to load the ring *i* very symmetrically, thus reducing the friction of the guide rollers y_1, y_2. Probably, however, the surface film of oxide forming on aluminium and the impossibility of using this metal in mercury cups would make it desirable to use some other, though heavier, metal. The contact length of the main switching piece *f* may be made of carbon (in order to reduce damage by sparking when opening the lamp circuit) and the upper part of quartz.

Residual Pressure at which Lamps may be Incandesced.—It is sometimes recommended that lamps should not be incandesced until the residual pressure of gases in the bulb has been reduced to 0·00013 atmosphere, but experience shows that no damage occurs if filaments are incandesced when the pressure reaches 0·00262 atmosphere; it must be remembered that a considerable part of the residue is by this time composed of inert gases from the filaments and joints, &c., which gases have no oxidising or other injurious effect on the incandescent filament. There is a distinct advantage in incandescing the filaments for as long a period as possible during evacuation, and this particularly applies to metallic-filament lamps, owing to the large number and surfaces of parts within the bulb, and (except in the latest types) large number of cemented joints.

It is especially important that the point (*c*) (fig. 1) be correctly chosen so that the lamps are switched in immediately, but not before, that vacuum is reached at which the filament can be incandesced without injury.

Fig. 6 represents part of a standard vacuum gauge. The right-hand tube is open to the atmosphere, the central stand-pipe is sealed at the top, and the left-hand tube is connected to the exhausting system. During the exhaustion of the lamps, mercury rises in the centre tube L, and when it reaches level 1, the stand-pipe G is isolated from the left-hand tube. As the mercury rises yet higher, the rarefied air in G is compressed, and by the time the mercury reaches, say, the 10 mark, on the scale, the vacuum in the lamp has reached such a value that the filaments can safely be incandesced. The corresponding mercury level in the vacuum gauge under calibration can now be marked, and thus the point *c* determined.

The dimensions shown in fig. 6 are in mm., and in the present case v = volume of stand-pipe above 1 = 2,286 mm.³; v_2 = volume of stand-pipe above scale mark 10 = 7·85 mm.³; p_1 = lamp vacuum corresponding to v_2, and requiring to be determined; p_2 = pressure of air in v_2. The pressure p_2 can never reach 1 atm., but its value at any moment can be calculated as follows:—

The diameter of L = 4 mm. and v_1 = 2,286 mm.³ corresponding to a column 182 mm. in height, and therefore a pressure of 0·238 atm., *i.e.*, $p_2 = 0{\cdot}762$ atm. Then, from Boyle's Law—

$$p_1 \cdot v_1 = p_2 \cdot v_2,$$

whence, substituting the above values for v_1, v_2 and p_2,

$$v_1 = 0{\cdot}00262 \text{ atm.}$$

Having once determined experimentally the critical residual pressure at which given filaments can safely be incandesced, the corresponding volume v_2, and hence the scale mark to which the mercury must rise in the stand-pipe of the vacuum gauge (fig. 6), can be calculated by the inverse of the above process.

An ultimate vacuum of about 0·002 mm. ($2{\cdot}62 \times 10^{-6}$) suffices, hence the difference between the vacuum at which the filament is first incandesced and the vacuum when exhaustion is considered complete, corresponds to about 2 mm. height in the vacuum gauge (fig. 1), and to increase this height sufficiently to enable the seven contact wires *b*, &c., to be fused through the glass, the diameter of the tube is locally constricted from 5 mm. to about 1·3 mm., thus providing a length of nearly 30 mm. for the control contacts.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

I notice that the above Institution threatens to come off its pedestal and do something for its ordinary members.

We have lately had a good illustration of what the "strongest Trade Union in the world"—namely, the Medical Association—can do for the medical man. Imagine our Institution saving their fully-qualified members from the 17s. per week job, in charge of 40s. to 80s. per week workmen. The workman has his Union, the 17s. engineer only the Institution of Electrical Engineers.

The *Electrical Times* tells us that recruits to the Institution "will find that membership will be of increasing value to them in their careers." I wish the word increasing had been left out; then one could recruit with an easy conscience. "Professional status in the electrical world" is all very well in its way, but it does not help some of us to earn an unskilled labourer's pay.

The Medical Association takes very good care of the professional status of the doctors: but, what is more, it also helps them to live. Overcrowded as the medical profession is, one cannot employ a doctor for 17s. per week, neither is it possible for a chemist to pretend he is a qualified medical practitioner.

When will our Institution become less dignified and more useful to the majority of its members? I am sure none of us would mind paying double or even treble our present subscription if we could feel as the doctors must now feel in regard to their own glorious and dignified "Trade Union." If the above ever comes to pass, there will be no need for members to recruit as at present. The difficulty will be to keep unqualified men out of the Institution of Electrical Engineers.

When shall we see at the head of your advertisement column:—"Before applying for the post of electrical engineer under the ——— Corporation, intending applicants are requested to apply to the Institution of Electrical Engineers"?

A. J. Abraham,
Engineer and Manager.

Aberdare Electricity Works,
October 23rd, 1912.

Switchgear Drawing-Office Expenses.

I am directed by my Council to invite, through the medium of your valued paper, the attention of municipal and consulting engineers and other principals interested in the purchase of switchboards, switchgear and apparatus to the burden at present imposed upon manufacturers by demands for drawings, the cost of preparing which is, in many instances, largely disproportionate to the value of the orders for which they are prepared.

It appears to be customary—the custom originating, no doubt, in competition, and now sanctioned by use—in every instance at the *inquiry* stage of a switchgear order, for purchasers to ask each tenderer for special drawings, irrespective of the size or value of the apparatus inquired for; and it is, thus, not unusual for a maker, when acting as sub-contractor, to be requested by a dozen different firms to supply, for tendering purposes, of each section of the order, a dozen sets of drawings in duplicate, together with blue prints and diagrams of connections and dimensions, the order itself being of the value of, perhaps, not more than £10. In the case of intermediate sub-contractors making the demand on behalf of some main contractor, the work is doubled, and may even be quadrupled.

It is submitted by members that, while in the case of large special switchboards, detailed lay-out drawings may reasonably be required, in the majority of cases an immense wastage of time and labour takes place in the manufacturers' drawing offices, most of the drawings demanded being unnecessary for the immediate purpose ; and that simple illustrations of the apparatus offered would, in the first instance, be amply sufficient to enable purchasers or their engineers to decide as to the tenderer or tenderers to whom they will, in the first instance, give the preference, who could then be required to submit the necessary drawings.

The grievance is, moreover, as it appears, not confined to the tender stage. In the contract stage also, the drawings required are, members submit, frequently excessive in number and variety, and unnecessarily detailed. In the case of motor panels, for example, of which a large number are sometimes ordered at one time, it is not unusual for three or more dimensional prints of each panel to be asked for.

My Council conceive that in many instances excessive demands for drawings may arise from thoughtlessness or lack of knowledge on the part of purchasers' assistants, who habitually, and, perhaps, excusably, make them as a matter of routine with every inquiry or order passing through their hands, specifications usually embodying "covering" provisions as to the drawings which shall be supplied if required.

From whatever cause arising, however, my Council feel assured that a remedy will be found for the grievance, and that, so far as it lies within the power of purchasers to apply it, the remedy will be applied. The interests of both parties are obviously served in the end by keeping down charges for unproductive labour ; and the total amount of drawing-office charges incurred yearly by manufacturers as a body is, under the present system, very large indeed, having regard to the fact that only one or two out of the 20 or more tendering firms can possibly get any order.

D. N. Dunlop,
Secretary, The British Electrical and
Allied Manufacturers' Association.

London, W.C., *October 25th*, 1912.

[The practice to which our correspondent refers is one to which we have from time to time drawn attention during the past ten years and more ; there is no doubt that it is, as he says, a source of great expense and waste of labour, and like some other familiar items in specifications, its observance is largely due to tradition. We refer to the matter more fully in our leading columns.—Eds. E.R.]

Generating Plant for Village Lighting.

"Little Man" hardly gives one any important data on which to found an answer to his query. This opinion in a day of highly-efficient internal-combustion engines may seem absurd, but from having advised on a good many such cases during the last few years, I am in a position to state that in many such small plants an examination of the methods of working them generally shows that with very little capital expenditure the output of the plant could be much increased, and the amount of fuel taken to run the increased load be actually decreased. It is not contended that such plants could show the fine results of the up-to-date internal-combustion engines ; that would be obviously ridiculous, but where capital is of such importance, it often results in a cheaply obtained steam plant, or the present plant, slightly altered, being able to suit the financial conditions of the owners better. If with fuel costs at 1·1d. per unit, customers are increasing, it follows that the said customers must be prepared to pay the cost of generating electricity in this fashion, or they would not apply for connection. The problem then becomes not one of extremely low costs per unit generated, but of extremely low capital expenditure per unit of plant.

Why not try running condensing and installing a feed-water heater ? These points alone would allow some extra output at a diminished coal cost, and as the extra power required appears to be very small, it may be that some extra load can be safely carried in this manner if the generator will stand, say, another 2 or 3 KW.

I agree with "Little Man" that such plants are able to fill a demand for electric lighting in out-of-the-way villages, when really modern plant would be too costly for the financial resources of the district.

Such plants are exceedingly interesting, and it is surprising how many such exist, and, above all, how they nearly all seem to satisfy their owners. If "Little Man" will communicate with me through the Editor, I shall be pleased to go into the matter on receiving full particulars of the present installation.

Electric Supply.

I was interested in your correspondent's letter under the above heading, and I think a good many of your readers would be glad of some further information about the small plant referred to, for a great many of these village lighting plants will be erected within the next few years. The question as to the best and most economical plant for such a job could hardly be answered unless one knew the maximum number of lights the plant would ever be likely to be called upon to deal with, but in your correspondent's case, I should think a reliable steam engine would be hard to beat. I am surprised that he does not add a feed-water heater to his plant, as this would certainly mean an economy in fuel. No mention was made of a storage battery, but presumably one is installed. Perhaps your correspondent would say (1) what is the voltage of his supply, and the system ; (2) what he expects as an ultimate maximum load ; (3) the rate per unit charged ; and (4) if the syndicate supplies meters and charges a rent for the same.

I am interested in two or three small village lighting schemes, and should be pleased to reciprocate with any information I can give.

E. J. Williams.

Inverness, *October 28th*, 1912.

Fuse Formulæ.

In a letter in your last issue under this title, Mr. W. H. F. Murdoch refers to a paper which Dr. Russell read before the Physical Society in 1910, and which he appears to have misunderstood.

Dr. Russell proves that if a wire carrying a current be cooled by a steady stream of liquid, flowing in a direction perpendicular to the length of the wire, the current which is necessary to maintain the temperature of the wire a given amount above that of the supply of liquid is proportional to $a^{1\cdot 25}$, where a is the radius of the wire. The assumptions made are that no heat is lost by conduction or by radiation, that the cooling liquid is incompressible, and that steady stream-line flow takes place. The theorem has received ample experimental verification.

For wires of small diameter stretched horizontally and cooled by a vertical convection current of air, the above conditions hold approximately. For flat strips they cannot be supposed to be true, nor for short thick wires.

Messrs. Schwartz and James show that the steady current required to raise a fuse wire to its melting-point is proportional to a^n, and that n lies between 1·13 and 1·32, except in the case of larger copper wires, where much of the heat is lost by conduction to the terminals. In the case of aluminium the causes which lead to the ultimate disruption of the fuse are very complicated, but the current required to *melt* the metal is shown to be proportional to $a^{1\cdot 27}$.

I am not aware that Dr. Russell claims to have discovered a new law for fuses, but I think he was not far from the truth when he stated that, previously to the appearance of Messrs. Schwartz's and James's paper, electricians were accustomed to estimate the fusing current of a wire by the method which is referred to by Mr. Murdoch as "*the best known*," viz., $C \propto d^{1\cdot 5}$. The index 1·25 for wires and cables in air is in excellent agreement with results obtained by Prof. Forbes as far back as 1882 (see *Electrician*, Vol. 9, page 497), and both he and Prof. J. T. Bottomley proved 30 years ago that the 1·5 law was erroneous.

There is no such statement in Dr. Russell's paper as $R = \rho_0/\pi a^2$; the resistance per unit length of the wire is taken as $\rho_\theta / \pi a^2$, ρ_θ being the volume resistivity of the wire at the steady temperature which it attains. The term "volume resistivity" (as to the meaning of which Mr. Murdoch seems to be uncertain) is defined in any standard book on testing, *e.g.*, Fleming's "Handbook of the Electrical Laboratory," Vol. I, page 252.

F. T. Chapman.

Hendon, *October 28th*, 1912.

Salaries in Canada.

The salaries paid in the electrical business, particularly in central stations, have often, and rightly, been the subject of comment in your columns. I notice, in your issue of September 27th, an advertisement for a switchboard attendant at 7s. 6d. a week. I should like to call the attention of the men in the old country, who accept similar positions, to the wages paid to switchboard men in Canada.

The rate of pay, of course, varies in different parts of the country, but a very fair average is from £3 10s. to £4 a week. In one station that I know of, two out of the three switchboard men are under 21 years of age. One I know to be 19, and he has had one year's experience. He gets £4 a week. Out of this he pays less than £1 a week to the company for board and lodging.

We are told that money is not everything in this life, but a jump from 7s. 6d. to £4 a week is almost worth considering. An increase in salary of over 1,000 per cent.! It sounds almost like the dream of the advertising manager of a correspondence school, nevertheless it is true.

Emigrant.

Canada, *October 19th*, 1912.

[We do not doubt our correspondent's statement, but, to prevent immediate and wholesale emigration, we may point out that the number of switchboard jobs in Canada is not unlimited, and most of them, no doubt, are occupied.—Eds. E.R.]

Commercial Development.

In view of the leading article contained in your issue of October 25th, I think it may be of interest to your readers to know that, whereas the British Commercial Gas Association has sold over 700,000 pamphlets in its first year, the Electric Supply Publicity Committee has sold over 2½ millions in 2½ years.

For reasons which are clearly stated in your article, this is the only field of operation in which the work of the Electric Supply Publicity Committee is open to comparison upon equal terms, but I think it shows that the Committee may be trusted to perform its duties satisfactorily, and I hope that your remarks may have the effect of providing the Committee with further opportunities for activity in the common interests of the electrical industry.

A. F. Harrison,
Chairman, The Electric Supply Publicity Committee.

London, E.C., *October 29th*, 1912.

[And this is—*publicity!*—Eds. E.R.]

Speech Frequency.

It has always been assumed in telephonic transmission calculations that the average frequency or pitch of the human voice is from 750 to 850. There appears to be some doubt as to the basis on which this figure was arrived at, and its correctness. It would be interesting to know, and perhaps some correspondent can say, on what basis this frequency has been adopted.

$2 \pi n$.

Association of Mining Electrical Engineers.—Mr. Sydney F. Walker, of Bath, has been re-elected for the fourth year in succession as the president of the South Wales Branch of the Association. His presidential address dealt with the introduction of electricity into mines.

THE EMPLOYMENT OF COMMISSION AGENTS.

BY OUR LEGAL CONTRIBUTOR.

Cases frequently arise relating to the employment of commission agents to travel in electrical goods. The salary or commission paid to a "man on the road" is money spent in a form of advertisement; and it is but natural that the dealer in fittings scrutinises the orders with the same care in order to be assured that the traveller, while making one for himself, is making two for the firm.

The first essential to the proper and efficient working of the travelling or canvassing department is to secure the services of a manager. It will be his duty to select competent and tactful canvassers who will temper zeal with discretion, and exercise such judgment that the firm will not be saddled with a heap of bad debts. How best can such a manager be remunerated? A good man requires a certainty, so a fixed salary is necessary, but to encourage industry, and above all, to make it worth his while to see that his subordinates do their work efficiently, it is advisable to give him an interest in the orders which they secure. That can best be done by allowing a commission or percentage upon the earnings which come in from his department.

It is easy enough to provide in an agreement that a manager shall be paid by salary and commission on the receipts of his department during a certain period; but a bare provision of this character is scarcely sufficient to meet the requirements of a rapidly expanding business. Suppose, for instance, that a man is employed to manage the canvassing department of a business whose travellers visit every town in England and Wales, for a period of five years. The business rapidly extends, and becomes so large that it cannot possibly be worked in its entirety from London. In the result branches have to be established; and a branch cannot be run without a manager. The question will then arise: Must commissions still be paid to the London Manager?

This raises, indirectly, a question of general interest, namely, Is a man who is paid by commission entitled to insist that the person or firm employing him shall so continue the business as to enable him to earn his commission? It may be stated as a general principle that a mere contract to employ a man at a salary imposes no obligation to find employment. If the salary is paid, the employer has done what is required of him. It is otherwise, however, if there is an agreement to pay a commission. In that case a man is entitled to have an opportunity of earning his commission. This may be illustrated by the case of Turner *v.* Goldsmith (1891) 1 Q.B. 544. There the defendant, a shirt manufacturer, by contract in writing agreed to employ the plaintiff, and the plaintiff agreed to serve the defendant as agent, canvasser and traveller on the terms—first, that the agency should be terminable by either party at the end of five years' notice; secondly, that the plaintiff should do his utmost to obtain orders for, and sell, the various goods "manufactured or sold by the defendant as should from time to time be forwarded or submitted by sample or pattern." And it was further provided that the plaintiff should be remunerated by such commission as was specified in the contract. After about two years the defendant's manufactory was burnt down, and he did not resume business, and thenceforth did not employ the plaintiff, who brought an action for damages for breach of contract. It was held by the Court of Appeal, reversing the decision of Justice Grantham, that the action was maintainable, and that the plaintiff was entitled to substantial damages, for the defendant, having agreed to employ the plaintiff for five years, did not fulfil the agreement unless he sent him a reasonable amount of samples to enable him to earn his commission, and that the defendant was not excused from fulfilling his agreement by the destruction of his manufactory by fire.

The mere fact that the payment of salary does not import the right to demand work so as to keep your hand in, was settled in Turner *v.* Sawdon & Co. (1901), 2 K.B. 653. In that case the defendants agreed to engage and employ the plaintiff as their representative salesman for a period of four years. Before the expiration of that time the defendants, though willing to continue to pay wages to the plaintiff, refused to give him any work to do as their representative salesman. In an action to recover damages for breach of contract, it was held that there was no obligation on the defendants to provide the plaintiff with work. Lord Justice A. L. Smith said :—

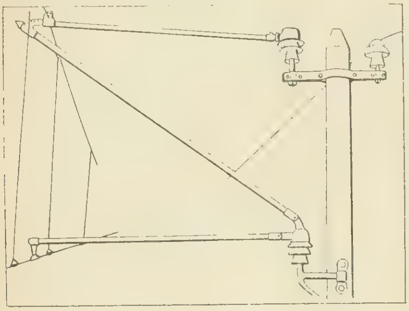
> It is within the province of the master to say that he will go on paying wages, but that he is under no obligation to provide work. The obligation suggested is said to arise out of the undertaking to engage and employ the plaintiff as their representative salesman. It is said that if the salesman is not given employment which allows him to go on the market, his hand is not kept in practice, and he will not be so efficient a salesman at the end of the term. To read in an obligation of that sort would be to convert the retainer at fixed wages into a contract to keep the servant in the service of his employer in such a manner as to enable the former to become *au fait* at his work. In my opinion, no such obligation arose under this contract, and it is a mistake to stretch the words of the contract so as to include in what is a mere retainer an obligation to employ the plaintiff continuously for the term of his service.

It follows from what has been said, that in the case of the manager of a canvassing department his employers could not remove from his sphere of influence any part of the country by the appointment of branch managers. In making arrangements with a manager therefore, care should be taken to make special provision for the expansion of business by the employment of branch managers.

A LIGHT BRACKET CONSTRUCTION FOR HIGH-TENSION TRACTION LINES.

The "Z" bracket shown in the accompanying sketch is built according to the Giros and Loucheur patent, and is the type exclusively employed on the 215 miles of 10,000-volt single-phase electric railways radiating from Limoges in the Haute-Vienne district. The advantages of the construction include cheapness, lightness, strength and flexibility. The three main members are of gas pipe, and the general method of connecting them to each other and to the insulators on the short brackets carried by the wooden poles is shown in the sketch.

The upper horizontal arm carries at its outer end a 34 sq. mm. stranded steel cable, from which is suspended the contact line (of 80 sq. mm. 8-section galvanised iron), according to the well-known catenary system. The lower end of the diagonal member and the inner end of the lower horizontal tube are carried from a second pole insulator. The upper horizontal and the diagonal tubes constitute the load-carrying bracket, while the lower horizontal arm simply acts as an "antioscillator." The connections between the tubes themselves and between them and the insulators are jointed, so that the flexibility of the whole suspension is very high.



A special counterweight device is erected on section towers at intervals of 3 or 4 km. along the route, and a uniform tension of 4 kg. per sq. mm. is thus maintained in the contact line. The conductor carried by the insulator on the right of the upper bracket in the sketch is a 10,000-volt bare copper feeder employed to compensate for the pressure drop in the contact conductor. A full description of the generating, distributing and traction equipment of the above system is to be found in a recent issue of *Houille Blanche*.

PURE TITANIUM.

By WALTER J. ADKINS.

The problem of how to obtain the metal titanium in a pure state has engaged for a long time the attention of scientists. Many lamp-makers have also been interested in the matter, as it is possible that lamp filaments of high efficiency could be formed from the metal. Pure titanium has been obtained for the first time as a result of the experiments which have been carried out in the Rensselaer Polytechnic Institute, Troy, New York, by Matthew A. Hunter. The most successful attempts to isolate the pure metal which have been made hitherto have resulted in the production of an ingot which contained only 5 per cent. of impurities. Hunter enclosed titanium tetrachloride, $TiCl_4$, in a metallic bomb with pure sodium. The capacity of the bomb was about 1,000 cb. cm., and it was built up out of machined steel parts. It is stated that it was capable of withstanding a total internal pressure of 80,000 lb. When the process is carried out it is said that the reaction inside the bomb takes place so rapidly as to be practically instantaneous, and it should be noted that the chemical action only commences after the steel envelope has been heated to a certain temperature.

It is said that tests made on the metal after it has been obtained in this way in a pure form show that it is hard and extremely brittle when cold, but that if it is heated to a dull red heat it is almost as easily forged as ordinary charcoal-iron. In appearance it resembles polished steel, but does not break with the crystalline structure which characterises the latter metal. Those who are interested in titanium from an electrical standpoint will regret to hear that all attempts made to draw it into wire of even comparatively large cross-sectional area have been unsuccessful as yet, although there is a strong probability that further efforts in this direction will result more satisfactorily. On the face of it the metal should be suitable for lamp-making purposes, as its melting point is approximately 1,800° C., whilst the specific gravity is about 4·5 and the specific heat about ·1462.

Suggested Tests of Motor-Car Electric Lighting Sets.—One of the features of the automobile movement during the past year or two has been the rapid adoption of electricity as the means of illumination for the lamps, and, in the case of covered cars, for the internal lighting. That well-known motorist and motor trader, Mr. S. F. Edge, who has been experimenting for some time with the different car-lighting systems at present on the market, reports that he finds a discrepancy between the relative values of the different systems as driving lights and also between their effective efficiencies. He also considers that most electric lighting sets have not a generator sufficiently powerful to supply the amount of electricity to the accumulators that is taken out of the latter during use, and that with many generators that are sold, one requires to charge the battery during the daytime in order to have sufficient current for use at night; that is to say, the lamps are taking more current out of the accumulators than the generator is putting in. Mr. Edge therefore considers that the time has come for some responsible body to carry out a series of clear and decisive tests. The points on which the trials should be based are, in his opinion, as follows:—

1. The distance at which a dark-clothed pedestrian can be seen distinctly on a dark road.
2. The width of lighting beam at distances of 20, 50, 150, 200, 250 and 300 yards from the car, the test of lighting beam area being the distinct visibility of dark-clothed pedestrians on a dark road.
3. The number of watts available for lighting at engine speeds of 200, 500, 1,000 and 1,500 R.P.M.
4. Prior to admission to the trials, each competitor should be required to state his claims as to the tests enumerated above.

THE MANCHESTER STREET LIGHTING REPORTS.

A very interesting series of reports is that submitted jointly, and individually, by Messrs. Haydn Harrison and Jacques Abady, upon the street lighting in Portland Street and Princess Street, Manchester. The joint report, which is the essential portion, reads as follows:—

We beg to report that we are agreed upon the following points:—

1. That for all practical purposes the degree of illumination in Portland Street and Princess Street is approximately equal.

2. That, based upon the figures of costs of current and gas, &c., given us by the respective departments, the arc lamps as used in Portland Street are provided at an annual cost which is less than the gas lamps as used in Princess Street.

3. That, as a comparison between the possibilities of arc lighting and high-pressure gas lighting, the results are vitiated by the fact that the high-pressure gas lamps are giving an efficiency very much below similar lamps when properly installed and adjusted.

The supplementary report by Mr. Harrison states that he has taken the figures relating to the cost of production of the rival illuminants as being correct.

Only four of the 16 arc lamps installed in Portland Street (those nearest Princess Street) have been taken into consideration, in order that a similar number and length of street might be compared with the H P. gas lamps in Princess Street.

The lamps were operated in the ordinary manner, but a considerable leakage of gas from the H.P. main was not taken into consideration when calculating the gas consumption. In both cases central light sources suspended from span wires were used; in Princess Street, Keith H.P. gas lanterns, each containing three inverted H.P. mantles supplied with gas at a pressure of 55 to 60 in. (of water), and a small compressor plant, electrically-driven, for compressing the gas, were installed; while in Portland Street there were Metroflam Magazine Flame arcs, with clear inner globes and partially-obscured outer globes, connected eight in series across 400-volt mains. A tower ladder was used in both cases for trimming, &c., and in this connection, Mr. Harrison draws attention to the lowering gear used in the City of London, which has proved satisfactory in the case of electric lamps, but, in the case of high-pressure gas lamps, often suffers from trouble with the joints.

The gas lamps have an average height of 26 ft. 6 in., and are an average of 107 ft. apart, while the electric lamps are all 27 ft. 6 in. high and an average of 121 ft. apart.

Mr. Harrison arrives at a consumption of 79·5 cb. ft. per hour for each gas lamp, costing for high-pressure gas 1·147d. per hour, which, with the additional cost of mantles, globes, labour, &c., brings the costs up to 1·5d. per hour, which would be increased, as regards maintenance, if the pressure were increased to improve the efficiency of the lamps.

For electric lighting, including the cost of carbons, trimming, maintenance, &c., he arrives at a cost of ·7d. per hour (energy, ·382d.) for all-night lamps, and ·9d. per hour (energy, ·625d.) for half-night lamps.

Taking equal cost, 1½d. per hour would give 1,750 C.P. with gas, and 6,364 C.P. with electricity; or 2,970 C.P. would cost ·7d. with electricity, and 2·54d. with gas. Two average illumination tables included, are as follows:—

	Princess Street gas lamps.	Portland Street arc lamps.
Candle-power at 20° to 25° ...	1,750 C.P.	2,970 C.P.
„ at 45°	1,670 C.P.	3,170 C.P.
Min. hor. illumination	·39 ft.-candles	·5 ft.-candles
Max. „ „	1·9 ft.-candles	2·26 ft.-candles
Conditions after 11.30 p.m.*		
Candle-power at 20° to 25° ...	49·5 C.P.	2,970 C.P.
Min. hor. illumination	·004 ft.-candles	·084 ft.-candles
Max. „ „	·7 ft.-candles	2·26 ft.-candles

*Alternate arcs extinguished; high-pressure gas extinguished, and low-pressure gas lamps used.

The following table gives average results arrived at by Mr Harrison:—

	Princess Street H.P. gas lamps.	Portland Street arc lamps.
C.P. of lamps	1,750	2,970
Lamps per mile	49·34	43·6
Running costs per lamp per hour	1·5d.	·7d. and 9d.*
Capital costs per mile	£2,537	£1,569
Running costs per 1,000 C.P.-hours	0·857d.	·236d. and ·3d.*
Cost per annum per mile, equal illumination	£675	£254 and £314*
Minimum illumination basis of comparison	·39 ft.-candles	·5 ft.-candles
Cost per mile of street per annum (up to 11.30 p.m.) at above illumination	£617	£254 and £314*

* After 11.30 p.m.

The capital costs are taken in the case of gas, for lamps, lanterns, poles, suspension and all accessories, at £50 per lantern; in the case of electricity, at £36 per lamp with all accessories.

Neither high-pressure gas main and compressing plant, nor series street lighting cable are included, as they have been included in the general charges of each undertaking.

Mr. Harrison adds that the illumination of the two streets, as far as the ordinary observer is concerned, is equal, but that the electric lighting is far cheaper, and even if the gas lamps had been working at double the efficiency, or the cost of electricity been doubled, the electrical method would still have proved the more economical for equal illumination.

Cases of more efficient H.P. gas lamps are found where higher pressure is used, but the Princess Street lamps give results similar to those obtained in other parts of the country.

Mr. Abady reports at greater length on the matter. He finds that the lighting by H.P. gas, in respect to general illumination, quality of light and freedom from involuntary extinctions, is better than the arc lighting; that the electrical C.P. is superior, and that the arc lamps are highly efficient, while the H.P. gas lamps do not attain normal efficiency.

That based upon the figures of cost supplied by the electricity and gas departments, the latter cannot supply three-burner H.P. lamps at as low a cost as can the electricity department supply 11-ampere flame arc lamps, (he, however, demurs as to the costs, considering that they cannot be safely taken as a basis in estimating for future extension of either systems).

The gas lamps have an efficiency of only 27 candles per cb. ft. of gas, whereas they could with suitable adjustment and pressure reach 50 candles; and in further extensions he recommends two-burner lamps, 20 ft. above ground and 130 ft. apart.

Subject to his criticism, he considers that the tests justify an extension of both systems, but arc lamps should be used for suspension over tramway routes.

As regards illumination, Mr. Abady finds under the arc lamps a mean of ·88 ft.-candles, and under the gas lamps a mean of 1·46 ft.-candles. Between the lamps he finds for the arcs mean figures of ·252 ft.-candles and ·251 ft.-candles on road and kerb respectively, and for gas, ·279 ft.-candles and ·250 ft.-candles in the same way.

In the case of direct C.P. readings, he finds in the case of the arc lamps, mean, maximum and minimum figures of 2,949, 3,170 and 2,767 candles at 20° S., and 1.478, 1,759 and 1,331 candles at 75° S.; the comparable gas figures are 2,173, 2,431 and 1,922 candles at 20° S., and 1,558, 1,613 and 1,473 at 75° S. As regards cost, Mr. Abady finds that each arc lamp consumes 600 watts per hour, and each gas lamp 80 cb. ft. of gas in the same time, and he reckons the cost of all-night electric lamps (4,000 hours) at £11 6s. 5d. per lamp per year, or ·68d. per hour lighted, and for half-night lamps (2,000 hours) at £7 18s. 2d. per lamp per year, or ·9d. per hour lighted; the gas lamps (2,000 hours) cost £11 9s. 2½d. per lamp per year, or 1·37d. per hour lighted.

In regard to capital cost, he finds that the 16 arc lamps in Portland Street cost £873 2s. 10d., inclusive of £306 for cable, while the four gas lamps cost £194 11s. 6d., *exclusive of anything for high-pressure gas mains and compressing plant.*

Mr. Abady then discusses the question of electricity and gas costs, and comes to the conclusion in regard to the former, that as the fixed charge on traction plant at Manchester is apparently £9·357 per KW. connected, while that for lighting and power is apparently £7·525 per KW. connected, that the lighting costs are reduced at the expense of the traction costs; he further fails to reconcile the charge for traction (no profit) 1d. per unit, 36 per cent. load factor, with the charges of ·682d. per unit on a 45 per cent. load factor for all-night lamps and 1·132d. per unit on a 23 per cent. load factor for half-night lamps, and other minor points are raised such as the necessity of charging the cost of street lighting staff and street-lighting mains to street lighting, although he does not consider it necessary to charge high-pressure gas mains in the same way.

With regard to the cost of gas, Mr. Abady is quite satisfied with the costs taken, but he states that the electricity renewals fund is below proper standard, while the gas department is in an exceptionally strong financial position, also that the latter has during the last 10 years contributed £605,783 in aid of the rates, as against £73,500 given by the former.

He also devotes considerable space to arguments, with a view to showing that the high-pressure gas lamps adopted at Manchester are not so efficient as they, or other types of lamp, could be.

Mr. Abady's report concludes with three appendices, and both his and Mr. Harrison's contributions are well worth close study by municipal authorities who are discussing the question of electricity *v.* gas lighting for the streets.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Camp" writes:—"Having connected a new consumer to our mains, after a few days we began to receive complaints from neighbouring consumers to the effect that their lights were unsteady, and on investigation we found that this was due to the heavy and irregular loads thrown on the mains by the new user The latter refusing to install apparatus which did not interfere with the supply to others, we eventually discontinued the supply to his installation, and we are now threatened with an action for damages on the ground that we should either have declined to supply the consumer in the first instance, or that, having commenced supply, we could not discontinue it without giving compensation. Can you refer us to the result of any similar action?"

⁂ Before pronouncing a final opinion on this question, it would be necessary to have an opportunity of seeing the documents in the case. It would appear, however, that the undertakers are protected by certain sections in the Electric Lighting Acts. Thus, by Sec. 18

of the Act of 1882, it is provided that while the undertakers may not prescribe any special form of lamp or burner, "No . . . person shall be at liberty to use . . . the electricity supplied them for any purpose, or to deal with it in any manner so as to unduly or improperly interfere with the supply of electricity supplied to any other local authority, company or person by the undertakers, and if any dispute or difference arises between the undertakers and any local authority, company or person entitled to be supplied with electricity under this Act, or any . . . order . . . as to the matters aforesaid, such dispute or difference shall be determined by arbitration." The Electric Lighting Clauses Act, 1899, Schedule Sec. 27 (4), goes further, and confers the right to cut off the supply. It provides that: "If the owner or occupier of any such premises as aforesaid uses any form of lamp or burner, or uses the energy supplied to him by the undertakers for any purposes, or deals with it in any manner so as to interfere unduly or improperly with the supply of energy to any other body or person by the undertakers, the undertakers may, if they think fit, discontinue to supply energy to those premises so long as the lamp or burner is so used, or the energy is so used or dealt with." It will be seen from this that even if the worst comes to the worst, "Camp" only has to fear an arbitration. To an action which might possibly be brought for breach of contracts, there appears to be an absolute statutory defence. The position of the undertakers will, of course, be unassailable if it is provided in the contract that the supply is furnished under and in accordance with the provisions of the Electric Lighting Acts. "Camp" would be well advised to consult a lawyer conversant with electrical matters. So far as is known, there is no report case on the questions he propounds.

"Flat Rate" asks :—"In the case of a company supplying electricity to a district under Parliamentary powers, can it enter into a contract with a large (or any) consumer to supply him for a stated sum per annum, instead of charging for consumption by a meter?"

⁂ It is clear that undertakers have power to enter into a special contract to supply power to any consumer provided that they do not show him undue preference. The question whether they show him a preference is determined by taking all the circumstances of the case into account. In one case a consumer agreed to take the whole supply required for his premises from the plaintiffs for not less than five years, paying 4d. a unit. It was alleged that there were other contracts with other consumers in existence, less favourable to those consumers. Mr. Justice Buckley interpreted the section thus: "It appear to me that the relevant words here are 'under similar circumstances to a corresponding supply.' There is left a latitude to the company making bargains with its customers where circumstances differ, or the supply does not correspond for different terms. How far they may go is a question of degree. The facts are that Gates (who had entered into a contract for two years at 4d.) is a very large consumer—his bill is stated to be 10 times that of the defendant. Moreover, he is a customer who burns largely upon the day load as distinguished from the night load, a circumstance which is to these companies of great importance. They are bound to keep their plant running in the day as well as in the night, to some extent at least, because some consumers want current during the day; and to get a customer who draws upon the day load is of use to them, because they are getting some return for running plant during hours which otherwise would be unproductive. May they take that into consideration? I answer, certainly they may. The 'circumstances' are not 'similar' where the one consumer is on the day load and the other is on the night load.

"Then what does a 'corresponding supply' mean? Does it mean that you are necessarily to treat the small consumer upon equally advantageous terms with the large consumer? The cost to the company may be very different, greater uniformity of demand, easier and less expensive collection of the amount to be paid are circumstances to which regard must be had." (See Metropolitan Electric Supply Co. *v.* Ginder (1901) 2 Ch. 799).

Tramcar Accident.—On Friday, last week, the inquest was concluded at Mitcham on the body of a boy named Alfred Allen Ward, of Leyton Road, Wimbledon, who was killed in a collision between a tramcar belonging to the South Metropolitan Electric Tramways and Lighting Co., Ltd., and a van, near Tooting Junction. The driver of the car, Walter Ducie, of Croydon, was arrested and charged with manslaughter, and was present under remand at the adjourned inquest. Evidence was given that the road was dark at the spot, and that the van was showing no light. The driver applied both brakes, and the result was that the boy's body took all the effect of the blow, the van escaping almost without damage. It was stated that if there had been only a foot more between the two vehicles no accident would have occurred. The evidence of Mr. A. V. Mason, general manager and chief engineer of the Tramways Co., was taken on the question of brake power. He said the car weighed 8 tons, and was fitted with hand and power brakes. The latter worked by short-circuiting the two motors, and, if applied in conjunction with the sanding of the metals, the car could be pulled up under ideal conditions in 30 ft. After making tests, however, he was doubtful whether a car could be pulled up in much less than 20 yards on the receipt of a sudden and unknown signal. The jury returned a verdict of "Accidental death," thinking that the evidence was not strong enough to warrant one of "Manslaughter" against the driver.

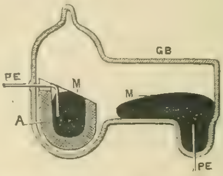
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Mercury Switch.

It has long been known that an electric current of considerable voltage may be broken between mercury surfaces in an atmosphere of hydrogen, without an arc of serious dimensions being formed. The heat generated is remarkably small. Of late years such interrupters, consisting of small glass tubes with sealed-in platinum electrodes, partly filled with mercury, have been tried for many purposes, without, however, giving complete satisfaction. It has been found that they are apt to crack or even to explode after a while, or the mercury becomes dirty.

Two causes have contributed to these defects. The tubes have been made cheaply and hastily, and under such circumstances a considerable number will leak at the sealing-in of the wires. They may be leaky when they leave the blower's hands, or they may develop minute cracks later as a consequence of strain set up in the glass on cooling. In filling them such defects are not usually discovered, as they must be in the analogous case of vacuum tubes. After a while, oxygen gets in from the air, and an explosion may ensue, or the mercury gets oxidised when breaking of current takes place. In any case, the glass gradually deteriorates, probably owing to electrolytic action, at the point where the spark occurs, and finally cracks at this point after the tube has been in use for some time.

The mercury break illustrated herewith, when properly manufactured and tested, is stated to be free from these defects, and to be indestructible. The tubes are given a special annealing treatment, and are tested for airtightness and strain in the glass. The spark of break is taken up on a small porcelain cup A in the figure. The illustration is full size for 10 amps.; 500 volts are broken with certainty. How rapidly the break may be repeated depends upon the nature of the circuit; once a second is not too much on a load of incandescent lamps. The inventor and patentee is Mr. H. Stafford Hatfield, who is having the switches made in small quantities under his supervision; his address is Technische Hochschule, Brunswick, Germany.



G B, glass bulb; M, mercury; P E, platinum electrodes; A, porcelain cup.

Fig. 1.—Section of Hatfield Mercury Switch.

A Prometheus Toaster.

The British Prometheus Co., Ltd., of Salop Street Works, Birmingham, have introduced a new toaster, which is extremely neat in appearance, and is light and readily handled. The construction is simple and owing to the entire absence of solder and the abandonment of the "double case" construction which has hitherto been followed the toaster should prove to be durable, and able to stand the use of breakfast room and kitchen alike. The elements are of a new type, and while ensuring the correct distribution of incandescent rays, permit the resistance itself to be

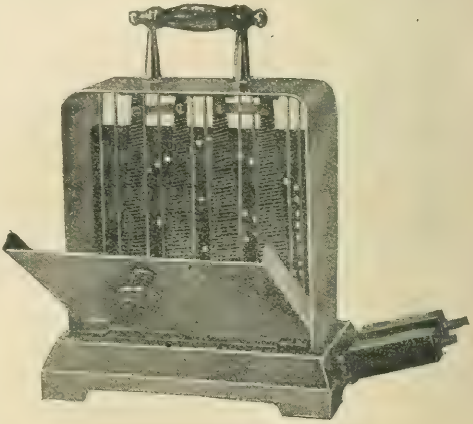


Fig. 2.—A Prometheus Toaster.

mounted in the most favourable manner possible. The bread, it is claimed, is toasted evenly over the whole of the surface, and it will be noticed that the doors are perforated to allow for the escape of moisture. Moreover, the doors are mounted so as to act as bread carriers, which will pull outward and downward, and they can be readily removed for cleaning purposes. The elements themselves are mounted in such a way as to afford every facility for renewal.

A.C. Motor-Starting Pillar.

We illustrate in fig 3 a recent addition to the standard ironclad control gear—Type D.F.C.—made by the General Electric Co., Ltd. This combination is for the starting of squirrel-cage motors by means of an auto-transformer starter shown at the bottom of the panel. An interlock device is fitted on the latter, which makes it necessary for the operator to move to the "start" position before he switches on to the "run." On the panel are also mounted an ammeter in a water-tight case an interlocked main switch and a separate three-pole fuse box. It will be noticed that all connections are run in screwed conduit. The whole pillar is liberally designed, and its rugged construction may be inferred from the fact that a 15-h.p. size weighs 420 lb. net. We understand that the General Electric Co., Ltd., are now specialising in the manufacture of starters for single-phase motors

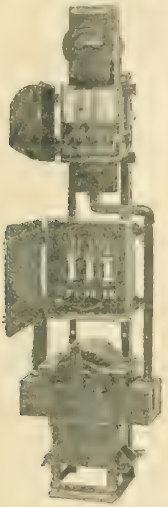


Fig. 3.—A G.E.C. Switch Pillar.

"Eclipse" Electric Heaters.

One of the most promising features of recent progress in electric heating is the willingness of makers to guarantee the durability of their apparatus, thus proving that the old complaint of unreliability can no longer be levelled against electric heating devices. The Electric and Ordnance Accessories Co., Ltd,, of Cheston Road, Aston, for instance, now give a guarantee for five years with their convector heating elements. A variety of new designs have been placed on the market by this firm, two of which we illustrate herewith. Fig. 4 shows a very inexpensive glow lamp radiator, of polished rolled copper steel, with polished copper reflector—a light and portable type. Fig. 5 is one of a series of combined convectors and radiators, in the "Sheraton" style, of antique dull brass; this is provided with three switches, and consumes, full on, 2½ units per hour. This type combines the advantageous features of both the convector and the luminous radiator, while either system can be used separately at pleasure.

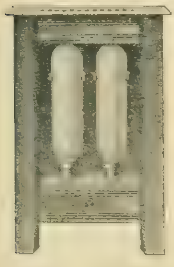


Fig. 4.—Portable Radiator.

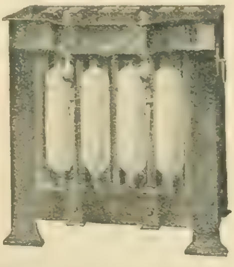


Fig. 5.—Combined Convector and Radiator.

B.T.-H. Mazdaliers.

The British Thomson-Houston Co., Ltd., of Mazda House Upper Thames Street, E.C. have introduced a new kind of fitting, called the "B.T.-H. Mazdalier." Two main considerations have been kept in view in the design of the Mazdalier—convenience in handling, storing and installing, and the provision of the most effective lighting results. Mazdaliers are convenient in the sense that they are supplied to the contractor packed in neat pasteboard cartons, which can be easily stocked on shelves. Every fitting is absolutely complete, with holders, galleries and wiring, and therefore the expense and trouble of installation are considerably lessened. The cartons, moreover, protect the fittings from dust and oxidisation. Mazdaliers are supplied in square and round tube types, for single lamps, or with two, three, four or five arms; and in two finishes, cloister (a rich oxidised copper) and brushed brass (a dull brass finish).

They can be easily and rapidly fixed, and made ready for service in a few minutes. The list prices cover holders and galleries, all completely wired—everything, in fact, but reflectors and lamps; and for a trifling capital outlay, and in a small showroom, a contractor can hold a large and varied stock of these compact fittings. Amongst other advantages, it is pointed out that by stocking a few of these fittings the contractor is in a position to execute experimental or temporary installations with a minimum of damage to the fittings and trouble to himself; and in shops, offices, houses, &c., whenever it is necessary to remove fittings, Mazdaliers can readily be taken down, packed in cartons, and stored, and kept in good condition until required. The prices of the fittings are so low that they can be used advantageously in place of cord clusters

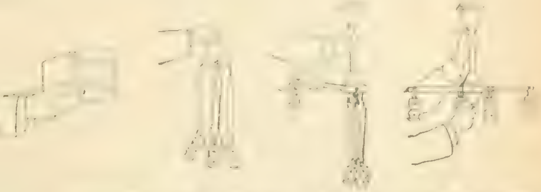


Fig. 6.—Mazdalier in Carton, as it Appears when Removed and Method of Building it up.

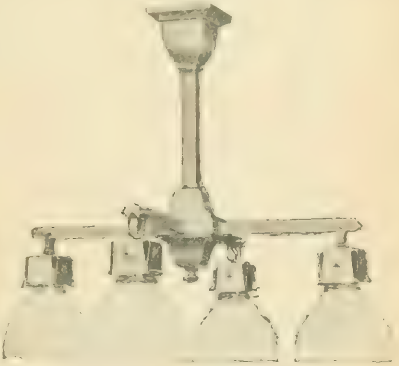


Fig. 7.—A B.T.-H. Four-Light Mazdalier.

The development of these fittings represents another stage in the B.T.-H. Co.'s "Good Lighting" campaign. First, the company placed the Mazda lamp on the market; next, they turned their attention to the provision of scientific and artistic reflectors, such as the Veluria and Holophane; finally, they have produced the Mazdalier fitting described above. By the supply of these lighting appliances, and with the assistance (in an advisory capacity) of the company's Illuminating Engineers' Department, the company claims that the contractor is enabled to meet every requirement of scientific and satisfactory illumination.

G.E.C. Cooking Devices.

The General Electric Co., Ltd., have brought out some additional cooking apparatus recently; this includes a breakfast set consisting of a hot-plate, a 1½-pint kettle and a 1½-pint saucepan. A neat little holder for four eggs is provided for the miniature saucepan. All the utensils slide on to the hot-plate, so that they cannot be accidently knocked off. Further, the "sliding-on" principle ensures the closest contact between the heating element and the utensil, thus making the appliance highly efficient in operation.

Another novelty is an electric teapot, so designed that after the water in the vessel has been heated by electricity to the boiling point, and the tea has become of the desired strength, the enclosed teaball, which holds the tea leaves, can be drawn up into the lid of the teapot. The capacity of the teapot is two pints, and it consumes 350 watts.

New G.E.C. Circuit-Breaker.

The General Electric Co., Ltd., have recently introduced a small circuit-breaker for A.C. and D.C., suitable for small motors, heating circuits, and other situations where fuses are inconvenient, which is to be known as the "Junior Salford" pattern. It corresponds in finish, design, and simplicity, to their "Standard Salford" and "Senior Salford" types, which at present range from 30 to 5,000 amperes, and upwards. The breaker will be made in various sizes from 5 to 50 amperes, in single, double, and triple-pole combinations, with overload or no-volt coils, and in open or enclosed type. The last named, which we illustrate in fig. 8, will have a cast-iron water-tight case complying with the Home Office requirements and Mining Regulations. The freehandle principle has been retained, while the closing handle acts a tripping device when it is required to open the circuit manually.

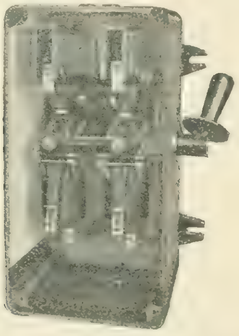


Fig. 8.—G.E.C. Junior Salford Enclosed Circuit-Breaker.

Insulating Shoes.

The St. Helens Cable and Rubber Co., Ltd., of Warrington, have sent us a sample of their new patent insulating shoe, which, as illustrated in fig. 9, consists of a golosh of ordinary type with crossed rubber ribs vulcanised upon the sole, the heel and the instep. The ribs do not add materially to the weight of the shoe, but considerably increase the safety of the user, for the amount of wear is very distinctly visible on the raised surface of the ribs, whereas it is difficult to tell how far it has affected a flat sole—especially as wear takes place inside the shoe as well as outside. An adjustable ankle strap enables the shoe to be worn on various sizes of foot over the boot, of course, with comfort. We have also received a sample of their cab-tire faced insulating mat, consisting of a sheet of insulating rubber faced with a layer of cab tire, which protects the former and greatly prolongs the life of the mat.

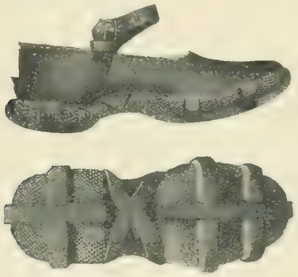


Fig. 9.—St. Helens Insulating Shoe.

BUSINESS NOTES.

Consular Notes.—Italy.—The British Consul at Naples reports that, although the concession for a metropolitan electric railway was granted to a local concessionaire only on January 12th, 1912, the negotiations for it had been progressing for some considerable time previously to this. The Société Franco-Italiana des Chemins de Fer Metropolitains de Naples, of Paris, is financing the scheme with an initial capital of 16,000,000 fr. The Naples office is in Galleria Umberto Primo. The line is to be 8 km. long in the town and is to have branches to neighbouring villages. There are to be from 13 to 15 stations in the town, with lifts and stairways to the outer surface. The greater part of the urban section will be underground. It is hoped to inaugurate the line within five years. Very little progress has been made with the execution of the scheme for the harnessing of the forces of the Volturno River for industrial purposes. Much difficulty has arisen from conflicting and competing interests. The Minister of Public Works has received the report of the Special Commission appointed by him to study the industrial and economic development of Calabria, especially with regard to the construction of three vast reservoirs in the Sila district. The projected works would seem to be of exceptional importance, and their execution of no great difficulty, owing to the formation of the land and its adaptability to be converted into vast artificial lakes. The three basins are to develop together a force of more than 160,000 H.P., which should provide ample power for electric light, traction, tramways and railways in Calabria, Basilicata and Pugia, as also for any other important industries which may be created on the spot. Furthermore, the water collected will serve to irrigate large tracts of the surrounding country, and, finally, by storing up the water, it would be possible to develop the course of the river Neto, on which project the State has already proposed an expenditure of £250,000. These extensive works, which are estimated to cost some £2,500,000, are to be executed by private enterprise without any intervention on the part of the Government, whose intention, however, is to further the scheme as much as possible. By the execution of this vast programme enormous advantages would accrue to the provinces of Calabria, where the present Minister of Public Works has already increased the railway mileage by some 600 miles.

Mexico.—The British Consul at Tampico reports that the concession for an electric tramway system has recently been acquired by British capitalists, and active work in construction will be started immediately. The same company have also purchased both of the existing electric light plants, and intend constructing a central power station for the lighting of the city, as well as for operating the electric tramways.

The Vice-Consul at Monterey reports that the Cia. Telefonica y Telegrafica Mexicana have owned and operated the telephone system in that city for upwards of 20 years under a Government concession which gave the company a monopoly. This concession having been modified, however, a new company, composed of native capitalists, and called the Nueva Telefonica de Monterey, has been formed, and is now engaged in installing its plant, wires, &c. It is expected that the competition of the two companies will give Monterey a cheaper and more efficient service than was formerly enjoyed. Both companies are placing their wires in the centre of the city in underground conduits.

The British Consul at Mexico City reports that, during the latter half of 1911, 541 km. of new Federal telegraph wires were strung in different parts of the Republic, and three wireless telegraph stations, viz., at Vera Cruz, Campeche and the Island of Madre Madre (off the coast of Tepic) were opened to the public. A direct telegraph service was inaugurated between Payo Obispo (Quintana Rooderista) and Corozal, in British Honduras, thus connecting the telegraph system of that Colony with the Mexican Federal system.

Norway.—The British Consul at Christiania reports that at the Christiansand Nickel Refining Works, where nickel is obtained electrically by Hybinette's method, the production in 1911 was 285 tons nickel, and 80 tons copper. The works have been extended to produce 600 tons nickel and 80 tons copper per annum. The Christiansand Works are taking over the Ringerike Nickel Works, and intend to refine the matte at Christiansand. The Norwegian export of calcium carbide in 1911 was about 60,593 tons. The cyanamide factory at Odda exported 13,172 tons, as compared with only 4,250 tons in 1910. The export of ferro silicon amounted to 5,745 tons. Electrothermic zinc exports amounted to 46,573 tons, chiefly from Sannesund, near Sarpsborg, but also from Trondhjem, mostly from imported raw zinc. There are two Norwegian aluminium factories at Stangfjord, and near Christiansand; their export is estimated at about 1,019 tons, or about the same as in 1910. The Norsk Hydroelektrisk Kvœlstofaktieselskab is stated to have acquired the greater part of the interests formerly held in the Rjukan companies, for the production of saltpetre, by the Badische Anilin and Soda Fabrik, and the chief administration of the concerns at Notodden and Rjukan has been taken over by the head offices of the first-named company at Christiania. Dealing with the Odda Works, the British Vice-Consul at Bergen points out that the cyanamide company (North-Western Cyanamide Co.) has increased its output of calcium cyanamide from 12,000 tons to about 15,000 tons per annum, the bulk of which is shipped to Germany, but considerable and steadily increasing quantities are sent to the United Kingdom and the British Colonies. The work has now been taken over by a a new British company, and the production is to be further extended up to 73,000 tons. The calcium carbide works of the Alby United Carbide Factories, Ltd. (who also own a factory at Meraker, near Trondhjem), are likewise arranging to increase their output from 30,000 tons to 80,000 tons per annum, of which about 56,000 tons are to be taken by the cyanamide company. The carbide company use about 20,000 H.P. from the electrical power station of the Tyssefaldene Co., but this will shortly be increased to about 56,000 H.P. The manager of the Tyssefaldene Co. is not resident in this district, but it is understood that the company own a small plant for the production of metallic alloys, and have had under consideration a proposal for the installation of a large plant for the electrical smelting of zinc. The eventual capacity of the power station is estimated at over 100,000 H.P., and is now being extended to a capacity of 84,000 H.P. In the three factories mentioned a considerable amount of British plant has been introduced. Dealing with electrical developments at Notodden, the British Vice-Consul at Skien points out that there are three factories for saltpetre, carbide of calcium electric smelting, &c. The electric power available is about 60,000 to 70,000 H.P., obtained from the Svaelgfos, Tinfos and Laenfos waterfalls. Proposals are also on foot to harness a fall above Hiternal so as to obtain electric power and transmit it to the Skien Fjord. If the idea is carried out it will mean an undertaking which will cost several million kronor. The municipal power works at Samnangar were nearly completed at the end of 1911, and were to supersede the present steam power works at Bergen in March last. The three turbines, one of which is to be kept in reserve, will develop a power of 3,500 H.P. each, and it is proposed later on to add others up to a total of 1,700 H.P. The machinery is entirely of Norwegian manufacture. The steam power station will be kept for reserve in case of emergency.

In view of the expansion of the use of electricity in Norway the remarks of the Vice-Consul at Bergen on British trade and the methods adopted by manufacturers are particularly interesting. He points out that whereas only 84 licences to British commercial travellers were issued in 1911, 352 were issued to German travellers. These figures require no comment. There are, however, distinct signs that British merchants have, within the last year or two, begun to show greater energy than formerly in pushing their business in Norway. In view of this increased interest, it might be suggested that British business managers and partners who wish to develop their trade with Norway might perhaps with advantage follow the example of some of our commercial rivals by undertaking personal visits in the country with greater frequency than now appears to be the case. Cases are known where this method has been attended with great success in other parts of the world, and more than one business man in Bergen has told the Consul that he would certainly feel more disposed to do business with a firm if he were in occasional personal relations with its head. Such a visit should be stimulating to resident agents, and need not interfere with the regular work of the firm's travellers, to which it would be supplementary. A knowledge of Norwegian, though, of course, a great advantage, would not in most cases be indispensable, provided German were spoken as well as English. It may, perhaps, not be out of place to point out that, in view of the attractions which the west coast of Norway offers to the tourist, a holiday might thus be made profitable as well as enjoyable, even if it were not thought worth while to come out for business purposes only. Local merchants, for the most part, take their holiday in June or July, and are in Bergen during August and September. Amongst the lines of business in which the United Kingdom does not appear to be getting her fair share of the business, one of the most noticeable of late has been electrical appliances. Although the resources of the country in water-power are still to a great extent undeveloped, the use of electricity is very general, and it would appear that the proportion of orders placed in the United Kingdom is relatively insignificant.

Japan.—The British Consul at Yokohama reports the trade in electric lighting, power and tramway plants there was steady during the year 1911, there having been a constant increase in existing plants and a considerable number of new undertakings brought forward. A difficulty, however, is that in most cases long terms of credit are asked for, which do not appeal to the manufacturer. The total value of electrical machinery imported in 1911 was £237,000. The increase in favour of gas-driven plants calls for passing notice ; both producer plants and suction-gas plants are inquired for. A feature of interest is the growth of water-power schemes in all parts of the country. Orders seem to be going mostly to Germany and to America. There has been a good demand for power and lighting cables for underground use, and the heavier and higher-tension cables are still ordered from abroad, but low-tension and the smaller cables are being made more and more in Japan under protection afforded by the tariff. Aerial and ordinary lighting and telephone wires are practically all made in Japan, the lead-covered cables only being imported.

Dealing with the tramways of Yokohama, the Consul points out that considerable extensions are now (1912) being made to the existing system, bringing outlying districts into close touch with the town. The work has been accompanied by much levelling and filling in of ground for building purposes, and whatever the actual prosperity of Yokohama, to the outward eye the city appears to be growing steadily. The following figures give the population and number of houses in recent years :—

	Population.	*Houses.*
1907	379,000	75,000
1908	393,000	78,000
1909	407,000	82,000
1910	420,000	84,000
1911	444,000	88,000

Allowance must, however, be made for the incorporation within the city limits of districts formerly outside. This amalgamation last year amounted to 12,000 persons and 2,000 houses.

The British Consul at Kobe, in a recent report, states that it is satisfactory to note that the fear expressed in some quarters that, on account of the revision of the tariff and the basing of some duties on the net weights, the importation of British machinery would show a serious falling off, was not realised in 1911. In comparison with Continental and American goods, however, British machines are, generally speaking, heavier, and therefore liable to higher rates.

The new tariff appears on the whole to work smoothly ; but in certain cases it is extremely difficult for importers to calculate the duty when making up tenders, as in certain instances it is assessed partly on the net weight of the goods and partly *ad valorem.* Switchboards and railway trucks may be mentioned as instances of this. The demand for electric traction plant in 1911 was brisk. The Ranzen Electric Traction Co. placed orders for machinery ; the Osaka municipality for rolling stock and air brakes ; the Hiogo Electric Railway Co. for sub-station machinery and rolling stock ; and the Keishin and Okayama Electric Railway Companies for high-speed engines and generators, boilers and rolling stock. Gas engine-driven stations for lighting and power were, as a rule, fitted with British plant, but German makers secured several orders by under-cutting British prices. Amongst important contracts for British machinery may be mentioned the contract for the equipment of the Kawasaki Dockyard in Kobe. The smaller town gas engines and suction gas plants are being made in Osaka in fair numbers. Large quantities of electric motors are made in Japan, but orders are still being placed in America, Germany and Italy, British prices being as a rule considered too high. Several thousand fan motors were imported from the three countries above-mentioned, and here again British machines are ruled out on account of price. Cables of all descriptions are largely made in Japan, though several orders have gone abroad. The demand for cables of the underground description is increasing as the tendency is to insist on high-tension cables being laid underground in the chief cities instead of being erected on poles overhead as heretofore. The Osaka municipality, the Kyoto municipality, the Kobe Electric Railway Co., the Osaka Electric Light Co. and the Ujikawa Hydroelectric Co. were large purchasers of cables during the period under review. For machine tools British makers secured several important contracts.

A demand has arisen for electricity meters, and large orders have been secured by a British firm. Recently, however, a very light type has been introduced from America and the Continent, and as the duty is assessed on the net weight of each instrument, our commercial rivals will probably secure more business in future. As regards water power stations, the Hiroshima Water Power Co. may be mentioned as having bought a large plant of British manufacture, and orders were placed for the Oita Hydro-Electric Co. for Continental machinery. This latter company is situated in Kyushin, but the orders were placed in Osaka. Incandescent lamps are made in enormous quantities in Tokio and Osaka—both carbon filament and metallic—and imports have consequently declined. The steam turbines ordered by the Nankai Railway and the Kobe Electric Light Co. were seized on arrival for infringement of patents controlled by a large American company having works in Tokio, and although the importers were finally allowed to deliver them, the case is still pending in the Courts ; consequently, British and German builders are hesitating to take orders.

During the year 1911 two serious scandals were brought to light. In one case the directors of an electric railway company were arrested for embezzlement of the company's funds, and in the other an electric railway campany repudiated a contract given to a British firm for British machinery, and the machinery was left on the hands of the importers. The Japanese Commercial Code was revised in October, 1911, and with ordinary precautions, such a case as the latter will not happen in future. During the year under review the Osaka Electric Light Co. placed a very large order for switchboards with a German firm. Two or three British houses tendered, but, as the German tender was much more detailed than the British ones, the latter were not seriously considered.

There has been a notable increase in the number of cases of extended terms of payment, and as British merchants as a rule do not care for this class of business, many orders were lost to our manufacturers.

The British Engineers' Association.—The Secretary has sent us the following particulars relating to this new Association :—President—Mr. Douglas Vickers. Vice-Presidents—Sir Robert Hadfield, F.R.S. ; Mr. Herbert Marshall ; Sir William Mather, P.C., LL.D. ; Mr. C. C. Scott ; Sir John I. Thornycroft, LL.D., F.R.S. Chairman of Executive Committee—Mr. Wilfrid Stokes (Ransomes & Rapier, Ltd.). Other Members of Council—Messrs. *H. Allcock (W. T. Glover & Co., Ltd.), A. Anderson (Edward Wood & Co., Ltd.), *T. O. Callender (Callender's Cable and Construction Co., Ltd.), W. Collingwood (The Vulcan Foundry, Ltd.), *Percy B. Crowe (W. H. Allen, Son & Co., Ltd.), F. R. Davenport (Willans & Robinson, Ltd.), *W. H. Dixon (Hadfield's Steel Foundry Co., Ltd.), *J. Cunningham Ford (T. Cooke & Sons, Ltd.), G. B. Hunter (Swan, Hunter & Wigham Richardson, Ltd.), Stainer Hutchins (The Power-Gas Corporation, Ltd.), Edward Jackson (Midland Railway Carriage and Wagon Co., Ltd.), Christopher James (Joshua Buckton & Co., Ltd.), H. Norman Leask (Heenan and Froude, Ltd.), *R. S. Lloyd (Hayward-Tyler & Co., Ltd.), Howard Marsh (George Fletcher & Co., Ltd.), Charles S. Schultz (Dick, Kerr & Co., Ltd.), *Arthur H. Smith (Holman Bros., Ltd.), T. Cuthbert Stewart (Stewarts & Lloyds, Ltd.), Philip Thaine (Vickers, Ltd.), John E. Thornycroft (John I. Thornycroft & Co., Ltd.), *Thomas Woof (Alfred Herbert, Ltd.). (Members of the Executive Committee are shown by an asterisk.) Honorary Members—Mr Byron Brenan, C.M.G., late Consul-General in China ; Sir Charle Dudgeon, one of the Commissioners for the Revision of Commercial Treaties with China ; Sir Walter Hillier, K.C.M.G., C.B., late Adviser to the Chinese Government : Mr. Claude Kinder, C.M.G the creator of the Chinese Railway system : Dr. George Ernest Morrison, newly appointed Adviser to the Chinese Government.

A Birmingham Supplies Business.—As we announced in our issue of August 30th, the Metallic Seamless Tube Co., Ltd., now have the headquarters for their electrical supplies business at Meta House, Corporation Street, Birmingham, a very central position. The building is one of six floors, two being devoted to a fittings showroom and general office accommodation, and four being used as stock rooms. The premises were opened in consequence of the need for additional premises due to increased business in electrical accessories cables and lamps In the showrooms there are varieties of electroliers, brackets, standards, &c., from which customers of the trade in the Midlands can make their selections. The stock-room floors are specially fitted up with every facility for the handling of goods. Each floor is 100 ft. long, running right through from Corporation Street to Newton Street; the goods and trade entrance is situated at the latter end. The top floor is devoted exclusively to lamps, shades, battery jars and other glassware. On the third floor general lighting accessories are stored, and on the ground floor conduit and conduit fittings, while in the basement there are cables, flexible cords, jointing materials, &c., as well as the trade counter. A goods lift serves all floors.

Book Notices.—"Les Canalisations Isolees." By J. Grosselin. 1912. Paris: Gauthier-Villars. Price 3 fr. 75 cents.

"*Bulletin* Mensuel de la Société Belge d'Electricité." August, 1912. Brussels: The Society. Price 1 fr. 75.

"Wechselstrom-Arbeitsdiagramme." By Emil Waltz. 1912. Berlin: Hermann Meusser. Price M. 22·50.

"*Transactions* of the Institution of Civil Engineers of Ireland." Vol. XXXVIII, 1911-12. Dublin: The Institution.

"*Boletin* de Ingenieros." Vol. III, No. 1. September 16th, 1912. Mexico: Secretaria de Guerra y Marina.

"*Bulletin* of the Imperial Institute." Vol. X, No. 3. October, 1912. London; John Murray. Price 2s. 6d. net.

"*Journal* of the South African Institution of Engineers." Vol. XI, No. 3. October, 1912. Johannesburg: The Institution. Price 2s.

Catalogues and Lists.—The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Net price list of 600-megohm grade rubber cables, of which large stocks are held at their London stores.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Leaflet No. 680, containing illustrated particulars of "Flexume" day and night electric signs, Aston "Midget-Lamp" signs for theatre service, and "Aston-Drum" double-sided illuminated swing or fixed sign.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—Booklet containing a full illustrated description of the construction and use of their new "Lumograd" instrument for the measurement of illumination. Copies will be forwarded on application.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—New catalogue, No. 537, giving very complete information respecting their dry cells, dry cell batteries, &c. A finger index separates sections relating to Obach dry cells for general purposes and for ignition, also Hellesen dry cells, Dura cells, and transport cells. Prices and general instructions are given. A separate leaflet describes and shows the Siemens "Satchel" electric lamp.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—Price list No. 15 (20 pages), containing full illustrated information, with prices, dimensions, weights, &c., of electric hand and bench drilling machines, grinding motors and accessories.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Folder relating to, and giving prices of, Osram drawn wire battery lamps for omnibus, motor-car and yacht lighting. Also a copy of the 10th edition of Section "H" of their catalogue relating to electric heating; this is a 16-page price list showing a variety of designs of luminous radiators, zig-zag luminous radiators, convectors, Bastian Quartzalite convectors, non-luminous heaters for ship, train and tramcar service, "Magnet" flat irons, electric kettles, and "Robertson" heating lamps.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Two leaflets illustrating aluminium bus-bars and connectors, and aluminium coils.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Mailing card concerning their breakfast cooker and grill.

The British Westinghouse Electric & Manufacturing Co., Ltd., Long Millgate, Manchester.—An attractive little folder (envelope series 4150/A), entitled "Kill the Chill," giving a few notes and prices of their convector and luminous radiators; also leaflet relating to Westinghouse horizontal gas engines.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.—New catalogue, consisting of some seven sections. The first of these, of some 32 pages, contains illustrations and very plainly indicated prices of incandescent lamps (Osram, Wotan, Mazda, Metfil, Tantalum, carbon filament, both English and foreign, "turn-down" lamps, &c.); the second section, devoted to arc lamps, includes Butt flame lamps, enclosed lamps, photographic lamps, cinematograph lamps, resistances, &c.; the third deals with cables and flexibles, jointing materials, &c.; the fourth (switchgear and lighting accessories) describes circuit-breakers, instruments, lampholders, wall plugs, switches, and a number of "Home Office" accessories; electric heating and cooking apparatus occupies the next section, Bastian, D.G., Price's, the Archer and Economic systems all being included, as well as lamp radiators; Holophane glassware occupies the next 16 pages; and the last section of all consists of 60 pages of illustrations and prices of electric light fittings of all kinds.

Schiersteiner Metallwerk, Schwerinstr. 3, Berlin, W., 57.—Leaflet describing a relay with enclosed mercury contacts for weak currents.

Allgemeine Elektricitats-Gesellschaft, Berlin.—Set of leaflets illustrating and describing the A.E.G. quick-break switches, motor switch panels switch cases, &c.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Eight-page illustrated list (No. 7,028), giving prices and data of the lamps used in their "Eye-Comfort" system of inverted, indirect and semi-indirect arc lighting, also resistances for same. The "Kandem" arc lamp suspension gear is also particularised.

The Brompton and Kensington Accessories Co., Ltd., 254-260, Earl's Court Road, Kensington, London, S.W.—24-page catalogue containing excellent illustrations, brief particulars and prices of the "B. & K." "Universal Electrical Home Needs." These include electric toasters, shaving-water heaters, flat-irons, electric kettles, boiling rings, tea-ball teapot, coffee percolators, coffee urns, chafing-dishes, &c. The company has been organised by the Brompton & Kensington Electric Supply Co., and it is introducing appliances which are the product of many years' experience, and which may be inspected at its showrooms. This catalogue is the first of a series to be issued by the company. Later ones will deal with cooking, heating and ventilation.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—The new catalogue of this company which has just been received, if it were worth its weight in gold would figure out substantially, for it is a solid volume of more than 500 pages of enamelled paper. It consists of 20 sections, with sectional divisional leaves to each, with printed tabs to facilitate reference. The opening pages contain a description of the company's works, and alphabetical and numerical indexes, also a particularly useful telegraph code. Coming to the sections, we think we shall find it somewhat difficult to select all the items from so vast a variety that should have mention, so we had better adopt a simpler method and state the sections, adding at the same time that, of course, any one of the sections can be obtained separately. Section "T," conduits and fittings and tools; "U," Simplex flexible wiring system, lead-covered wiring; "D," distribution boards, switchgear, enclosed fuses and fuse wire; "M," watertight fittings for mills and ships, also steel reflectors, &c.; "W," wires and cables for lighting, bells, and telephones, &c.; "A," accessories; "B," electric bells and telephones; "P," porcelain insulators; "L," metal-filament lamps; "V," fans and small motors, drilling machines, &c.; "H," electric heating appliances; "C," electric cooking appliances; "E," automatic electric lighting plants; "S," electric signs and stage lighting appliances; "I," instruments, ammeters, and voltmeters; "Z," electricity meters; "F," electric fixtures; "G," shades, glass and silk, Spookie shades; "R," Holophane glassware, vacuum cleaners, and sundries. As will be gathered, the contents cover all kinds of installation apparatus, with the exception of large machinery and generating plants. In addition to being of direct service to the trade, it is recommended for hanging in contractors' premises for reference by consumers. There is a substantial increase in the size of the catalogue in comparison with that issued a couple of years ago. Prices are as far as possible set out in tabular form. The firm are also issuing a small 24-page booklet, dealing with electric heaters and convectors, of a convenient size for the pocket or for enclosing with correspondence. This booklet is an abridgment of their large heating catalogue, and contains all the latest designs; some 50 different patterns are shown altogether. Supplies of these booklets may be obtained by contractors or central station engineers interested, overprinted with their names and addresses. A novel departure has been introduced by the company in making all the prices quoted for radiators inclusive of internal wiring between the switches and holders, such internal wiring being in every case brought to two substantial screw terminals mounted on a special bridge piece fixed to the inside of the case, so placed that it cannot be accidentally touched. Special flexible for use with these heaters can be obtained protected by wire armouring without extra cost, and a special form of wall socket has been designed for use with the armoured flexible.

Messrs. E. Bennis & Co., Ltd., Little Hulton, Bolton.—16-page pamphlet, containing a full descriptive account of their patent high-temperature coking stoker and patent self-cleaning compressed-air furnace, its construction and operation. Reports of tests of boilers fitted with these stokers are given.

Messrs. Hinchcliffe, Green & Co., Aire Street, Leeds.—Advance leaflet, giving description and tabulated prices of their single-phase squirrel-cage motors, for the manufacture of which they have equipped their works with up-to-date machinery. Copies of the list will be sent on application.

Messrs. Baxendale Bros., 96, Whitechapel, Liverpool.—A special net price list of electrical accessories is being issued to-day.

Messrs. Bergtheil & Young, Ltd., Finsbury Court, Finsbury Pavement, London, E.C.—Binding cover containing a number of lists (No. 50) detailing the "Bandy" variable-speed S.P. A.C. motors, for lift or crane service, giving tabulated prices, weights, &c.; also diagrams of connections, test curves; drum type reversing controllers; half-tone views appear of the motors applied to crane and pumping work.

Trade Announcements.—Mr. Harold Jaggar announces that he is continuing at Commercial Street, Batley, the business of Messrs. H. Jaggar & Co., electrical engineers.

Messrs. Hutton Bros., electrical engineers of Swindon, have, owing to increased business, taken the Quantock Works, Devizes Road, which they will open early in November, on completion of the necessary alterations.

Messrs. Doulton & Co., Ltd., are purchasing the goodwill and connections of the business of Messrs. J. Stiff & Sons, Lambeth, as from December 25th, 1912. Messrs. J. Stiff & Sons will discharge all their liabilities accruing to that date and will collect accounts in the usual course.

Liquidation.—Direct Gas Fuel, Ltd.—This company is winding up voluntarily, with Mr A. W. Good, of Moorgate Station Chambers, E.C., as liquidator. A meeting of creditors is called for November 11th

Electrical Trade with New Zealand—The report of the British Trade Commissioner for New Zealand in referring to the preferential tariff, states that the same goods which the Dominion is trying to keep out by higher duties in the interests of the United Kingdom, are being pushed in by British shipowners through lower freights granted on German and American goods, and the deliberate policy of the Dominion is thereby being frustrated. As the idea is prevalent that preferential duties apply to all imports, or at least to all classes of goods where there is serious competition from foreign countries, the report points out that in 1910 two-thirds of the total value of competitive imports came in under tariff items where no preferential duty exists, these including tools and a considerable portion of electrical goods. Among the commodities imported under the preferential section of the tariff, mention is made of motor and bicycle lamps, there being a considerable purchase of American electric lamps, which is no doubt influenced by the very large importation of American motor-cars. The imports of electrical machinery increased by £25,000 to £132,000 in 1911, and the share of Great Britain rose by £22,000 to £76,000, or from 50·5 per cent. to 57·6 per cent. In the case of gas and oil engines, the value expanded from £90,000 in 1910 to £129,000 in 1911, the British share having advanced from £66,600 to £104,000, and the balance being practically all of American origin. The British share of steam engines in 1911 was £8,354 out of a total of £9,203. Referring to the question of public works, the report states that the development of water-power is a matter of some importance. At the time of writing, tenders were being invited in connection with a large scheme for using the energy from Lake Coleridge for the supply of electricity to Christchurch and vicinity. Other proposed schemes are the utilisation of the Wairoa Falls for Whangarei, and also of Lake Waikaremoana. The development in these cases is not likely to be rapid, as the Government policy is to keep these matters under State control. The report is a comparatively short one, but the general advice given in it should be particularly valuable to those who wish to promote trade with New Zealand.

LIGHTING and POWER NOTES.

Acton.—In the friendly arbitration between the U.D.C. and the Metropolitan Electric Supply Co., Ltd., Mr. H. H. Collier has been appointed valuer, to act on behalf of the Council in the matter of rental to be paid by the company for certain lands referred to in the agreement, the preparation of which has been left in the hands of the clerk and solicitor.

Algeria.—The municipal authorities of Khenchela are considering a scheme for the establishment of a central electric lighting station in the town.

Barking.—The Electricity Committee has decided to increase all scale charges for current for power purposes by ½d. per unit.

Barnsley.—Some inconvenience was caused on Thursday evening, last week, when, at about 11 o'clock, there was a sudden failure of the electric light, the cause being, it is said, the violent collision of a taxi-cab with a fuse-box at the bottom of New Street. The service was restored within the hour.

Bispham.—As the Council is able to provide more electricity than its own district requires, it is proposing to obtain powers to supply lighting in the adjoining districts of Cleveleys and Thornton. The formal consent of Thornton Council is now being sought.

Brentford.—A mains extension to Brentford End has been decided upon by the Heston-Isleworth Electricity Committee, in order to supply current to the new offices and works which have been erected on the east side of the Grand Junction Canal.

Bradford.—The Corporation's electricity undertaking is in a flourishing condition, and on the past year's working a net profit of £8,052 is shown. For private lighting purposes 94,771 units more than in the preceding year have been sold, the bulk consumers have received 679,659 more than during the previous 12 months, whilst smaller consumers who require current for motive power and heating purposes have purchased 500,840 more units than a year ago. Owing to the increased output the total working costs per unit have decreased in spite of the higher price which has had to be paid for coal.

Burnley.—The Electricity Committee has considered the charges for electrical energy for power purposes, and has made the following changes: For the first 39 hours' use per quarter of maximum demand, 1¾d. per unit; all units above that amount, 1d. when the consumption is equal to or above 400 hours use per E.H.P. per quarter, ·9d. per unit flat rate; where it is equal to or above 500 hours, ·8d.; where it is equal to or above 600 hours, ·7d. Existing consumers will come on to the new scale at the end of the quarter. The Committee has been empowerod to make special charges to any consumers who will guarantee an annual consumption of 100,000 units of energy or more for a day load.

Bushey.—The U.D.C. has been asked by private persons to allow the E.L. mains to be extended to Bushey Heath, owing to the high price of gas. The matter has been referred to the E.L. Committee.

Caldy (near West Kirby).—The Wirral R.D.C. has decided to have Caldy village lighted by electricity.

Canada.—The Civic Power and Light Department of the City of Winnipeg is now considering the necessity of enlarging the capacity of the power house, owing to the rapid industrial development of the city, and the consequent demand for power. For the coming Spring it is recommended that two extra units be installed. The Department is now getting 95 per cent. of the new business of the city in competition with private corporations, which before the completion of the municipal plant last year, enjoyed a monopoly of the supply of light and power.

Seven hundred farmers of the township of Yarmouth, Ont., have applied to the Hydro-Electric Commission for power. This is significant; the Canadian farmer of the present day runs quite a lot of machinery, and some kind of power is indispensable. The gasoline engine now supplies this power, and its use has become general, but it appears that electricity is to have the preference.

Cheltenham.—The revenue account of the electric light undertaking shows that the receipts for the last year, inclusive of a balance of £3,644 from the previous year and £1,409 transferred from reserve fund, amounted to £28,793. The ordinary outgoings totalled £10,416, interest on loans took £4,775, and instalments in repayment another £3,877, while £3,672 was transferred to sinking funds. The balance in hand at the close of the year was £5,599, or an increase of £1,955. The number of units sold was 1,867,559, in the proportions of 658,501 for public lighting, 584,547 to private consumers, and 624,511 for traction. As compared with the previous year the increase was 94,341 units.

Continental Notes.—Austria.—During the month of August last, 36 projects for the utilisation of water power in different parts of Austria were submitted to the State Hydrographic Department in Vienna. During the same period 24 concessions were granted in respect of previous applications, the intention in the majority of the cases being to utilise the water-power in the generation of electrical energy for lighting and power purposes.

A large power station, described by the *Oest. Wasserwirtschaft*, is projected on the Danube, with a view to completely utilising the unappropriated power of that river for the production of electricity. The preliminary labours are so far advanced that an outline of the scheme is possible. It is intended to construct a low-pressure station, whose average capacity will be 135,000 H.P., and its highest 150,000 H.P., the electric current generated being destined for the use of the capital; and, with a view to independence of the variable water-level, the station will work in connection with the projected large station at Krems-Kamp. The constructive works comprise the building of a movable weir, of such a character that at high water it will offer no hindrance to navigation. This weir, it is considered, will take three years to build. A canal, 12 km. long, will conduct the water to the power house, and serve as a fairway for shipping. Its least waterflow will equal 50,000, and its greatest, 130,000 cb. m. per hour. At the end of the canal a lock for the shipping will be constructed, 200 m. long and 22 m. broad. The power house will be built to accommodate 18 Francis turbines. The whole of the constructive works are expected to be completed within the three years. In the opinion of our contemporary the installation, in its gigantic proportions, will place the greatest power stations of the world in the second rank.

Russia.—A new electricity generating station, for the supply of current for lighting and power purposes, was put into operation in Odessa on October 10th.

The factories in the Moscow district are rapidly adopting electricity as the motive power. According to a recent report, 20 out of the 48 establishments in the Lefort quarter of the city are now electrically driven.

Finland.—A large electricity generating station, with a capacity of about 2,000 H.P., is about to be established by Messrs. A. Ahlstrom and Co., of Norrmark, owners of large saw and paper mills in that town. The electrical part of the plant is to be supplied by the A.E.G.

Coventry.—At the meeting of the City Council on Tuesday, it was decided to spend £1,000 out of revenue upon the purchase of electric motors. The opinion of the Electric Light Committee was confirmed—that it was desirable that, in the event of a Bill being promoted in the next session of Parliament, a clause should be inserted to authorise an extension of the area in which the Corporation is empowered to supply electricity.

Dorset.—An effort is being made to form a County of Dorset Electric Supply Co. The share capital is given as £75,000, and 51,000 shares of £1 each are offered for subscription at par. The towns it is proposed to serve are Dorchester, Sherborne, Wimborne, Swanage, Blandford, and Lyme Regis.

Chile.—Plans and estimates submitted by Mr. George Kenrick for the erection of a central electric generating station for the purpose of supplying electrical energy to the town of Talcahuano and the suburbs of Morro, El Arenal and San Vicente have been approved. Twelve months are allowed for carrying out the work.

Dromore.—The promotion of an electric lighting scheme advanced another step at a special meeting of the Urban Council. The clerk read a letter from Mr. John Hamilton, offering a generating station site, with a lease for ever or for a term of years. There was a mill race in connection with the premises capable of supplying water for eight months in the year, and sufficient space to erect additional plant to supply motive-power for the remaining four months of the year. After a discussion, it was decided that the clerk should write to Mr. Hamilton, asking his terms. Mr. Burns suggested that buying out the gas company might be cheaper in the end. The chairman said, by adopting this scheme, they were agreed that electric lighting was cheaper. The engineers advised that £2,000 would be enough to spend the first year, and the present lighting of the town was costing £150 a year. The entire scheme would not cost more than £2,000. The clerk was given authority to obtain a provisional order.

Dudley.—The sale of the Corporation's electric light undertaking was again discussed on Thursday in last week, at a meeting of the local Traders' Association. In this instance the chief speaker was Councillor H. W. Hughes, chairman of the Corporation Electrical Committee, who contended that as the result of the sale the ratepayers would have returned to them every penny that the undertaking owed, they would be recouped for losses in the past years, and the existing rates for power and light would not be increased. The suggestion to retain the power station involved the provision of extra capital amounting to £23,000, plus a certain increase in the price of current to the tradespeople. The meeting passed a resolution declining to either recommend or condemn the sale of the electricity undertaking, but placing on record an opinion that much of the present difficulty in which the Electrical Committee finds itself is due to neglect and mismanagement.

Dundee.—The consumers connected to the Corporation mains are taking advantage of the cheap rate charged for heating and cooking, and a large number of radiators, hot plates and irons are now being used by them. An industrial laundry has been equipped with 15 electric irons, as well as motors for driving the various machines, and several fans have also been fitted.

East Cowes.—The U.D.C. has decided to invite the E.L. Committee to tender for public lighting, and to quote for the wiring and lighting of the Town Hall.

Eastbourne.—The Electricity Committee has decided to invite tenders for the supply of a number of new flame arc lamps to replace the present ones which are of an obsolete pattern. The engineer estimates the saving in consumption of current, after providing for the extra cost of carbons and interest on outlay, at £222 per annum.

Eccles.—The electrical engineer has been instructed to submit an estimate of the cost of removing the existing arc lamps on the tramway centre poles in Church Street, and providing and fixing on each centre pole a cluster of four metal-filament lamps.

Edinburgh.—Some time ago the T.C. agreed to obtain an estimate for the lighting of the Calton Hill by electricity. It has now been decided to get an estimate of the cost of high-pressure gas. The result will be awaited with interest in view of the Manchester report, referred to elsewhere in this issue.

Gravesend.—With reference to the application of Mr. Castle, of Northfleet, for a supply of current to his new cement works, the T.C. has decided to grant the request, subject to a proper agreement, with guarantees, being entered into. The capital expenditure necessary to give the supply is estimated at £6,200.

Greenock.—At its meeting on Monday, the Corporation decided unanimously to ratify the agreement with Port Glasgow T.C. regarding the supply of electricity for power and light to that burgh. It was arranged that an arbitration clause should be inserted in the agreement; Provost McMillan, who referred with satisfaction to the end of the long-drawn-out controversy, said it was probable that Port Glasgow would soon have a supply of electricity for all purposes, and that this would be to the interests of both towns.

Haslingden.—At the T.C. on October 24th, the chairman reported that application had been made to the L.G.B. for sanction to borrow £5,250 for the provision and laying of new mains, house services, &c. It was decided that authority be asked at the L.G.B. inquiry that the loan be so increased as to afford a supply of electricity to Helmshore.

Heston—Isleworth.—In a report to the Electricity Committee, Mr. Percy Rycroft, electrical engineer, says that some 18 months ago, 72 irons were purchased for distribution amongst various consumers. This stock has now been exhausted, and recent letters from consumers have shown that the irons were very much appreciated and were freely used. The original irons cost 7s. 6d. each, and he estimates that every iron in moderately active use represents a revenue of about 10s., in addition to such apparatus being an effective and reliable introduction for other apparatus, such as radiators, cookers, &c. For a further supply of 100 irons, Mr. Rycroft has now received a quotation from the manufacturers of 5s. 6d. for the 4 lb. size, and 7s. for the 6 lb. size, and he advises the Committee that this should prove a very good investment.

Heywood.—In consequence of the illness of Mr. A. A. Day, the Bolton electrical engineer, the Heywood Electricity Committee, has decided that Mr. S. J. Watson, electrical engineer to the Bury Corporation, be requested to give a report on the whole of the undertaking of the electricity works, and that a fee of 25 guineas be paid, such payment to cover all necessary attendances by him on the Committee.

The Electricity and Tramways Committee has made arrangements with the Burns Ring Spinning Co., Ltd., and Messrs. T. Isherwood & Co., Ltd., for the supply of current for power purposes.

Hove.—The local Ratepayers' Alliance has discussed at length the proposal to municipalise the Hove electric supply undertaking and passed a resolution condemning it, and requesting the T.C. not to proceed any further in the matter.

Ilford.—At the last meeting of the U.D.C., Councillor Philpot, speaking on the balance-sheet of the electricity undertaking for the past year, stated that the Council had had another successful year, and were carrying forward £1,600 to their reserve fund—an increase of £200 over last year. Their revenue had increased by £1,293, and their expenditure by £769, but included in the latter amount was £582 for the discounts that had been given for the prompt payment of accounts. By carrying forward £1,600 to the reserve and depreciation account, they raised that fund to £10,500, this being their actual cash reserve, which, with freehold land and premises, brought up the total value of the reserve to £11,890. The gross profits for the year amounted to £14,493, and they had generated 4,000,000 units.

India.—The first modern high-tension electrically-driven flour mill erected in India was recently started by Mr. A. M. Monteath, President of the Calcutta Chamber of Commerce.—*Indian Textile Journal.*

Ipswich.—St. Helen's School is to be lit by electricity, and the Education Committee has decided to allow Messrs. Mann, Egerton & Co. to tender for the installation in opposition to the Corporation electricity department.

Leigh (Lancs.).—The L.G.B. has sanctioned the borrowing by the Council of £2,511 in connection with the electricity undertaking.

London.—Marylebone.—The B.C. has agreed to extend the ½d. rate (on the telephone system) for cooking, to business premises under contract for lighting as from Christmas, 1912, and they will also be allowed, as an alternative to the existing rate, to have electric heating at ½d. per unit on payment of an addition of 20 per cent. on the primary charges under the telephone system, this to take effect as from October 1st.

St. Pancras.—Application is to be made to the L.C.C. for sanction to borrow £13,780, made up as follows:—Machinery, £5,914; mains, £5,240; services and switches, £2,005; meters, £621. The Electricity Committee has decided to insure the undertaking against loss of profits in case of fire for a period of one month, at a premium of £21 per annum, less 15 per cent.

Loose.—The Maidstone T.C. has asked the P.C. to be allowed to tender for public lighting by electricity. A supply is available from the tramway mains.

Oldham.—By a large majority the T.C. has decided in favour of a recommendation of the Electricity Committee that application be made to the B. of T. for sanction to an extension of the electricity mains beyond the municipal boundary, in order to supply energy to drive a cotton mill in the adjoining township of Chadderton.

Peterborough.—The Corporation had received the sanction of the L.G.B. to the borrowing of £500 for service extensions, and application is to be made for a further sanction for £1,000 for new mains.

Rickmansworth.—The U.D.C. has decided to protest against any of the roads in the rural area being broken up for the laying of E.L. mains, under an order being applied for by the Watford U.D.C.

Salford.—An agreement is to be entered into with the Guardians for a supply of current for lighting purposes to the several institutions under their control within the borough. The agreement covers a period of 10 years, and provides that the charge per unit shall be 2½d. Agreements are also to be entered into for supplies of energy with Messrs. Gatley, Vickers & Co. and Edward Wood & Co., Ltd. In the former case the company is to guarantee a minimum consumption of 50,000 units per quarter, at a price of ·8d. per unit for the first 50,000, and ·7d. in excess of the 50,000, these rates to be allowed on condition that the company uses either high-efficiency, metallic-filament or flame arc lamps throughout the works. The latter firm is to agree to a minimum of 400,000 units per quarter, and to pay an all-round price for current consumed for lighting and power at a flat rate of ·85d. per unit, based on the price of coal being 10s. per ton. A coal clause is inserted in each agreement.

Sevenoaks.—The newly-formed Electricity Co. has asked the R.D.C. to consent to the proposed application for a prov. order, which will include the rural parishes of Shoreham and Halstead. The Council has deferred its decision.

Stoke-upon-Trent.—It is expected that the formal opening of the new central power station at Hanley will take place about the middle of November. The site of the works, which were completed some weeks ago, is near Hanley Park.

Shotton.—Efforts are being made to carry out a scheme of E.L. for the district in conjunction with Hawarden and Queensferry. Particulars of the cost, &c. have been prepared by Mr. Dutton, of the Sandycroft Foundry, and a meeting of the ratepayers is to be called to consider the project.

South Africa.—The Harrismith (Cape Province) T.C. has under consideration the adoption of a hydro-electric power scheme in connection with the main water supply from Platberg Mountain. The scheme provides for an output double that of the present coal-driven electric light station, and also for practically an unlimited supply of day power for industrial purposes.

Swanage.—The B. of T. has deferred for three months the question of revoking the E.L. Order, 1906, held by the U.D.C.

Truro.—The T.C. has decided in favour of the Corporation applying for its own prov. order for E.L. Similar applications are being made, as has been intimated in the Electrical Review by the Gas Co., Mr. Pressland, of London, and Dr. Purves, of Exeter.

Uruguay.—The Bill creating a State monopoly of electricity supply and traction has now become law. By it the State is authorised to establish power stations where required, and to acquire by expropriation or by purchase the present existing undertakings in several towns in the interior, the Monte Video undertaking having already been acquired. Says the *Times* correspondent:—The creation of this monopoly means, in effect, the closing of the door upon all private enterprise in an important and appropriate field; and as the Government most certainly has neither the capital nor the administrative resources to meet the rapidly-growing requirements of the country in this direction, it also means a rude check to its progress. Traction, I may add, did not appear in the original draft of the Bill, but was included at the last moment in committee, no one knowing anything about it until the clause had been approved. This inclusion creates a formidable obstacle to future enterprise in the establishment of electric tramways and railways, for the Government is most certainly not in a position to supply electric energy for these purposes. The Bill is one of the fruits of President Batlle's Socialistic idea that all services of a public character should be performed exclusively by "the State," and as the present Chambers are entirely under his control, the idea is being given legislative authority, regardless of consequences.

Walthamstow.—The charge for current supplied to the tramways undertaking during the current year has been fixed at 1⅜d. per unit. The electrical engineer has been instructed to report as to the cost of controlling the whole of the electric street lamps in the district by means of automatic time switches, and as to the saving which would be effected.

Watford.—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £12,938 for additions to the electricity station, and the provision of cables for three years. There was no opposition.

Witham.—Steps are being taken to form a local company at Witham for the purpose of establishing an E.L. undertaking, with a nominal capital of £6,000, of which £4,500 will be called up at once. Messrs. Crompton & Co., Ltd., who have taken the initial steps in the matter, feel that the time is now ripe to inaugurate an E.L. undertaking in the town.

Wolverhampton.—Application is to be made to the B. of T. for a provisional order for supply within an area comprising the parish of Bushbury, and repealing the powers contained in the Midland Electric Power Distribution and Lighting (Extension) Order, 1900, as confirmed by the Electric Lighting Orders Confirmation (No. 7) Act, 1900, as far as regards the parish of Bushbury.

TRAMWAY and RAILWAY NOTES.

Australia.—According to the *Morning Post*, Mr. Hay, an English expert, who was appointed by the Government to investigate the traffic problem of Sydney, recommends the construction of a bridge to connect Sydney with North Sydney, so as to relieve the ferry congestion, and a system of underground electric railways for the city and the suburbs. The total cost of the work, exclusive of the bridge, is estimated at £4,500,000.

Barnoldswick.—In connection with the scheme for connecting Barnoldswick with Gisburn, by a light railway about 4½ miles long, at an estimated cost of £60,000, a Committee of landowners and manufacturers has been formed to take the matter in hand. It is proposed to apply to the Light Railway Commissioners for an order authorising the raising of the necessary capital, and the work of constructing the railway.

Chester-le-Street.—A deputation from the Council which waited upon the Gateshead Electric Tramways Co. with the request for an extension of the motor-'bus service from the tramway terminus at Wrekerton, through New Washington to Washington Village, was informed of the company's willingness to provide it, as there were already on order more motor-'buses than would be required for the proposed Low Fell to Chester-le-Street service.

Chile.—Plans submitted by Don Macario Ossa Cerda for the construction of an electric railway between Santiago and Valparaiso, passing by way of Curacavi and Casa Blanca, have been approved. The actual construction of the line must be completed within 14 months.

Continental Notes.—Austria.—The Austrian State Railway authorities have decided to establish a plant for the utilisation of the water power of the River Ill, near Nenzing (Vorarlberg), in the generation of electrical energy for traction. It is estimated that about 5,700 H.P. will be available.

France.—The estimate of £168,344 for the construction of the tramway projected between Grenoble and Villard-de-Lane has been sanctioned by the Conseil Général of the Departement of the Isère. *[illegible]*

A scheme is at present under consideration for the construction of an electric railway between Lourdes and Mauleon in the Basses Alpes.

Germany.—Official sanction has been accorded to the scheme for building a series of electric tramways between Mörs and Rheinburg in the Rhineland. The Rhenish-Westfalischen Electricitats-Werke are carrying out the undertaking, which will cost over £100,000.—*[illegible]*.

Spain.—An electric tramway scheme, due to a suggestion of King Alfonso, is in course of realisation to connect Segovia with La Granja. The engineer, Rafael Brenosa, nominated by the King, has completed the surveys for the permanent way, and is now engaged in planning the site for the hydroelectric station on the River Valsain. The line is intended for goods as well as passengers, and will thus stimulate the industrial prosperity of the districts passed through.—*Electron.*

Switzerland.—It is reported that the power station at Bardonnechia, erected for the electrification of the Mont Cenis tunnel, has been destroyed by an explosion and fire. The damage is estimated at £80,000, and the accident will indefinitely postpone the electrification of the tunnel.

Italy.—Plans are being prepared in respect of a projected electric tramway between Feramo and Porto S. Giorgio.

It is proposed to convert the steam tramway between Pisa, Pontedera and Navacchio-Calci to electric traction.

Dunfermline.—Mr. George Balfour, chairman of the Dunfermline and District Tramways Co., and several of his directors, have had a conference with the Town Planning Committee with regard to the tramway provision for the new territory in the neighbourhood of Rosyth. At one time, it was expected that the old Grange Road, which leads directly from the centre of old Dunfermline to a point near Rosyth Dockyard gates, and over which the company have running powers, would have been widened for tramway purposes. Now, however, it is stated that the main road which is likely to be chosen will be a new highway having an approach farther to the west. On behalf of his company, Mr. Balfour is said to be seeking powers which members of the Corporation value at from £20,000 to £40,000. No final adjustment was arrived at between the parties at last week's conference, but to the demands of the Council representatives, it is stated, Mr. Balfour is not willing to accede.

Edinburgh.—At its meeting last week the Tramways Committee considered a motion by Councillor Robertson, advocating the expediency of the Corporation itself taking over and working the tramway system after the expiry, in 1919, of the present lease of the Edinburgh and District Tramways Co. The Committee agreed to recommend the T.C. to adopt a resolution to this effect.

Elland.—The result of the plebiscite on the tramway question was made known last week. Nine questions had been asked the District Council, three having reference to Huddersfield and the remainder in connection with Halifax. There was a poll of 80 per cent. of the electorate, 2,285 votes being cast; 2,134 were in favour of the Huddersfield system, and only 112 against. For paying a subsidy to Huddersfield rather than miss the tramways 1,432 voted in favour and 688 against. In favour of the Halifax system there were 1,536 votes, against 644; 1,977 voted against a subsidy being granted to Halifax and 154 in favour of the subsidy. Only 264 votes were cast for giving a subsidy to Halifax, even if Elland missed the tramways thereby, while 1,829 were in direct opposition.

Halifax.—An agreement has been entered into between the Corporations of Brighouse and Halifax as the result of which the Halifax tramway system will be extended to the Sun Inn, Rastrick, a distance of two miles. One condition laid down by the Halifax Corporation is that Brighouse shall oppose the proposals of the Huddersfield Corporation to bring its tramway service along another route into the centre of Brighouse. Included in the arrangement is the widening of the Halifax gauge between Bailiffe Bridge and Rastrick from 3 ft. 6 in. to 4 ft., which will permit of a connection being made with the Bradford service at Bailiffe Bridge.

A conference has taken place between the Halifax and Bradford Corporations to discuss through-running arrangements between Halifax and Bradford, and Bradford and Brighouse.

Indian Railway Electrification.—From an Indian contemporary we gather that *pourparlers* are now passing between Sir George Clarke and the Administration of the Bombay, Baroda and Indian Peninsula Railways and the Bombay Port Trust, with a view to obtaining expert advice generally on the system of electrification to be adopted on all the Bombay suburban lines worked by these three bodies, the expenses of the investigation to be shared between them.

In sanctioning a scheme for rebuilding Colaba Station, the Bombay Government has laid down a condition that the railway south of Dadar Junction, at least, must be electrified, and this has brought matters to a head. At the end of 1910, Mr. Alfred Dickinson, consulting engineer to the Tata hydro-electric scheme, looking into the prospects of electrifying the Colaba-Bandra section, the power to be obtained from the Tata works.

Liverpool.—Presiding at the final meeting of the Tramways Committee for the municipal year, Sir Chas. Petrie announced that the first nine months of the present year had proved a record. Passengers numbered 99,903,672, an increase over the same period in 1911 of 4,130,330, or 4·3 per cent.; mileage was 9,349,669, representing an increase of 114,238, or 1·2 per cent.; receipts totalled £469,026, an increase of £22,237, or 5 per cent.; and earnings per car-mile were 12·04d., or an increase of ·43d. Having regard to the satisfactory receipts, which indicated that the public appreciated the service during the experimental period, the Committee decided to continue the running of the first-class cars on the Garston and Pierhead, the Croxteth Road, Calderstones Park, West Derby, Knotty Ash, and Aintree and Pierhead routes. The experimental period, which expired on September 26th, in connection with first-class cars on the Litherland and Lime Street route, had been extended for three months, but on the Wavertree route it had been discontinued owing to lack of support.

London.—The directors of the Metropolitan and G.N. and City Railways have notified an agreement whereby the former will take over the latter line as a going concern as from June 30th next.

The Central London Railway has also officially notified its intention of applying for Parliamentary powers to extend its line into the Thames Valley.

At the resumed and final B. of T. inquiry into the collision on the G.N. and Piccadilly Railway at Caledonian Road Station, the evidence of the motorman, who had sufficiently recovered to attend, was heard. According to him, the signal was off, showing a green light. The company's evidence is to the opposite effect, and neither was corroborated.

Scarborough.—In moving, at the meeting of the T.C., the adoption of the minutes of the Streets and Buildings Committee, Mr. F. A. White referred to an interview with representatives of the Railless Electric Traction Co., Ltd., as to the establishment in the borough of a system of railless cars, and hinted that the present tramway company would most likely be helped out of its dilemma.

Swansea.—The General Purposes Committee has received a verbal report from Mr. Selon (London), the tramway expert called in to advise as to running a tramway up Mount Pleasant and over Town Hill, with a view to the development for building purposes of the large Corporation estate. The gradient up Mount Pleasant is about 1 in 8, but Mr. Selon said that a perfectly safe electric tramway could be constructed, and recommended that at the top of the hill one branch should run along and join the Sketty terminus of the existing system to the west, and another branch extend to join the Carmarthen Road section of the existing tramways to the east. He was asked to send in a written report in time to enable the Corporation to apply to the Light Railway Commissioners for a provisional order to carry out the scheme.

TELEGRAPH and TELEPHONE NOTES.

The Balkan War.—The *Times* states that the representative of a wireless telegraph company has arrived in Belgrade to make arrangements with the Servian Government for erecting wireless stations in the newly-occupied towns, and providing a service between the allied Balkan armies.

Home-Made Telephones.—Farmers in the Temiskaming district, Northern Ontario, have just purchased three tons of wire to string between the farms, so that they can always be in telephonic communication one with another. They will cut the poles out of their own bush, dig their own post-holes, string their own wire and be their own electricians; and, lastly, own their own service. This is but following the example of other farming communities in Ontario, with a strong desire to get some of the advantages of civilisation without paying city prices for them.—*[illegible]*.

Imperial Wireless System.—The Select Committee appointed to inquire into the Marconi agreement with the Postmaster-General met on Saturday, and elected Sir Albert Spicer chairman. On Tuesday it began to sit for the purpose of taking evidence. It was announced that the Committee would hear any person who could bring before it any facts of which he might be possessed with reference to the charges or allegations of corruption on the part of any person or official in connection with the Marconi agreement.

At the first meeting of the Select Committee on Tuesday, Sir A. F. King, secretary to the Post Office, gave evidence, reviewing the history of the Imperial wireless scheme and the steps that had been taken towards carrying it into effect. It originated with the Marconi Co., which in March, 1910, applied to the Colonial Office for licences to establish a chain of stations throughout the Empire, without any financial assistance from the Government. The question was referred to the Cable Landing Rights Committee, which recommended that the scheme should be carried out by the State, and that negotiations should be opened with the Marconi Co. for that purpose. The Committee of Imperial Defence, on receipt of the above recommendation, in December, 1910, approved of that course, and treated the matter as urgent. At the Imperial Conference, held in June, 1911, a joint committee was appointed to carry into effect a resolution in favour of the establishment of wireless stations throughout the Empire, and the Post Office submitted proposals which included the payment of an annual royalty of £75,000 to the Marconi Co. for the use of its patents, a royalty of 5 per cent. on the gross receipts, and £50,000 for the erection of each station. The Cable Landing Rights Committee recommended the Postmaster-General to negotiate with the company on this basis, and an agreement was arrived at under which the company would construct the stations for £60,000 each, and take a royalty of 10 per cent. on the gross receipts for 28 years, with power to the Government to terminate the agreement after 18 years, or earlier if it ceased using the Marconi patents, together with other provisions. The tender was accepted on March 17th, 1912.

The Poulsen Wireless Telegraph Co. offered to erect long-distance stations at £34,000 each, but proof of the company's ability to effect continuous communication was not forthcoming. Tenders were not publicly invited, on the ground that no wireless company except Marconi's had acquired practical experience of long-distance working.

The witness was examined at length regarding the course of the negotiations. He stated that the Norwegian Government had made an agreement with the Marconi Co. at a higher price, and that estimates prepared by the Admiralty and Post Office engineers showed that the cost of the stations was reasonable. If the Poulsen Co. could have been relied upon to do the work, the Post Office would have accepted its tender, but the necessary experiments would have occupied a year or more, and the matter was urgent. The Poulsen interests had no company formed in this country, and no capital for experimental work. Had war arisen while the experiments were in progress, the position of the Post Office would have been indefensible. Sir A. F. King was still under examination when the Committee adjourned.

On Wednesday Sir A. F. King's examination was continued throughout the sitting, turning mainly on details in connection with the previous day's proceedings. The witness denied that the Marconi Co. acquired any monopoly under the agreement.

West Africa.—A wireless station at Fort Lamy, about 100 km. from Lake Chad, has just been completed, and has opened communication with the station at N'Guigmi, on the north-west side of the Lake, distant 210 km. The average range of these two posts is 300 km. Fort Lamy is the termination of the French telegraphic network in Equatorial Africa, which, by these new wireless posts, is placed in communication with French West Africa and with the European system, by means of the French cable from Brest to Dakar.—*Journal des Postes.*

Wireless in Wales.—The *Times* states that arrangements have been made by the Marconi Co. for the location of their Welsh trans-oceanic wireless station. The receiving station will be at Cefndu, near Carnarvon, while the transmitting station will be in the neighbouring county of Merioneth, close to Towyn.

Strike on a Cable Steamer.—According to the *Evening Standard*, 23 members of the crew of the cable steamer *Minia* struck work at Halifax, Nova Scotia; 14 were arrested and punished, but the other nine are still missing.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 5th. Balancer for the U.D.C. See "Official Notices" October 18th.

Atherton.—November 6th. One 250-KW. single-phase transformer, for the U.D.C. See "Official Notices" October 25th.

Australia. — SOUTH AUSTRALIA. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" to-day.

December 17th. Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

November 8th and 12th.—(*a*) 340 A.C. and 800 D.C. electricity meters; and (*b*) insulated copper cables, for the Melbourne City Council. See "Official Notices" October 25th.

NEW SOUTH WALES.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

Austria.—February 15th, 1913. The time for sending in tenders for an electric clock installation in Vienna has been extended to this date. Tenders to be forwarded to the Magistrats-Abteilung V., Vienna.

VIENNA.—November 11th. Supply to the K. K. Postökonomie-Verwaltung of 50,000 kg. of sal-ammoniac.

Barrow-in-Furness.—November 5th. Electrical and steam plant, &c., in connection with the electricity works extensions, for the Corporation. See "Official Notices" October 18th.

Birmingham.—November 13th. Uniform clothing and caps for the Corporation tramways. The Offices, Congreve Street.

Canada.—November 8th. The City of St. Boniface, Man., invites tenders for a variable speed motor and a motor driven pump (1 to 1½ million gals. per 24 hours) against a pressure of 65 lb. (domestic) and 100 lb. (fire). 550 volts three-phase A.C. City Engineer's Office for plans. 5 per cent. deposit. Tenders to Mr. J. B. Cote, City Clerk.

Dublin.—November 4th. General stores for a year, for the Dublin United Tramways Co., Ltd. See "Official Notices" October 18th.

November 5th.—3,000-KW. steam turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" October 18th.

Dundee.—The T.C. invites tenders for the reinforced concrete piling and foundation work for the extension of the generating station at Carolina Port. Mr. H. Richardson, general manager and engineer.

Eastbourne.—The T.C. has decided to invite tenders for the supply of new flame arc lamps for public lighting.

Edinburgh.—The Edinburgh and District Tramways Co., Ltd., invite tenders for general stores (engine and boiler), electric light supplies, castings, &c. Mr. C. W. Shepherd, general manager South Charlotte Street.

Egypt.—November 11th. Tenders are invited by the Egyptian Ministry of the Interior for a Diesel oil engine with accessories, and a three-phase alternator with exciter, required for the extension of the electric light works at Zagazig. Sealed tenders for the complete installation, made on stamped paper of 30 milliemes, to the "Directeur de la Section des Municipalités et Commissions Locales, Ministère de l'Interieur," Cairo. Bank guarantee for 2 per cent. of the amount of the offer, with tender. The *cahier des charges* and plans may be seen at the "Section des Municipalités," as above, where copies may also be purchased on payment £E. 2 (£2 1s. 0½d.), which will not be returned.—*Board of Trade Journal.*

France.—Paris.—November 9th. Tenders are required for the supply of battery material in two lots; also for telegraph office apparatus and accessories in five lots, and switchboards for telegraph lines. Tenders to be sent to the Sous-Secrétariat des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

Greenock.—November 18th. One 3,000-KW. three-phase turbo-alternator, with condensing plant, &c., for the Corporation. See "Official Notices" to-day.

Hull.—November 20th. Electric lighting, fittings and bells, for the Teachers' Training College, Cottingham Road, for the Education Committee. Particulars (deposit £1 1s.) from the City Treasurer, Guildhall, Hull. Drawings to be seen at the Education Offices, Albion Street.

Italy.—Leghorn.—November 12th. Tenders are invited for the supply of electrical coal-hoisting and unloading apparatus for the port of Leghorn.

Keighley.—November 11th. One 2,000-KW. steam turbo-alternator, for the Corporation. See "Official Notices" October 25th.

London.—L.C.C.—November 4th. Carbons, fittings, insulating materials and lamps, for a year. See "Official Notices" October 18th.

Port of London Authority. November 1st. Stores and materials, including carbons for electric arc lamps, carbon filament lamps, glass and glassware, india-rubber and gutta-percha goods, steam and other fittings, &c. Stores Superintendent, 106, Fenchurch Street, E.C.

L.C.C.—November 6th. Electric lighting installation at Mantua Street School, Battersea. See "Official Notices" October 25th.

L.C.C.—The Main Drainage Committee is about to invite tenders for new coal elevators and additional conveyor gear in connection with the extension of the boiler house at Crossness pumping station.

L.C.C.—November 13th. Electric lighting installation at the Ricardo Street School, Poplar. See "Official Notices" to-day.

Manchester.—November 9th. The Corporation Rivers Committee is inviting tenders for one 96-tube fuel economiser in sections of six tubes each, for Davyhume Sewage Works. Specifications, &c., from the Secretary, Rivers Committee, Town Hall.

Monkseaton.—November 13th. Construction of railways at Monkseaton, widening of a portion of the Avenue branch, and a new railway to Seaton Sluice, for the North-Eastern Railway. Plans, specification, and schedules of quantities obtainable from Mr. C. A. Harrison, chief engineer, Forth Banks, Newcastle-on-Tyne.

Morocco.—December 14th. Moroccan Adjudications Commission. 4,000 wooden telegraph posts. Tenders to M. le Président de la Commission Général des Adjudications et des Marchés, Dar-en-Niaba, Tangier. Copies of the form of tender and other particulars may be seen at the Commercial Intelligence Department of the Board of Trade, London, E.C.

Rawtenstall.—November [illegible]. Lancashire boiler, with superheater and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" to-day.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture. Commercial Intelligence Branch, Board of Trade, [illegible] Basinghall Street, E.C.

South Africa.—November 18th. The Municipal Corporation of Cradock, Cape Province, is calling for tenders for two 50-KW. Diesel oil engines and dynamos complete, also supply mains and public lighting. Specifications from Mr. B. A. Paterson, town clerk, on deposit of £2 2s.

Spain.—November 21st. The municipal authorities of Lirio (province of Valencia) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Lirio (Valenćia).

November 20th.—Tenders to the offices of the "Gobierno Civil de Jaén," for the establishment and working of a telephone system in La Carolina (Jaén). Although this contract will probably be awarded to a Spanish firm, nevertheless, the carrying out of the work may involve the purchase of some material outside Spain.—*Board of Trade Journal.*

Wakefield.—November 9th. Slack and smudge coal, for a year, for the Corporation electricity works. Electrical Engineer, Calder Vale.

York.—November 16th. Construction of about 1¼ miles of light railways, for the T.C. Mr. H. Craven, Town Clerk. Returnable deposit of £5.

CLOSED.

Barking.—The quotation of the British Westinghouse Co. has been accepted by the U.D.C., at £41, for an exciter and field resistance for a rotary converter; also the quotation of Messrs. Allen & Simmonds, at £181, for repairs to No. 5 engine at the generating station.

Bath.—Messrs. Lambert & Sons, Bath, after severe competition, have secured the contract for lighting the new hydro throughout by electric light, and also for part of the heating.

Burnley.—The tenders of Messrs. Siemens Bros. & Co., Ltd., London, for the supply of cable for the Colne Road section has been accepted.

Canada.—The British-Canadian Engineering and Supply Co. have been awarded contracts for supplying and erecting electric lighting plants in the following western towns:—Ruston-Proctor producer, gas engines and plant, together with all electrical equipment, both in and outside the power house; Gull Lake, Sask., 64 B.H.P.; Hanley, Sask., 50 B.H.P.; Outlook, Sask., 72 B.H.P.; Waldena, Sask., 50 B.H.P.; Rapid City, Man., 50 B.H.P. The suction gas plant, consisting of a gas engine and a gas producer, appears to be gaining considerable popularity in Western Canada. The Ruston-Proctor producer gas engine appear to be in favour.

Darlaston.—The Mechanical and Electrical Engineering Co., of Walsall and Birmingham, have secured the contract to equip the works of Messrs. J. and R. Rose, Ltd., of Darlaston, with motive power. They are putting in the Burnand patent wound rotor motors and regulators.

Eccles.—The tender of Mr. E. Beals—£202—for electric wiring and fittings, electric bells and telephones, has been accepted by the Corporation.

Halifax.—The Corporation has placed an order with the British Insulated and Helsby Cables, Ltd., for 3,400 yards ·075 E.H.T. 6,600-volt three-core cable.

Italy.—The tender of the Società Italiana G. Bono e Cia., of Milan, has been accepted for the supply of 30,000 zinc electrodes for Callaud piles.

The Società Metallurgica Vittorio Cobianchi, of Omegna, have secured the contract for the supply of 30,000 kg. of 3·17 mm. gauge galvanised iron wire for telegraph purposes.—*Giornale dei Lavori Pubblici.*

London.—L.C.C.—The Highways Committee received the following tenders for telephone cables required for the maintenance of the Council's various tramway telephones:—

W. T. Henley's Co.	(Accepted)	£1[illegible]7
Western Electric Co.		1[illegible]
Siemens Bros. & Co.		186
Johnson & Phillips		[illegible]

South Africa.—The Boksburg Municipality has decided to install a railless traction system, and, according to the *South African Mining Journal*, has accepted the following tenders:—

H. Ainsworth.—R.E.T. cars, £7,215.
Sykes.—Two motor-converters, £1,[illegible].
H. Ainsworth.—Spares, £40[illegible] 1s.
Dick, Kerr & Co.—Poles and fittings, £2,274.
Hubert Davies & Co.—Overhead line material, £1,2[illegible].
Hubert Davies & Co.—Cable and wire, £[illegible]
Telegraph Manufacturing Co.—Tower wagon, £11[illegible].
Dick, Kerr & Co.—Tools, £218.

India.—Messrs. Siemens Bros. Dynamo Works, Ltd., have secured the contract for "Wotan" traction lamps to the Great Indian Peninsular Railway Co. for the ensuing 12 months.

Reading.—The T.C. on October 24th accepted the tender of the Tudor Accumulator Co., Ltd., for a battery, at £899; and that of the Lancashire Dynamo and Motor Co., Ltd., for an automatic reversible booster, at £324.

Salford.—The T.C. has accepted the tenders of Messrs. L. E. Wilson & Co. for an electric fan, &c., £21; of Messrs. E. M. Evans & Son, for electric light cables, £354; and of the Earl of Ellesmere, for 2,000 tons of No. 2 best washed slack, 11s. 10d. or 12s. per ton, according to mode of delivery.

Rathmines.—The U.D.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for 428 yd. ·05 low-tension triple-concentric cable and disconnecting boxes.

Shanghai.—The Municipal Council has accepted the tender of the British Insulated and Helsby Cables, Ltd., for high and low-tension cables and trifurcating boxes.

Shrewsbury.—The T.C. has accepted the tender of Messrs. Adams & Co., of Shrewsbury, for electrical supplies.

Wolverhampton.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., at £270, for an additional panel for the main switchboard at the generating station.

Worksop.—The U.D.C. has accepted the offer of the British Insulated and Helsby Cables, Ltd., for 25 electrolytic prepayment meters.

FORTHCOMING EVENTS

Institution of Electrical Engineers (Manchester Local Section).—Friday, November 1st. At 7.30 p.m. At the Midland Hotel, Manchester. First meeting of the session. Address by Mr. A. A. Day, to be delivered by Prof. E. W. Marchant, vice-chairman.

Tuesday, November 5th.—At 7.30 p.m. At the University, Manchester. Paper on "The Turbo-Generator: A High-Speed D.C. Generating Unit," by Mr. W. Cready.

Royal Institution.—Monday, November 4th. At 5 p.m. General meeting.

Society of Engineers. Monday, November 4th. At 7.30 p.m. At the I.E.E., Embankment, W.C. Paper on "The Generation and Electrical Transmission of Power for Marine Transportation," by Mr. W. P. Durtnall.

Institution of Civil Engineers.—Tuesday, November 5th. At 8 p.m. At the Institution of Mechanical Engineers, Westminster, S.W. Presidential address by Mr. R. Elliott Cooper, and presentation of medals.

Institution of Electrical Engineers (Glasgow Students' Section).—Tuesday, November 5th. At 8 p.m. At the Royal Technical College, Glasgow. Address by Mr. W. W. Lackie, chairman.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, November 6th. At 7.30 p.m. At the Hotel Metropole, Leeds. Inaugural address by Mr. S. D. Schofield, chairman. Smoking concert.

Physical Society.—Friday, November 8th. At 8 p.m. At the Imperial College of Science, South Kensington. Papers on "A Method of Measuring the Thomson Effect," by Mr. H. R. Nettleton; "An Improved Joule Radiometer and its Applications," by Mr. F. W. Jordan; and "The Thermomagnetic Study of Steel," by Dr. S. W. J. Smith.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, November 4th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 5th.—"B" Company. Recruit instruction, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, November 7th.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 8th.—"D" Company. Recruit instruction, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, November 9th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

Registration of Contractors at Liverpool.—The decision of the Liverpool City Council requiring firms whose names appear on the Corporation list of contractors, and who wish to have them retained in future, to pay a registration fee of 5s., has occasioned much indignation in many trading circles. The British Electrical and Allied Manufacturers' Association has presented its protest against the resolution, and has written to the Council pointing out that the registration fee is regarded as objectionable, as adding an additional tax to the expenses, already heavy, incurred in municipal trading. The letter adds that members are proposing, subject to the direction of the Council of the Association, to refrain from complying with it, and asks whether the Corporation can see its way to rescind the resolution or hold it in abeyance.

Royal Mint.—The forty-second annual report of the Deputy Master, the Rt. Hon. William Ellison Macartney, shows that, during 1911, over 146 million pieces were struck. The issue of gold coin exceeded 33 million pounds sterling, this being more than 2½ times the average of the past 10 years, and 8 millions in excess of any previous issue. The net profit on the year's working amounted to £374,266. In the memorandum by Mr. Rigg, superintendent of the operative department, details are given of the cost of the coal-gas fuel recently adopted for bullion melting in the new melting houses (see Electrical Review, November 3rd, 1911). The figures show that, from April to December, 1911, the cost per cwt. of bullion (gold, silver and bronze) melted, was 13·8d., and the corresponding figure from January to March, 1912, was 11·1d. This reduced consumption has been brought about by various minor modifications, and there is good reason to anticipate further economy in the future. As no nickel-bronze alloy, involving as it does an increased consumption of fuel, was melted during the period referred to, the above figures cannot be regarded as an average year's work. For gold only during the year, the cost per cwt. melted was 5·2d. The new gold melting house has 10 furnaces, the necessary burners being supplied with gas from a 4-in. main and with air from a 5-in. copper pipe. The blower for the air blast is a No. 6 Reichelm, driven by a 14-h.p. Siemens motor. The silver house contains 16 furnaces; 6,000-oz. crucibles are in use, but the furnaces are adapted for an 8,000-oz. size, and these are to be substituted at an early date. In the gold house an ordinary day's melting is 3 tons of standard bullion, and in the silver house as much as 9·6 tons of silver can be dealt with.

Heavy demands were made during 1911 on the newly-formed stamp plate and die department, in connection with the preparation of plates and dies for postage and National Health and Unemployment Insurance stamps. Since the commencement of this work 125 adhesive stamp electros and 2,566 electros for postcards, and other stamp and instruction plates, have been prepared, as well as 62 electros for National Health and Unemployment Insurance requirements.

During the year the old "Grasshopper" atmospheric engine, employed to drive the automatic weighing machines, was replaced by a Siemens motor. Two other motors have also been installed, thus bringing the total number in use to 89, with a gross horse-power of 786. Arc lamps of various types number 78, as against 77 in 1910. Incandescent lamps have increased from 951 to 1,008, and three new electric radiators raise the number in use to 10. The average monthly output of the generators during 1911 was 29,163 units, as compared with 26,193 in 1910.

The report of the Deputy-Master of the Ottawa branch Mint states that electrolytic refining was commenced there in Jan., 1911, and that by the end of the year 10 silver and 12 gold cells were ready for work, the former for the first parting of the silver and the base metals from the gold, and the latter for the further refining of the gold thus treated. Owing to a difference in voltage of the two sets of cells, it was not found economical to use the same dynamo, as the introduction of resistance to balance the circuits would have caused complications. A smaller generator, giving 225 amps. at 15 volts, was therefore installed for the gold cells, and the original dynamo used for the silver cells only. A still smaller machine is used for the gold-dissolving cells for the production of gold chloride. By this means each set of cells can be worked at its maximum capacity. This plan has been adopted in the latest of the United States refineries. A successful innovation has been the heating of the gold cells by electric heaters in place of steam coils. The heaters are worked with a time switch, which automatically opens and closes the circuit every 12 hours, so that the current is not being used when the cells are idle.

Tramcar Accidents in Glasgow.—Answering a Parliamentary question by Mr. Watt, Mr. Robertson stated that 13 fatal accidents had been reported to the Board of Trade as having occurred on the Glasgow Corporation tramways during the present year, eight of which were due to persons being knocked down by a car. None of these accidents occurred on steep gradients, and in no case did the speed appear from the reports made by the Corporation to have exceeded 12 miles an hour. A speed of 16 miles is permitted on certain portions of the Corporation tramways, but on steep gradients lower limits of speed have been imposed.

In the Parliamentary questions Sir W. Menzies asked the President of the B. of T. whether, having regard to accidents on the tramway system of Glasgow, he would state, for the purposes of comparison, the number of miles travelled, the number of passengers carried, and the number of accidents on all the electric tramways in London, and the same figures for the Glasgow tramways. Mr. Buxton replied that during 1911 36 persons were reported to the Board of Trade to have been killed, and 927 to have been injured on the various tramway systems within the Metropolitan police district. The corresponding numbers in respect to the Glasgow tramways were 8 persons killed and 203 injured. Approximately 800 million passengers were carried during the year in Greater London in cars running 80 million miles, whilst in Glasgow about 275 million passengers were carried and 22 million car-miles run.

An Engineering Exhibition.—It is stated that an exhibition of the Engineering and Allied Trades will be held in Bristol during February next.

Electrical Trades Benevolent Institution.—The date of the annual festival dinner has been definitely fixed for Wednesday, April 16th.

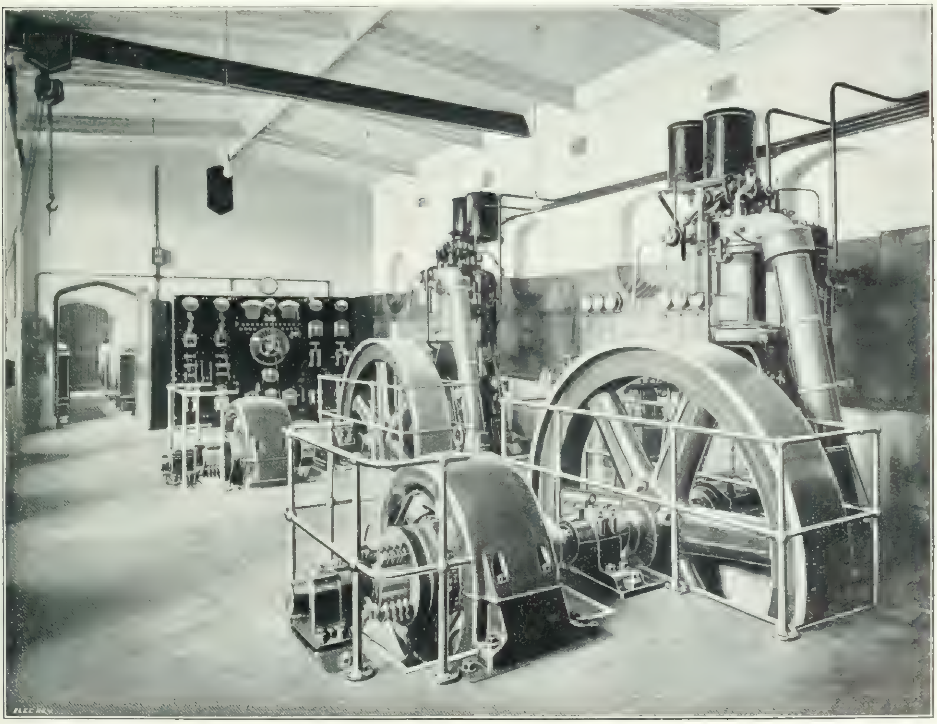
(*Continued on page* 710.)

ELECTRICITY AT STONELEIGH ABBEY.

Stoneleigh Abbey.

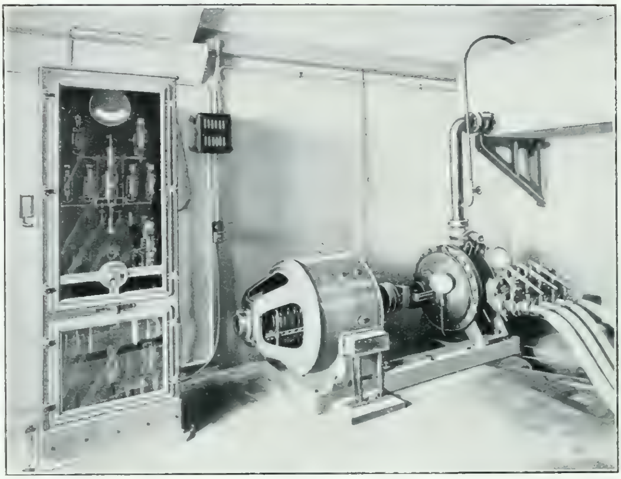
We were recently enabled by the courtesy of the Right Hon. Lord Leigh to pay a visit to the installation of electric light and power which has been carried out at Stoneleigh Abbey, Kenilworth, the family seat of Lord Leigh, by the Midland Electric Light and Power Co., of Leamington Spa. This installation presents many features of more than ordinary interest; in addition to a very extensive lighting scheme, it provides for the electrical driving of the farm and estate machinery, and a novel and effective system of fire protection, and it has been carried out with a single eye to the attainment of the most satisfactory results, regardless of the cost. Safety and durability have been amongst the most prominent considerations, and the amenities of the historic mansion, a large part of which was erected in the tenth century, have been most carefully preserved.

The system employed is two-wire direct current at 100 volts, a pressure which has proved, with metallic filament lamps, quite adequate to meet all requirements. The generating plant has been housed in a building which formerly formed part of the stables, and, as will be evident from the accompanying illustration, is both lofty and well lighted, besides providing ample floor space. The plant consists of two Diesel engines coupled to shunt-wound dynamos; the engines, which were built by Messrs. Sulzer Frères, are rated at 50 B.H.P. each, running at 250 R.P.M., and drive four-pole dynamos supplied by the Electric Construction Co., Ltd., of the interpole type, giving 260 amperes at 100 to 150 volts. Over each engine a girder run-way is provided to carry lifting tackle. Fuel oil is stored in a 10-ton underground tank outside the building, from which it is raised by a hand-pump to an elevated drum, whence it gravitates to a pair of filters near each engine. A pair of storage cylinders containing compressed air for starting purposes is provided, with the blast receiver, for each engine, and the two sets are coupled by pipes so that they can be used in connection with either engine. The local water supply is hard, and to avoid deposit in the jackets the cooling water is circulated through a Little cooler provided with a motor-driven fan, so that the same water is used continuously; this is a novel and useful feature of the plant. In view of recent events, it is interesting to note that provision is made for blowing off any lubricating oil which may—and does—find its way into the blast receivers, by means of a connection to the bottom of the latter. The exhaust from each engine is taken into a drum silencer, from which it passes through a short pipe into a second drum, by way of extra precaution against noise, before it escapes to atmosphere; and an expanding cone device at the top of the exhaust pipe further guards effectively against



Interior of Engine Room at Stoneleigh Abbey.

Saloon in Stoneleigh Abbey.



Rees Roturbo Electric Fire Pump.

nuisance from this cause, the exhaust being inaudible at a short distance.

The main switchboard is situated at the end of the engine room, and provides for two main feeders, besides the two generators and the storage battery. A Chamberlain & Hookham meter is connected in circuit with each feeder, and two, for charge and discharge respectively, with the battery. An Everett-Edgcumbe leakage detector is mounted on the board beneath the end-cell regulating switch, which is operated on the discharge side with a Trumpy automatic regulator. The latter has been found quite satisfactory.

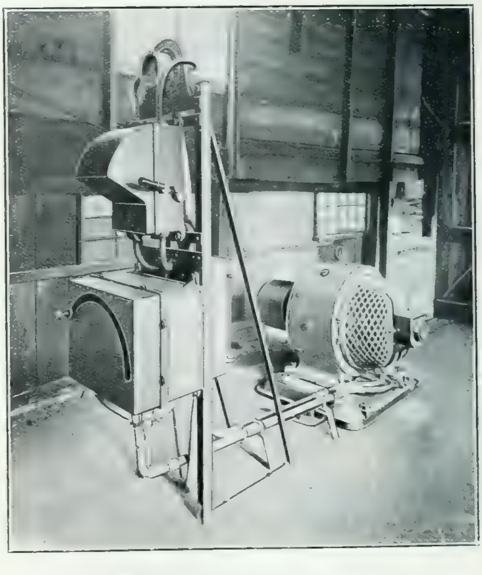
The connections from the switchboard to the battery in the adjoining room are of solid bare copper rod, bent cold, and carried through the wall in ebonite tubes; in the battery room they are carried on porcelain bobbins.

The battery consists of 56 Tudor cells, each of 2,000 ampere-hour capacity at the 10-hour rate, and is believed to be the largest installed in any private house in this country. It is capable of giving a discharge of 800 or 900 amperes for short periods without injury, and can supply power to a 40-H.P. motor in the sawmill, or to the fire pump, for several hours. The room in which it is housed—another part of the old stables—is large and airy, and is well ventilated with the aid of Sturtevant electric fans.

From the main switchboard a pair of two-wire feeders of 0·4 sq. in. section, insulated with vulcanised bitumen, are laid on the solid system, in earthenware troughing, to the Abbey and the farm buildings respectively. In the Abbey the feeder is looped into a main switchboard in the old part of the building, and is carried on to a similar board in the newer portion. Each of these boards is provided with main double-pole switches and fuses, and is combined with a distributing switchboard controlling the distributing fuseboards on the various floors. The wiring is everywhere enclosed in screwed solid-drawn steel tubing, supplied by the Credenda Conduits Co., of Aston. The greatest possible care had to be exercised to carry out the wiring without injury to the existing decorations, the wainscoting and panelling being in many cases of great age and beauty, and it will readily be understood that heavy expense was incurred in dealing with this difficult and delicate part of the work; but it was very successfully accomplished, the conduit being everywhere concealed (except in the basement) without showing a trace of its erection. The existing fittings also had to be utilised as far as possible; these were mainly candelabra and colza lamps, and in the former electric candles were employed, as illustrated in the adjoining view of a saloon, while the latter, having opal globes, were easily converted, though the wiring of the fittings presented some awkward problems. Under the circumstances, it was impossible to introduce modern methods of illumination such as indirect lighting, and we cannot but think that personal comfort and freedom from glare have been sacrificed to an affectionate regard for the antique.

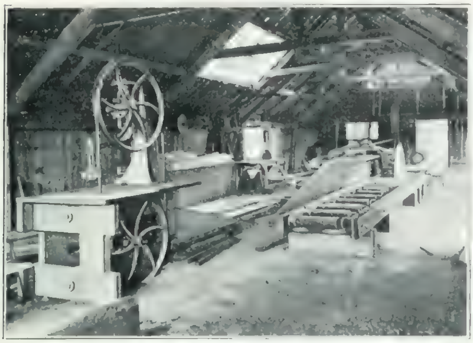
No attempt has yet been made to carry out even a portion of the cooking electrically, though a considerable number of electric heaters, both radiators and convectors, are employed. In other respects, however, full advantage has been taken of the capabilities of the supply; for example, electric fans and hot plate cupboards are freely used in the huge kitchen and elsewhere, knife cleaners and plate polishers are driven by motors, and an automatic electric organ-blower has been fitted to the organ in the old Chapel which forms part of the Abbey. The installation comprises some 1,500 Osram lamps in all, though the exact number cannot easily be determined. The original vaulted crypt is lighted with electric lamps fixed in the ancient lanterns on the walls.

In the farm buildings—which are all lighted with electric lamps in strong glass fittings—a chaff-cutter and corn-crusher is driven through a countershaft by a 6-H.P. motor,



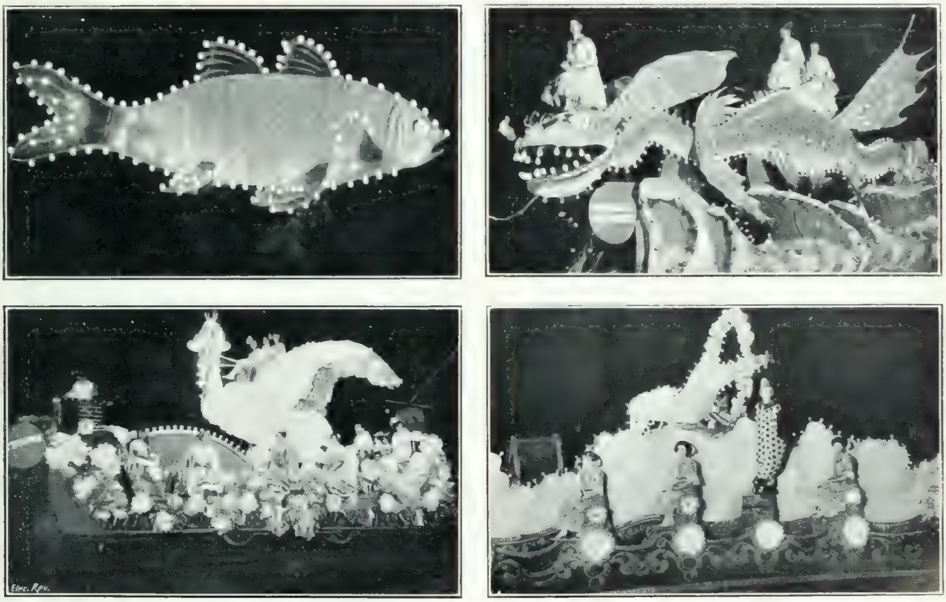
Motor driving the Sawmill.

and in the sawmill two circular saws and a band saw are electrically driven. In the latter case the motor, of 42 H.P., is mounted in a shed, together with the starting and regulating gear, as illustrated on page 706, and drives an underground shaft, which passes under the mill and drives the saws by belt. One of the saws is 5 ft. in diameter. The motors are of Messrs. Veritys' make, shunt-wound and provided with interpoles. Many of the workmen's cottages are electrically lighted.



Electrically-driven Sawmill at Stoneleigh Abbey.

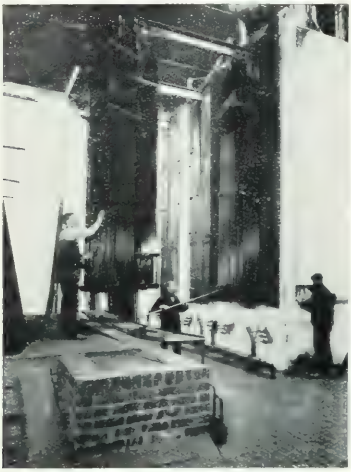
The electrical fire-pump installation is of exceptional interest. Formerly a large modern steam fire engine, hauled by horses, was depended upon, but the time taken to get this into operation—at least 10 minutes under the most favourable conditions—was a great drawback, as the most important period in the case of an outbreak of fire is the first minute or so, during which it can often be got under control. A very complete electrical pumping plant and system of hydrants has, therefore, been installed, which ensures the provision of an instant and abundant supply of water.



An Electrical Fairyland: Illuminated Devices at Los Angeles. (See p. 708.)

A ring main has been laid underground entirely round the Abbey, as well as a rising main which feeds hydrants on each floor, and on the roof of the building. Outdoor electric lamps are provided near the hydrants on the roof. The pumping plant is fixed in a pump house close to the Abbey, and about 100 yards from the River Avon, which flows past the Abbey at a level of 15 to 20 ft. below the floor of the pump room. The pump was made by the Rees Roturbo Manufacturing Co., Ltd., of Wolverhampton, the sub-contractors for the complete installation, and is driven by a motor rated at 35 B.H.P. for normal duty and up to 55 H.P. for emergency duty; the pump is continuously and automatically primed from the domestic water supply, and arrangements are made so that any leakage of the footvalve is at once indicated, so that the pump cannot fail to act directly it is called upon. An abundant supply of water is obtained from the river, which feeds a sump through a grating. The maximum output of the plant is about 400 gallons per minute at a pressure of 117 lb. per sq. in. We give on page 706 a view of the pump, showing the motor and switchgear, and four hoses connected with the fire mains above mentioned; in case of need, these hoses could be used to couple the mains to the steam engine, but that is a very remote contingency. The motor is controlled by automatic switchgear supplied by Messrs. Brook, Hirst & Co., which can be set in operation by push-buttons installed at the various hydrants; the speed with which the plant gets to work is extraordinary, the full pressure being available in less than half a minute. A great advantage of the Rees-Roturbo pump in this connection is its automatic regulation; no matter how many jets are brought into service, the motor can never be loaded above its normal rating, and the drop in pressure when a large number of jets are in operation is small, although the volume of water thrown per second is greatly increased. On the other hand, if all the jets are shut off no harm is done, as the pressure never rises above a fixed value; hence it is possible to leave the pump always connected with the main which supplies the Abbey, as there is no risk of a burst pipe and consequent damage to the contents of the Abbey. The pump gives a most efficient and unbreaking jet, to an unusual height. The switchgear does its work admirably; it runs the motor up to the full normal speed, and on emergency, resistance can be inserted in the motor field by hand, so as to increase the speed and output. The system, as a whole, is well worthy of the attention of owners of large buildings where an immediate supply of water in case of fire is a necessity, as it provides this with certainty and simplicity.

The fire pump is ordinarily used for watering the garden and similar service, which affords an additional guarantee that it shall be found in good order when an emergency arises. It will be noticed that the attendance of the fire brigade—composed of employés—is not necessary to bring the fire plant into use; any person at a hydrant can, unaided, start the pump instantly and bring a jet to play on the fire. Hence it is called the "one-man fire engine" by the members of the brigade.


Stoving Ovens for Enamelling Conduit at the Simplex Works (see next page).

The difficulty of drying hose which has been used has been neatly solved by placing a few electric heaters in a box lined with asbestos, and provided with connectors for the nozzles. The hoses are hung up from the rafters of the riding school over this box, with their lower ends fitting over the connectors, and the natural up-draught of heated air through them soon dries up the moisture, with a current of 20 amperes at 100 volts.

Element Winding Room at the Simplex Works.

A complete system of telephones connected with an exchange with 20 ways has been installed in the Abbey and the houses of various members of the staff of the estate; a special jack-board has also been provided for the use of Lord Leigh, which enables him to isolate any person from the system and to speak with him alone, without going through the exchange, and therefore without the possibility of interruption or overhearing.

Provision is made in the coach-house, now a roomy garage, for charging an electric brougham, and doubtless in course of time many other uses will be found for the versatile agency which is now at the disposal of the residents. As regards the economic aspects of the matter, it is interesting to note that whereas, when oil was used for lighting and coal for driving the sawmill, &c., the former cost £300 a year and the latter £200, the total cost of fuel oil for the Diesel engines, which has replaced both these items, for a year was only £25. The capital charges on the plant would go far towards balancing these figures, but the facts are certainly remarkable, and, of course, the convenience, safety, saving in labour, and other advantages of electric light and power are all to the good.

In conclusion, we must express our thanks to Mr. Percy Olver, the manager of the Midland Electric Light & Power Co., who has been responsible to Lord Leigh for the whole of the installation, and also to Mr. Fish, the estate engineer, for affording us the opportunity of visiting this very excellent example of country-house equipment, and for providing the photographs and particulars embodied in this article.

AN ELECTRICAL FAIRYLAND.

More beautiful and dazzling than the dreams of the "Arabian Nights," or the wonders of Grimm's fairy tales, are the electrical pageants that take place every two or three years in Los Angeles, California—a city of fiestas and carnival displays. These electrical wonderlands are usually given in connection with the gatherings of some great organisation, such as the Order of Elks or Shriners, when delegates and visitors flock from all parts of the world to this pleasure-loving city to elect their officers and (mainly) to have a good time. On these occasions great parades are the order of the day (and night), and it is in connection with the night pageants that the marvellous electrical floats are sent through the streets. The expert electricians and the artists work together on such occasions to produce masterpieces of imagination, painted in coloured light. Each float costs about a thousand dollars, and contains myriads of incandescent bulbs of all colours, which are used to outline the fantastic designs. Many of these are chosen from the characters of Mother Goose or fairy tales, and others depict weird and wonderful creatures such as the octopus, the sea serpent or the dragon, while such creations as gigantic gold-fish, dragon flies, storks and all manner of animals, insects and birds are reproduced in gigantic size and blinding coloured lights. Some of these devices are reproduced on p. 707.

Assembling Shop for Heating and Cooking Apparatus.

No horses are used to draw these electric floats, as they are built upon flat cars and derive power to propel them from overhead wires, with which they make contact by trolleys. No drivers are in sight, as they are concealed by the decorations, and the pageant moves through the streets with no visible means of propulsion. The lighting is also derived from the overhead wires, and in some of the floats electrical mechanism is used to give motion to the weird creatures. For instance, the gold-fish waves his fins and moves his head from side to side as if he were swimming, while the stork extends his long neck and peers in every direction. The sea-serpent wriggles and rolls his eyes, and the trick horse regularly jumps through a hoop every couple of minutes like a circus nag. In some instances fountains of real water are kept playing by a little electric motor, and in others a "flasher" causes waves of light to traverse the design of the float, giving a brilliant and living effect.

To add still more to the beauty of the pageant, places are arranged on most of the floats for young girls, clad in classic drapery, who toss flowers to the by-standers along the streets.

No royal procession in other centuries could equal the vivid display of colour and light which our own age has been able to produce from the mysterious fluid, electricity, which produces effects as wonderful in their beauty as are its manifestations of power in their majesty.

THE SIMPLEX CONDUIT WORKS.

Some years ago (November 9th, 1906), we described and illustrated the Simplex Co.'s works at Garrison Lane, Birmingham; since then additions have been made which include departments devoted exclusively to the manufacture of fuse wire and enclosed fuses, decorative metal work, electric light fittings, and electric heating and cooking.

On the opposite page we give some views taken in the factory, which gives permanent employment to upwards of 300 hands, and is one of the most complete of any devoted solely to the manufacture of the smaller kinds of electric lighting and power supplies and current-consuming devices.

The conduit and fittings department is specially laid out for the manufacture in quantities of fittings and accessories for conduit wiring, which now number many hundreds of different types.

The switchgear and fuse department is devoted to the manufacture of main switchboards, sub-distribution boards and kindred apparatus. All types of sub-distribution boards are assembled in the shop, as well as motor-control panels, switchboard panels and main boards for private plants.

As an auxiliary to the manufacture of distribution boards, the company some years ago laid down very complete machinery for the production in large quantities of fuse wire and enclosed fuses, and they are now among the foremost manufacturers of this class of material. All grades of enclosed fuses are made, from 3 amperes low voltage up to 300 amperes at 2,000 volts. The company are also sole makers of Hope's "Bi-Metal" fuse wire. A large hydraulic press has been installed for the manufacture of fuse wire and strip.

The company have largely developed the manufacture of cast-iron watertight fittings for use in factories and for outdoor lighting. For this purpose, as well as for the manufacture of conduit fittings, a very extensive foundry for casting in common iron, malleable iron, brass and aluminium has been established.

Arising out of that section of the works set apart for the production of the conduit system is a department devoted to the assembling of the china accessories for use therewith; these include the many types of "porcelain interiors" which have been designed for use with conduit boxes, jointing pieces, and similar labour-saving devices.

The company have a large department devoted to the manufacture of heating and cooking material. In addition to the standard material which is manufactured, this department is in a particularly favourable position to undertake special work, such as electrically-heated appliances for restaurants and for industrial purposes, at the shortest notice. In the element winding section alone nearly 20 hands are employed. In connection with this department is a very completely equipped test-room, in which all appliances are thoroughly examined before leaving the factory.

A year or two ago the company purchased the business of Messrs. Jesson, Birkett & Co., the well-known Birmingham firm of art metal workers, and upon this incorporation have built up their electric fittings department, which is directly under the control of Mr. T. Birkett, late managing director of Jesson, Birkett & Co. An extensive plant for plating in copper, nickel, silver, pure tin, and for bronzing has been installed, and another department is devoted to the manufacture of fans and small motors.

The company have now established offices, branches and agencies throughout the country to the number of 12, at which stocks of Simplex material are maintained. In a large number of instances representative showrooms are also included, and each branch is under the charge of a competent engineer.

ELECTRIC COOKING IN A SCHOOL.

The accompanying illustration shows the "Tricity" cooking installation in the kitchen of St. Cyprian's School, Eastbourne, which has been carried out by the local "Tricity" agents, Messrs. R. H. & J. Pearsons, and comprises four standard ovens, 19 in. × 16 in. × 14 in., four 2-gallon urns, and two duplex and two single cookers for boiling and grilling. The apparatus is divided into three batteries, respectively for roasting, hot water, and grilling and boiling; each battery is independently controlled by a main switch and fuse, a system permitting easy extension in any direction.

An Electric Kitchen

The school is situated on the outskirts of the town at the foot of the Downs, so that Mr. Brydges, the Eastbourne engineer, deemed it advisable to give a supply by installing a 12·5-kw. Berry transformer connected to the high-pressure mains; this has been placed in a brick chamber immediately outside the kitchen.

The maximum demand of the installation is 15 kw., and a minimum consumption of 10,000 units per annum is guaranteed. During term time the household numbers 100.

Concreting Wooden Poles.—The Indianapolis Light and Heat Co. now makes a practice of concreting all its poles at the ground line to prevent rotting and deterioration, some 1,500 poles having been so treated during the last season. New poles are erected and first allowed to stand a year to make sure that they have become firmly set. With a small spade an opening 4 in. to 5 in. wide is then made all round the pole to a depth of 3 ft. or 4 ft., and this is poured full of concrete, tamped securely and troweled off with an inclined water-shed to prevent water from standing about the base. The concrete collar extends a few inches above the ground, and gives a neat appearance to the pole base. A concreting gang of four men with a team can concrete eight to ten poles in this manner in a day. Estimating the cost of keeping such an outfit in the field to be about $15 a day, Mr. T. A. Wynne, general superintendent of the Indianapolis company, figures the cost of concreting poles at $1.50 each. Experiments with enclosing the poles in a covering of concrete before erection have also been carried out at the company's pole yard. These earlier experiments have all been discarded, however, in favour of the new plan of concreting at the ground line, the portion to which the major part of the deterioration is confined. Old poles as well as new are receiving this treatment, which is expected to extend their lives by an amount far exceeding the outlay for the concreting work.—*Electrical World.*

NOTES.

(*Continued from page* 704.)

Fatalities.—On 23rd ult., at Southwark, an inquest was held concerning the death of Thomas Woodland Crane (33), an electrical fitter in the service of the L.B. and S.C. Railway Co., who died in Guy's Hospital on the previous Sunday from the effects of burns sustained earlier in the day in the course of his employment in the company's electric sheds at Norwood Junction.

Mr. C. H. Brewer, solicitor, and Mr. R. H. Houghton, superintendent of the electric department, represented the railway company.

Herbert Sansom, foreman of the electric sheds, stated that before going to supper on Saturday, October 19th, the deceased had done some work in No. 4 road, the current from which witness had cut off. Witness gave Crane the key of the switch. The same key controlled the current for Nos. 5 and 6 roads as well. At a quarter to one a.m. witness was in his office when he saw the light go out, and he at once knew that something had happened. Just then deceased's mate came and said, "Mr. Sansom, Crane is on No. 7 road, and the current is off." Witness replied that 7 and 8 were alive, and that Crane had the key for 4, 5 and 6. Rushing into the switch cabin, witness put No. 7 road to earth, and went up to the station and told them to keep the current off. On going to No. 7 witness found the deceased on the roof of a train with his feet hanging over the guard rail. He was in flames, and witness eventually smothered these by the aid of some coats, motorman Cruse having meanwhile come to his assistance. The deceased was then removed to the store room, where his injuries were treated, and he was afterwards conveyed by train to Guy's Hospital, where he died the same day. When asked what he was doing on No. 7 road instead of No. 4, the deceased replied, "What road was I on?" When witness told him he was on No. 7, he answered, "No. 7; well, I have got the key for Nos. 4, 5 and 6." Although he was in dreadful agony, he added, "No one was to blame, only myself." Witness subsequently examined the train, and found that the bows were up instead of down, and that the high-tension door was shut instead of being open. The deceased should have lowered the bows before commencing work or getting on top of the train. Mr. Brewer explained that there was not a printed rule to this effect, but it would be put in the revised rules which were now in the press. The deceased well knew that the bows should have been down. The voltage was about 6,500 volts. Witness added that he had himself told the deceased that the bows should be down while work was being done. He could not account for the deceased being on the wrong road. He was a careful man, and had never met with an accident before. It was the duty of the deceased to come to him for the key of the switch controlling the section on which he was going to work. If he had asked for the key of No. 7, the accident would not have happened. The bows being up would not have made any difference if the road had been dead. Witness heard that the rear part of the train was alight after the accident. The deceased was about to put a new strip of aluminium on the bows, and he could not have done that while they were resting against the overhead wire. The deceased had done Nos. 4, 5 and 6 roads. Mr. Brewer intimated that the accident had been reported to the Board of Trade. Continuing, Mr. Sansom said he was responsible for cutting off the current. Men never allowed him to see them working with the bows up.

Bertram Mackrell, the deceased's assistant, who was mounting a ladder at the time, said deceased touched the live wire, which short-circuited, and set fire to his clothes. Witness admitted that the deceased did not always lower the bows, and on one occasion he had remonstrated with Crane for taking unnecessary risks at the Crystal Palace. Witness also admitted that he had been supplied with the company's book of rules, but had never looked at them. They sometimes disregarded the rule which required the high-tension doors to be closed. Deceased, he added, was a skilled mechanic.

Dr. Arthur James McNair, of Guy's Hospital, described the deceased man's terrible injuries, and said he died from shock following the electric current and the burning. Witness did not know how many volts it took to kill, but they had a patient alive in the hospital who had had 6,000 volts. The deceased told Witness that a short circuit occurred at Tulse Hill, and all the lights went out; that he got on the train by mistake, and the current was turned on.

Mr. Brewer said the effect of the deceased touching the live wire was to make a short circuit and stop all the electric trains. The lighting of their sidings was done by the Croydon Corporation, independently of the company's own supply.

After hearing further evidence, the jury returned a verdict of "Accidental death," adding that they were unable to agree as to whose fault it was—whether the company's or the deceased's. Mr. Brewer expressed the company's regret at the accident, and their sympathy with the widow and family.

Post Office Engineers.—In the Parliamentary Papers Mr. Snowden asked the Postmaster-General whether it was to be understood that 44 was the total number of second-class engineers who, as the result of his reconsideration, were to be advanced to the class of assistant engineers. Mr. H. Samuel replied that as the result of a very full and searching inquiry into the claims of the second-class engineers to be advanced to the class of assistant engineers, he had been glad to find himself in a position to confer immediate advancement upon 44 officers. He hoped to be able to grant similar advancement to a limited number of other members of the second class as opportunities arose.

The Johannesburg Gas Engines.—It will be remembered that one of the conditions of the compromise between the Johannesburg Municipality and Messrs. Beardmore & Co., was that the firm should be granted a three months' option of purchasing the gas plant for the sum of £5,000. The option expired in July last, and, in consequence, the whole plant became the property of the Council. The Tramway and Lighting Committee then decided to ask Prof. Dobson to report as to the value of the plant. After a preliminary investigation, Prof. Dobson asked the Committee to vote a sum of 200 guineas for a thorough investigation. The Committee approved of his suggestion, the sum was voted by the Council, and endeavours are now being made to turn the engines to account.—*South African Mining Journal.*

A 15,000-kw. Unit for Manchester.—We are interested to learn that the Manchester Electricity Committee last week accepted the tender of Messrs. James Howden & Co., Ltd., of Glasgow, for the above plant, with Messrs. Siemens as sub-contractors for the alternator, and Messrs. Richardsons, Westgarth, for the condensing plant. The main turbine will be of the Howden-Zoelly pure impulse type, with 14 wheels, designed to work with a steam pressure of 200 lb., superheat 200° F., a vacuum of 27½ in., and to run at a speed of 1,000 R.P.M. The shaft diameters at the journals will be 16 in. The main alternator will be of the totally enclosed type, and will embody all the recent improvements in design introduced by Messrs. Siemens. The ventilating air is to be supplied by fans on the rotor as well as by an external blower. All air will be filtered by the standard method adopted at Manchester on all the large turbo-alternators, the air being taken in and exhausted from the top half of the stator frame. The rotor of the machine will be of the solid type, cylindrically wound. The main condenser will be of the "Contraflo" design, and will be worked in conjunction with circulating pumps of the Rateau type, in duplicate, both sets being steam turbine driven. The kinetic air-pumps and water pumps are also to be in duplicate, and each line is to be driven by an auxiliary steam turbine. The weight of the turbine and alternator will be 250 tons, which, with the inclusion of the condensing plant, will bring the total up to approximately 350 tons.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall, S.W., on Thursday, October 24th, when there were present Messrs. A. H. Stanley (London United), chairman; H. E. Blain (West Ham), W. C. Ullmann (East Ham), F. Schofield (Leyton), L. E. Harvey (Ilford), C. Mittlehausen (Bexley), A. Coveney (Erith), W. Hammond (Metropolitan Electric), S. Dudman (Dartford), E. J. Vaughan, (Luton), and T. B. Goodyer (Croydon), hon. secretary. The following were unable to be present: Messrs. W. Holmes (Barking), W. Murray (Walthamstow), R. Birkett (Southend-on-Sea), R. C. Bullough (Colchester), T. Medcalf (Swindon), P. N. Gray (Gravesend), J. A. Forde (Isle of Thanet), A. T. Lambert (Maidstone), A. V. Mason (South Metropolitan), T. B. Holliday (Hastings), and Z. E. Knapp (London United). Mr. H. E. Blain was elected chairman, Mr. W. C. Ullmann, vice-chairman, and Mr. T. B. Goodyer was re-elected hon. secretary.

The Electrical Engineers' Ball, 1913.—The tenth annual Electrical Engineers' Ball is to take place on Friday, January 31st, at the Hotel Cecil.

Electric Sleep.—Following on the experiments of Dr. Leduc with direct current, Dr. F. Nagelschmidt, of the Berlin Finsen Institute, has succeeded in employing alternating current to induce sleep and anaestesia without injury to the patient, the margin between an adequate "dose" and the amount necessary to cause death being much greater than in the case of direct current.

An Electrical Scaling Machine.—A demonstration was given a few days ago at Messrs. Swan, Hunter & Wigham Richardson's dry-dock at Wallsend-on-Tyne, of a new machine for scaling ships' plates, which is claimed to be equally efficient in scaling the internal surfaces of boilers, &c. The machine is manufactured by the Electrical Engineering and Equipment Co. The demonstration took place on the outer skin of the Russian volunteer ship under repairs at the docks. The tool consists of four steel wheels, similar to milling cutters, and the driving power is a small electric motor, power being conveyed through a flexible shaft to the cleaning tool. The motor has a speed of from 1,000 to 1,500 R.P.M. When the power is applied the cutters fly from the centre rotating at a high speed and when applied to the scale it is instantly removed. The patentee of the machine was pitted against an expert worker with a pneumatic tool, and the result was that the electric cleaner accomplished in four minutes what it took six minutes to do with the pneumatic tool. There was a large attendance of official representatives from the neighbouring shipyards.

Manchester Electro-Harmonic Society.—The first meeting of the session of the Manchester Electro-Harmonic Society was held on Friday last at the Albion Hotel, Manchester, when about 150 members and friends were present. The president, Mr. S. L. Pearce, in opening the proceedings, said he was glad to see so many present. Since the inaugural concert in the spring, there had been an increase in the membership, and everything promised for a successful future. At the time of the last concert there was a membership of 70, but the membership to-day stood at 123, and there were also about 25 vice-presidents. That showed an increase of 53. The concert, which was given under the management of Mr. W. J. Smith (hon. musical director), was of a very high order, and was much appreciated by the members present. The next concert is fixed for Friday, November 29th, and good artistes have been engaged.

Institution and Lecture Notes.—Institute of Marine Engineers.—At a meeting held on October 11th, Mr. Summers Hunter, the new president, dealt with various questions connected with the past, present, and future of marine engineering. He made reference to the electrical propulsion of ships, and said that it had been so far exploited chiefly by Americans, but the Clyde and the Tyne were both again to the fore in this new development, with which the name of Mr. William P. Durtnall would always be associated. He mentioned the electrically-driven vessel *Jupiter*, which the American Government were fitting up and also a vessel being built by Messrs. Swan Hunter & Wigham Richardson, at Newcastle, of 2,400 tons dead-weight capacity, the latter vessel being driven by two Diesel oil engines, electrically geared to the propeller by the use of the polyphase A.C. system.

Rontgen Society.—The report of the Council for the past year shows that the revenue fell short of the expenditure, the deficit being met from reserves. Sir James Mackenzie Davidson is the new President, and Mr. C. E. S. Phillips hon. treasurer, Dr. F. H. Low continuing as hon. secretary.

Junior Institution of Engineers.—The annual meeting is to be held on Wednesday, November 13th, at 7 p.m., at the I.E.E. Building, Victoria Embankment.

The Polytechnic, Regent Street, W.—The first of the special series of lectures on illuminating engineering was delivered on Friday last. Mr. W. C. Clinton, of University College, gave a brief account of the fundamental laws of light and colour, and showed some interesting experiments illustrating the appearance of coloured objects illuminated by the arc lamp, the mercury vapour lamp, and the neon tube. The next two lectures of the course, on November 1st (to-day) and November 8th, will deal with electric lighting, and will be illustrated by lantern slides and exhibits of the latest types of lamps.

Institution of Electrical Engineers (London).—The dates announced for London meetings during the 1912-1913 session, which opens on November 14th with Mr. Duddell's presidential address and the presentation of premiums, are as follows:—

November 28th
December 12th and 19th
January 9th and 23rd, 1913
February 13th and 27th
March 6th and 13th
April 10th and 24th
May 1st and 22nd

Spanish Government Supplies.—Referring to foreign supplies to Spanish Government Departments, the *Gaceta de Madrid* of October 1st publishes several alterations in the list of articles in the requisition of which the Spanish Ministry of War and Ministry of "Fomento" may permit foreign competition. The more important additions to the list include gasoline, lubricating oils, sectional iron, steel, high-class machine tools, heavy wood-working machines, leather-working machines, telephone apparatus, small crucible furnaces, electric furnaces for tempering and fusing metals, appliances for extracting foul air, water meters, surgical and medical apparatus of all kinds, apparatus and luminants for lighthouses, special light and sounding buoys. There is no change in the other Government Departments' lists of material for the supply of which foreign competition is admitted. These lists may be seen by British firms at the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

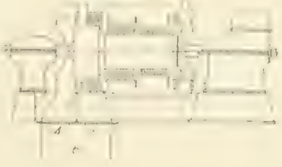
Electric Clocks.—The placing of an electric clock outside certain premises at the corner of High Street, Clapham, and Venn Street, to advertise an electric theatre, was held by the Court of Appeal this week to be a projection bringing forward the front of a building. The matter came before the Court upon an appeal by the Electric Palaces, Ltd., from an order made by Mr. Justice Joyce in an action brought by the lessors, A. C. Jones & Co., Ltd. The Electric Palaces, Ltd., were, by the terms of their lease, under covenant not to make any alterations to the front, nor by means of any projection to bring forward the front of certain rooms above a shop in the occupation of Jones & Co., at the corner of High Street, Clapham, and Venn Street. The rooms in question were used for the purpose of advertising an electric theatre in Venn Street, but Mr. Justice Joyce held that the erection of the clock was a breach of the restrictive covenants of the lease, and this view was upheld by the Master of the Rolls and Lords Justices Farwell and Hamilton.

Appointments Vacant.—Assistant electrical engineer, for the Bray U.D.C. (£104); switchboard attendant, for the Portsmouth Corporation (25s.); clerk, for the Swindon Corporation Electricity and Tramway Departments (£70); electrical fitters and armature winders, for H.M. Dockyard, Devonport (36s.). See our advertisement pages in this issue.

The Aluminium Price Advance.—According to statements emanating from aluminium trade circles in Germany and Switzerland, an exceptionally large demand has arisen for aluminium, and it seems as if the upward movement in prices will develop into a general rise. The consumption experienced a large increase in 1910, whilst further progress of considerable extent took place during the severe contest which preceded the recent reconstitution of the International Syndicate. At present the call for articles for military equipment in the Balkans is very active, and the whole of the production of aluminium in the United States is being absorbed by domestic consumers. As contrasted with the present brisk demand, it has to be remembered that the production of the companies using water-power in the Alpine districts is directly influenced by the situation of the water in the winter. The price of ingots has already reached the stage of £85 per ton.

Electricity Supply.—A small private electricity supply business, which has been running for some seven years, is hampered by want of capital for extensions. As the district has never been canvassed, there is probably fair scope for development, if any reader cares to take it up.

Steam Turbines with "Exhaust Disks."—In the *Revue de Mécanique*, M. Delaporte recently pointed out that there is a certain pressure limit beyond which the turbine ceases to benefit by any further expansion. If, however, part of the exhaust steam is removed to the condenser at that pressure, the remainder can be further expanded in the turbine with advantage. On this basis a turbine has been constructed with an additional set of blades called the "exhaust disk," 1 in the figure below, through which five-eighths of the steam is allowed to pass, the rest being diverted into the condenser 6 by the diaphragm 2 and guide blades 5. By this means nearly 4 per cent. extra power is gained. A further advantage can be secured by continuing the diaphragm 2 so as to divide the condenser into two chambers corresponding to the passages 3 and 4, though the circulating water is provided by a pump common to both. The pressure in compartment 4 is lower than that in 3, and a resulting increase in efficiency of 6·8 per cent. has been recorded in actual tests.



Electrical Production of Steel.—It was mentioned at the recent meeting of the R. Lindenberg Steel Works Co., of Remscheid-Hasten, that the Witkowitz Iron and Steel Co. have taken a licence for the Lindenberg process for the electrical production of steel. This is the first large Austrian company which has embarked on the manufacture of steel by electricity, and it is considered probable that other Austrian steel-makers will follow the example in the future. The Gelsenkirchen Co. has recently ordered a furnace for its large works at Esch, Luxemburg, which is intended, in the first place, for the smelting of ferro-manganese. During the past two months the Lindenberg Co. has brought into operation an electric furnace of 25 tons capacity, which is claimed to be the largest hitherto built. The furnace is charged with 28 tons, and works in conjunction with two Bessemer basic converters, in the sense that the charge consists of molten metal, which is unfinished basic steel. Although the furnace has only been in regular operation for a few weeks, the results already obtained are said to confirm the opinion of the directors that it will be possible, with large furnace units, to produce electrical steel more cheaply than the open-hearth quality.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Ilford U.D.C. has appointed Mr. George Francis Gregory, second charge engineer at the electricity works, as outdoor superintendent, and has increased the salary of the electrical engineer (Mr. A. H. Shaw) from £475 to £500, as from Michaelmas last.

Mr. J. P. Robson has been appointed assistant electrical engineer to Shipley U.D.C.

The Liverpool Tramways and Electricity Committee is making a recommendation to the City Council asking for authority to arrange for the retirement of Mr. Alfred Clough (resident electrical engineer), at a rate to be mutually agreed upon, and that in the special circumstances of the case a superannuation allowance equal to one-half of his present salary, be paid to him from the date of his retirement. Mr. Clough, who was associated with Mr. A. B. Holmes, in the direction of the Liverpool electricity undertaking, has been receiving a salary of £1,100 per annum.

Mr. Harold Gray, borough electrical engineer, Accrington, has sustained a sad bereavement by the death of his wife, which took place suddenly, at the age of 29, only 4½ months after marriage. Many of our readers will desire to join us in an expression of deep sympathy with Mr. Gray.

Mr. W. Thompson, senior switchboard attendant to the Walthamstow undertaking, has been appointed charge engineer for three months on trial.

Mr. R. E. McDonnell has resigned his position as electrical engineer at Bray. The Council recently decided to grant him a bonus of £30, and to advertise the position at £2 per week, Mr. McDonnell to be given preference if he applied for the post.

Tramway Officials.—On the 25th ult. Mr. Andrew Nance, manager of the Belfast Corporation tramways, was presented by the staff of the undertaking with an illuminated address in acknowledgment of his work in instituting a scheme of bonuses for workers. Mr. Nance, in reply, said the Corporation were precluded from anything in the nature of co-partnership or profit-sharing, but they had been able to institute a system of co-operation by which every member of the staff participated in a bonus which depended for its amount on the profits of the undertaking.

General.—Mr. Thos. J. Sack has resigned the post of works manager to the Micanite and Insulators Co., Ltd., to take up a similar position with the Electrical Apparatus Co., Ltd., of London. He has been presented with a marble clock, suitably inscribed, by the employés of the Micanite and Insulators Co., Ltd.

The marriage took place at St. Robert's Church, Harrogate, on October 23rd, of Mr. Wm. O. Pepper, of Shipley, Bradford, and Miss Blanche M. Tindall, daughter of Mr. John Tindall, of Harrogate.

Mr. N. A. Saltmarsh, late manager at Watford, for the National Telephone Co., has been transferred to Southend-on-Sea.

A South African contemporary states that Mr. M. I. Williams-Ellis recently returned to the Rand to act as representative-in-chief at Johannesburg for Messrs. Sandycroft, Ltd. Mr. Herbert Briggs will continue to act for the company in a consultative and advisory capacity.

Mr. A. E. Mohring, chief of the export department of Messrs. Crompton & Co., Ltd., has left England for a short business tour in India. He will be away for about three months.

Obituary.—We regret to learn that Mr. Charles K. Falkenstein died on October 23rd, at his residence, Homeleigh, Lanercost Road, Tulse Hill Park, S.W., at the age of 75 years, after a prolonged illness. His indisposition, however, did not prevent him from being actively engaged in business until within less than four weeks of his death. Mr. Falkenstein had been closely interested in ebonite practically from the time of its introduction into this country, both as regards its manufacture and its application to electrical and other purposes. He had been associated with the Britannia Rubber and Kamptulicon Co. since 1864, first at their works at Bow Common, and later in the City of London. The funeral service was at Christ Church, Streatham Hill, on Saturday last, 26th ult., the interment taking place at Streatham Cemetery, Tooting, in the presence of a number of Mr. Falkenstein's friends, and many beautiful wreaths and other floral tributes were received. The deceased gentleman leaves a widow and an only son, Mr. Conrad K. Falkenstein, A.M.I.E.E., to whom we desire to extend our sympathy in their bereavement.

NEW COMPANIES REGISTERED.

Coventry Electric Clock Co., Ltd. (124,954).—This company was registered on October 24th, with a capital of £15,000 in £1 shares (10,000 preference), to carry on the business of manufacturers of and dealers in electrically-driven clocks, watch-works and machinery, &c., to acquire from H. G. Coventry and T. Rushton the benefit of certain existing inventions relating to electrically-driven clocks or watch works. The subscribers (with one share each) are:—H. G. Coventry, 152, Gray's Inn Road, W.C., civil engineer; T. Rushton, 24, Salisbury Road, Upper Holloway, N., electrical clockmaker. Private company. The number of directors is not to be less than two or more than five; the first are H. G. Coventry (permanent director and chairman; special qualification, £300 shares); and S. E. Barron; qualification of ordinary directors, £100 shares. Registered office, 152, Gray's Inn Road, W.C.

Rotherham Electrical Engineering Co., Ltd. (124,964).—This company was registered on October 24th, with a capital of £2,000 in £1 shares, to carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, &c., and to adopt an agreement with S. Walford-Grout and J. E. Tongue. The subscribers (with one share each) are:—S. Walford-Grout, Horninglow, Burton-on-Trent, engineer; J. E. Tongue, The Poplars, Regent Street, Rotherham. Private company. The number of directors is not to be less than two or more than three; the first are S. W. Grout (chairman) and J. E. Tongue (both permanent governing directors, subject to holding £500 shares). Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Llanelly Motor and Electrical Engineering Co., Ltd. (124,961).—This company was registered on October 24th, with a capital of £5,000 in 900 preferred ordinary shares of £5 each and 500 founders' shares of £1 each, to carry on the business of manufacturers of and dealers in motor-cars, motor-cycles and motor-propelled carriages, omnibuses, machines and vehicles of all kinds, electrical and mechanical engineers, manufacturers of and dealers in electric light and electrical apparatus, &c. The subscribers (with one preferred ordinary share) are:—C. G. Ace, 32, Murray Street, Llanelly, auctioneer; L. L. Pugh, 21, Talbot Street, Cardiff, insurance manager; W. P. Rees, Great Western Terrace, Llanelly, secretary; D. Pearson, 1, Sandy Terrace, Llanelly, foreman; W. E. Clement, Ryecroft, Queen Victoria Road, Llanelly, iron merchant. Private company. The number of directors is not to be less than two or more than five; the first are C. G. Ace, L. L. Pugh and D. J. Evans; qualification, £100. Solicitor, D. Jennings, Cowell Street, Llanelly. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

British Ackley Brake and Supply Co., Ltd. (124,932).—This company was registered on October 23rd, with a capital of £10,000 in £1 shares, to carry on the business of mechanical engineers and manufacturers of and dealers in apparatus capable of being used in connection with brakes and other railway and tramway supplies, &c., and to adopt an agreement with G. S. Ackley. The subscribers (with 40 shares each) are:—G. S. Ackley, 2, Norfolk Street, Strand, W.C., manufacturer; E. E. Daglish, 2, Norfolk Street, Strand, W.C., engineer; W. L. Larkin, 2, Norfolk Street, Strand, W.C., engineer. Private company. The number of directors is not to be less than three or more than five; the first are G. S. Ackley (chairman and governing director, subject to holding not less than 300 shares), E. E. Daglish and W. L. Larkin; qualification, 20 shares. Registered office, 2-3, Norfolk Street, Strand, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cleveland and Durham Electric Power, Ltd. (89,539).—Return dated October 14th, 1912. Capital £700,000, in 350,000 pref. and 350,000 ord. shares of £1 each; 333,705 pref. and 157,600 ord. shares taken up; £1 per share called up on 331,935 pref. and 79,608 ord.; £411,003 paid; £80,302 considered as paid on 1,770 pref. and 78,532 ord. (with exception of £6 5s. paid in cash). Mortgages and charges: £340,000.

CITY NOTES.

National Telewriter Co., Ltd.

The directors' report for the period from May 23rd, 1911, to June 30th, 1912, states that the agreement with the American company alluded to in last year's report has been completed. The latest types of instruments are giving every satisfaction. The rent roll of the company has increased by about 50 per cent. during the six months prior to the date of this report, and substantial reductions in expenditure have been effected. These benefits, however, were not secured in time to have an appreciable effect upon the accounts now presented to the shareholders.

The third annual general meeting was held on Wednesday, at the Cannon Street Hotel, E.C., Sir George Craggs presiding.

The Chairman, in moving the adoption of the report, said that owing to enforced absence abroad at the beginning of the year, Mr. E. W. W. Edwards resigned his position as chairman, and his colleagues invited him to take that position. As they knew, he held the largest interest in the company, and they would feel that that was a guarantee that his best services, like those of his co-directors, would be devoted to the interests of the shareholders. Mr. T. Bernbaum on the termination of the arrangement made with him, took up the foreign and Colonial development which promised well. Some excellent business had already been done, for which they were much indebted to him. That was the third ordinary general meeting of the company, and the board regretted that the accounts for the 13 months to June 30th did not show better results, although they were a considerable improvement on those of the previous years. The figures now before them did not represent the position of the company at the present moment; all conditions had greatly improved since they were made up. They had added to the rent roll, and had also effected considerable reductions in expenditure, and he felt confident that when the directors came before them next year it would be with better results. Since becoming chairman he had given additional time to the supervision and conduct of the business. Reductions in working expenses, however, could not be carried out immediately they were decided upon, nor could business obtained be included, although the expenses of obtaining that business had been paid. For instance, after they had received an order from a subscriber there was a lapse of time between the date of order and its fulfilment, chiefly on account of the delay in the provision of the wires for the service by the Post Office. Thus some of the business that had been obtained prior to June 30th did not come into the present accounts, and such of it as was included counted only for a short period of the year under review. Although, of course, they received payments in advance, yet only that proportion that was actually earned from the date of installation to June 30th came into the credit of the profit and loss account. They would better appreciate the point when he explained that during the past six months they had increased their annual rentals by nearly 50 per cent., but that, owing to the reason stated, almost the whole of this new business did not become operative until the current financial year. In the accounts for last year the amount transferred to suspense account was £5,790. If these accounts had been for a year and 38 days to correspond with the period covered by the present accounts, the figure would have been £6,400. This year it was £4,345, which was much better, though still not satisfactory. Expenditure on capital account during the period for instruments, construction of exchanges, plant, &c., was £5,652, as against £6,779 for the previous year. Cash in hand at the end of the period amounted to £13,059 16s. 9d. The value of rentals carried forward was £1,463, as against £1,118 for 1911. They had heard a good deal about the instruments at previous meetings. He was glad to be able to say that they were working well, and their subscribers were satisfied. The technical improvements spoken of by the chairman at last year's meeting, both as regarded the American instruments for private lines and the British instruments for the exchange, had proved to be of considerable value, and great advances had been made in their efficiency. The London exchange was going ahead in a satisfactory manner. Many thousands of telegrams were being transmitted week by week between the Central Telegraph Office, the cable companies, and their subscribers, and there were a number of firms who found it of considerable use in the transaction of their business, and they hoped before long it might form a general means of intercommunication between buyer and seller, and between various firms who had business relations with each other on a much larger scale. Having regard to the accuracy of transmission, the permanence of the records and the saving of time and money effected by the instrument in the business of a number of leading commercial houses, it was a matter of great surprise to the board that the general adoption of the Telewriter was not quicker. They had a number of satisfactory installations in Liverpool and in Manchester, and they were well situated in those two towns for carrying on business. In view of that they had decided forthwith to open an exchange in Liverpool. A new exchange had been opened in the West End in order to facilitate communication between West End and City houses. Proceeding to give particulars of some of the individual installations, the chairman said that one had been supplied to the Allan Line for one of their steamers sailing between Liverpool and Montreal, the transmitting portion of which was situated in the Marconi room, and the receiving portion in the chart room, so that all wireless messages as they were coming in were immediately transmitted to the proper quarter. That was an important adjunct to the Marconi apparatus on ships, which should before long be realised by shipowners and others who were interested. Several receivers could, if required, be operated by one transmitter, and the messages received be simultaneously delivered to different parts of the ship. There were many directions in which the instruments would be of great use to the Army and Navy, and they hoped some day the authorities would realise it. Arrangements had been completed for mutual working with the several American companies who owned nearly all the patents of the Telewriter outside the British Isles.

Mr. E. B. Ellice Clark seconded the motion, and it was carried without discussion.

Edison & Swan United Electric Light Co., Ltd.

The directors' report for the year ending June 30th, 1912, is as follows. We have inserted the figures from the previous year's report in italics:—The net revenue account shows that £42,820 (*£49,154*) has been brought forward from profit and loss account. Interest on debenture stocks has absorbed £15,702 (*£15,702*); £5,500 (*£5,500*) has been set aside as depreciation on freehold and leasehold property, plant and tools; £7,500 (*£7,500*) has been applied in writing down values of stocks; £2,225 (*nothing*) has been written off the expenditure on foreign branches, trade marks, and experimental account; and £1,447 (*[illegible]*) has been reserved on account of bad and doubtful debts. The result as shown in the net revenue account is a credit balance of £10,446 (*£19,010*), to which must be added £8,356 (*£6,843*) brought forward, thus making a total of £18,802 (*£25,856*). Of this amount the directors propose to place £10,000 (*£17,500*) to reserve fund, carrying forward the balance £8,802 (*£8,356*). Cost of establishing the business, goodwill, &c., £390,432 (*same*), has been brought forward at the figure standing in the last balance-sheet. The freehold and leasehold property and plant have also been brought forward at the value stated in the last balance-sheet, with the addition of the amount expended to June 30th, 1912, less depreciation charged in net revenue account. The Altrincham Electric Supply, Ltd., shows encouraging progress in its lighting business generally. In addition it has entered into an important contract for the supply of power, which will come into operation in the beginning of 1913. The usual dividend has been paid on its shares. This company has applied for, and has had allotted a further 5,000 £1 shares fully-paid in this undertaking. Its indebtedness to this company has been reduced during the year by £5,392 on current account. There has been expended on capital during the year ending June 30th, 1912, £6,226 (*£5,361*), largely on account of extensions to plant in connection with the engineering works. The directors have given careful consideration to the question, and having due regard to the requirements of the business, have decided not to recommend the payment of a dividend on the shares on the present occasion. (*Last year it was stated that trading showed satisfactory progress.*) The annual meeting is called for November 7th.

Cape Electric Tramways, Ltd.

Mr. Ludwig Breitmeyer (chairman) presided on Wednesday at the offices, London Wall, E.C., over the meeting of this company.

In moving the adoption of the report, the Chairman said the returns for both Cape Town and Port Elizabeth again showed a substantial improvement on the previous year's figures, and justify the hope that he expressed last year that the company would be able to increase its dividend. The increased profit enabled the directors to recommend the payment of a dividend of 5 per cent., free of income-tax, on the ordinary shares of the company, besides again placing £8,000 to reserve account, and carrying forward a balance of over £4,000 to next year's account. They had carried nearly a million passengers more than in the previous year with increased receipts of about £8,000, and there was every indication in the months that had elapsed since the close of the financial year, these figures were being more than maintained in the current year. This was very important, and he wanted to impress them with it. The directors were very gratified to be able to recommend a dividend which was double that of last year. In order to do this, they had had to appropriate a portion of the profit carried forward from the previous account. The board, however, felt justified in making this appropriation, as the monthly returns in the new financial year since July 1st last showed advances again, and they had no doubt that this small encroachment would be more than recovered in the current year. At the same time, it must be borne in mind that the plant was getting older, and that the reserve fund would require strengthening in the future by some additional appropriation. Though they had every reason to look forward to a continued increase in the traffic returns, he anticipated that the greater portion of that increase for the next year or two would be required for the purposes he had mentioned. The reports from the general managers of Cape Town and Port Elizabeth placed the shareholders in possession of full details regarding the working of the systems during the year under review. In conclusion, he might add that the outlook generally was satisfactory. Cape Town had survived the removal of the Administration to Pretoria remarkably well, and had now, according to the recent address of the retiring Mayor, firmly established itself as the real Capital of the Union, and general business conditions there showed a promising development. In Port Elizabeth also the business outlook had further improved; both exports and imports showed good increases. The energetic Town Council of that port were undertaking sundry important measures to enhance the attractiveness of the place as a seaside resort for up-country residents, which were sure to bring many visitors to the place, and their tramway business would undoubtedly reap its share of the benefits of these improvements.

Admiral Sir A. Hastings Markham seconded the motion.

Mr. Theophalis asked what had been done with regard to the running of motor-'buses in Cape Town, to which he drew attention at the last meeting.

The Chairman said they had a few 'buses running, and the experiment looked to be a good one, but he would prefer to make a fuller statement at the next meeting. They could not run them on the Dock Road because of the bad state of that road, which was now being remetalled.

Mr. May said he understood they were running 'buses from the Green Point round the Kloof just as feeders to the tramways, but in view of the state of affairs in London, he thought the board ought to keep their eyes open to see that no other company came in with 'buses and took the tramway traffic from them. It might be a serious matter.

The Chairman said the directors were fully alive to that eventuality, and that was the reason why they had gone in for 'buses, but it must be remembered that the conditions of London and Cape Town differed greatly. There were heavy gradients in Cape Town which made it difficult to run 'buses, and there was no County Council to spend millions of money on the roads. Consequently motor-'buses were not the same danger to the tramways in Cape Town as in London.

Mr. May said he realised this, but the 'buses would run on the roadway of the tramways. What he meant was that if 'buses were to come in the company might as well run them themselves.

The Chairman said that was the reason why they had started them, and so far they had no competition. Of course, competition might come, but at any rate they would be in a position to deal with it.

Mr. Walker asked if there was anything to report about the Sea Point Railway.

The Chairman said it was in the same position as a competitor as before, but, as the conditions were more prosperous in Cape Town, they had attracted passengers who were content to pay 1d. more on the tramways. The railway had to run four or five years more under the present conditions, and then the Government would take it over.

The report was adopted, and, on the motion of Mr. Fuller, the sum of 1,200 guineas was voted to the board as their remuneration for services during the past year. Last year £800 was voted.

West India and Panama Telegraph Co., Ltd.—The report of the directors for the half-year ended June 30th states (says the *Times*) that the revenue amounted to £46,718, against £47,318 for the corresponding half-year of 1911, and the expenses were £27,110, against £25,329, leaving a balance of £19,608, to which is added £1,559 interest on investments, and £2,018 brought forward, making a total of £33,185. The directors have placed £2,000 to reserve, and they propose to pay a dividend on the ordinary shares of 1s. 6d. per share, free of tax, leaving a balance to current half-year's account of £2,791. The traffic receipts show a decrease of £487, as compared with the corresponding period. The expenses of repairing cables, charged to revenue, amounted to £8,611, as compared with £6,897. This is exclusive of an expenditure of £3,022, which has been charged to reserve, in respect of 42 knots of new cable used in the repair and partial renewal of the Jamaica-Ponce and of the Jamaica-San Juan sections.

Continental.—France.—La Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Paris, is increasing its capital from £1,000,000 to £2,000,000.

Messrs. Dupont & Co. Société d'Eclairage Electrique des Automobiles is the name of a new company which has lately been formed in Paris with a capital of £5,000.

Perth Electric Tramways, Ltd.—The directors have called extraordinary meetings for to-day to consider their proposals for the sale of the undertaking to the Government of Western Australia. It seems that the Government offer is £25,000 less than was asked by the company, but the company has had another full year's profits which exceed that amount. In their circular the directors state a number of reasons why sale to the Government is a desirable course to adopt, yielding a handsome return to the investors.

Western Telegraph Co., Ltd.—The directors, after transferring £115,000 to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £15,000 to the provision on account of investment fluctuations, recommend a final dividend of 3s. per share, making with the previous distributions, a total dividend of 6 per cent. for the year to June 30th, and a bonus of 2s. per share.

Cape Electric Tramways, Ltd.—The directors have declared a dividend of 5 per cent. free of income-tax.

Singapore Electric Tramways, Ltd.

Sir Frank Swettenham presided over an extraordinary meeting of the above company, held at 19, St. Swithin's Lane, E.C., on Tuesday, for the consideration of the following resolution :—"That the capital of the company be reduced to £100,000, and that such reduction be effected by cancelling paid-up capital which has been lost, or is unrepresented by available assets, to the extent of 15s. per share on each of the 400,000 issued shares of £1 each of the company, and by reducing the nominal amount of each of the said shares to 5s."

The Chairman, in moving the resolution, said the board had thought it advisable to call the meeting, because the principle of reduction of capital had already been agreed on at a previous meeting. At the previous meeting it was decided that they should write off 12s. 6d. a share, and they made that proposal because the manager had cabled that the valuation of the undertaking and plant was £425,000. When the valuation arrived in this country the board felt it necessary to question it, and they referred it back to the manager for details, with the result that the manager gave the reduction at £381,642. With that before them, the board felt it very advisable to make the shares 5s. instead of 7s. 6d. One shareholder had made a small objection, as he thought they were incurring further expense by making the further reduction, but that was not the case, because they had not done anything with the previous resolution, and therefore the expense, which in any case would be very small, would not be practically increased by this amended resolution.

Mr. E. Davis seconded the resolution, and it was carried without discussion.

Ferranti, Ltd.

The seventh annual general meeting was held on Thursday last week at Basildon House, E.C., Mr. A. W. Tait presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 629), said that the profit for the year to June 30th, 1912, was £51,759, showing an increase of £2,865, and the net profit, after providing for general establishment charges, repairs and renewals, legal expenses, bad debts and directors' and trustees' fees, was £24,333, as compared with £22,045. During the five years from 1908 to 1912 the assets of the company had increased by £89,703, this increase being mainly represented by—increase in plant, machinery and tools, £21,916; expenditure on work in hand, £37,750; stocks and stores, £6,529; book debts, £26,650; and buildings, £4,135. The increase in the company's liabilities during the same period was £41,610. He was sure that the shareholders would recognise that this was a very substantial improvement in the company's position. The results for the year under review were not only satisfactory in themselves, but were really better than they appeared, owing to the fact that during that period there was considerable labour unrest, which naturally affected the cost of production and the total output. They would remember that in the summer of 1911 they had the railway strike, followed by the dock strike, and at the beginning of this year they had the coal strike. Those troubles necessarily added to the cost of fuel and carriage, apart from the consequent disorganisation of business. Nevertheless, the company was able to show a record in output, as well as in profits, and the current year, so far as it had gone, was decidedly encouraging, and there was reason to believe that if there were no unforeseen set-backs, the result should be at least as favourable. They would appreciate, however, that the expanding nature of the company's business had necessitated, and would necessitate for some time to come, the absorption of further working capital, and they would observe from the report that it was the intention of the directors to issue £50,000 five-year 6 per cent. notes, secured on £50,000 first mortgage debentures. At the last annual meeting authority was given for the increase of the borrowing powers, and negotiations were entered into with a view to placing the debenture stock, but it was found that, owing to the state of the market and the present unpopularity of electrical securities, it was impossible to place the issue, except at a very considerable sacrifice. The directors therefore consulted several of the parties largely interested in the company, and it was decided to obtain the necessary working capital required by the issue of five-year notes. The proceeds of the issue would be applied to redeeming the balance of the prior lien debentures, which stood at the figure of £16,100, and the redemption of temporary loans, which amounted to £19,122, and the balance would be applied as further working capital for the company. It was, however, a term of the issue that during the period of the notes, such profits as the company might make after payment of the interest and sinking funds on the first and second debentures, and the note issue, would be accumulated as reserve, and, therefore, available as further working capital for the company. It would, therefore, be seen that during this period the company would be unable to declare dividends on its shares. But, although this might be unpleasant news for the shareholders from the point of view of revenue, they should take into account the strengthening of the position of the company generally, in which they were so largely interested, and the consequent increase in the capital value of their security. They would observe from the accounts that at June 30th, 1912, the company had accumulated in the form of depreciation reserves, a sum amounting to £47,350, and if the company made the same comparative progress during the next five years, the position of the shareholders would have enormously improved. He hoped by that time they would be able to make arrangements which would compensate the preference shareholders for their long period of waiting, and to then commence and continue the payment of regular dividends. The company had in the past received every encouragement and support, not only from its shareholders, but also from its debenture-holders, because, as they were probably aware, under the terms of the trust deed, sinking funds for the redemption of the first and second debenture issues should have been in operation from the commencement of the new company's operations, but as the money was required for the development of the company's business, the debenture-holders had up to now agreed to the waiving of their rights in that connection. The directors now felt that the time had arrived when they were able to carry out that obligation, and, therefore, from the end of this year the sinking funds on these debenture stocks would be put into operation, and the gradual redemption of stock by the application of these funds would still further improve the position of the shareholder. With regard to the business generally, he said the various departments were in a flourishing, as well as an efficient, condition. Every department showed considerable progress during the year, and the expansion of the meter and switch business was decidedly encouraging. With regard to the meter business, they had made arrangements for the efficient working of the Ferranti c.c. meter on the Continent, which would be of considerable advantage to the company, and their business in Canada was not only a profitable one, but showed signs of healthy expansion, and their sales in other parts of the world were encouraging. The switch department was now standardised for the manufacture of all classes of switchgear, and the orders which the company had received showed that the merit of the company's work was appreciated. They had during the year developed certain lines in cooking and heating apparatus which were likely to be valuable adjuncts to the company's business. That record of progress was a good and sufficient answer to the absorption of working capital which was taking place and the necessity for conservative measures if progress was to be maintained and increased. At the present time the company's works were employed to their fullest capacity, and it had been necessary to lay down extensions of certain departments of the company's business to meet these requirements. He felt sure that the shareholders would appreciate the explanations which had been given, and would approve the policy which the board had carried out and which they recommended should be continued for some little time as the benefits would all accrue to their ultimate advantage.

Mr. J. M. Henderson seconded the motion.

Mr. Nalder asked what possibility there was of paying a dividend in the near future, and the Chairman, in reply, said that the directors had considered the possibility of paying some interest to the shareholders, but if they wanted the business to progress they would have to wait a little longer, and then they would have an excellent paying business.

The report was adopted.

Cuba Submarine Telegraph Co., Ltd.

The directors' report for the half-year ended June 30th last, states that the total receipts of the six months were £23,722, while the expenses amounted to £7,834, leaving £15,887, plus £7,656 brought forward, giving a total of £23,543 to be dealt with. The sum of £2,000 has been placed to the reserve against loss on investments, £4,000 added to the reserve fund, which now stands at £92,000, and £2,000 to the pension fund. The dividend on the preference shares will absorb £3,000, and leave £12,543, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax, the balance, £7,743, being carried forward. The cables continue in good working order. A scheme of pensions for the employés of the company has been prepared by the directors, which, subject to the sanction of the shareholders, they propose to carry into effect, and £2,000 has been reserved in the half-year's account to establish the fund for this purpose.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to :—

Brisbane Electric Tramways Investment Co., Ltd.—Further issue of 15,000 ordinary shares of £5 each, fully paid (Nos. 75,001 to 90,000).

Consolidated Cities Light, Power and Traction Co.—Fully-paid scrip for $4,000,000 first lien 5 per cent. gold bonds.

To appoint a special settling day in :—

Compania de Electricidad de la Provincia de Buenos Ayres, Ltd.—Further issue of £150,000 5 per cent. first mortgage gold bonds of £20 each (Nos. 37,501 to 45,000).

And to allow the following securities to be quoted in the Official List :—

London Electric Supply Corporation, Ltd.—Further issue of £100,000 4 per cent. first mortgage debenture stock.

The Committee have appointed special settling days as under :—

Wednesday, November 6th.—Bolton (Thomas) & Sons, Ltd.—£300,000 5 per cent. first mortgage debentures of £100 each (Nos. 1 to 3,000) (registered).

Synthetic Products Co., Ltd.—80,830 cumulative participating preferred shares of £1 each, fully and partly (10s.) paid (Nos. 1 to 7 and 25,008 to 105,830).

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordinary shares of £5 each, fully and partly (£2 10s.) paid (Nos. 230,001 to 270,000).

Thursday, November 7th.—Brazilian Traction, Light and Power Co., Ltd.—1,003,614 shares of $100 each, fully paid.

And ordered the undermentioned securities to be quoted in the Official List :—

Bolton (Thomas) & Sons, Ltd.—£300,000 5 per cent. first mortgage debentures of £100 each (Nos. 1 to 3,000) (registered).

Brazilian Traction, Light and Power Co., Ltd.—1,003,614 shares of $100 each, fully paid.

United River Plate Telephone Co., Ltd.—Further issue of 40,000 ordinary shares of £5 each, £2 10s. paid (Nos. 230,001 to 270,000).

Allgemeine Elektrizitäts Gesellschaft.

The directors of the A.E.G. state that, after deducting general expenses, taxes, depreciation, interest on loans and the cost (£53,000) of the last issue of bonus the net profits earned exclusively from manufacturing amounted to £1,219,000 in the financial year ended with June 30th 1912, as compared with £1,107,000 in the preceding year. At the general meeting on December 3rd it is proposed to recommend the payment of a dividend of 14 per cent. on share capital of £6,500,000, as contrasted with 14 per cent. on £5,000,000, and 7 per cent. on £1,500,000 in 1910-11. Apart from the provision made for depreciation, according to the practice hitherto followed, it is intended to place £150,000 to the reserve fund, which thus becomes increased to £3,250,000, or the equivalent of one-half of the share capital. The turnover invoiced in the first two months in the new financial year, and the orders on hand, show a considerable increase, as compared with the corresponding period in the previous year. The following table indicates the developments which have taken place in recent years:—

		Net profits.	Amount distributed.	Percentage dividend.	Placed to reserve fund.
1906-7	...	£713,000	£600,000	12	£50,000
1907-8	...	796,000	600,000	12	50,000
1908-9	...	819,000	650,000	13	63,000
1909-10	...	921,000	700,000	14	100,000
1910-11	...	1,107,000	805,000	14	118,000
1911-12	...	1,219,000	910,000	14	150,000

The directors, as in previous years, refrain from giving any intimation as to the amount of profits obtained from the financing side of the business, and, consequently, of the sums derived from this source to the strengthening of the internal reserves. It is now proposed to make a fresh issue of £1,250,000 in ordinary shares, in order to maintain the "liquidity" of the company. The shares are expected to be offered at the price of 210 per cent., which will permit of a further allocation of about £1,250,000 to the reserve fund.

Monte Video Telephone Co., Ltd.

The annual ordinary meeting was held on October 23rd at Winchester House, E.C., Mr. Charles Lock presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 629), said that the year under review gave them a gross revenue from subscriptions, rentals, and transfer fees of £61,556, compared with £52,553 last year. The reason for that very considerable increase was that during the past year they had included the gross camp receipts because they had taken over that system as from the commencement of the year, whereas in the previous year they only took into the receipts the net amount received from the then lessee. The working expenses with the larger number of subscribers, had naturally shown a fairly large increase, and they had also to meet exceptionally heavy expenditure in the shape of repairs to damage caused by storms, which, he was sorry to say, they were never quite free from in Monte Video. They had also had to expend a considerable sum in dealing with the repairs to the Camp system, which was taken over from the lessee towards the end of the last financial year. He believed, however, that the results from the Camp system would fully justify the expenditure they had incurred, as they were looking for an increase of business in that direction, and they would naturally get the profit which the lessee used to get. After meeting all those expenses, and the fees of the local board which appeared this year at the full amount for the first time, they had a balance of £25,911 as net profit, as against £22,000 last year, an increase of about £3,000. In the special circumstances of the company the view of the board was that, although they had a somewhat larger net revenue to deal with, they had better proceed on conservative and cautious lines. They might at some future date, and he would be very glad if it was in the near future, have to incur very considerable expenditure in installing an underground system, if and whenever they should be so fortunate as to secure the requisite concession from the Government authorising them to do so. They had not yet obtained that concession, although they were always working for it. If they obtained it, it would be necessary to scrap a considerable amount of their overhead plant which had become obsolete. Under those circumstances, the board had thought it best that they should restrict their dividends to the same amount as they had paid on previous occasions. In order to deal with the possibility of having to scrap their plant in the future, they proposed to apply a considerable portion of the revenue to the depreciation fund, and that fund had this year been increased by £15,000. They had also thought it desirable to raise the reserve fund to the round figure of £60,000 by adding £1,500 to it this year. After those appropriations, they would be justified in paying 5 per cent. dividend on the preference shares, and 6 per cent. on the ordinary, as last year. Proceeding to deal with the figures in the balance sheet, the Chairman said it would be noticed that real estate in Monte Video stood at £2,600 more than it did last year. The reason was that some of their exchanges were getting overloaded with lines, and it was necessary to afford them some relief. After mature deliberation, they had decided to establish a new exchange, which he was glad to say was now practically ready for working. He could not conclude without again referring to the question of the concession they were trying to get for an underground installation. He was sorry to say that their position in that respect was very little changed from what it was last year. They were keeping their claims before the Government but so far they had not met with the desired success. In the meantime, it might be considered that the delay that had occurred in dealing with this matter had not been free from benefit to the company. During the years that had elapsed since they started to make their application, there had been considerable development in the telephone system. The automatic system was coming very much to the front, and it might be that if they had obtained the concession earlier, they would have installed the common battery system which was now in vogue in London. He was told that the automatic system was now being tried in this country, with a considerable measure of success, and in the opinion of many telephone experts, it was the coming system. If that was so, when they obtained their concession, they would be able to install the most modern system known to the telephonic world. He must again remind them that the Government of Uruguay was still considering the question of establishing a telephone service of its own. He understood from advices received from Monte Video that His Excellency the President had recommended to the Government that they should adopt their own telephone service. No doubt before anything was done, the matter would have to be referred to the Government department there, which was similar to the British Board of Trade. Their representatives in Monte Video and the members of the local board were in constant communication with them in London on the matter, and they relied upon them to be alert to safeguard the company's interests. With regard to the propriety of the Government undertaking a business of this sort, opinions might differ, but it seemed to him that their company, with the very extensive knowledge which it had as to local requirements, and with the experienced officials and staff at its disposal, might, with far greater benefit to the community, be allowed to continue its services, improved with modern appliances and an underground system, rather than that the Government should undertake the risk involved in starting an entirely new venture. It was quite unnecessary for the Government to go to that expense, particularly as they were quite willing, in any concession which they might ask for, to give the Government any reasonable powers of expropriation on fair terms of purchase. It seemed to him that an agreement between the company and the Government based on those lines would ensure all that the Government required, and would be much more for the benefit of the community, because it would not deter the influx of foreign capital into the country which it so badly needed for its development. He hoped the Government would see the matter in its proper light, and not try to enter into competition with their company.

Mr. J. G. Le Marchant seconded the motion, and the report was adopted.

STOCKS AND SHARES.

Tuesday Evening.

The financial position, rather than the political, continues to dominate the Stock Exchange, although the House still scans the Near Eastern horizon with a good deal of nervousness, not knowing how far the war may embroil nations other than those at present engaged in it. Money for settlement purposes this week was very stiff, but plentiful enough, considering the circumstances. It is something of a relief for the Stock Exchange to be closed on the Friday in this week, though evidence of the uneasiness which abounds is displayed in the refusal of the Committee to extend the recess over the following half-day.

Home Railway stocks are moving on irregular lines. The speculation in Metropolitan Consolidated has died down to some extent, and, in consequence, the fluctuations this week in the price have been less wide than usual. Lively interest was aroused by the announcement that the Metropolitan Company has advanced a good way in its negotiations for the acquisition of the Great Northern and City Railway, the company which for years past it was assumed the Great Northern Railway would eventually take over.

The news, of course, explains the rise that has occurred in the price of the Great Northern and City shares from 1¾ to 2⅜, at which they now stand, and which is considered by authorities in the house to represent approximately the value of the shares, taking Metropolitans about 55. Some who peer into the future ask whether the move on the part of the Metropolitan may be the precursor of another that shall bring this Company into closer alliance with one of its bigger brethren, but as to this time will show. The Central London trio of stocks is steady, notwithstanding the report that the *pourparlers* said to have been passing between the Twopenny Tube and one or two of the leading steam lines are now reported to have come to an abrupt conclusion. This induced a little selling at the end of last week, but since then prices have partially recovered, and on balance the Ordinary and Deferred are both 2 lower. Districts are remarkably quiet, and City & South Londons provide an exception to the prevailing depression by advancing 1½ to 42½ middle.

Endeavours are being made to spread the impression that a powerful group is endeavouring to obtain control of the Metropolitan Electric Tramways Co., in order to link it up with the London United and to enter into an agreement with the London County Council for the joint working of the line. That some scheme or other is in the air is probable enough, but it may be just as well not to build too freely upon the expectation of the Tramways Combine following in the footsteps of those which brought the London General Omnibus Company under the same ægis as that of the Underground Electric Railways. and which caused such a sensational rise in the price of 'bus stock. Fuller particulars will be awaited with keen interest. and they should be available shortly. Underground Electric Railways shares and income bonds, after advancing a little, went back again, so that on balance the bonds are a point down at 87, the shares being unaltered at $3\frac{3}{8}$, while the 1s. shares eased off to 12s. So far as the London United Preference are concerned, the price shows a fall of $\frac{1}{4}$. British Electric Tractions are still a weak market. the Deferred having gone back to 6, and the 7 per cent. Preferred to $38\frac{1}{2}$.

There is practically nothing of fresh interest to report in the section for English Electricity Supply shares. St. James' gained 5s. on top of their previous rise of twice that amount, and Chelsea shed 2s. 6d., but apart from these there is no movement at all. Holders do not care to part with shares, in view of the prospects of the companies; and buyers are as little eager to pick up shares as in most of the other markets round the Stock Exchange. Already clients and members alike are casting their prophesies forward to Christmas; and it is urged that, with the festival less than two months away, he need be a confirmed optimist who thinks of material increase of business between now and then.

In the Telegraph market, the firmness of Marconi's deserves notice. The appointment of a Committee in the House of Commons has done a lot to quiet a certain amount of nervousness which worried the market earlier this month; and, in addition to this, another factor has been a good deal of closing on behalf of bears. Canadians, Spanish and Americans hardened up a little, in sympathy with the parent shares; and the market does not look bad, although it must be noticed that each rally brings in a few shares, and on the week there is no change. As may be supposed, sundry private-circulation prospectuses are going round the City, with details of various wireless inventions which will, according to the statements made, completely oust Marconi from the present field, but it is bardly necessary to say that the price of Marconi shares is not influenced by such competitors.

Amazon Telegraphs are better, and West India and Panama Ordinary rose $\frac{1}{8}$ on the declaration of an interim dividend of 1s. 6d. per share. Direct Spanish Ordinary have again improved, and the Preference also rose $\frac{1}{4}$. The company seems to be doing very well, and certainly there are not many shares in the market to satisfy the steady demand. Anglo-Americans are a little lower, and the Eastern group marks time. Western Telegraphs eased off a shade, and falls of $\frac{1}{16}$ took place in Oriental Telephones and Monte Video Telephones. National Telephone Deferred is a quieter market, and on balance the quotation is $2\frac{1}{2}$ down. Reuters have come into some prominence in consequence of the war, and the price keeps steady at $11\frac{1}{8}$. The Stock Exchange amuses itself with yarns of how simultaneous cables are continually arriving at the offices of the great newspaper agency giving diametrically opposite information as to the result of the various engagements.

The Latin-Canadian group has its fortitude rather severely tried by steady liquidation in certain of its stocks and shares. The news from Mexico has been much more comforting this week, and Mexico Trams recovered a point, though Mexican Light and Power fell 2. Both companies' prior charge issues have given way. Montereys are down 2. Vera Cruz fails to recover from its earlier weakness. Rio Trams and Sao Paulo Trams have been marked down 10 points each. Montreal Light. Heat and Power shed 5. and Shawinigans are 2 lower, the company's Bonds both showing declines. Anglo-Argentine Tramways 4 per cent. Debenture was pressed for sale, and a loss of $1\frac{1}{4}$ is the result; while Calcuttas dropped $\frac{1}{8}$ upon further consideration of the report. La Plata Trams are $\frac{1}{8}$ higher. and in some quarters are talked better, though. of course, they are a very speculative investment.

Manufacturing shares afford some indication of the manner in which investments have been realised through force of circumstances. Henleys are $\frac{1}{4}$ down, and the Preference lost $\frac{1}{16}$. India-Rubbers have gone back another 10s. On the other hand, there are rises in British Aluminium Ordinary and British Westinghouse Prior Lien stock; while Dick, Kerr Preference at $\frac{7}{8}$ are $\frac{1}{16}$ better, the handsome yield apparently attracting purchases. The Rubber market is dull and uninteresting. Prices have a sagging tendency, and it is argued that there is nothing in the present situation to encourage buying until the price of the raw stuff exhibits signs of advance.

City Electric Light Co., Ltd., Brisbane.—The report of this company for the half-year ended July 31st, 1912, presented at the meeting held at Brisbane on September 17th, stated that after making additions to the reserve fund, dividend equalisation fund, franchise and purchase sinking fund, accident insurance fund and renewal, replacement and contingencies account, there remained a credit balance of £6,888, which, with the balance brought forward from last half-year, made £9,274 to be disposed of. The directors recommended that a dividend be paid of 3 per cent. on the preference shares, and $6\frac{1}{4}$ per cent. on the fully-paid ordinary shares, and of $6\frac{1}{4}$ per cent. on the contributing shares, the payment thereof, together with the dividend duty, absorbing £7,329, leaving a balance of £1,945 to be carried forward. Reference is made to the excellent work of the staff, which again contributed to the results obtained. "It is pleasing to note that the co-operative principle of issuing shares to its employés, which the company introduced some years ago, has been continuously satisfactory."

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Oct. 23	2,729	+ 80	21	33,454	+ 140	14·4	..
Ayr	" 26	405	+ 17	23	9,523	+ 223	8	..
Birmingham Corp.	" 19	21,780	+4,317	29	30[illegible],928	+96,828	57·17	..
Blackburn	" 23	2,447	+ 216	$30\frac{4}{7}$	36,770	+ 457	14·62	..
†Blackpool Corp. ..	" 17	820	+ 146	..	69,108	+ 5,583	11·87	..
Blackpool-Fleetw'd	" 26	722	+ 67	16	22,875	— 575	[illegible]	..
Bournemouth ..	" 23	8,241	+ 45	$29\frac{3}{7}$	59,282	+ 1,771	21·95	..
Bradford	" 19	11,791	+ 948	29	163,970	— 760	56	..
Brighton	" 27	1,781	— 7	30	33,618	— 1,069	9·5	..
Bristol	" 25	13,625	+1,366	..	299,521	+24,325	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	" 18	639	+ 122	42	12,601	+ 3,326	3·65	..
Barnsley	" 18	402	+ 15	"	7,542	— 245	..	..
Barrow	" 18	697	+ 78	"	16,200	+ 3,118	5·37	..
Devonport ..	" 18	1,079	+ 53	"	22,673	+ 1,601	8·85	..
Gateshead ..	" 18	2,221	+ 84	"	43,812	+ 9	11·25	..
Gravesend ..	" 18	445	+ 25	"	8,883	— 176	6·5	..
Greenock.. ..	" 18	1,631	+ 184	"	34,260	+ 3,549	7·25	..
Kidderminster ..	" 18	209	+ 17	"	5,124	+ 75	..	..
‡Leamington ..	" 18	28	+ 25	"	1,209	+ 475	..	..
Merthyr	" 18	431	— 4	"	8,473	— 882	2·9	..
Metropolitan ..	" 18	16,828	— 551	"	370,192	— 1,288	22	..
Middleton ..	" 18	679	+ 37	"	14,201	— 318	8·5	..
Mid. Joint Com'tee	" 18	6,798	+ 670	"	128,770	+ 6,964	..	..
Oldham—Ashton	" 18	1,267	+ 62	"	25,767	+ 1,527	9·13	..
Peterborough ..	" 18	263	+ 18	"	5,837	+ 336	5·81	..
Potteries	" 18	4,219	— 33	"	80,164	— 1,523	29	..
Rothesay	" 18	134	+ 16	"	10,254	+ 453	2·75	..
Southport ..	" 18	657	+ 12	"	12,884	— 266	8·17	..
S. Metropolitan..	" 18	1,678	+ [illegible]0	"	85,986	— 958	..	..
Swansea	" 18	2,341	+ 83	"	48,596	+ 205	12·5	..
Tynemouth ..	" 18	885	+ 35	"	10,729	— 936	3·75	..
Weston-s-Mare ..	" 18	127	+ 1	"	6,660	— 1,297	8	..
‡Worcester ..	" 18	567	+ 19	"	12,577	— 78	5·75	..
Wrexham ..	" 18	245	+ 31	"	4,865	+ 558	..	..
Yorks. Wool. Dist.	" 18	2,260	+ 87	"	45,586	+ 1,123	17	..
Miscellaneous ..	" 18	445	+ 28	"	9,887	+ 173	..	..
Burnley	" 26	2,989	+ 278	..	..	..	12·44	·7
Burton-on-Trent ..	" 27	587	24	30	8,277	— 470	6·6	..
Bury	" 27	2,488	+ 65	30	39,691	— 356	22·5	..
Cardiff	" 26	4,733	+ 191	30	74,053	— 1,976	17·35	..
Chatham and Dist.	" 24	1,731	+ 122	43	37,072	— 48	14·98	..
Cork	" 24	921	— 48	43	20,823	— 949	9·89	..
Croydon	" 18	3,540	— 141	39	58,473	— 994	11·6	..
†Darlington.. ..	" 19	229	+ 112	29	6,557	+ 62	4·87	..
Darwen	" 25	565	+ 36	30	8,461	+ 220	4·36	..
Dover	" 19	464	+ 2	29	7,696	— 562	4·75	..
Dublin	" 25	11,015	+ 163	..	100,611	— 8,813	54·25	..
East Ham	" 26	2,108	+ 14	30	32,581	— 880	7·87	..
Exeter	..	..	..	..	..	..	..	..
Glasgow	" 26	38,431	—1,[illegible]90	..	397,470	— 9,611	98	..
Hastings	" 24	1,7[illegible]6	+ [illegible]9	..	..	..	19·8	..
Hull	" 26	6,641	+ [illegible]9	30	88,829	+ 933	13·5	—1
Ilkeston	" 25	276	— 12	30	3,386	— 699	..	..
Ipswich	" 26	780	— 3	30	14,173	— 221	10·5	..
Kilmarnock.. ..	" 26	323	+ 18	23	3,927	— 173	4·25	..
Lancashire United	" 23	2,782	+ 151	48	58,128	— 18	39	..
Leeds	" 26	15,329	+ 405	30	235,648	+ 7,423	112·7	..
Leicester	" 26	5,248	+ 94	43	109,792	+ 3,3[illegible]0	[illegible]	..
Leith	" 26	1,244	+ 61	$23\frac{3}{7}$	16,554	+ 352	8·724	..
Liverpool	" 19	24,203	+ 965	$41\frac{6}{7}$	502,318	+21,476	119	3
‡L.C.C.	" 16	81,821	—5,370	..	1,206,657	—70,465	141·1	—·5
London United ..	" 26	11,412	+ 13	..	271,623	—13,463	..	..
Lowestoft	" 26	363	— 6	3	693	— 10	8·5	..
Manchester ..	" 26	33,232	+ 772	30	506,276	+16,995	105	..
Newcastle	" 26	9,305	+ 278	..	133,295	— 2,229	31·3	..
†Newport	" 17	697	+ 50	28	19,913	— 558	7·25	..
Oldham	" 27	4,125	— 29	31	64,373	+ 8,527	28	..
Pontypridd	" 26	851	+ 25	30	11,906	— 6 9	5·5	..
Portsmouth.. ..	..	..	..	..	..	..	15·75	..
Preston	" 23	1,594	+ 88	30	25,181	+ 1,119	10	..
Rotherham	" 23	1,814	+ 442	$29\frac{3}{7}$	22,185	+ 1,901	18	6
Salford	" 28	9,644	+ 184	$30\frac{1}{7}$	153,632	+ 3,312	41	..
Sheffield	" 27	18,802	+ 863	..	206,362	+ 8,146	40	..
Southampton ..	" 23	2,274	— 50	29	38,267	— 106	11	..
Southend-on-Sea ..	" 23	1,232	+ 186	30	26,833	+ 2,662	7	..
South Shields ..	" 26	1,258	+ 97	30	19,436	+ 136	10·25	..
Tyneside	" 23	1,119	+ 84	17	8,532	— 689	11	..
Wallasey	" 22	1,994	+ 10	$29\frac{6}{7}$	34,441	— 455	8·72	..
Walthamstow ..	" 26	1,820	+ 3	30	24,833	— 884	9	..
West Ham.. ..	" 17	4,937	— 375	$28\frac{4}{7}$	76,057	— 2,985	16·45	1·2
Wolverhampton ..	" 23	2,100	+ 175	30	30,647	+ 681	18·75	..
Cen. London Rly...	" 26	10,979	+ 836	17	79,807	+ 2,037	6·78	·4
City & S. Lon. Rly.	" 27	6,162	— 465	17	49,236	— 3,776	7·26	..
Dublin-Lucan Rly.	" 25	247	+ 11	17	2,681	— 110	7	..
G.N. and City Rly.	" 26	3,038	— 45	17	23,408	— 96	3·5	..
L'pool Overh'd Rly.	" 27	3,136	+ 293	..	28,215	+ 2,245	6·6	..
Llandudno-Col. Bay	" 25	385	+ 70	47·5	15,438	+ 725	6·5	..
Lond. Elec. Ry. Co.	" 26	28,385	+ 465	..	214,460	+ 6,160	21·25	..
Mersey Railway ..	" 26	4,825	+ 443	17	35,651	+ 3,775	4·5	..
Metropolitan Rly...	" 27	84,421	+ 397	17	285,827	+ 6,263	25·75	..
Met. District Rly...	" 26	26,838	+2,170	..	2[illegible]7,448	+18,299	25	..
Anglo-Argentine ..	" 21	108,240	+9,212	..	2,140,264	+90,112	..	..
§Auckland	Sept. 27	18,4[illegible]8	+ 2,593	..	68,9[illegible]8	+10,586	24·1	..
Bombay (B.E.T.) ..	Oct. 4	6,335	+ 100	39	119,722	+ 5,806	..	..
§Brisbane	Sept.	22,700	+1,660	9	181,094	— 3,566	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Oct. 26	8,517	+ 56	..	..	+13,278	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Sept.	3,251	..	9	28,788	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Oct. 15	1,692	+ 202	..	81,634	+ 8,500	14·7	2
§Montevideo ..	Sept.	27,711	+4,465	11	317,818	+44,299	..	..
Perth (W.A.) ..	Oct. 25	4,006	+ 591	..	80,229	+11,401	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.*	Dividends for 1911.	1912.	Closing Quotations	Rise + or Fall	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	9½— 10½	..	5 1 9
Do. 4½ % Pref.	10	4½	4½	9¼ - 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100		4 10 0
Brompton & Kensington, Ord.	5	10	9	9 — 9½	..	5 [illegible] 3
Do. 7 % Cum. Pref.	5	7	7	8½ - 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5	4⅞ - 5⅛		4 1[illegible] 0
Do. 4½ % Cum. Pref.	5	4½	4½	4½ - 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	.	4 3 4
Chelsea, Ord.	5	5	5	4⅞ - [illegible]	⅛	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	98 - 101	..	4 9 1
City of London, Ord.	10	8	6	16 — 18	..	4 [illegible] 0
Do. 6 % Cum. Pref.	10	6	6	12½— 14	..	4 [illegible] 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	6	4	11½ - 11¾	..	5 2 2
Do. 6 % Pref.	10	6	6	11¾— 12¼	..	4 10 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil		[illegible] - 1½		Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 - 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾ - 5¼	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4¾ - 5¼	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 94	..	4 14 9
Hove	5	9	8	7¾ - 7¾ xd	..	5 14 3

NAME.	Stock or Share.*	Dividends for 1911.	1912.	Closing Quotations	Rise + or Fall	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	5	[illegible]		7½— 8	..	5 12 [illegible]
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½		1¾ — 2¼		[illegible] 1[illegible] 8
Do. 6 % Pref.	5	6	6	4¾— 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4	[illegible] — 4¼	..	4 17 [illegible]
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4¾	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ - 99½	..	4 10 6
Newcastle on Tyne 5 % Pref., Non-Cum.	5	5	5	4⅝ - 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	[illegible]	..	4 18
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	[illegible]	[illegible]	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10	9½ - 10½	+ ¼	4 17 7
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88		3 19 7
Smithfield Markets, Ord.	5	2	..	1⅝— 1⅞	..	..
South London, Ord.	4	3	.	3 — 3½		5 11 0
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1¼ - 1½		5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11
Urban, Ord.	£3	Nil		¼— ½	..	..
Do. 5 % Cum. Pref.	5	2		2¼ — 2¾	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½ - 88½	.	5 1 8
Westminster, Ord.	5	10	9	8¾ — 9¼		5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 [illegible]

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½— 5¾	..	5 4 4
Calcutta, Ord.	5	8½	..	7 — 7¼	½	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ - 5⅛	.	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½— 94½	1	5 5 9
Canadian Gen. El. Com.	$100	7	7	115 —119	1	5 17 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	⅞— 1	..	8 0 0
Do. 5 % Deb.	100	5	5	91 — 97		5 8 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	[illegible]	..	Nil
Do. 6 % Pref.	1	6	6	[illegible] xd	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½— 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 8
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 13 8
Mexican Lt. & Power, Common	$100	4	4	83 — 86 xd	2	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105 xd	—1	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	93½— 95½	..	5 4 9

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	84 — 86	2	5 16 3
Montreal, Lt., H. and Power	$100	8	9	[illegible]	—5	3 7 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	[illegible]	39 — 42	..	..
River Plate, Ord.	Stock	10		240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	109 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	141 —145 xd	2	3 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 — 108	—1	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½	— ½	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	96½ - 98½ xd	..	4 11 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref.	1	11⅞d.	17⅞d.	¾— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	.	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7¾ — 8¼	+ ¼	4 18 6
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	145½—147½	..	5 8 6
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph	Stock	8	8	67 — 69 xd	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½—111½xd	— ½	5 7 7
Do. Def.	Do.	30/-	..	25⅝— 25⅞	⅛	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½— 7¾	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	—1	4 16 3
Cuba Telegraph	10	6	..	9½— 10½	..	5 14 3
Do. 10 % Pref.	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¾— 4	+ ¼	5 0 0
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7¼	+ ¼	6 18 0
Direct United States Cable	10	5	4	7¼— 7¾	..	6 9 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	129 —132 xd	..	5 6 1
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79 xd	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	99½—101½	..	3 18 10
Eastern Extension	10	7	7†	12¾— 13¼ xd	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	10¾— 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12¾— 13¼	..	4 10 7
Great Northern Telegraph	10	18	18	28 — 29	..	6 4 2
Indo-European Telegraph	25	13	..	57½— 59½	..	5 9 3
Mackay Companies Common	$100	5	5†	86 — 89	..	5 13 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	.	5 — 5½	.	3 18 2
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅝— 4⅞	..	3 14 0

Monte Video Telephone, Ord.	1	6	..	1 — 1⅛	— 1/16	5 13 0
Do. 5 % Pref.	1	5	5	13/16— 15/16	..	5 6 8
National Telephone Def.	Stock	6	.	154 —156	—2½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100 —101	..	4 9 1
Oriental Telep. and Elec.	1	8	.	1 11/16— 1 13/16	— 1/16	4 8 2
Do. 6 % Cum. Pref.	1	6	6	1 5/32— 1 7/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10	10¾ — 11¼xd	..	8 16 2
Submarine Cables Trust	Cert.	6	6	126 —129 xd	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	[illegible] — [illegible]	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅜— 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 1/32 - 1 3/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	8¼— 8¾	+ ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅝— 11⅛	..	5 7 10
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾— 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	.	4 17 1
Western Telegraph, Ltd.	10	7	7†	13¼— 13¾	— ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	96½ — 98½	..	4 1 3
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98½—101½ xd	..	4 8 5

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Oct. 29th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/32 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	¾ — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½ — 13½	..	..
Do. Do. Deferred ..	100	.	.	5 — 7	—1	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	84 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	90 — 94	..	5 6 5
Do. 4½ % 2nd Deb. ..	100	4½	4½	79 — 83	..	5 7 2
Central London Railway, Ord.	100	8	8†	72 — 74	—2	4 1 1
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	..	71 — 73	—2	2 14 10
Do. 4 % Deb.	100	4	4	100 — 102	.	3 18 5
City & South London, Ord. ..	100	1⅜	1¼†	42 — 43	+1½	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 — 109	..	4 11 9
Do. Do. 1896	100	5	5	105 — 107	..	4 13 6
Do. Do. 1901	100	5	5	105 — 107	..	4 13 6
Do. Do. 1903	100	5	5	104 — 106	..	4 14 4
Do. 4 % Deb.	100	4	4	99 — 101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼ — 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	11/16 — 23/32 xd	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5⅛ — 5⅝	—⅛	..
Do. 4 % Deb.	100	4	4	72 — 76	..	5 5 3
Metropolitan Railway Consol. ..	100	1⅞	1½†	52¾ — 53¼	—1	3 1 0
Do. Surplus Lands	100	2⅝	2¼†	63 — 65	—1	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	84 — 86	+1	4 1 5
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	37¼ — 38¾	+ ½	Nil
Do. 6 % Deb.	100	6	6	141 — 143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 — 101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	88 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅛ — 1¼ xd	..	4 16 0
Do. Def.	1	Nil	..	3/32 — 9/32	— 1/32	Nil
Do. 5 % Pref.	1	5	5	27/32 — 29/32	— 1/32	5 10 6
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % Deb.	100	5	5	96 — 99	—1½	5 1 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	3¾ — 4	..	Nil
Do. "A"	1/-	..	..	1/32 — 2/32	..	..
Do. 4½ % Bonds	100	4½	4½	99 — 101	..	4 9 1
Do. 6 % Income	100	1½	£2	86 — 88	—1	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4 13/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	91½ — 93½	—1¼	4 5 7
Do. 4½ % Deb.	100	4½	4½	99 — 101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 — 101	..	4 19 0
Auckland Trams, 5 % Deb. ..	100	5	5	103½ — 105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 — 100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 — 100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	..	7¼ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ — 103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	142 — 147	..	5 8 10
Do. Pref. Ord.	100	6	6	115½ — 119½	+ ½	5 0 6
Do. 5 % Pref.	100	5	5	104½ — 107½	..	4 13 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 — 101 xd	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 — 105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	101 — 103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	6 — 6½ xd	..	5 7 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3
Cape Electric Trams	1	2½	..	[illegible]	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 — 102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 — 103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	½ — ¾	+ ⅛	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	..	1 1/16 — 1 5/16	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 — 102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	91 — 94	—1	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ — 102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	113 — 117 xd	+1	5 19 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	92¼ — 94½	—2½	5 5 10
Do. 6 % Bonds	100	6	6	96¼ — 99½	—2	6 0 7
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7 1/16 — 7 9/16	..	6 12 5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 — 101	—1½	4 19 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 — 102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5¼ — 5¾	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	145 — 155	—10	3 4 6
Do. 1st Mort. 5 % Bonds ..	..	5	5	100½ — 102½	..	4 17 7
Do. 5 % Mort. Bonds ..	100	5	5	95½ — 97½	..	5 2 7
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	255 — 265	—10	3 15 6
Do. 5 % 1st Deb.	$500	5	5	102 — 104	..	4 14 4
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	101 — 104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 — 103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	½ — ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼ xd	1/16	4 6 2
Do. Pref.	1	6	6	1 7/16 — 1 9/16 xd	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	1/16 — ⅛	+ 1/16	..
Do. 6 % Cum. Pref.	1	Nil	..	⅜ — ⅝	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	—1	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7¼ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 11 1
Do. Deb...	100	4½	4½	102 — 104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	½ — ¾	..	Nil
Do. Deb...	100	4	4	60 — 63		6 7 0
Do. 6 % Prior Lien	100	6	6	100 — 103	+1	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	.	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10¾ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½ — 101½	..	4 8 8
Castner-Kellner	1	20	15†	3 11/16 — 3 13/16	..	5 4 9
Do. Deb...	100	4½	4½	105 — 108	..	4 3 4
Crompton & Co.	8	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16 — 13/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16 xd	+ 1/16	6 8 0
Do. Deb...	100	4½	4½	97 — 100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	¼ — ½	..	Nil
Do. fully paid	5	Nil	..	1½ — 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12¾	— ¼	6 13 4
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	— 1/16	4 9 0
Do. Deb...	100	4½	4½	102 — 104	..	4 6 7
India-Rubber, G. & T.	10	..	..	10½ — 11½	— ½	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	34 — 36	..	6 13 4
Do. Deb...	100	4	4	98 — 100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

TRADE STATISTICS OF SWEDEN.

The following figures show the imports of electrical and similar goods into Sweden during the year 1910, and are taken from the official statistics which have recently been issued; the figures for 1909 are given for purposes of comparison, and notes of any increases or decreases have been added.

	1909. Kronor.	1910. Kronor.	Increase or decrease. Kronor.
Electric meters.			
From Germany	402,000	611,000	+ 209,000
„ Great Britain ...	30,000	71,000	+ 41,000
„ Other countries ...	3,000	2,000	— 1,000
Total ...	435,000	684,000	+ 249,000
Electric incandescent lamps.—			
From Germany	402,000	642,000	+ 240,000
„ Great Britain ...	—	1,000	+ 1,000
„ Switzerland ...	—	7,000	+ 7,000
„ Austria-Hungary ...	—	29,000	+ 29,000
„ Holland	—	7,000	+ 7,000
„ Other countries ...	12,000	9,000	— 3,000
Total ...	414,000	695,000	+ 281,000
Dynamos and parts thereof.—			
From Germany	132,000	184,000	+ 52,000
„ Great Britain ...	1,000	4,000	+ 3,000
„ Switzerland ...	127,000	81,000	— 46,000
„ France	—	12,000	+ 12,000
„ Austria	16,000	—	— 16,000
„ Other countries ...	17,000	7,000	— 10,000
Total ...	293,000	288,000	— 5,000
Electric motors and parts thereof.—			
From Germany	378,000	447,000	+ 69,000
„ Great Britain ...	19,000	7,000	— 12,000
„ Switzerland ...	127,000	12,000	— 115,000
„ United States ...	15,000	22,000	+ 7,000
„ Other countries ...	14,000	28,000	+ 14,000
Total ...	553,000	516,000	— 37,000
Transformers and parts thereof.—			
From Germany	238,000	235,000	— 3,000
„ Great Britain ...	1,000	2,000	+ 1,000
„ Switzerland ...		22,000	+ 22,000
„ Austria	115,000	—	— 115,000
„ Other countries ...	3,000	1,000	— 2,000
Total ...	357,000	260,000	— 97,000
Telephone apparatus.—			
From Germany	12,000	6,000	— 6,000
„ Great Britain ...	1,000	1,000	—
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	14,000	9,000	— 5,000
Telegraph apparatus.			
From Denmark	5,000	3,000	— 2,000
„ Germany	1,000	2,000	+ 1,000
„ Great Britain ...	1,000	2,000	+ 1,000
Total ...	7,000	7,000	—
Gas motors.—			
From Germany	102,000	28,000	— 74,000
„ Great Britain ...	23,000	33,000	+ 10,000
„ United States ...	41,000	8,000	— 33,000
„ Other countries ...	3,000	2,000	— 1,000
Total ...	169,000	71,000	— 98,000
Petroleum and benzine motors.			
From Germany	63,000	56,000	— 7,000
„ Denmark	26,000	50,000	+ 24,000
„ Great Britain ...	7,000	17,000	+ 10,000
„ France	10,000	17,000	+ 7,000
„ United States ...	74,000	162,000	+ 88,000
„ Other countries ...	23,000	28,000	+ 5,000
Total ...	203,000	330,000	+ 127,000
Turbines.—			
From Norway	111,000	17,000	— 94,000
„ Germany	3,000	1,000	— 2,000
„ Great Britain ...	—	3,000	+ 3,000
Total ...	114,000	21,000	— 93,000
Accumulators.—			
From Germany	477,000	497,000	+ 20,000
„ Great Britain ...	7,000	6,000	— 1,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	486,000	504,000	+ 18,000

	1909. Kronor.	1910. Kronor.	Increase or decrease. Kronor.
Rheostats.—			
From Germany	689,000	689,000	—
„ Great Britain ...	10,000	19,000	+ 9,000
„ Switzerland ...	42,000	69,000	+ 27,000
„ Other countries ...	15,000	16,000	+ 1,000
Total ...	756,000	793,000	+ 37,000
Elevators.			
From Germany	81,000	44,000	— 37,000
„ Holland ...	99,000	—	— 99,000
„ Great Britain ...	4,000	5,000	+ 1,000
„ Other countries ...	14,000	2,000	— 12,000
Total ...	198,000	51,000	— 147,000
Cranes.			
From Germany	134,000	38,000	— 96,000
„ Great Britain ...	56,000	85,000	+ 29,000
„ United States ...	10,000	91,000	+ 81,000
„ Other countries ...	25,000	25,000	—
Total ...	225,000	239,000	+ 14,000
Copper wire, twisted, and cable not insulated.—			
From Germany	117,000	137,000	+ 20,000
Copper wire covered with textiles.—			
From Germany	6,000	7,000	+ 1,000
„ Other countries ...	1,000	1,000	—
Total ...	7,000	8,000	+ 1,000
Copper wire covered with rubber.—			
From Germany	5,000	2,000	— 3,000
„ Other countries ...	1,000	1,000	—
Total ...	6,000	3,000	— 3,000
Electric cables covered with lead.—			
From Germany	2,767,000	3,078,000	+ 311,000
„ Holland	43,000	63,000	+ 20,000
„ Great Britain ...	251,000	281,000	+ 30,000
„ Other countries ...	7,000	2,000	— 5,000
Total ...	3,068,000	3,424,000	+ 356,000
Copper wire otherwise insulated.—			
From Germany	252,000	279,000	+ 27,000
„ Great Britain ...	15,000	21,000	+ 6,000
„ Other countries ...	1,000	9,000	+ 8,000
Total ...	268,000	309,000	+ 41,000
Other electric cable.—			
From Germany	226,000	326,000	+ 100,000
„ Great Britain ...	3,000	10,000	+ 7,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	231,000	337,000	+ 106,000
Steam turbines.—			
From Germany	64,000	114,000	+ 50,000
„ Great Britain ...	7,000	18,000	+ 11,000
„ Switzerland ...	319,000	29,000	— 290,000
„ Other countries ...	3,000		— 3,000
Total ...	393,000	161,000	— 232,000
Steam boilers.			
From Germany	115,000	36,000	— 79,000
„ Great Britain ...	75,000	230,000	+ 155,000
„ Other countries ...	19,000	7,000	— 12,000
Total ...	209,000	273,000	+ 64,000

Krone = 1s. $1\frac{1}{3}$d.

Wire Lamp Patents in Germany.—It will, perhaps, be remembered that a year or two ago the three largest makers of wire lamps in Germany (Siemens & Halske Co., the A.E.G. and the Auer Gasgluhlicht-Gesellschaft) entered into a community of interests in regard to patents for the construction of drawn-wire lamps, in the sense of an interchange of patents and processes. It is now reported that the Bergmann Electricity Works Co., which is engaged on a new process, is in negotiation with the three firms in question with a view to being included in the community so as also to be able to produce drawn-wire lamps, without the risk of patent proceedings.

RECENT DEVELOPMENTS IN WIRELESS TELEGRAPHY: WITH SPECIAL REFERENCE TO SHIP INSTALLATIONS.

(*Concluded from page 680.*)

Receiving and Transmitting Circuits.

Source of Primary Energy.—According to the class of station concerned, from ½ to 10 KW. of energy must be provided in the primary circuit of a ship installation (see above). Stations requiring from 250-500 watts input may conveniently be operated from the ship's supply network (24-220 volts) by the use of a resonance inductor and a high-speed trembler contact feeding the closed oscillation circuit of the spark sender. The sending key controls the primary current, and a variable resistance provides for the control of the inductor train and the wave "tone." In large stations a D.C. shunt motor, capable of wide speed variation, is driven from the ship mains and direct coupled to a suitable alternator. Whenever traffic is brisk the converter set should be kept running continuously, and, in any case, it is best located in a weatherproof chamber outside the main operating room.

Sender.—The frequency of the oscillating current in the aerial is about 1,000,000 cycles per second, and, as energy cannot be delivered at such a frequency from a dynamo-electric generator, a method of working is employed which is admirably exemplified by the high-frequency "natural" vibrations persisting in a bell gong after the latter has received one of a series of low-frequency blows from a vibrating hammer. Alternating current from a 200-volt 1,000-cycle machine, say, is transformed to from 8,000 to 20,000 volts, which pressure is supplied to a condenser in the "exciting" circuit. Once per cycle of the charging current the condenser discharges across a spark gap and the energy then oscillating in the primary circuit is rapidly transferred by "coupled" inductance coils to the aerial circuit. This transference corresponds to the "hammer-blow" in the above analogy, and the aerial energy now oscillates at the natural frequency of the aerial for some time after the primary oscillation has ceased; during this period the secondary oscillation is undamped by any reaction from the primary.

Receiver.—It is unnecessary to dilate upon the principles of reception. With uniform radiation in every direction from the sending station (and directive transmission is yet in embryo) the energy in the receiving aerial may be less than $1/10^7$ that radiated from the sending station, and in shipwork the inevitable limitation of the aerial dimensions makes the conditions yet more arduous, so that the best possible tuning circuit and detector should alone be employed. The conditions of ordinary marine working make simplicity and strength imperative, so that a compromise is necessary. Fig. 16 illustrates a very useful and simple form of receiving circuit, which has been greatly adopted in the German mercantile marine.

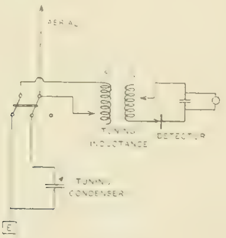

FIG. 16.

The old slow-spark system of working used a "coherer" *detector* (depending for its operation on a breakdown voltage between its terminals), controlling a Morse printer through a relay circuit. Now, however, "quantitative" or "current" detectors are almost exclusively employed. The Schlömilch electrolytic detector has been, and is still, widely used, but detectors of the "contact" class* will probably be chiefly used for marine work in future. These detectors are extraordinarily sensitive, but they are not suitable for working a Morse printer, and it becomes necessary to receive messages by aid of a telephone, which must therefore be kept to the operator's ear during the whole of his working shift. This is obviously a great objection on cargo steamers or other vessels to which few messages are likely to be addressed, and it seems probable that various call-relays, suitable for use in conjunction with contact-detectors, will soon be perfected. The Telefunken call apparatus comprises a sensitive galvanometer connected in place of the telephone receiver, and ringing a call bell by a relay circuit if any predetermined wave length acts on the aerial for 10 seconds. The latter condition guards against false alarms due to "atmospherics," and a cardan suspension prevents false alarms due to ship movements, but no device yet devised will discriminate between those signals at a given wave length which are, and are not, intended for the vessel; so that, in such frequented waters as the Channel, the satisfactory use of such a call apparatus would be impossible. A more practical solution of the problem seems to be the arrangement of definite hours of continuous attendance on all vessels unable to support a day and night service for the reception of signals.

Complete Installation.—The leading particulars of the standard radio-equipment designed by the Telefunken Co. for use on large mercantile vessels are as follows:—Primary input, 3-4 KW.; guaranteed antenna radiation, 1·5 KW. Guaranteed range of transmission, with average ship aerial, 650 km. by day, and 1,200 km. by night. Space occupied by equipment 2 × 2 × 2 metres; weight of transformers, 600 kg.; weight of remainder of equipment 300 kg. Generator frequency (variable over a wide range, to permit tone adjustment), 500 cycles per second normal; H.T. delivery from transformers, 8,000 volts; transmitting wave length, 300-900 m.*; receiving wave length, 200-2,500 m. normally, 4,000 or 6,000 m. arranged for if desired.† The energy radiated is regulated by using one or more of the eight spark-gaps provided, and a hot-wire ammeter is installed to check the working of the installation before commencing message work.

Auxiliary emergency stations and aerials (see fig. 11) should be installed on every vessel so as to make the radio-telegraphic communication of the latter, at least for a little while, independent of any power supply from rotating machinery. As noted above, an accumulator battery and high-speed trembler contact form the essential features of such a station which, with an input of 500 watts, and using a small auxiliary aerial will transmit 200 km. by day and 400 km. by night. It is desirable that the auxiliary should be entirely independent of the main equipment.

General Working Conditions; Legislation; Interchange of Messages.

The extensive adoption of radio-telegraphy in the German mercantile marine began considerably later‡ than in the British and American fleets, mainly for the reason that, up to 1907, German vessels had very restricted facilities for intercommunication with coastal stations. Prior to the Berlin Congress, Marconi land and ship stations refused to communicate with stations equipped with "foreign" systems.§ The folly, if not the actual danger, of such a monopolistic policy, was formally recognised, and provisions made for compulsory intercommunication between stations working on *all* systems, by the International Conference of 1907, when all the important States, excluding Italy and the U.S.A.‖ agreed that (1) A sufficient number of "public" coast stations should be erected in their respective territories to meet the needs of shipping, and that, irrespective of the nationality of the ships and land stations and of the radio-system employed, inter-communication be compulsory, when possible. (2) All except England, U.S.A. and Italy, agreed that such inter-communication should also be compulsory upon ships.

The recently-constituted Betriebsgesell fur drahtlose Telegraphie should do much to combine the interests of various radio-systems in Germany, and it further proposes to undertake the important duty of supplying telegraphists to passenger steamers, and then accepting entire responsibility for technical efficiency and the fulfilment of official regulations. On cargo steamers, no such special staff can be afforded, but the great simplifications and improvements in the design of working parts during the last few years make satisfactory operation by any person who has received a short period of training quite possible.

Courses of instruction in radio-telegraphy have been arranged in the Hamburg, Bremen and Elsfleth Schools of Navigation, and during the last 18 months, 42 ships' officers have passed the official examination in this subject. A special department has lately been inaugurated at the Ecole Superieure d'Electricité for practical and theoretical instruction and research in wireless telegraphy and telephony,* and it is to be hoped that, in a matter of such importance, other authorities will take steps to provide further training facilities.†

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* These are composed of various "couples" of different metals, or of various metals (one at a time) in contact with various crystalline minerals. The action of the detectors appears to be partly thermo-electric and partly rectifying. See also ELECTRICAL REVIEW, Vol. LXVIII, pages 11 and 72.

* Raised to 1,600 m. by the use of auxiliary inductance; usually mercantile vessels work only on the international wave lengths for this class, viz., 300, 450 or 600 m.

† It is common for a ship to send to a land station at 600 m. wave length and to receive at 2,000 m. from the latter.

‡ Two years ago, 58 ships were equipped: now more than 160 are fitted.

§ The large Hamburg-American and Norddeutscher Lloyd lines could not afford to neglect the use of radiography, and therefore respectively contracted to use none but the Marconi system till 1914 and 1917.

‖ Italy recognised the desirability of the regulations proposed, but was herself bound by contracts with the Marconi Co.; the U.S.A. was something of a turncoat in the matter. The result of her (enforced) abstention from the international agreement has been that Italy has lost the bulk of the wireless traffic which should have fallen to her coast stations, to the French Mediterranean stations and the powerful Austrian station on the Adriatic. The U.S.A. stations are not bound to accept all messages, but the State stations do so, so far as their other obligations permit. The large number of private stations which have been erected to work various systems makes the position of the Marconi Co., as regards monopoly, weak. The American law of July 1st, 1911, stipulating that all vessels, of whatever nationality, coming under specified classes and sailing to and from American ports, shall be equipped with radio-telegraph apparatus and shall exchange wireless messages with *any* other ship—not only enforces a rapid development of wireless telegraphy in the American mercantile marine, but also deals a severe indirect blow at the Marconi monopoly.

Wireless Telegraphy and Navigation and Coastguard Duties.

Radio-telegraphy has already firmly established itself as an aid to navigation. In addition to the Eiffel Tower signals,‡ there are now despatched mean-European time signals from the Norddeich station (at 1 a.m. and 1 p.m.), under the control of the Wilhelmshaven Observatory. The code arranged is very similar to that adopted by the Eiffel Tower, and comprises a train of warning signals followed by a set of time signals, the last of which ends at 1 o'clock precisely. Weather and storm reports, averaging about 25 words in length, conclude this invaluable service. The cost of the necessary installation is no greater than that of a medium quality chronometer, and is particularly justified in the case of small vessels plying in the areas served by the land stations.§

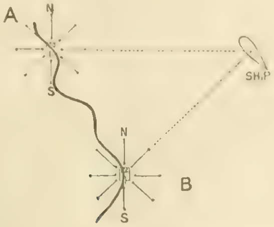

Fig. 17.

The commercial value of maintaining continuous (or nightly) communication between land stations and ships bound on long voyages can hardly be over-estimated, and it is interesting to note that wireless telegraphy has already proved of great value in preventing port contagion from infected ships, and in generally expediting the work of port sanitary officers.

The use of radio-telegraphy as a supplement to, or even as a substitute for, lighthouses, is now widely recognised, and most of the important lighthouses are now provided with wireless apparatus. In fog and storm, the light-beam is more or less invisible, but wireless warnings can still be emitted, and it is possible for a ship to take its bearings accurately by receiving signals from two coast stations, the exact position of which is charted. The principle of a system which has been evolved in Germany, is illustrated in fig. 17. A number of coast stations are each provided with 16 or 32 aerials, directed towards the points of the compass. At each station, the sender is automatically connected in sequence with each aerial, and thus emits a continuous train of signals according to a code which is predetermined for each station. The operator on board a ship off the coast notes down the signals from the two stations nearest-by, and ascertains which signal is the strongest in each group. This will be from the aerial directed towards the ship, and a certain degree of interpolation being possible between the aerials, the position of the vessel can be accurately determined from the chart showing the stations and coast concerned. This system needs no special receiver or aerial on the ship, but it certainly appears that the Bellini-Tosi radio-goniometer* is, on the whole, a much more practical, economical and satisfactory arrangement.

Statistics are steadily being collected as to the effect of various atmospheric conditions on the quantitative results of wireless working, and it may ultimately be possible to prophesy, with some degree of certitude, the interdependance between the working of a given station and meteorological conditions. At present we can do little more than generalise in this matter.†

PROCEEDINGS OF INSTITUTIONS.

Correct Time.

By R. Myles Hook.

(*Abstract of paper read on October 14, 1912, before the* Institution of Post Office Electrical Engineers.)

Since 1852 the Post Office has received an hourly signal transmitted automatically from the Mean Solar Clock at Greenwich Observatory, and at 10 o'clock every morning that signal was retransmitted by telegraph to every telegraph office throughout the kingdom, all the clocks being then reset by hand, which is still done at 9 a.m. daily. To provide watch and clock makers with a daily time signal sufficiently accurate to meet their requirements an instrument called the chronopher was designed by Mr. C. F. Varley. This was of the nature of a multiple change-over switch, operated by means of a spring motor, released by an electrical contact on a clock. The time signal from the Observatory was made to synchronise automatically the clock controlling the chronopher. The chronopher, as installed in those early days, is still doing useful service, but has become much overloaded. The temporary disturbance of the telegraph wires has also resulted in such inconvenience to telegraph traffic that it has now become necessary to introduce a new system.

The hourly signal continues to be transmitted from the Mean Solar Clock at Greenwich Observatory to the Central Telegraph Office in London, where it is received upon a main relay forming part of the new chronopher apparatus. The local side of this main relay operates other relays which transmit the hourly signal to London renters, and ring bells, &c., fixed in various administrative and operating departments of the group of buildings associated with the General Post Office headquarters.

Certain provincial offices have been chosen as sub-chronopher stations, and their circuits, regarded as main distribution circuits, are connected to the tongues of groups of switching relays which normally retain these circuits in connection with their telegraph apparatus, but which, when operated by control circuits from a special electrical clock, transfer the telegraph circuits from the telegraph apparatus, and bunch them on the tongue of a transmitting relay so that a positive current, which forms a preliminary or warning signal, is sent out on all distribution lines. On the receipt of the Greenwich signal, the operation of the main relay causes the transmitting relays to reverse the current on the lines momentarily, the reversal constituting the distributed time signal. At the provincial offices similar apparatus, but on a smaller scale, is installed for secondary distribution over other circuits radiating therefrom to individual offices, wherein hand-operated switches control the arrangement of the local circuits for transmitting the signal to subscribers' premises.

Special switching devices are introduced in the new chronopher to enable the Admiralty stations at Portsmouth, Weymouth, Plymouth and Deal to send reporting signals from their standard clocks (in the case of Deal from a time ball), which signals follow one another in succession over a second wire from London to the

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* The maximum number of pupils is at present limited to 20, who are very carefully selected by merit. In addition to a comprehensive scheme of practical work, lectures are delivered on theoretical and practical radio-telegraphy, on international and local regulations, on electrical units and electrical and mechanical testing (as applied to radio-telegraphy), and on meteorology and electrical discharges in gases. A number of the studentships are reserved for military and naval officers at a fee of £24; the ordinary fee for the course is £30, or £12 for permission to attend all the lectures. The training is spread over a period of three months.

† While facilities are so limited and so costly, these special courses can never be attended by the rank and file of wireless operators, and the latter have to acquire their knowledge of the special conditions of wireless work by devious and more or less unsatisfactory means. Even a carefully-planned course of continuous instruction in radio-telegraphy must occupy three or four months, and an operator can hardly be allowed to take charge of a station till he can receive and transmit 78-80 letters per minute.

‡ See also Electrical Review, "Wireless in Horology."

§ Large ships, already equipped with powerful wireless equipments can take advantage of the above service as a matter of course. The value of the time, and especially of the storm signals, is, however, relatively greatest in the case of small coasting and fishing vessels, and the equipment of the latter at least with receiving apparatus, forms a most interesting and important problem. A certain large Dutch and German fishing company has recently equipped a number of steam trawlers in its employ with simple radio-telegraph installations for transmitting instructions regarding the distribution of shoals, from vessel to vessel, and for the reception of storm signals, instructions regarding return to market and so on, from land stations. One member, at least, in each crew is instructed in the use of the apparatus, and a simple code is adopted to avoid giving information regarding best fishing areas to rival boats. So far, the cost of the scheme has been fully justified by the results attained. On the reception of storm warnings, all the vessels fly the customary visual warnings for the benefit of vessels not provided with wireless apparatus.

The American Government is reported to have purchased 50,000 wireless *receiving* equipments for use on fishing vessels. The apparatus is very simple, and costs only £24 per set, as against £300 for many equipments which have hitherto been designed for this service. It is hardly necessary to point out that such a price as the latter is quite prohibitive.

* See also Electrical Review, Vol. 69, December 15th, 1911, pp. 974 *et seq.*

† Among the most recent results in this field may be cited Esau's work (see also "Z. f. S.," January, 1912, page 23). This investigator divides atmospheric conditions, as affecting the damping in "wireless" circuits into two groups—those electrical conditions leading to comparatively small effects, and those, such as hoar frost, rain and snow, leading to more pronounced effects. According to the existing electrification of the atmosphere, the damping experienced may vary 8-20 per cent, and can be definitely connected with the number of ions travelling to earth *via* the aerial. The damping increases with the transparency of the atmosphere, with rising wind velocity, with decreasing relative humidity, and with the formation of cumulus and nimbus clouds. There is a daily cycle curve of damping, which is smoother in winter than in summer, and an annual curve of damping shows maxima in June, August and December, and minima in February-March, July and October. Fog has little influence on the damping of the aerial, but up to 200 per cent. increase may be caused by a coating of hoar frost or ice; 100 per cent. by rain and 50 per cent. by snow

Observatory, and enable the Astronomer Royal to check the performance of the clocks. Distribution to the provinces takes place at 10 and 1 o'clock, and at the provincial sub-chronopher stations the switching relays are joined in groups for the 10 o'clock, 1 o'clock, or both signals according to the service required in any particular town. The controlling clocks are set so as to operate the switching relays from 1½ minutes before to 1½ minutes after the hours. The whole of the country is thus divided into convenient districts from the centre of which any town therein may obtain the time signal automatically and without inconvenience. This scheme is, of course, extremely elastic, and will enable growth to take place unhampered by considerations regarding the use of long and expensive telegraph wires. Instead of having upwards of 200 such circuits radiating from London as heretofore, only about 20 are required with the new system.

For watch and clock makers who have business with chronometers and precision timepieces, used for transport in surveying or navigation operations, the time signal is not generally directly used as a means for the correction of their regulator clock or the timepieces under test, but as a means whereby the constancy of their daily error or "rate" may be ascertained. For the determination of the rate nothing can be better than a single stroke on a gong, or some such audible signal. The firing of a gun, as is customary in a good many places, is useful as an audible signal only for places in propinquity to the gun, because of the time which elapses before the sound travels to a distant observer. For exact work it is the flash that is noted, when it can be seen. In an important city in the North, a great public clock—the standard for the city—is corrected by hand, and therefore may sometimes be appreciably out of time. This clock is provided with a bell, upon which the hours are struck, but whose note at 1 o'clock, whilst prepared for by the mechanism of the clock, is let off by the 1 o'clock Greenwich signal, quite regardless of the fact that, apart from the mechanical lag in the striking gear, the sound of the bell must take an appreciable time to reach the outskirts of the city. Quite a lot of expense must have been incurred in providing the special mechanism involved, and a comparatively large annual sum is paid for the signal, whereas for a much smaller capital and annual expenditure the clock itself might have been automatically synchronised, and the bells left to take care of themselves, as has recently been done at Aberdeen Town Hall, where the synchronising gear is so arranged that *all* the hours are struck exactly at the right time.

The most important visible signal is the time ball, many of these being in use to-day. This type of signal is the standard means for observatories to announce a certain hour—usually 1 o'clock—to observers within the radius of visibility. The most important duty of time balls lies in the means they afford to ships for checking the rates of their chronometers. For this purpose the Admiralty Dockyard stations round our south and south-west coasts have been provided with time balls; some dropped by the Greenwich signal at 1 o'clock, others dropped every hour by an electric current sent out from a regulator clock, which is corrected to agree with the Greenwich signal.

Another class of visible signal one sees in watchmakers' shops is the deflecting needle of a galvanometer. As it requires two observers—one to see the signal and one to observe the clocks—with the very considerable risk of personal error occurring between them, it cannot be of what one might call *scientific* value.

For the physical correction of clocks there are many methods. Hand correction may be dismissed at once as haphazard and most unscientific. There is, however, one really scientific method of what I may call electro-manual correction devised by Sir George Airey, which is used to-day—notably, amongst other instances, on the Mean Solar and Sidereal clocks at Greenwich, and also in the clocks at the Admiralty stations. In the Admiralty clocks are two pendulums, vibrating seconds, one suspended immediately behind the other. The one is entirely free on its suspension, but is normally latched to one side by a detent, which is released by the arrival of the Greenwich signal; the other, which controls the clock, has fixed to it a permanent magnet, which, with the vibration of the pendulum, swings just clear of the poles of an electromagnet fixed to the case. On the release of the free pendulum, should the clock be absolutely to time, both pendulums will vibrate in phase with each other, but if there be any variation, the difference in phase may be read on a suitable scale, and then a current is sent round the electromagnet in such a direction as either to attract or repel the permanent magnet; thus, by altering its effective centre of gravity, accelerating or retarding the clock pendulum until both are again in phase. These clocks are also provided with electrical contacts to enable them to report automatically their performance to Greenwich, and to drop the time balls. The Mean Solar and Sidereal clocks at Greenwich are corrected in the same way, save that, as their performance is observed on electrically-operated seconds indicating dials, by which the clock error may be compared with a transit observation, the free pendulum is not required. Up to quite recently this appeared to be the only method by which an error of a fraction of a second could be physically corrected, without involving a permanent alteration in the regulation of a pendulum. There is, of course, in this system, as in all systems where a personal element is introduced, some risk of personal error; but in the hands of skilful and trained observers, the foregoing method offers possibilities for very close correction indeed.

The majority of the methods for zeroising clocks by means of a synchronising current in use at the present time depend upon the action of a lever or roller caused to come into contact with, and push round, a spiral cam or its equivalent. With certain restrictions this method is reasonably good.

When it was decided that the Post Office should consider the question of automatic correction from a practical point of view, the methods previously in use were very carefully analysed, and, after experimenting at some length, we arrived at several rather important conclusions, amongst others that the periodic checking of a gaining rate—as in Ritchie's method—was fundamentally correct, because of the backlash that must perforce exist in any train of wheels; whereby any attempt to move a slow clock forward would disengage the teeth of the train from their driving position, which space would afterwards have to be gathered up when the correcting power ceased to apply, obviously leaving the clock incorrect to the extent of such backlash. This, of course, does not occur when setting back or checking a gain is concerned, for the engagement of the teeth of the train is not disturbed. An important desideratum recognised was that whatever might be the method adopted, the additional part or parts to be added to a clock must be of such design as to be readily incorporated in all the classes of clock in use in the Post Office from 10-in. timepieces up to comparatively large 36-in. dial clocks, and, above all, the cost of the apparatus and fixing it must be reasonably low.

A small electromagnet detent was therefore designed, which can be readily attached behind the dial of any timepiece, and in which the magnet has no positive work to do. A pin on the armature is arranged to project through a hole in the dial in such a way that, periodically, when the minute hand reaches the sixtieth minute, it engages with a flattened pin riveted to the hand. With the magnet unenergised, the pin on the hand easily pushes the detent pin to one side, and, because of the different arcs in which the two pins move, ultimately clears the detent, allowing the armature to fall back to its normal position upon the poles of the magnet. If, however, the magnet be energised, the armature is simply locked in position (which, of course, requires much less effort than actually to move the armature through any distance), and then, by the engagement of the pins, the clock is held up, the hands meanwhile slipping on their arbors without stopping the train, until at the cessation of the current the hands are allowed to progress. Such, then, is a synchroniser, which, when equipped with a pair of terminals, fixed to a clock and included in an electrical circuit having a suitable hourly signal thereon, is all that we require to enable an erratic timekeeper to be converted into one whose performance may be relied upon implicitly within an error limit of a fraction of a minute. The electrical resistance of the synchronisers used on Post Office installations is 10 ohms, and all the clocks in a building are connected in series or in series-parallel groups, the voltage at the master clock being regulated so as to afford a current value of about 250 milliamperes in each circuit, whatever be the number of clocks. Actually 100 milliamperes are ample, but it is found to be safer to allow a wide margin.

We have not standardised any fitting for correcting turret clocks, because these being usually made to order, one at a time, vary so much in constructional detail, that any attempt to apply a standardised attachment would be comparatively expensive. We, however, standardise the principle. It may be interesting to know that for a number exceeding six clocks in one building, the cost of the Post Office system, including all wiring and a master clock, which I shall presently describe, averages approximately no more than £1 per clock. It will, of course, not be overlooked that there remain the annual charges for maintenance and winding the synchronised clocks.

We now use a master clock, which is more of the nature of a time-controlled switch than a clock. This consists of a pendulum, electrically-driven on the Hipp principle, which, through a pawl and a ratchet wheel, drives a worm gear connected to a very simple train of wheels, embodying one-hour and 24-hour wheels. The 24-hour wheel is provided with cams which operate, at the proper time, electrical contacts controlling automatic switches or relays for the proper reception of the 10.0 and 1.0 o'clock Greenwich signals. The hour wheel carries a pin which once an hour, from about two minutes before the exact hour, depresses a lever to make the circuit for the hourly correcting signal. The lever is released, and thus breaks the circuit, precisely at the 60th second of the 60th minute of the hour. The arbor of the ratchet wheel carries a heart-shaped cam by means of which an electromagnet armature provided with a roller extension zeroises daily the whole of the train. It is, of course, obvious that synchronising by a cam in this case, on the quickest moving member of the train, is not open to the objection which would apply, as I previously remarked, to the same method applied directly to the minute arbor of a clock. Since these clocks were designed, a patent has been taken out by the Silent Electric Clock Co. for a master clock synchronising method which seems to be the most scientific, and promises to be the most efficient, system yet devised for the purpose. In this method Sir George Airey's method for barometric compensation is in part made use of. That is to say, the pendulum is re-regulated automatically to a degree proportional to the observed error of the clock, either fast or slow, by means of the effect of minute variations of an automatically adjusted magnet upon another carried by the pendulum. An arbor rotating once a minute, or once in a half-minute, carries a small two-segment commutator which carries three brushes. These are disposed about the commutator in such a way that if the clock be absolutely right upon the receipt of the time signal, one of them, which is connected in the local circuit of a relay on which the signal is received, rests upon the insulation between the segments, whilst the other two rest, one upon each of the segments. If the clock be right, the local circuit is therefore disconnected, but if it be fast or slow, the local circuit is completed through one or other of the brushes to either of a pair of electromagnets, whose armatures, by means of a step-by-step propulsion mechanism, rotate a wheel, one step at a time, forwards or backwards, and thereby cause the magnet to recede from or approach the vibrating member and so retard or accelerate the rate of the pendulum.

As the corrections are applied by minute steps, one at a time, the clock, when set up, may be roughly regulated, and then left to regulate itself. The corrections will operate time after time, until the clock finds itself correct, when they will cease to be effective. Should the distance through which the correcting magnet moves be so great that if, when the corrections have matured, it is found that the next correction has a tendency to transfer the error to the opposite rate, the initial position of the correcting magnet may be varied by hand, so that the actual effect of each step in its movement may be varied within a wide range. This, in itself, offers possibilities for comparatively coarse or extremely fine correction—possibly closer than normally possible by hand regulation. Should this method, upon trial, be found to be as perfect as it seems, there is no doubt but that it will be adopted for Post Office purposes.

This master clock, of course, is also used as the control clock for sub-chronopher stations in connection with the new time distribution scheme, to which I referred earlier in the paper. I may add that, recognising the fact that telegraphic interruptions do occur, the electrical circuits are so arranged that a false synchronising signal cannot be accepted by the clock, nor can the entire failure of the signal interfere with its normal going.

The foregoing, then, is the scheme which the Post Office has adopted for ensuring the observance of correct time at offices where spring or weight-driven clocks are already in existence, and the extension of the system is being proceeded with as rapidly as convenient.

Synchronisation such as this, is, after all, but a sort of compromise. It is useful where a number of clocks exist which cannot well be scrapped. But it is evident that personal attention is still necessary, for they have to be wound up.

Types of electrically self-wound clocks, suitable for synchronisation, there are in plenty; there is now operating in London a firm who are selling, and leasing upon rental terms, clocks of this class. But it seems to me that it is a singularly roundabout way to achieve the object when, if one must depend upon electricity for the provision of an exact time service, that object can be attained by the use of such simple and inexpensive mechanism as the modern electrically-propelled clocks, driven by electrical impulses from one master clock.

So far as the Post Office itself is concerned, where the equipment of a new building, or one hitherto not adequately provided with clocks is in question, we should invariably install a purely electric system whose master would be automatically synchronised. H.M. Office of Works have equipped many buildings, including post offices, with the Magneta clock system. They have not, however, gone so far as to arrange for the automatic control of the master clocks, preferring apparently to rely upon the personal correction made, if necessary, when the master clocks are manually wound up daily, as is necessary with the Magneta system.

Premising daily synchronisation by a Greenwich signal, exact time-keeping qualities are really not of prime importance, and in my opinion an ideal system should consist of a master clock, which should be entirely independent of personal attention for winding or correction, lending itself readily to automatic correction, and connected to secondary clocks in which the moving parts should be as few as possible and coupled with driving mechanism of the rotary type—akin to an ordinary electric motor. In 1896, when the Post Office acquired the telephone trunk wires, we found the need for large clocks indicating periods of ¼ minute, and those which were then made in accordance with the design of Mr. Kempe were operated by rotary armatures. These clocks, made more than 15 years ago, are still in use and are doing their work satisfactorily, much more so, I feel sure, than if they had been driven by ratchet work, which would have involved some measure of adjustment to take up wear, and more or less variable springs which are almost inseparable from that type of gear. These particular clocks, designed a long time before the electric clock industry had reached its present stage of perfection, are rather unique, inasmuch as the third concentric hand revolved once a minute in four jumps of a quarter of a revolution each ¼-minute, involving a little mechanical problem not quite easy of accomplishment, but so easy, when done. The clocks were made in two sizes with 24-in. and 5-in. dials, similar driving mechanism being employed in each size. Their functions are now, however, being performed by Calculographs and time clocks.

Where master clocks are synchronised, whatever be the method adopted, arrangements should be made that the operation be *entirely* automatic and not dependent upon manual attendance in the event of any failure of the signal.

When one considers how very essential, for the correct operations of commerce, is a rigid adherence to a uniform standard of time, it is a matter of wonder to me that so few persons who would not, nor could, dispense with means for ascertaining the time, do not go one step further and insist upon the time which they make use of being correct time. Correct time is fully appreciated, and any increase in the facilities for accurate and wide distribution is welcomed and made use of without stint, by our Naval and Mercantile Marine.

We now have the benefit of the radio-telegraphic stations on the Eiffel Tower and at the mouth of the Elbe transmitting time signals for the benefit of all who have means for listening to them. The cost of the apparatus necessary for the reception of these signals on ships unprovided with radio-telegraph apparatus is from £10 to £20, not a large sum when compared with the immense value of the service thus obtained; and aerials having an elevation of 20 m. are sufficient for vessels within a radius of about 200 miles. I may add that the facility afforded by radio time signals is of immense value in surveying operations, for, by this means, most minute differences in longitude can be calculated.

Institution of Electrical Engineers.

On Monday last week Mr. W. C. Mountain, M.I.M.E., delivered his inaugural address as chairman of the Newcastle Local Section of the Institution. Referring first to the gratifying activity prevailing in the electrical trades, he expressed a hope that means might be found to diminish excessive competition between British manufacturers. The address related mainly to the application of electricity to mining purposes, with which he had been associated for many years, and which was now making very rapid strides. He did not think that the West Stanley colliery explosion was due to the use of electricity, though it led to the revision of the Home Office Rules, which, in their new form, would involve considerable modification in many old installations. Their main object was to ensure a good mechanical protection to all cables, an efficient system of earthing, and improvement in the design of switchgear, together with better supervision of electrical plant underground. After reviewing the requirements embodied in the new Rules, and pointing out the great expense that would have been entailed if collieries, already well equipped and with no accidents recorded against them, had not been exempted from complying with them until 1920, Mr. Mountain discussed the action brought against Mr. Imrie, manager of the Chopwell Colliery, by the Home Office, on the ground of non-compliance with the rules, which was decided in favour of the former; he considered that the case had been dealt with by the technical Press in a somewhat harsh manner, as the Consett Co., who owned the colliery, had installed armoured cables, and were as quickly as possible meeting the new requirements.

In the North of England coal-owners were fortunate in having one of the largest electric power companies available, and given a cheap supply of electricity, they were well advised to take advantage of it. But in many districts there was a large amount of unsaleable coal which was sufficiently good for steam production, and waste heat and gas could also be profitably utilised; hence it was gratifying to see that private power stations of considerable size were being installed all over the country. With exhaust steam turbines, after allowing for all charges, the cost of generation had been as low as 0·15d. per unit, and in many cases under 0·2d., though the load factor was only about 30 per cent.

Regarding electric winding, for heavy work and with cheap coal or waste heat available, he still thought the modern steam winding engine the cheaper system of winding; but for small outputs there was a very large field for electric winding, and a very considerable amount of work was being done in this direction. The use of helical-cut gearing had assisted greatly, as it enabled smaller and cheaper motors to be used. The simple induction-motor was quite suitable in cases where the peak load when starting did not cause any trouble. The use of a motor-generator introduced risk of breakdown. For cables in mining work he preferred those insulated with bitumen, provided there was no risk of decentralisation of the conductors. The pillar type of switchgear, with draw-out arrangements for isolation, was very satisfactory for use underground. Care must be given to the earth connection of the armouring of the cables to switch cases, as well as to the junction boxes, controller cases and motor frames. The slip-rings of motors should be enclosed if there was any likelihood of gas being present, but he did not consider the total enclosure of large motors satisfactory. Broadly speaking, total enclosure was a mechanical protection only, as doors or covers might be left improperly secured; and where there was any positive danger of gas in part of a colliery, it was better to install compressed air there. Electrical compressors could be employed near these places, but the average disk coal cutter consumed about 600 cb. ft. of free air per minute at 45-50 lb. per sq. in., and each such machine would, therefore, require 70 to 75 H.P. in the motor-compressor, the resulting efficiency being 30 to 40 per cent. compared with the direct use of electricity. Taking the horse-power at £5 per annum, this meant an additional annual expenditure of about £250 per coal-cutter.

Three-phase coal-cutter motors might be wound for as low a pressure as 110 volts, which could not cause a dangerous shock, a small transformer being combined with the gate-end switch. High-pressure current could then be brought by small cables near the working face, and possibly the total cost would be lower than if the standard voltage of 500 volts were adopted.

For high lifts the three-throw plunger pump was better than the centrifugal pump, in point of efficiency, the combined efficiency often being as high as 80 per cent. Single-reduction helical gear had improved the efficiency, but it ought always to run in oil. For large volumes of water at moderate heads, the centrifugal pump was better. Portable pumps should be of three-throw type. Electric haulage had made enormous strides, its economy being unapproachable. Some years ago, Mr. Mountain substituted an electric for a compressed-air haulage, with the result that the engine I.H.P. was reduced from 500 to 166. As regarded the driving of rolling mills, very great economies could be effected by the electric driving of many of the rolls, live rollers and other auxiliary machinery, but he doubted whether a real commercial saving could be effected in the case of very heavy reversing mills.

Electric refining of steel, electric traction on railways, ship propulsion, and other developments, were also touched upon by Mr. Mountain, who, in conclusion, said he felt that a consulting engineer ought to be willing to accept makers' standards as far as possible, and should give the manufacturer a fairly free hand as regarded design; he should clearly specify his requirements and the conditions under which the machinery was required to work, and call upon the manufacturer to provide information regarding the construction of apparatus, which would enable the engineer to form a decision based upon the merits of the plant and not only upon price. A low tender often proved in the long run to be by far the most expensive offer. He had no sympathy with some of the claims for consequential damages which had been brought against electrical manufacturers and engineers in the past; the purchaser could easily be protected by a fair and equitable contract.

LEGAL.

The National Telephone Arbitration.

(*Continued from page* 653.)

Mr. William Slingo, continuing his evidence, said that the total number of the larger magneto exchanges was 168, and one or two of the 41 which had been replaced with the battery system were not multiple exchanges. He had had 31 multiple magneto exchanges inspected. He estimated that it would take about six years to clear out all the magneto exchanges. In certain cases the magneto telephone was connected with the common battery exchanges, he believed there were some 23,000 instruments so connected; in most cases their life was over, and they ought to be withdrawn from the service and replaced with the central battery system as soon as possible.

Further questioned, Witness said that he could deal with the whole plant within two years and with the employ of 15,000 men.

Counsel: Would you have any difficulty in obtaining that number of men to put on work of this description?—I do not think so; I have at the present time 12,000 men doing maintenance and construction work, and I could undoubtedly get more. The total length of telephone wires of the Post Office amounted to 464,958 miles.

Cross-examined by Sir A. Cripps, Witness was pressed very closely as to the reason why in making up the Post Office estimates he did not proceed upon the lines of taking the cost of the work executed and the plant placed in the Post Office telephone system, and then comparing it with the cost of similar work and plant belonging to the Telephone Co., making due allowance for the variety of plant and difference of conditions, instead of proceeding upon what Mr. Snell called the "contractor's basis." He maintained that, with so many variations and differences in the construction and nature of the work and plant involved in the establishment of the two systems, it would not have been practicable to adopt the course suggested.

Questioned as to the number of telephone stations under the Post Office on December 31st, the date of the transfer, and March 31st, the date of the lease, Witness said the number of stations in London on March 31st was 74,146 completed and working, 398 completed and not working, and 10,025 private-wire stations. On December 31st, the number of exchange stations in London was 79,835, and in the provinces 39,160.

Cross-examined with regard to aerial cables, Witness said that the average life of a properly constructed vulcanised-rubber cable was about 12 years, and that of a rubber-covered dry-core cable, which was not so long-lived, was no more than nine years. The lead-sheathed cable had a life of about 15 years. A great deal of the aerial cable would be replaced because so much of it was faulty, and also because the Post Office desired to replace it by the underground system. He thought the two varieties of rubber cable should be taken down at once. They were giving so much trouble with the working circuits that this course was desirable.

His Lordship: Do you mean to say that, in some peculiar way, the performance of their duties ceased with the transfer of the company's system?—Witness said he did not mean to suggest that. The cables were in an unfit condition for the work they had to do, and dry air was being pumped into them every night in order that they might work the next day. They needed desiccation continuously and changing of wires.

His Lordship: In other words, you think they are used up?—I do.

Sir A. Cripps: How long did you think the lead-covered cables would remain *in situ* when the transfer was carried out?—Witness pointed out that he had fixed the life at 15 years.

On re-examination by the Solicitor-General, Mr. Slingo said, referring to the effect of electrolysis, that, until a cable was taken up in all its length, it was quite impossible to tell whether electrolytic action was going on in underground cables. So long as the lead was continuous in any thickness, there was no fault. The effect of electrolysis, he said, was variable—the greater the current the greater the amount of lead eaten away. He distinguished, of course, between the gradual chemical action of electrolysis, and the sudden melting effect of a strong current accidentally assailing the lead. As long as any ordinary stray current ran along the lead there would be no decomposition. It was where current escaped that the electrolytic action occurred. The current, however, might choose to take the pipe rather than the lead, and at a manhole or surface box, or wherever there was a break the current would pass into the lead across the gap. In order to avoid that, it was the practice of the Post Office wherever there was a break to join iron pipes by a lead strip, technically known as a "bond." When the cable was laid in a non-metallic conduit, the cable was connected by wire to an earthplate buried in the ground, so as to take away any stray current which might be travelling along the lead sheath. That was technically known as "earthing."

As a matter of fact, do you find that you do avoid the risk of electrolytic action to a very great extent by this "bonding" and "earthing"?—Oh, yes. The National Telephone Co.'s cables, he said, were neither "earthed" nor "bonded," and were, consequently, more subject to electrolysis.

Mr. Justice Lawrence reminded the witness that he had himself exhibited a portion of lead-sheathed cable rendered faulty by electrolytic action.—The Witness admitted it.

Mr. Justice Lawrence: Then, though you adopt methods for obviating this damage, they don't always succeed?—Mr. Slingo said that was so, but explained that it greatly minimised the danger, so that he had no doubt the Post Office cables suffered much less from the effects of electrolysis than the cables of the National Telephone Co. It would be possible still, he added, to "bond" or "earth" the cables taken over from the National Telephone Co., but that would not remedy the damage already committed. It was the experience of the Post Office that, since the adoption of these two devices, faults in cables had been much rarer than before.

Witness said he agreed with the estimate of the company as to the life of aerial cables—15 years for lead-covered, nine years for rubber-covered dry core, and 12 years for vulcanised rubber-covered cables. In conclusion, he said the stations of the Post Office and those of the company could not be properly compared as to cost, those of the Post Office being much the more costly, for many reasons, among which was the fact that the Post Office provided a larger margin of spare plant than the company.

In the course of further evidence, Mr. Slingo said the Post Office would remove the aerial cables taken over from the National Telephone Co. as soon as possible. The coverings of these cables were either vulcanised rubber, india-rubber or lead. The first two of these were not now being used in new telephone work in this country, and the aerial cable was only being used where it was practicable to have a lead covering. Where it was possible to avoid it, however, the Post Office did not put up aerial cables at all.

Mr. Buckmaster: Can you use aerial cables in the county of London?—We have not any. The Telephone Co. has, but we are going to take them down.

Answering further questions, Witness said that rubber-covered dry-core cables were very subject to developing faults. Out of 42,948 miles of these wires taken over there were 14,000 spares. It was only the spares that could be tested, and of these 80 per cent. were found to be faulty.

Mr. Buckmaster explained that these questions were asked witness with a view of showing the amount of depreciation in the aerial cables taken over. The parties had agreed upon the cost of construction, it was true, but there remained the question of the life of the plant as determined by the degree of depreciation. His object was to show that the life of the plant was shorter than the National Telephone Co. said it would be, and that consequently the agreed figure for cost of construction must be reduced by a greater amount than the company reckoned.

Witness said the proportion of cables covered with vulcanised rubber which had been found faulty was 20·48 per cent. as compared with 80·06 for rubber-covered dry-core cables.

Mr. Buckmaster: What are the causes which lead to lead-covered cables becoming useless?—Vibration, lightning, atmospheric fumes in certain districts, occasional wholesale damage by fire, &c., were all factors causing depreciation of cable. He considered that the use of vulcanite and india-rubber-covered cables was dead. Lead-covered cable would have a life of probably 15 years. He had not had much experience of bare wires in this connection, but the life of bronze wire should be materially shorter than that of copper wire. It was very much thinner, and therefore more liable to break down.

Examined next with regard to exchange equipments, Witness said that the magneto exchange instrument would not be retained in use for a longer period than was necessary. They would all be converted in the common-battery system. The common battery was more rapid in working and more satisfactory than the magneto system. The latter was admittedly out of date at the present time. Since the Post Office had taken over the National Telephone Co.'s system, they had replaced the magneto with the central battery in 41 of the larger exchanges, and in 74 of the smaller exchanges they had taken away the magneto system and installed the common-battery signalling equipment.

Mr. James O. Callender, one of the assistant managers of Callender's Cable and Construction Co., Ltd., and joint manager of the Anchor Cable Co., Ltd., on examination by Mr. Buckmaster, K.C. (for the Postmaster-General), said Callender's Cable Co. contracted both for the supply and the laying of cables; the Anchor Co., for the last five years, had confined themselves to supply. Callender's Co. contracted to lay in conduits prepared for them, and also to construct and prepare the conduits themselves. During the last 10 years he had estimated for and supervised contract work costing over £5,000,000 in this country and abroad. His experience in telephonic work had not been so great as in the supply and laying of electric light and power cables, but he had supplied and laid a number of telephone cables in this country. There was no difference in the cost of operations and handling between these and telephone cables.

Mr. Buckmaster: What does the cost of supervision include, so far as contractor's work is concerned?—Primarily the salaries of the engineers engaged in supervision work, the cost of such clerical assistance as they need, rent, rates, and taxes of stores, and petty cash for stationery, &c.

What do you add to cover these items?—Twenty per cent. on the cost of labour.

What do you include in the cost of labour ?—All labourers, workmen of all kinds engaged in handling and laying the cable, jointers and jointers' mates, foremen, watchmen, storekeepers, labour for handling at the stores, and workers of every description, in short. When a contract is made for the supplying and laying of cable, the work is placed in the hands of an engineer, who sends to the works for any material he requires, and it is the duty of the works to supply the material at any point he may direct within the ordinary cartage limit of the railway. Anything beyond that is debited to the contract. All charge up to that point is a charge against the material. So far as plant and tools are concerned, we keep a central depôt at the works, whence they are issued to the contract as required. In the case of large plant a rent is debited against them, small tools on their return to the depôt are valued at what they are then considered worth. There was nothing added in respect of storage of material. His company kept a store in every town in which they did work, but that was included under the head of supervision. A very slight percentage of the heavy material ever went into that store. They would make the same arrangement for supplying a contractor that they did when they were themselves contractors, if he asked that to be done, as he certainly would do if he knew his business.

What do you add for the contractors' profits ?—Ten per cent. on the labour plus supervision. Five per cent. is generally considered a correct figure for administration, preparation of plans, &c., by the people for whom we do the work.

The Witness said he had prepared a complete schedule of the cost per mile of the cables required for replacing the National Telephone Co.'s system, as at December 31st, 1911. He estimated for the supply only not for the laying ; but his company would have been pleased to contract both for supplying and laying them. The output of his company, however, was not sufficiently great in telephone work to warrant them in undertaking to supply and lay the whole system within two or three years, but they would have been prepared to undertake one-fourth of the amount, and there were five or six other firms carrying on a large business in the supplying and laying of electric cables in this country.

In answer to other questions, Witness said he did not anticipate that there would have been any difficulty in getting the necessary copper, which was estimated at about 6,000 tons, in the system of the National Telephone Co.

SIR ALFRED CRIPPS said it was 13,000 tons.

MR. CALLENDER explained that he spoke of cables only, not of overhead wires.

MR. BUCKMASTER : Do you anticipate that there would be any disturbance of the market if an order for, say, 6,500 tons of copper were placed at a particular time ?—No.

MR. DANCKWERTS (for the company) : For immediate delivery ?—Certainly.

MR. CALLENDER proceeded to explain that if a person wanted to buy 6,000 tons of electrolytic copper at any one time, he would be faced by the double difficulty that he could not get it and that he would probably put the market up against him. But he could go into the market and buy 6,000 tons of standard copper. Then when he required the electrolytic copper from time to time he would go to the drawer and tender his warrants for the standard copper, together with the difference in price between the two qualities of copper, and get his electrolytic copper.

MR. JUSTICE LAWRENCE : Is not there a risk that you could not get it ?—There is no risk, my Lord, because I could go to the standard refiners and get it there.

MR. JUSTICE LAWRENCE : We were told that they were chiefly in America.—They are, but there are two in this country.

We have been told that the copper market is very sensitive and somewhat erratic.—It is both sensitive and erratic, my Lord.

MR. JUSTICE LAWRENCE : Then I should have thought there would be a risk in the matter.

MR. CALLENDER thought not. The difference in price between standard and electrolytic copper, he explained, was about £3 per ton. The maximum variation between the two kinds during the last 10 years had been £4 10s. a ton, and they had come as near each other as 25s. So all the buyer had to do was to provide for any variation in the difference.

In cross-examination by SIR ALFRED CRIPPS, K.C. (for the company), Witness said his company had supplied and laid telephone cables to the value of £25,000 annually in this country alone during the last 10 years. If he were to reckon those supplied abroad the total would be a very different one. He estimated that the cost of carrying out a contract within a limited time was not more, but rather less, than where the work was extended over a long period. The cost of supervision, for instance, would be less where the work was carried through rapidly.

MR. D. C. JACKSON, a civil and electrical engineer in America, and member of other similar bodies in that country, on being called to give evidence for the Postmaster-General, and examined by Mr. Branson, said he was a member of the firm of Messrs. D. C. and W. M. B. Jackson, engineers, of Boston, Mass., and Chicago. He himself was Professor of Electrical Engineering in the Massachusetts Institute of Technology. His firm, he said, were consulting engineers, dealing with electric lighting, power and telephones. He was engineer to the Massachusetts Highways Commission, a quasi-judicial body having control of the rates and service of the telephone companies in the State, and he had had to give his attention to both these points. He had also had experience as to the capital outlay required for putting up a telephone system, and the question of the life of plant. His telephone practice alone had covered nearly a million stations during the last few years. The Witness said he had paid three special visits to this country at the invitation of the Post Office for the purpose of advising as to the best method of inventorying and valuing the National Telephone Co.'s plant. He had inspected the plant in 12 of the 98 centres of the company's system, and had made an examination of 57 of the company's exchanges, including 15 of the larger ones.

Objections were raised to the witness's qualification as an expert in this country, but the examination was allowed to continue.

MR. JACKSON then, in reply to MR. BRANSON, said that if he had to ascertain the value of the plant in the National Telephone Co.'s system at a particular day, he should look upon the cost of construction as estimated by a contractor or contractors as the best method of determining the question. To that he would add the cost of the undertaker's administration.

MR. JACKSON, continuing, said he had himself been a contractor engaged in the construction of electric light, power and railway systems. He was at one time at the head of the contracting department of the Edison General Electric Co., dealing with contracts amounting to from three-quarters of a million to a million pounds per annum.

MR. BRANSON : What figure would you add for contractors' supervision ?—20 per cent., or perhaps less, to the cost of material, freight, labour, casualty insurance, cartage and other associated costs. That 20 per cent. would cover such costs as the contractors' office or staff as far as wages and salaries are concerned, and the establishment charges. His own experience with the Edison Co. was that they never approached 20 per cent. for such costs.

MR. JUSTICE LAWRENCE did not see how the witness could put the cost at 20 per cent., if in his experience that percentage was never approached.

The witness said 20 per cent. was the outside figure to be estimated, and where a man had a chance of making a profitable contract he would put this cost at the maximum. His own experience never exceeded a cost of 15 per cent, but he had made contracts in which he allowed 15, 18, and 20 per cent. For contractors' profit, he would add 10 per cent. to the figures already discussed. If the contractor were himself the manufacturer there was a difference. When he was with the Edison Co. the contracting department was never expected to make a profit upon the plant supplied by them, but it was expected to make a 10 per cent. profit on labour and everything bought outside.

For the employer's work—making the contract, inspecting materials during construction, finally making the approval of the construction and certifying for the payment of the contractor, he would not allow more than 5 per cent. The amount of the employer's burden would be proportionately less in a large contract than in a small one. It would be more expensive to build up a system piecemeal than by continuous work.

The Witness was then examined as to the probable effect on the market of 13,000 tons of copper, the amount used in the National Telephone Co.'s system. The annual output of electrolytic copper in the United States, he said, was about 600,000 tons, about half of which was exported. The output of the rest of the world was from 100,000 tons to 125,000 tons, so that the proportion of the amount of copper contained in the company's system spread over two years represented 9 per cent. of the world's output. The average visible supply of copper at any one time varied from 100,000 to 300,000 or 400,000 tons.

MR. BRANSON : Is it your view that a purchase of 13,000 tons of copper would have any effect upon the market ?—No, not if made judiciously. If a contractor had an order to build a plant containing 13,000 tons of copper, he would have all his copper purchased within a few weeks, for delivery as he wanted it during the term of his contract, without any disturbance of the market. As the English market drew a very large proportion of its supplies of copper from the American producers, his experience in America was applicable to this case.

The lead in the company's cables Witness estimated at 38,000 tons. The annual output of the world was over 1,000,000 tons, and the purchase of 28,000 tons would not affect the market. The same answer applied to the purchase of the 900 tons of tin used.

Witness said the small magneto switchboards used by the company were identical with plant used in America, and he put both the physical and effective life of these at 10 years, and about the same for large magneto switchboards. He put the physical life of the common battery plant at 15 to 20 years, and its effective life at 10 years, the shortness of the effective life being caused by the rapid and steady development of the art of telephony. Subscribers' apparatus he gave an effective life of about 10 years. The best way of computing the depreciation value of a plant, he said, was first to take the estimated effective life of each species and the age at the time under consideration ; from these one could compute the balance of expectation of life and compare it with the value of the new plant, adding the salvage value of the plant.

The cross-examination was deferred.

MR. ALEXANDER SIEMENS, President of the Institution of Civil Engineers, &c., said his firm had been engaged in all kinds of electrical work for many years. They had laid eight Atlantic cables. He had seen the estimates put forward by the Postmaster-General in thi arbitration, and agreed with it. He thought it was ample. Witness put the cost of contractors' supervision at 21 per cent., contractors' profit at 10 per cent., and contracting engineer's fee at 5 per cent. Nor further provision was made for ordering and storing—in fact, in work of that kind, no store was necessary, because the plant was only delivered where it was needed. Where his firm were both contractors and manufacturers, the supplies were kept in store at the works until they were wanted, and that was the usual practice. Mr. Siemens said his firm could undertake to complete the whole of the National Telephone Co.'s system in 2½ years, both underground cables and overhead wires, by restricting the number of outside orders for the same period. His firm was using about 2,000 tons of electrolytic copper per annum in their work at

Woolwich, but that could be increased to 4,000 tons, so that without disturbing their general business they could apply 2,000 tons to this telephonic business. And if necessary the works could be extended within six weeks. He did not anticipate any difficulty in getting enough labour either inside or outside for the completion of the contract. There might be some difficulty at first in getting a sufficient supply of jointers, but these could be trained in two months. The work could be carried on at as many different points as were necessary to expedite it. If his firm here had any difficulty in turning out the cable he would get the help of the houses of Siemens in other countries which dealt with 30,000 tons of electrolytic copper a year. The Berlin house alone was now consumg 80 tons a day, or at the rate of 24,000 tons a year. Witness said his firm laid the original telegraph lines in Russia in '57, in Argentina and Brazil, and had done a great deal of work in India. His firm, he said, wrote off 10 per cent. a year on all their plant, so to say, leaving 90 per cent. of the original value at the end of the first year, then 10 per cent. on that, and so on in diminishing principal.

In cross-examination by Mr. Danckwerts, K.C., Mr. Siemens said he required to make no calculations in order to arrive at an agreement with the estimates of the Post Office. He would not have known his business if he had not been able to do so without fresh calculation.

In re-examination by the Solicitor-General, witness explained that the integral parts of the cost of cable were 90 per cent. for material, 5 per cent. for making, and 5 per cent. for establishment charges. When the works were run at night, the increased cost of labour was balanced by the decreased cost of establishment charges. He added that the representatives of the firms of Siemens in various countries were in the habit of having periodical conferences on the condition of business, and as the result of one of these, they were now erecting large telephone works at Woolwich. "We think there will be a demand for telephones now." he said.

Mr. G. W. Cook, a retired superintendent engineer of the Post Office, gave evidence to show that several of the cement conduits of the National Co. were, on inspection, found to be defective, mainly on account of the cement blocks getting out of alignment.

Mr. Geo. Wm. Hook, on further examination by the Solicitor-General (Sir John Simon), spoke of a case in Plymouth where the blocks in a cement conduit of the company had become so far out of alignment that they could not get a mandrel through, and one was actually lost in the duct.

Mr. Justice Lawrence said he did not see how that affected the case.

The Solicitor-General said the parties had agreed a value to be put upon these cement block conduits when they were new. Now the Court had to determine how much further life was left in them. The view of the Post Office was that their present condition was such that their remaining life was very short. Supposing the Post Office showed that there was reason to think that in a substantial part of the whole these blocks were out of alignment, with the result that there was not a 3-in. hole left, they were already in a condition when they had served their best years and had become inefficient, almost obsolete conduits. That, he thought, would have a bearing on the question of life.

His Lordship said the condition of the conduits would, of course, be taken into consideration, but he would not allow himself to be influenced by the loss of a mandrel.

The Witness said that the 3-in. conduits of the company should have taken a 2¾-in. mandrel if they had been clear, but out of 183 miles examined by him, 30·657 of the conduits were blocked to the 2¾-in. mandrel, 23·217 would take a 2½-in. mandrel, 2·476 would take a 2-in. mandrel, and 4·964 were below that.

Sir Alfred Cripps (for the company) asked if it was not the case that all except a very small proportion of the company's cables would pass through a 2½-in. or even a 2-in. duct.—Mr. Hook said he did not know that, but pointed out that the trouble was a progressive one.

Mr. Jackson was recalled for cross-examination, but Sir Alfred Cripps declined to ask any further questions.

Mr. Wm. Aitken, M.I.E.E., on examination, on behalf of the Postmaster-General, by Mr. Branson, said he had been exclusively connected with the telephone industry for 30 years. For 10 years he had been in the employment of the British Insulated and Helsby Cables, Ltd., during part of that time as telephone engineer in charge of their telephone manufacturing works, now formed into a separate company under the name of the Automatic Telephone Manufacturing Co., Ltd. His company had supplied 25 trunk and 11 common battery exchanges to the Post Office, and had also supplied plant to the National Telephone Co. Upon the agreed figures for cost of labour, tools, &c., used in the construction of a telephone system, he estimated that an allowance of 20 per cent. should be made for supervision, with 5 per cent. on freight, cartage, &c., to cover the money laid out on that account, if competition were not very keen, but if it were keen 15 per cent. would probably have to go. There would be nothing to add beyond that on that head. For contractors' profits he would add 10 per cent. on the cost of labour, tools, &c. As contractors they added no contractors' profit on plant manufactured by themselves, but on goods bought from other manufacturers they added 5 per cent. The manufacturers' profit on plant, he said, was about 10 per cent., but it varied very much. Witness said he agreed with all the estimates on exchange equipment, subscribers' apparatus, &c., and his company would be prepared to undertake the contract to replace these on the National Telephone Co.'s lines on those terms within three years.

In cross-examination by Sir Alfred Cripps, Witness said that the capital of the Automatic Telephone Manufacturing Co., Ltd., was £1,000,000, but he did not know how much had been paid up. The company, he said, had only been in existence, as such, for nine or ten months, but it had previously been long engaged in large contracts as the British Insulated and Helsby Co.

Mr. Sidney George Leech, a joint managing director of J. B. Saunders & Co., Ltd., and a M.I.E.E., said his firm's office was in Westminster. His firm, he said, were contractors only and not manufacturers. They were engaged in the construction and maintenance of overhead telephone and telegraph lines, also on electric light and power lines carried overhead. At present they were maintaining the telegraph systems belonging to 24 of the smaller railway companies. Having no factory of their own, they bought the supplies necessary for any construction work they undertook. For supervision in the erection of poles and standards, and the placing of bare wire and aerial cable, he estimated that 19 per cent. should be charged on the cost of tools, &c. Contractors' profit he never estimated at more than 10 per cent., but it was usually less. He also charged a percentage of the material bought for the work. He allowed nothing for storage.

In cross-examination by Sir Alfred Cripps, Witness said the amount of telephone construction his company had done during the last five years under contract was negligible, and as regarded telephone work for the railways, whose telegraphs and telephones they maintained, he could not separate construction from maintenance. The annual figure under both these heads was, roughly, £30,000. He thought supervision and administration would cost more where work was spread over a long period than when it was executed in a short time, but labour would not.

In re-examination, Witness said the 19 per cent. which he estimated for supervision and administration was arrived at by reference to the actual amounts shown in his firm's contracts.

Mr. Andrew Young, valuer to the London County Council for the last 24 years, on examination by Mr. Schwabe, said he would allow 5 per cent. for headquarter administration, of which 4 per cent. would go to the engineer to provide for the cost of devising the scheme of the work, for preparing all designs, plans, estimates and other documents, supervising the work, providing a drawing office and other engineers in charge of the construction of the work, and any machinery that might be necessary for the inspection and testing of any materials, &c. He allowed 10 per cent. on the fundamental cost for contractors' profits, and said the contractors in that 10 per cent. included all contingencies. In preparing a contract, an engineer might make a separate allowance for contingencies, but the contractor would not do so. If the sum so allowed by the engineer were not wholly expended, the residue went back to the employer. But there was no need of a contingency fund in the case of work that had already been executed. He said he had never before heard of a charge for interest on plant, and as for the cost of obtaining subscribers' agreements, he thought that ought rather to be a charge upon the business than upon the construction.

Mr. Justice Lawrence: Supposing the purchaser takes over the subscribers and their agreements?—Then I consider that the profits come in there, and under the Tramways Act we are not allowed to take profits into consideration.

Sir James Woodhouse: Are you aware that the Post Office, before they go into a district, canvass a district in order to ascertain the probable number of subscribers?—They may do so.

Would that, in your view, be any part of the cost of constructing the exchange?—No, my Lord. I consider it should be taken out of the revenue, and not added to the capital value.

In cross-examination by Mr. Danckwerts, Witness said it was his experience that contractors were willing to accept a 10 per cent. profit, but he could not estimate how much contingencies and establishment charges would reduce that, before the actual net profit of the contractor was ascertained.

Mr. Justice Lawrence: Have you made any estimate of what his net profit is to be?—No, my Lord. I only know that contractors will accept contracts on the 10 per cent. basis.

In answer to other questions, the Witness said he had valued the plant only, in the ordinary way; if he had had to value the system as a going concern, of course the value would have been considerably greater. He made no allowance for obsolescence of plant.

In re-examination by Sir John Simon, Witness said that the plant of the undertaking would be of no more value because it was taken over as a going concern. The increased value belonged not to plant but to goodwill. He was strongly of opinion that a sinking fund basis was not a proper one to apply in order to ascertain the value of a plant which was not new.

The Solicitor-General said the Post Office would finish its evidence this week, and he suggested that a break of a few days might then be made before arguments were entered upon. That would allow Mr. Snell and Mr. Gill to complete their efforts to simplify the mode of determining the life of plant.

(*To be continued.*)

Compensation Claim.

There was a settlement on Monday, at Blackburn County Court of the case in which John Thomas Watson, electrical engineer, Royal Terrace, Darwen, claimed £222 from Messrs. Dick, Kerr & Co., electrical engineers, of Preston, on account of the death of his son, Evan, who was killed whilst working at respondents' works. The father set up a claim of partial dependence, and it was decided to grant him £78.

Attorney-General v. London Electric Railways Co.

On Friday last Mr. Justice Neville, in the Chancery Division, had before him the motion by the Attorney-General, at the relation of the Gordon Hotels, by which it was sought to restrain the defendants until the trial of the action or further order, from pumping at their works on the Embankment in a manner which, it was alleged, was calculated to damage the relators' property.

Mr. Felix Cassel, K.C., and the Hon. H. B. Ponsonby were counsel for the plaintiffs, and the Railway Co. was represented by Mr. Bramwell Davis, K.C., and Mr. [illegible].

Mr. Cassel said that the motion was to restrain the defendants from pumping water from their works in violation of an express provision in their Act of Parliament under which they were carrying out these particular works. The action was brought by the Attorney-General at the relation of the Gordon Hotels, who owned the Hôtel Metropole, at the corner of Northumberland Avenue and Whitehall Place, and they were apprehensive that this pumping would endanger their buildings, and other buildings in the immediate neighbourhood. The defendant company was an amalgamation of the Charing Cross, Euston and Hampstead Railway, the Baker Street and Waterloo, and he thought also the Piccadilly, but with that they were not concerned. The defendant company, under an Act of 1911, had power to make a loop line, the object of which was to bring the Charing Cross, Euston and Hampstead into direct communication with the District Railway, the present terminus of the Charing Cross, Euston and Hampstead being under the Charing Cross Station of the South-Eastern and Chatham, and having no connection with either the Charing Cross Station of the District or the Embankment Station of the Baker Street and Waterloo. By the London Electric Railways Act of 1911, which authorised this loop, it was provided that the construction of the railway should be by metal shields worked by hydraulic pressure, and of such length as to protect the soil. Sec. 5 provided that, where fluid was found, compressed air should be applied to prevent the inflow of any sand, silt or gravel, and the excavation should be immediately stopped until compressed-air machinery was provided. Sec. 6, which was the important one, provided that, except in the case of something unforeseen, or for the purpose of removing running water, no use should be made of a pump or other like method of removing water from the works. What the defendants were doing, and, in fact, had done ever since December 28th, 1911, when these works were commenced, was to pump continuously at a point quite close to the District Station. It was not disputed that they had been pumping ever since December, 1911, and that the pumping was still going on, but they said the pumping was now being done by another company. It was, however, admitted that they were doing it up to October 12th at the rate of about 100 gallons a minute. Since the motion was launched, however, an undertaking had been given that the pumping should be as little as possible, and should not exceed 60 gallons a minute. That undertaking was given before the Vacation Judge, and the motion had stood over until that day; but on October 12th the plaintiffs received a letter from the defendants' solicitor to the effect that the Metropolitan District Railway proposed to proceed the following week with works authorised by an Act of 1912, and it would be necessary for them to pump, and that the pumping operations of the defendant company had been suspended for the time being. The letter concluded, and it was written so that the plaintiffs might not in any way be taken by surprise, that the Metropolitan and District were not restricted in any way as to pumping. All the plaintiffs knew was that the same pumping was still continued, though they were now told that it was by a different company under a different Act of Parliament.

Mr. Bramwell Davis said that his clients had ceased pumping, and he was quite willing to undertake to let the plaintiffs have notice if at any time it was proposed to resume pumping on behalf of the London Electric Railways, who were the only defendants to this action.

Mr. Cassel said he felt the difficulty of pressing for an interim injunction when the defendants said they had ceased to pump.

Mr. Bramwell Davis: And my friend shall have seven days' notice of any intention on our part to resume. He could not, he said, give an absolute undertaking that there should be no pumping without seven days' notice as an emergency might prevent such an undertaking being fulfilled with reasonable safety. The plaintiffs, however, might take it that there was no immediate intention by the London Electric Co. to resume pumping.

Mr. Cassel said, under the circumstances, he could not ask for an injunction upon the motion, but asked whether the trial of the action could not be expedited.

His Lordship thought that was reasonable as the motion had not been pressed, and it was no doubt better for all parties that they should know where they stood.

Mr. Cassel suggested that the motion might be used as a summons for directions and the date of pleadings fixed.

His Lordship said that if it was only a question of whether under their Act to pump as they had been pumping, no pleadings would be required.

Mr. Bramwell Davis said that his contention would be that under their Act of Parliament they were entitled to pump, but it was not only a question of whether what they had been doing in the past was authorised by the Act. There was another question, which was, that it was only a trifling amount of water that they had been pumping. The Act said that if unforeseen circumstances arose, they could pump water to a trifling amount.

Mr. Cassel: Thirty-nine million gallons a day.

Mr. Bramwell Davis: That is a matter of evidence.

After some further discussion, it was agreed that the motion should stand over until the trial of the action, with liberty to bring [illegible] the defendants to give seven days' notice of any intention on their part to resume pumping. Leave was also given to the parties to appeal in Chambers for inspection if they were unable to come to a mutual arrangement.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

8 PROPOSED NEW DUTCH TARIFF.—The Board of Trade have just issued a translation of a proposed new Dutch Tariff. The draft tariff previously issued has been considered by a Committee of the Netherlands Government for upwards of a year, and the rates now published are those finally suggested by the Government. The following are the changes which, if carried into effect, will most interest readers of the Electrical Review :—

	Present rate, ad val.	Proposed rate, ad val.
Cables and wire of copper for electric installations insulated and other copper wire having material wound, spun, or plaited round it	5 %	6 %
Articles and manufactures of copper, brass or bronze not separately mentioned :—		
Roughly worked	5 %	10 %
Polished, lacquered, &c.	5 %	12 %
Porcelain for the insulation of electric current ...	5 %	6 %
Glass globes for the manufacture of incandescent electric lamps	5 %	Free
Asphalte and asbestos paper...	5 %	10 %
Rolling stock for railways and tramways	5 %	10 %
„ „ for transportable railways	5 %	6 %
Machine tools, boilers, pumps, refrigerating machines and air-compressors with fittings ...	Free	6 %
Accumulators	5 %	Free
Dynamos and electromotors	Free	6 %
Hoisting and conveying appliances worked by machine or hand-power...	5 %	6 %
Accessories for steam, water and ventilating installations, such as cocks, shut-off valves, &c. :		
(*a*) Fastened to or imported with the plant ...	Free	Free
(*b*) Other	Free	6 %
Appliances (apparatus) not being machine or hand tools, not separately mentioned	Free	6 %
Implements not separately mentioned ...	Free	Free
Parts of driving machinery, such as axles, couplings, crankshaft bearings, transmission belts, &c.	Free	6 %
Engine and boiler packing	Free	6 %
Mathematical, physical, surgical, optical and electrical instruments and apparatus not separately mentioned...	5 %	6 %
Lamps and ornaments for gas, electric or other means of lighting, with or without the globes belonging thereto, not separately mentioned	5 %	12 %
India-rubber manufactures not separately mentioned	5 %	12 %
Celluloid manufactures not separately mentioned	5 %	12 %
Asbestos, even if mixed with other substances :		
Worked, not separately mentioned	5 %	6 %
Mica, in sheets not more than 1½ mm. thick ...	Free	6 %
Mica articles, if not separately mentioned... ...	5 %	12 %
Aluminium wire for electric insulation (insulated), other wire having material wound, spun, or plaited round it	Free	6 %
Iron wire with other material wound, spun or plaited round it	Free	6 %

No duty shall be levied :—(*a*) On the packing of imported goods such as cases, barrels, baskets, straw, hay, shavings, &c., serving to protect the goods during the transport from breakage or other damage.

(*b*) On the packing of imported goods, such as large jugs or stone bottles, tins, cases and the like in which the goods are, as a rule, stocked and kept by the person who sells them again, but not delivered to the consumer.

(*c*) On small soldered tins, paper, and tin-foil, in which the goods are wrapped or by which they are separated from one another, small boards or reels round which trimming, ribbon or thread is wound, unpainted and plain (bare) cardboard boxes and similar packing material (even if the goods are packed therein for direct delivery to the consumer, in so far as this packing material as such has no commercial value, or, after unpacking, is no longer serviceable for a similar destination.

A duty of 12 per cent., *ad valorem*, shall be payable on the packing of imported goods not falling under the previous paragraphs, it will not be necessary to indicate in the Customs declaration the correct name of the packing, but it will be sufficient to declare it as packing for retail sale.

The provisions of the previous paragraphs, shall also be applicable to goods on which duty is levied according to a standard other than weight or which are admitted free from import duty.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,402. "Electric controller contact." J. Dawson. October 14th.

23,404. "Sparking plugs for internal-combustion engines and other purposes." A. J. Riley. October 14th.

23,409. "Switchboard connecting cords and the like." P. P. Craven. (Addition to 11,306, 1912.) October 14th.

23,417. "Electrical token apparatus for railways." A. T. Blackall and C. M. Jacobs. October 14th.

23,429. "Composite material suitable for use in the construction of heating elements, rheostats and the like." A. C. Whish. October 14th.

23,430. "Electric ignition apparatus for internal-combustion engines." H. Leitner. October 14th.

23,432. "Dynamo-electric machines." R. A. Holbech. October 14th.

23,450. "Manufacture of explosives, fuses, detonators, percussion caps and the like." A. Jaques and G. Wells. October 14th.

23,451. "Electrical heating apparatus more especially vulcanisers." H. R. Nash. October 14th.

23,453. "Electric incandescent lamps." T. F. J. Truss. October 14th. (Complete.)

23 458. "Transmitting apparatus for use with wireless telegraph systems." W. H. Shephard and A. E. McKechnie. October 14th.

23,475. "Process for the manufacture of chemically-pure tungsten." C. H. Fischer. October 14th.

23,514. "Electric cut-outs." Voigt & Haeffner Akt. Ges. (Convention date, November 2nd, 1911, Germany.) October 15th. (Complete.)

23,520. "Electric shade carrier." A. E. Otway, J. H. Ormrod, and W. J. Purdue. October 15th. (Complete.)

23,527. "Telephone systems." H. F. Taylor. October 15th.

23,542. "Automatic electric current controller for limiting the consumption of current." L. Abbatecola. (Convention date, March 26th, 1912, Italy.) October 15th. (Complete.)

23,545. "Electro-osmotic extraction of water from animal, vegetable or mineral substances." Gesellschaft fur Electro Osmose m.b.H. (Convention date, July 17th, 1912, Germany.) October 15th. (Complete.)

23,564. "Wire terminal plugs." C. E. Mowrer. October 15th. (Complete.)

23,576. "Automatically-operated fans." W. J. Stimson. October 15th. (Complete.)

23,588. "Wall plugs for electrical fittings." F. Scheinig. (Convention date, October 16th, 1911, Austria.) October 15th. (Complete.)

23,590. "Electric clock systems." L. J. Aron. (Convention date, October 16th, 1911, Germany.) October 15th. (Complete.)

23,593. "Filaments suitable for incandescent electric lamps and the like." British Thomson-Houston Co. (General Electric Co., United States.) October 15th.

23,594. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 15th.

23,595. "Incandescence electric lamps." J. Red. October 15th.

23,597. "Magnetic speedometers." R. Haddan. (Stewart & Clark Manufacturing Co., United States.) October 15th. (Complete.)

23,605. "Sparking plugs." F. A. L. Johnson. October 16th.

23,607. "Electrical metal conduit cutters." L. H. Marlor, T. G. Hann and J. T. Foster. October 16th.

23,621. "Fittings for electric conduits and the like." C. H. Klyne and S. E. R. Beekroft. October 16th.

23,639. "Trolley poles for tram and like cars." A. Kenneth. October 16th.

23,669. "Motor-controlling switches." W. E. Lake. (Sociéte Anonyme du Temple, France.) October 16th. (Complete.)

23,689. "Turbo-electric machines." A. Rolfe. October 17th.

23,694. "Police call alarms." T. Grant. October 17th.

23,703. "Apparatus for automatically controlling electric heaters or the like." G. Wilkinson. October 17th.

23,718. "Deriving electric current formed by means of thermo-electric elements." P. Ferra. October 17th.

23,726. "Apparatus for use in the heating or sterilising of fluid by means of electricity." T. McClelland, jun. October 17th.

23,732. "Portable self-contained electric tell-tale and dash-board light." W. H. Cole. October 17th.

23,733. "Electric heating devices." A. E. Woodhouse. October 17th.

23,734. "Reception of electric waves." R. Goldschmidt. (Convention date, October 18th, 1911, Germany.) October 17th. (Complete.)

23,750. "Branch boxes for electric conductors." J. Kramer. October 17th.

23,774. "Incandescent electric lamps and holders therefor." A. W. Beuttell. October 17th.

23,775. "Evacuated envelopes." British Thomson-Houston Co. (General Electric Co., United States.) October 17th.

23,776. "Resinous compositions." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 17th.

23,786. "Cinematographs." R. J. Samson. October 18th.

23,811. "Electric lamps." G. S. Brighten and H. Forster. October 18th.

23,812. "Telephone indicating apparatus." M. S. Conner. October 18th.

23,814. "Fitting electric lamps to firemen's helmets." W. C. Angel and E. A. Creane. October 18th.

23,832. "Electric condensed water cleaners." E. Von Wild and J. de Miquel y Almirall. (Convention date, April 1st, 1912, Spain.) October 18th. (Complete.)

23,850. "Switch-operating devices for tramways and the like." W. Zuckerman. October 18th.

23,860. "Electrical heating devices." A. F. Berry. October 18th.

23,861. "Cooking utensils and other heating apparatus." A. F. Berry. October 18th.

23,869. "Manufacture of mica plate." C. Fischer. October 18th. (Complete.)

23,870. "Device for transferring the energy from one electric oscillator to another by shock excitation." H. Sefton-Jones. (Jacoviello Soc. Anon. and F. Jacoviello, Italy.) October 18th. (Complete.)

28,877. "Plug for electrical plug contacts." H. Stotz and Stotz & Co. (Convention date, October 20th, 1911, Germany.) October 18th. (Complete.)

23,887. "Pocket electric lamp signalling apparatus." H. Neuburger. October 19th.

23,890. "Fittings for electrical conduits." J. E. Noirit. October 19th.

23 911. "Electric driven vacuum cleaning apparatus." W. Griffiths and Wizard Dust Extractor Co., Ltd. October 19th.

23,917. "Electrical current-limiting switches." H. J. Railing, J. Strachan and E. E. Hoadley. October 19th.

23,918. "Automatic electrically operated elevators." R. Liljeblad and Aktiebolaget Elevator. October 19th. (Complete.)

23,940. "Means for indicating when the flow of current in an electric circuit is interrupted." A. F. Berry. October 19th.

23,955. "Sparking igniters for explosive engines." E. A. Raves. October 19th.

23,959. "Process of plating." R. Rafn. (Convention date, October 21st, 1911, Germany.) October 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Furnaces. A. L. J. Queneau. 19,305. August 29th.

Apparatus for giving Intermittent Flashes of Light. Julius Pintsch Akt.-Ges. 19,369. August 30th. (January 16th, 1911.)

Method of Electrically Bonding, and a Bond for Rails or the like. E. Vedovelli. 21,720. October 2nd.

Telephone Instruments. W. H. Derriman. (Automatic Enunciator Co.) 21,812. October 3rd.

Telephone or like Instruments. W. H. Derriman. (Automatic Enunciator Co.) 21,814. October 3rd.

Telephone Systems. W. H. Derriman. (Automatic Electric Co.) 21,815. October 3rd.

Vapour-Electric Apparatus. P. C. Hewitt. 21,827. October 3rd.

Elevated Railway for the Conveyance of Passengers' Luggage and other Goods. S. Arnold. 22,406. October 11th.

Electric Incandescent Lamps. A. W. Gast. 22,779. October 16th.

Electric Lamps. W. H. Fulper. 22,925. October 17th.

Photometric Apparatus for Indicating and Measuring Changes in Electrical Pressure. J. S. Dow. 23,931. October 28th.

Wireless Telegraphy. J. Gardner. 25,278. November 14th.

Electric Diaphragm Horns and like Sound-Producing Means. W. P. Thompson. (Akt.-Ges. Mix Genest Telephon and Telegraphenwerke.) 25,489. November 15th.

1912.

Electric Frequency-Indicating Instruments. British Thomson-Houston Co. (General Electric Co.) 128. January 8th.

Apparatus for The Operation of Electrical Clocks by Electric Waves. F. Schneider. 3,966. February 16th.

Systems for Operating or Controlling Time Indicating Devices. L. J. Aron. 7,636. March 29th. (Patent of addition not granted. Divided application on 12,666 of 1911, September 28th.)

Trolleys or Overhead Collectors for Electrically-Driven Vehicles. R. Francq and V. Francq. 7,772. March 30th.

Electric Arc Lamps. W. Schaffer and Heimann. 8,140. June 21st. (April 5th, 1911.)

Electromagnetically-Operated Switches, Particularly Adapted for Controlling Electric Motors. L. Schattner. 8,678. April 12th.

Anode Supports for use in Electroplating. Spirella Co. of Great Britain. (Spirella Co.) 9,149. April 18th.

Apparatus for Winding Incandescent Electric Lamp Filaments on their Supports. Soc. Francaise d'Incandescence Par le Gas (System Auer). 10,092. April 25th. (May 1st, 1911.)

Alarm Signalling and Controlling Devices. A. Richter and Bock. 10,223. April 30th. (Divided application on 21,959 of 1911, October 5th.)

Searchlights. L. Pasqualini. 13,679. June 11th.

Method of and Apparatus for the Electric Transmission of Signs or Speech in Mines. J. H. Reineke. 15,256. June 29th.

Plug Connections for Electrical Work. A. A. Warner. 17,151. July 23rd.

Metalliferous Mine Installations.—Electrical installations in metalliferous mines sometimes call for a considerable amount of attention owing to the fact that in the first instance they were designed and put to work without due regard to the special conditions which obtain in mining practice. It is unsafe to apply, without modification, designs which may prove satisfactory for factory or similar installations above ground, inasmuch as the conditions are quite different, when one comes to consider the mining proposition. For example, the temperature in a mine is often very considerably above that attained on the surface, and there is a large amount of dust and damp usually present, all of which tends seriously to militate against the successful operation of such systems. For this reason, the use of the ordinary type of lampholder in the lighting of pit bottoms, shafts and roads is highly inadvisable, owing to the large amount of dust and damp which get into the holders. Under such circumstances, it is almost certain that there will be an accumulation of verdigris on the contacts and lamp tops, which in its turn will cause short circuits.

The ideal fitting for lighting purposes is a type constructed of porcelain, with the wires led in from either side, and having contacts sunk in the porcelain. If the lamp is then protected by means of a good thick well glass with a ring or hanging lip, and the use of flexible wire is avoided, it is probable that a great improvement will usually be found in the working conditions attending the use of electric light in mines. For connecting-up purposes, two leads should be run from the mains, of 3/22 gauge, insulated with vulcanised indiarubber.

In some mines a good deal of reliance is placed upon the use of porcelain insulators for low-pressure power circuits, but it should be pointed out that, especially when the mine is situated in moist tropical climates, the use of single-shed insulators is likely to prove unsatisfactory, inasmuch as there is sure to be a very considerable amount of leakage. So pronounced was this defect in one instance in the tropics, that the whole system employing the use of single-shed insulators was replaced by three-shed insulators, and when tests were made, a very much more satisfactory result was obtained than before.

THE

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CHINA CALLS TO THE BRITISH MANUFACTURER.

SEVERAL years ago we implored our readers to do all that lay in their power to secure for Great Britain a reasonable share of the future electrical and engineering trade of China. We made the appeal, as powerfully as we knew how, for a personal intelligent investigation of the whole situation. We adopted a style a little more direct than is generally desirable, owing to the urgency of the question, and we entitled our article "You are Wanted in China!" expecting that section of our readers who are responsible in such matters to place their own emphasis upon the "You."

We have no complaint to make respecting the attention given to the call, for interesting and earnest attempts are to-day in progress which were not then, attempts which should do something to strengthen our position in a market where it is imperative that we should be very much alive. But the few efforts that we have in mind, worthy as we know them to be, are indeed small when one compares them with the enormous needs of 400 millions of people whose leaders, at any rate, are on their feet and alert, while vast hosts of others are awakening out of the long national sleep. Awakening for the multitudes of China means Westernisation, or what we call Civilisation, and Civilisation—be it good or bad is not the question—means needs never before experienced, as Mr. E. T. Williams shows in his article on another page. Westernisation means more railways, coal and iron mines development, sanitation and numerous other public works; it means industrial enterprise, including factories; it suggests universities and new colleges and schools; it means electric light and power and traction, telegraphs and telephones; it means hospitals and scientific apparatus, and in the end — years and years hence maybe, when we in these islands have used and exported more of our coal supplies, unless Providence show a continuous regard for the well-being of Western races, perhaps the Yellow Peril, which we are sometimes inclined to pooh-pooh. That eventuality, however, need not make us turn in our sleep at the moment—posterity will be able to handle its own problems.

Unpractical ideas and ideals dismissed, we regard civilisation and all that it means as something greatly to be desired for the China of to-day and her millions, and we are up against this very practical proposition: Civilisation is inevitable; the cultivation of trading relations promotes international friendship; the assistance of "the foreigner" is required; British manufacturers are equipped for just this sort of enterprise—our engineers and contractors have left their object lessons in every quarter of the globe, and we need to secure our own people's well-being at home by foreign trade expansion. What, then, is to prevent our going in and securing a large share of trade in territories which during the next 50 years or so must yield a wonderful harvest?

Without unduly repeating our earlier observations respecting the greatness of the opportunity, we would say that we are at the beginning of a great movement—let us see to it that we are at the head of it! Our foreign competitors have whetted the edge of their commercial weapons—listen to Shylock's knife upon the stone!—and if in our own short-sightedness we leave our place unoccupied, or hold it only weakly, they will be there. There is proceeding among the nations such a struggle for Far Eastern trade as was never before witnessed, and, unless we throw off our apathy and our trust in our past reputation, the future of the British trader in China will be as that of the Turk in Europe—so far as prestige is concerned we shall be told to quit! Let the reader not imagine that at our time of life we are in a mood for panic—the position is not lost yet, but the great guns have been brought against it, and the resources of modern international competition are being used by Germany and America alike, demanding of us as Englishmen that we shall summon all our forces and secure what we hold already, and fight our way to full possession of fields which now, in a trading sense, present great opportunities.

Remember that the rising generations in China know as well as we do what must come with the progress of civilisation within their vast Empire. Remember that thousands and thousands of their leaders have learned in civilised countries what time has wrought in them. Remember that many have acquainted themselves intimately with the manufactures of those countries, and have returned home with an indelible impression. Remember that they sit at the feet of European and American teachers of science and engineering. They thus are prepared to go forward. Are we? They know that, however rapidly the country progresses in general ways, it must be many years before they can possibly manufacture electrical machinery and apparatus and engineering material within their own borders to a hundredth part of the extent that speedily advancing civilisation must entail. Mining, railway and water-power work will demand much of their attention first—cannot the British people of the next decade or two hope to do a fair share of the electrical work that they are unable to do for themselves?

We print the foregoing thoughts as food for careful digestion, and hope that none will think that we exaggerate either the scope or the urgency, but we are anxious for these observations to immediately eventuate in something tangible. To that end we ask our electrical and engineering manufacturing and trading friends to turn to an article appearing in our following pages from the pen of Prof. C. A. M. Smith, who has recently arrived in Hong Kong, and taken up his post as Professor of Engineering at the University there. Geographically, Hong Kong leaves nothing to be desired from the standpoint of British trade. Chinese engineering students will doubtless before long throng the University classrooms and laboratories in search of knowledge. In these laboratories or workshops they will be familiarised with steam and electrical machinery and apparatus—whose shall it be? German? American? or—in a *British* University—*British*? That is a point our manufacturers can settle with little more than a thought. They can, if they will, have working representatives right on the spot, in the hands of young China—the future purchaser—with British name-plates which will tell a lasting tale. Here is an investment that should in days to come—sooner as well as later—yield an incalculable return. Who will be the first to grasp the opportunity and send what is required? Shall the response be speedy and hearty too? The game is well worth while.

Prof. Smith, the writer of the article referred to, may be relied upon to maintain his reputation for energy, of which our own and certain newspaper pages, as well as the students of East London College, where he was one of the professors, have in the past borne their own witness. We have reasons for knowing that he accepted the invitation of the University of Hong Kong to organise the applied science work, at some considerable self-sacrifice. He has gone to China, voluntarily facing the inconvenience of isolation, climate, &c., for a remuneration less than he was earning in London, although well aware that the cost of living in the Far East is in excess of that of the Metropolis. Whether he would desire us to say this or not, it will serve to bring out what we know he would wish to emphasise in respect of the present Chinese position, namely, that a little immediate self-sacrifice on the part of our firms is what is required in order to make the Hong Kong University eloquent of the merits and claims of British engineering.

The Institution of Electrical Engineers.

On Thursday next the Institution in London will commence the first session under the new Articles of Association—in the provinces it has already been begun—and we hope to witness the inauguration, if not of a new policy (for the letter of the Institution's aims is not changed, as expressed in the Memorandum of Association), at any rate, of a new spirit, a new attitude towards its duties, and an enlightened conception of what those duties consist in. The Memorandum is one of those documents which may be casually perused by the initiate who has newly acquired the dignity of membership, but are rarely, if ever, consulted afterwards; it is, however, an interesting and significant declaration of the objects for which the Institution was established, which are broadly summed up in one of its clauses as being "To promote the general advancement of electrical and telegraphic science and its applications. . . ," and, in addition to certain specified proceedings, "to do all such other lawful things as are incidental or conducive to the attainment of the above objects."

Here is indeed a comprehensive programme, only a part of which has hitherto been adequately performed; but spurred on by the eloquence and enthusiasm of Dr. Ferranti, and fortified by the provisions of the new Articles and the augmented funds which their operation will place at the disposal of the Council, the Institution has now an unprecedented opportunity to prove its mettle, and to attain to a standard of efficiency that has until now been beyond its highest aspirations. In this it will but emulate, in the departments of administration and organisation, the marvellous achievements of the industry in the technical and scientific branches. The turbo-generator, the metal filament, the wireless telegraph, the Röntgen rays, the electron—these and other admirable inventions and discoveries have revolutionised the art and science of electrical engineering, and it is only fitting that the brain of the industry, the mechanism of control and organisation, should take part in the regeneration which is in progress and arouse itself to play the leading *rôle* in the great developments which we hope to see realised in the near future.

Some hints as to directions in which the Institution might well take action are given in the interesting address of Mr. A. A. Day to the Manchester Local Section, of which we give an abstract elsewhere in this issue. Mr. Day, a pupil of Dr. Ferranti, directs attention to the disadvantages under which the industry labours, and which will delay the coming of the time when electricity is in universal use, unless every opportunity is taken to secure uniformity of system and concentration of effort. The immense advantage of uniformity would be felt by no one more than by the manufacturer and the contractor, whose diversity of designs and variety of stocks would be greatly reduced, while the cost of production would also be lowered. The possibility of linking up adjoining areas, and of concentrating the generating plant in large power stations, would be immensely facilitated, and thus the cost of supply would be diminished. The consumer would also benefit by relief from the present confusion as to the correct voltage of his lamps, the type of current for his motors, and so on. We confess that we have not much faith in Governmental intervention as a rule, but in certain cases it is indispensable, as in the case of wayleaves cited by Mr. Day. Curiously enough, Mr. Schofield also touched upon the question of uniformity, in his address to the Yorkshire Local Section, and both referred to the lessons of the coal strike.

Regarding the intentions of the Council under the new *régime*, the statement drawn up by Mr. Robert Hammond, after the special meeting of November 2nd last year, threw a good deal of light upon the points which exercised the minds of the members when they were confronted with the new articles. This statement, unfortunately, has not yet appeared—so far as we have been able to ascertain—in the *Journal* of the Institution, but we hope it will be placed on record amongst the *Proceedings*. Failing that, the gist of its contents, and of the Annual Report of May, 1911, which also dealt at some length with questions of future policy, will be found in our reports published at the time, and we do not think it necessary to recapitulate the various proposals then brought forward. Suffice it to say that if they are duly carried out, the members will undoubtedly derive largely increased, and more directly personal, benefits from their membership, and the prestige of the Institution to which they belong will be steadily increased, raising their status with it. There is a vast amount of work to be done —the difficulty is not to point out openings for improvement, but to show how they can be filled.

On January 1st the system of admission by examination will probably be introduced in connection with the Associate Membership, and we may expect to see a considerable number of men admitted in anticipation of that date, partly to avoid the unknown terrors of an examination on an unpublished syllabus, and partly to take advantage of the more favourable terms offered to those who join before then. This process has, in fact, been in progress for some time past, and on August 31st the membership stood at the round figure of 6,600—a very satisfactory number, second only to the membership of the Civil Engineers. We hope it will not be long before the 7,000 is attained. The examination question is one of great difficulty, calling for the most careful consideration; we trust that enlightened views will prevail, and that the aim will be to prescribe a real test of culture and technical ability, rather than a mere feat of mental gymnastics or a test of memory. A *viva voce* examination by shrewd and competent observers, possessed of a deep and sympathetic insight into human nature, and free from fads, should form an essential feature of the system; and the fact that engineers in practice always have their reference books and note-books at hand should be recognised by permitting the unrestricted use of such aids in the written examination. Thus cramming will be avoided, and the candidates will be enabled to prove their true worth. The examiner who is always trying to trip up a candidate is the curse of the examination system. No time should be lost in issuing some indication of the ground that will be covered and the standard of general education that will be required of candidates.

A Nice Complication at Buenos Ayres.

After having gradually absorbed nearly all the electricity supply works in Buenos Ayres, including at least one British undertaking, several years ago, the German Transmarine Electricity Co. finds itself at last confronted with the prospect of fresh competition, although rivalry has been threatened on previous occasions. This time it seems that a supply contest will really take place, as the Municipal Council has now granted a light and power supply concession to the Compania Italo-Argentina de Electricidad, to whose application reference was made in this journal two or three months ago. Not only so, but the Government has sanctioned regulations to allow the carrying into effect by the Lacroze Railway and Tramway Co. of the hitherto unexercised clause in its concession which permits that company also to furnish light and power to the public. The German company's concession runs to 1957, and dates from 1907, when the undertaking, which had been in existence in one form or another for a period of 15 years, was consolidated. The 20th clause of the concession provides that the company shall be entitled to claim all facilities which may be granted to other legally sanctioned electricity works in the future. Now the Lacroze concession was issued in 1904, and as a railway company, the undertaking has a perpetual concession based upon national law; it also enjoys exemption from Customs duties for the importation of materials, and has other facilities which the German company does not possess, as the latter must transfer its undertaking under certain sale conditions to the city on the expiration of the licence in 1957. As the decree to give effect to the supply clause in the 1904 concession of the Lacroze Co. was only published on August 6th, 1912, the question arises what date should apply to the concession in so far as the supply of light and power to the public is concerned. The settlement of the problem promises to lead to legal proceedings, the result of which is uncertain. On the one hand, a German correspondent at Buenos Ayres, who apparently represents the Teutonic company, states that the opinion of various lawyers is that the decree of August in the present year has to be regarded as the commencement of the Lacroze concession for supply to the public, and the German company has consequently lodged a claim with the city for the grant of the improved facilities devolving upon the Lacroze Co. under its own concession. On the other hand, the city and the Minister of Public Works assume the standpoint that the general concession of 1904 also applies to the enabling clause of August, 1912, and that, as the former was granted before the German concession, Clause 20 in the latter does not come into application. It is now considered, the correspondent adds, that a legal process can only be avoided if the Government repeals the August decree, but, in this case, a claim for compensation on the part of the Lacroze Co. would probably be made. The idea of suggesting the revocation of the Government decree, under the circumstances, is delightfully frank. It certainly shows the lengths to which the supporters of a foreign monopoly will go in order to endeavour to ward off possible competition. We shall probably next hear of the Standard Oil Co. asking the German Government not to proceed with the attempt to create a State monopoly of the petroleum trade in the Fatherland.

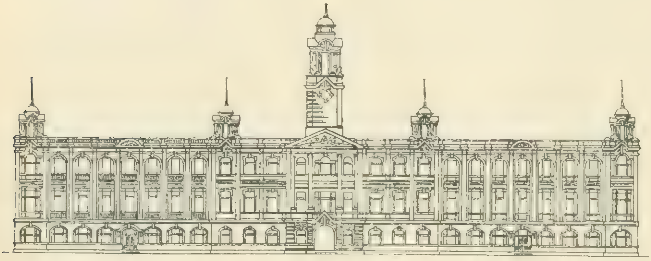
Ionomagnetic Rotation.—A new phenomenon has been observed by Prof. Righi to which he gives the name of ionomagnetic rotation. If a spark from a condenser of considerable capacity is sent horizontally through a gas and two small vertical vanes of mica in the form of a cross are suspended in the middle of the discharge by a fine fibre attached to the centre of the cross, the spark produces no rotation of the cross. If, however, a vertical magnetic field is established in the gas, the cross rotates through a considerable angle if the gas is air, and over a small angle in other gases. Prof. Righi ascribes this rotation to the bending of the paths of the ions or electrons and to the additional protection which the vanes afford each other against impacts from one side rather than from the other in these circumstances. The observed rotations indicate that the effects of the positive ions are in general greater than those of the negative.—*Nature.*

THE UNIVERSITY OF HONG KONG.

An Appeal to British Engineers.

By Prof. C. A. M. Smith, M.Sc.

The eyes of the world are at present fixed upon China. The events of the last few months have been so remarkable and have happened with such acceleration that it is dangerous and difficult to forecast the future. And yet two or three things are certain. (1) China means to become modernised; (2) China contains enormous natural resources; (3) The traders of the world are looking to the Far East for their markets of the future.



Elevation of Hong Kong University.

Concerning Hong Kong.

It was once remarked by an unsympathetic foreign critic that the Britishers had "blundered into the best places on the earth." About 70 years ago the Union Jack was run up, for the first time, on a granite island at the mouth of the Canton River. There were a few Chinese pirates on the island in those days; now there is the city of Victoria. The island is called Hong Kong—so is the port, usually, although its correct name is Victoria.

To-day Hong Kong is, as regards tonnage, the biggest port in the world. There are docks, built by British enterprise, of large dimensions. Hong Kong is the centre of the trade between China and Europe. It is the gateway to the East.

Hong Kong possesses a University. It was opened with simple but appropriate ceremony on March 11th, 1912. Sir Frederick Dealty Lugard, the Governor and Empire builder who inspired the University, opened the magnificent new buildings.

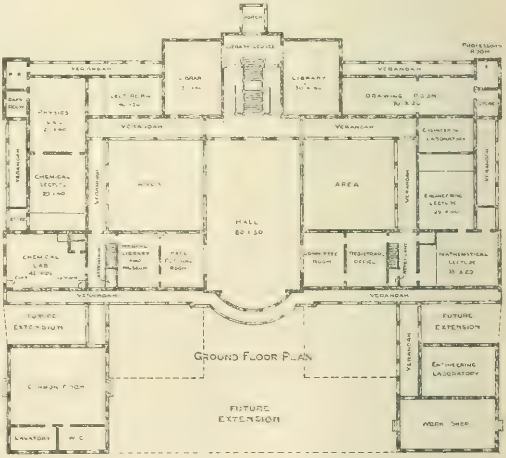
The main building affords laboratories and lecture rooms for the accommodation of 500 undergraduates, and it is planned to be capable of extension. It possesses a magnificent site, is the most conspicuous edifice in the Colony, and is the first glimpse of Hong Kong obtained by the visitor from "home."

The site was given by the Colonial Government—an area of 709,789 sq. ft. It is situated 200 ft. above the sea level overlooking the magnificent harbour. A Parsee resident of the Colony—Sir Hormusjee Mody—gave the buildings. Chinese residents and neighbouring Chinese merchants subscribed over a million dollars to the endowment fund. The English firm, Messrs. Butterfield & Swire, and their allied companies, gave a donation of £40,000. This firm controls the Tai Koo Docks and engineering works. The chair which the writer has the honour to fill is named the Tai Koo Chair of Engineering. The Legislative Council has voted £1,200 a year, annually, as a contribution to the funds of the University. The "Home" Government provides £300 a year for King Edward Scholarships. His Majesty King George V. also caused a letter to be written in which was an expression of his cordial approval, and wishing the University every success.

Objects of the University.

The objects are stated in the preamble to the Ordinance of Incorporation, in the following words:—"The promotion of arts, science, and learning, the provision of higher education, the conferring of degrees, the development and formation of the character of students of all races, nationalities and creeds, and the maintenance of the good understanding with the neighbouring Empire of China." To quote Sir Frederick Lugard:—

> With reference to the first two of these objects, it was stated in various speeches which were made at the time when the scheme was inaugurated, more especially the speeches at the laying of the foundation stone, that the desire of the promoters was to begin with Chairs or Faculties (Medicine and Engineering), which would be of practical utility to China in coping with disease, in developing her resources by railways and by the exploitation of her mineral wealth, and in checking by the light of modern engineering science the terrible floods which almost every year give rise to famines, and carry off millions of starving people. To these is added an Arts Degree to enable those students who desire to adopt an official career to take a good degree, more especially in English, and in the language and literature of their own country and in political and commercial economics. It is, moreover, hoped that the Hong Kong University will be largely instrumental in making King's English the predominant language in the Far East, as pidgin English is already in business and commerce. Such a result would no doubt bring in its train important political and commercial benefits.
>
> For instance, a man trained in the engineering formulæ of other Western nations would not understand British catalogues and engineering particulars, and would draw up his specifications in accordance with the gauges and standards with which he was familiar. The same thing applies to other branches, and it is, of course—so far as mere material and commercial benefits are concerned—of great importance what language is used as the medium for conducting business.
>
> In fact, it may be said that the root idea of the Hong Kong University lay in providing a means of higher education where Chinese boys could remain under the influence of their own parents and guardians in the environment of their own people so that they would be subject to the strong control which Chinese opinion exerts upon young men, instead of being turned adrift in a foreign country where a liberty unknown to young students in the East is allowed to undergraduates, and where they often learn the vices of the West and become denaturalised, and conceive a contempt for the social and political institutions of their own country, and an ill-informed hostility to all constituted authority. These tendencies have led Chinese parents to regard residence at Western Universities with a distrust which has only too often been well founded.



Ground Plan of University.

Engineering a Feature.

It may be advisable to quote a resolution by the Court of Governors:—"It is resolved that the objects of the University are (*inter alia*) to afford a higher education more especially in subjects of practical utility, such as applied science, medicine, &c."

That shows the decided intention of making practical science a feature of the work.

Finally, the writer would quote from a despatch from the Viceroy of Canton to the chief officials of the various Government bureaux under his jurisdiction, requesting them to meet and discuss means to raise subscriptions in aid of the Hong Kong University Endowment Fund. (Translation.)

He wrote : -

I have perused more than once all the documents which I have received from Hong Kong relating to the proposed scheme. The project appears to have for its principal object the complete training of persons of ability, who will be of real use to us in our industrial and commercial enterprises.

The teaching of applied science, including civil, mechanical and electrical engineering and surveying, meets the present and most urgent need of our country, and the institution of a faculty of medicine is most important, as it works for the improvement of sanitation and the preservation of health.

He then gives the advantages of the scheme :—

1. Up to the present time our country has not a properly organised institution to impart a professional and technical training to our people, though the establishment of such an institution has long become an urgent necessity. The minds of most young men from noble or wealthy families are bent on official ranks and adverse to laborious studies so that they all turn their attention to the study of politics ; whereas ambitious youths of the poorer classes, though willing to go through a course of professional and technical training, are in want of means and a suitable place for their training. Once the Hong Kong University is established, the cost being moderate and the locality close at hand, it is possible for every Chinese youth to join it.

2. Since in China itself there is no such properly organised institution for professional and technical training, we are compelled to send our students thousands of miles away from their native land to Europe or America where official supervision is rendered ineffectual and parental control nugatory. Besides, in youth the character is not yet properly formed, and some of the students may, through idleness or through indulgence to excess in amusements, become lazy in their work, others from want of proper control and restraint drift into immoral and loose habits, and of late our students residing abroad have caused us the greatest anxiety. On the other hand, Hong Kong is so close to us that our young men who went there to study would be almost within sight and hearing of their superiors, parents and elders.

3. In our country we have at present no specialists who have a profound knowledge of technical and scientific subjects, and whatever professors we may require have had to be engaged from abroad, and that merely on their reputation and without actual knowledge of their true qualities. As a rule, scholars who have a good character and great learning are disinclined to accept our invitation and come to a distant land like China, where the mode of living differs so much from that observed in the West. But in the Hong Kong University the professors are to be engaged by the British themselves, who have better and easier means of inquiry and of distinguishing between the properly qualified and the incompetent. They are sure not to permit a responsible position to be occupied by an inferior man, and thus to tarnish the fair name of their Institution. Those professors who have already gained a reputation will be glad to join the staff, Hong Kong being a British Colony, and the social conditions there similar to those to which they have been accustomed. With a properly qualified staff of professors we may look forward with assurance to the successful training of the students.

4. It costs many hundreds of dollars a year to maintain a student in Japan, and many thousands to maintain one in a Western country. In both cases there must be added the very considerable expense of travelling there and back. The expenditure has taxed the resources of the different provinces to the uttermost, and great anxiety is felt as to the future. However, if our students could be sent to Hong Kong instead, a great part of this expenditure would be saved.

Having these four advantages it seems to me that the establishment of a University in Hong Kong has a most important bearing upon the professional and technical training of the people of China. A Parsee gentleman, Mr. Mody, out of fellow-feeling for Asiatics, has generously given a large donation for the erection of the buildings of the University. His munificence deserves every respect and praise. Is it not then our duty, officials and merchants alike, to join our efforts to co-operate and assist ?

The British Engineers.

The University has laboratories for experimental work in heat engines, electrical machinery, hydraulics, strength of materials, &c. At present there is practically no equipment. All the money available is essential for endowment purposes.

The laboratories are admirable showrooms. In four years' time we shall have more than 100 applied science students —we have nearly 50 students in this first year taking the fundamentals of applied science instruction, viz., physics and chemistry, &c. We want equipment badly, and we need it at once.

A Business Deal.

The writer does not appeal for charity. He offers a clear business proposition. Here is your opportunity to advertise in the Chinese market. Will you let it slip ?

Up and down the China coast the traders of other nations are preaching the decadence of British engineering enterprise. They will point to the Hong Kong University with delight to support their arguments if British firms remain inert.

Every piece of machinery presented to us will have a suitable name-plate. We want prime-movers of dimensions not more than 15 B.H.P. We want electrical apparatus such as you will find in any University laboratory. We have at present almost exhausted the generosity of the local Chinese merchants. When I ask them for money for applied science work they reply that the English engineering firms have everything to gain by presenting apparatus and machinery. If we can obtain these gifts from home, we will raise money locally for chairs of mining and metallurgy.

One final word : "*Do it now.*" Please do not delay. He who gives quickly gives twice. We are fighting the battle for British engineers. Surely we may expect some encouragement from them !

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

It was suggested by a correspondent in your issue of November 1st that the Institution of Electrical Engineers might be of use to the "17s. man," but I would point out that the I.E.E. is useless while it retains as members chief electrical engineers and others who are responsible for the payment of these low salaries, and will not consider a general increase under any circumstances. An instance of this occurred in a municipal undertaking recently, where the chief electrical engineer is a M.I.E.E.

The "Chief" was written to collectively by the whole of the charge engineers of sub-stations of 1,500 to 2,000-KW. capacity, requesting an increase in their salaries ; there was immediately a flutter at headquarters to find the instigator of such an audacious request (who was to be dismissed at the first opportunity, I suppose). Finally, after two months an interview was obtained, at which the "Chief" emphatically stated that—

1. The request for an increase was impudent.
2. He could obtain men to do the same work for £1 per week, as instanced in your advertisement columns.
3. He had put labourers in charge of sub-stations successfully.
4. The best thing that they (the sub-station engineers) could do was to move on to somewhere else.

This is, I believe, not an isolated case, and as "The Institution" is useless to the general body of electrical shift men, the only thing left to do is to form an "Association of Electrical Shift Men," whose object would be to obtain reasonable payment for their services. I should be quite willing to act as hon. secretary of such an association *pro tem.*

Sub-man.

Switchgear Drawing Office Expenses.

With reference to Mr. Dunlop's letter (page 689, current number of the ELECTRICAL REVIEW), no one wants a multiplicity of copies of one drawing, but there are two sides, at least, to the problem. Mr. Dunlop has had experience, and will agree with me that even the largest manufacturers leave details to juniors, who too often have not passed the age when they realise that their work is not above criticism, and the department manager, whose work is unquestionably so, does not touch the details referred to.

My reasons for being specific and exacting are based on expensive experience, and I will give instances—one in connection with each of three of the largest manufacturers ; and if Mr Dunlop will show me a better course I will adopt it.

1. Switchboard general arrangement drawing approved, and building designed to suit materials delivered, and after erection was half finished it was discovered that the general arrangement drawing, which stated a scale, was 4 ft. shorter

than details supplied. Result: Crane had to be raised to higher level and roof trusses raised to clear crane's new position.

2. Switchboard ordered to manufacturer's drawing through a contractor, the specification calling for interlocking to render board foolproof. General arrangement showed dimensions overall without details, and 14 reminders and requests bringing no detailed information to the contractor *in time*, he took the risk of guaranteeing that the offer met the specification.

The leading manufacturer then put forward a design embodying extra panels, and the result of adjustment and mutual sacrifice between manufacturer and contractor was that the contractor's profit was nil.

3. Switchboard ordered to general arrangement, one view; dimensioned plan and two elevations of space available accompanied inquiry; the apparatus supplied filled all the space, including the Home Office passageways.

I never consider a tender sufficiently complete unless it includes evidence that the manufacturer has set out every detail to ensure completeness and size in three dimensions to show client and contractor, without unreasonable use of their time, that it is correct in size and complete for the purpose specified.

Another detail that is unsatisfactory is the statement "generally in accord with specification." This when used in a tender leaves a loophole that the aforementioned junior and sometimes higher-placed individuals consider large enough to go through.

C. D. L.

London, E.C., *November 2nd*, 1912.

The Lighting of Bakers' Ovens.

I should be pleased if any of your readers would tell me how to light up the inside of a baker's oven by electricity.

The lighting is at present done by a four-swivel gas bracket, which is swung in and out of the oven door.

I have tried the same method with a carbon-filament lamp with disastrous results, the ordinary fittings wire inside the bracket having its insulation burnt off in a few hours. I have tried asbestos-covered wire on the outside of the bracket; this is not satisfactory, and I find that the solder on the lamp cap is always melting, causing shorts.

I should be pleased to know of any method which will stand rough usage.

Blight.

Fuse Formulæ.

With further reference to my letter in the Electrical Review of October 25th on this question, I should like to add the following remarks.

In the case of a thin wire heated to fusing point by a current of electricity, the interior of it is at a much higher temperature than the surface exposed to the air. In such a case the stream lines of current will take the path of least resistance, and the current will concentrate near the surface. In small diameter wires, where the cooling effect of the surface is great comparatively speaking, this effect ought to be considerable. It does not appear possible, even by means of Fourier-Bessel functions, to solve the problem, although somewhat similar problems have been worked out by Weber (Crelle Bd. 76, 1873). If as an approximation we assume the resistance to resemble that of a thin hollow cylinder and cooling to be proportional to surface, then this gives $c \propto d$, where d is the diameter of the wire. This appears to agree with Schwartz and James's values, viz., tin 1·13, copper 1·19, and W. T. MacCall's result about 0·92 for the index.

As regards thick wires this effect is negligible, since the cooled shell is only a small fraction of the total area; one would therefore expect to find better agreement with the $d^{3/2}$ law.

This appears to be the case judging from result of experiments.

W. H. F. Murdoch.

Millhill, *October 28th*, 1912.

P.S.—Since writing the above letter, I have read with amusement Mr. Chapman's letter in the current Electrical Review. I feel rather sorry for Mr. Chapman, as he seems to fall into the common error of believing that ρ_0 is a constan over the area πa^2, or through the unit volume.

The theory hailing from South Kensington is absolutely a rotten as the famous Navier-Poisson theory proving beyond all doubt that a certain ratio was $\frac{1}{4}$. Dr. Russell in much the same way, by false reasoning, arrives at a value 1·25, and states in his paper "we see that the fusing current varies as the 1·25th power of the radius." Nobody except a South Kensington student could "see" it. Anyway, I am sorry I do not propose to bow down and worship a false theory, when a better one is at hand.

W. H. F. M.

November 3rd, 1912.

Motor-Hiring in Leeds.

By your article on the above, I am led to believe that you have not been fully informed of the actual state of affairs in Leeds.

Electric motors can be had on hire from fully half-a-dozen motor makers and merchants in Leeds on very reasonable terms.

My firm has placed on hire in Leeds over 200 motors during the past 12 months, and I can assure you that in no single case has a man been refused a motor.

By the enclosed lists you will see that our charges and conditions are very reasonable; they cover all sizes up to 100 H.P., and half the payments made for hiring are refunded if the motor is purchased outright.

We are doing a large business in London on the same conditions with great success.

E. Brook.

Huddersfield, *November 2nd*, 1912.

[The list enclosed shows that in the case of motors on hire, 18 sizes are listed ranging from ½ to 100 H.P., with quarterly hire rates of from 7s. 6d. to £10 respectively. On temporary hire, rates are quoted for the first four weeks and per week after.

On hire-purchase, 20 sizes are listed, from ¼ to 100 H.P., with hire-purchase by means of a deposit and 5, 12 or 20 quarterly payments, which, in the case of the 100-H.P. motor, works out at £20 deposit and £35, £19 and £15 respectively.

On simple hire, the firm supplies the motor, starter, switch and fuses, but does no wiring or fixing; while hire-purchase terms entitle the customer to the motor, with switchgear, &c., wired and fixed on the floor and connected to the supply meter if within 20 ft. of the starter.

In both cases Messrs. Brook maintain their goods until purchase is complete.—Eds. E.R.]

Generating Plant for Village Lighting.

In regard to the letters of "Electric Supply" and Mr. E. J. Williams, which I read with interest, and for which I tender those correspondents my thanks, I give a few more particulars concerning my plant.

I realised immediately after sending my former letter that important data had been omitted; one item was the annual output, which is now 5,000 units or so, but is mounting up. The selling price is at present 8d. per unit. Some of your readers will stare at this, but small plants like this are in a category by themselves, and cannot be dealt with like town plants of a hundred times the size.

To begin with, the syndicate running the affair is composed entirely of gentlemen with no electrical knowledge, and it was important to scheme things so that the concern would show some surplus very soon, as they might have lost belief in the thing before it had a fair chance. The next question was, of course, would people pay 8d. per unit? The reply is, "Yes, willingly," in the circumstances. There is no gas (and if there were, it would run to 5s. or 6s. per 1,000 here), and oil lamps are the only competitor. When 8d. per unit was mentioned at first, our prospective customers said, "Oh, it's altogether too dear. Why, it's only 4½d. at W—." So I approached them thus: "If we provide you with a lamp which will run for seven hours for 1d., and a bigger one, which will light your sitting room well, and give you five hours for the same sum, will you be satisfied?"

"Oh, yes." So a few penny-in-the-slot meters were installed, and we got our 8d. a unit easily, attaining the above results with 17-watt and 25-watt tungsten lamps. There are 36 business houses on the route of the mains: out of these, 31 have electric light, two more have passed their orders in for installing it, and another, we believe, is on the point of doing so. This leaves 2 out of 36 not accounted for. We have private houses and places of worship as well. The plant was started in July, 1909, and the supply has been on day and night since without a failure of any kind. Of course, a battery is installed, and the routine is simple. The engine is started about dusk each evening, and runs till 9.45 or 10.0 p.m., the generator during this run supplying all the lights, and also bringing the battery up. Regulation is effected by end cells; I don't know whether a booster is worth while. The plant is practically never run except during the above hours, and then at full load, tending to economy of fuel and labour. The voltage is 100, distribution on the two-wire system by bare wires on wood poles. It may be remarked, as to the voltage, that at the time of starting, metal-filament lamps were not made above 130 volts, and the three-wire system was considered too complicated for its advantages to be utilised. It will be seen that the whole plant is on the very simplest lines, and is smaller than many country house installations. I run the whole affair, driving, keeping plant in order, seeing to meters, in fact taking responsibility for the maintenance of the supply on a contract rate of 3d. (not ·3d.) per unit. This is satisfactory to my employers and to myself; I can work as long or as short as I like—all they want is good results. Let those who gasp at the 3d. remember that a man could run a plant 10 times the size with no more ability and time taken up, making wages cost ·3d. per unit, but if the bigger plant is not needed, the wages must come comparatively heavy—it can't be helped. The running of the plant takes on the average some four hours per day of my time, and house wiring separately paid for, of course, fills up a fair amount of the rest. Then there is usually plenty of work in the way of isolated plants to level things up. I have written at some length, I feel, but I wanted to make clear that there is ground for my conviction that a field exists for such plants. It is significant that people in the locality who were contemptuous critics of the thing at its inception and prophesied its early demise, are now our customers, and would not like to change.

Your correspondents mention a feed heater. This is an obvious and easily installed improvement, and had not been overlooked, but the advent of the crude oil engine had made me hesitate to add to the present plant, hence my former letter.

In brief reply to Mr. E. J. Williams's points (1) and (3) are already answered; (2) is very hard to state just at present; regarding (4), after consideration, we decided that the advantages of meters on the whole justified their cost, particularly when you get a motor meter for a sovereign or so; and ordinary meters are charged at 9d. per quarter rent, slot meters (1d. and 1s.), 1s. per quarter.

A Little Man.

November 4th, 1912.

NOTES ON A FACTORY INSTALLATION.

By E. P. AUSTIN, A.M.I.E.E.

In the application of electric driving to girder and plate working machines there are points of special interest, in addition to the distribution problems that are more or less common to all workshop installations. It is the writer's intention in the following lines to deal with distribution questions that deserve special attention, but more particularly to consider the electromechanical details that belong to the driving of girder working machines.

In a particular case under review, a works engaged in the manufacture of coal-handling and colliery plant generally is supplied from a tramway feeder at 500 volts D.C.

The energy is received in the factory at the point nearest to the tramway system on a master switchboard, constructed throughout of iron, which carries the supply authorities' cut-outs and meter and the consumers' master switches and fuses, all of which are ironclad, with side switch levers and doors interlocked.

The Home Office Regulations allow single-pole control on motors and apparatus connected to tramway circuits and prohibit *single*-pole switches on any earthed conductor, yet it is a wise precaution to use D.P. control throughout; otherwise in the event of a motor being disconnected for any purpose, a careless person may reconnect wrongly and leave a single-pole switch on the earthed conductor only. This question was more fully dealt with by the writer in an article appearing in the Electrical Review of May 26th, 1911.

In line with these considerations, an iron distribution board is installed which carries ironclad switch cartridge-fuse sets that control the individual motor mains. It is situated at a central point for the motor load, and is fed from the main service board by a concentric paper-lead cable drawn into fibre ducts buried in the shop floor. These ducts successfully withstood the floor being levelled with a steam road roller, and the constant storage and handling of 200 tons of girders over the portion of the floor under which they pass.

Each motor is separately fed from this board, and is provided with the usual ironclad main switch and starter at a point most convenient for control at the tools it drives.

Fuses are used only at the distribution board, so that the danger of an incompetent workman renewing fuses is remote, since such people have no access to the board. A detailed account of the starting gear appears at a later point in its proper sequence.

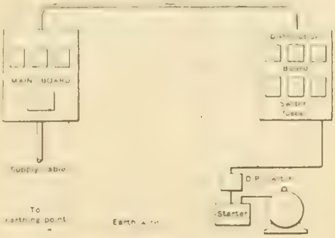


FIG. 1.

All cables are run in steel tubes, of heavy gauge, suitably earthed at a point that is in direct contact with the tramway rails; reference to the diagram in fig. 1 will make more clear the principle that has been described in the foregoing.

An overhead three-motor travelling crane is fed from the service board through a D.P. switch fuse set; but following the lines of tramway practice, the controllers are connected for single-pole control, with the field coils on the negative or unbroken conductor, and reversal is effected on the armature circuit. This system of connection is advisable to prevent the breakdown of the field coils to earth at the instant of opening the controller.

In order to facilitate handling the long girders, &c., the lay-out of the shop is arranged to give full clearance between side walls; and with this end in view, the machines are accommodated in a lean-to structure running the whole length of the shop. An upper flooring in this lean-to forms the bed for some of the motors, which drive by direct oblique belt-drive the individual machines. Thus the working tables of the tools are left clear of obstruction from the shop side, and the belts are used to their best advantage.

The question of group and individual drive is decided by the nature of the work, the load factor of the machines, and the spacing, which last point means abnormal lengths of shafting in proportion to the number of tools driven, if one main drive only is employed.

The bulk of the work is intermittent in character, and consists of shearing, cropping, sawing, punching and drilling, but a broad division may be drawn between the machines running fairly continuously and those used only at intervals during the day.

In the first class are the cold saws and the drills. One group is made up of two cold saws and one cropping machine, all three driven from one shaft. Results of load tests on this group are given below, from which it will be seen that the group method is the best in this case, in view of the conditions that two out of these machines are generally working, and the shafting loss is small :—

Motor.	*Load in H.P. input.*	
18 B.H.P. shunt	shaft and loose pulleys	4
interpole	and one saw	5·37
	and two saws	6·7
	and two saws and cropper	18·0

The average time of sawing is 20 min. for a 6-in. girder, but the speed may be increased to twice this value for cuts of small area. Diameter of saw is 2 ft. 4 in., thickness ¼ in., R.P.M. 8, giving a peripheral speed of 58 ft. per min.

The length of the above-mentioned shaft is 30 ft., with five bearings and five pulleys of varying sizes and weights. The initial starting current is 22 amps., with an average of 7 amps. on all succeeding notches.

The question of type of motor is one that needs careful consideration. The girder cropper possesses a heavy fly-wheel, and would commonly be driven by a heavily-compounded motor, but since other machines are driven from the same shaft, the big drop in speed consequent on using the cropper would decrease the output of its neighbours. Therefore, an approximately constant-speed machine of big overload capacity for short duration is used. A more detailed account of fly-wheel effect in special cases is given later.

The remaining group-drive consists of a line of three radial drills with travelling drilling heads for high-speed work, all driven by bevel gear from a main shaft on the ground level, and arranged at right angles to the length of the shop. All these can be used on the same girder or perform individual work, as desired. The main shaft is belt-driven by an adjustable-speed interpole compound motor giving a 500 to 1,000 R.P.M. variation on field regulation. Its rating is 13 to 15 H.P. at 500 volts, depending on speed. No other speed adjustment is used on the drills, since this wide range meets all requirements. The starter and field regulator are interlocked, so that the motor can only be started on its lowest speed, *i.e.*, strongest field. The power required of this motor is as follows :—

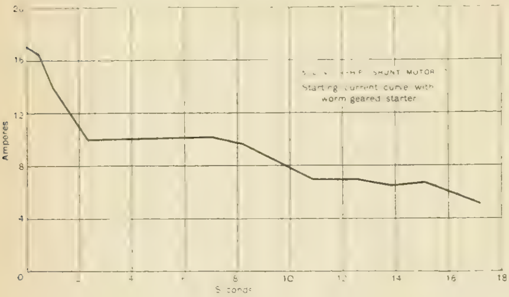


FIG. 2.

Initial starting current on shaft and drills unloaded	18 amps.	× 500 volts.
Running current thus, at 500 R P M. ...	4 ..	..
,, ,, ,, at 750	7½ ,,	,,
,, ,, two ⅝-drills, at 750 ,, on motor	15 ,,	,,

The remaining machines in the shop have their individual motors, driving them from above, as previously described, by means of belts direct on to the fly-wheels, all striking gear being dispensed with. On this account special precautions are necessary in the choice of starting gear. The requirements to be fulfilled may be briefly summarised as follows: Simplicity of apparatus requiring minimum attention, combined with robust construction, complete enclosure of arm and contacts (but ventilation of resistance elements is desirable) and a distinct and certain indication of the position of the starter arm. It must not be possible to start up so quickly that the accelerating current is likely to burn out the starter or damage the motor. The fly-wheels possess considerable inertia, and must therefore be accelerated slowly. To meet these conditions the writer has found that a worm-geared handle on the starter answers well, and the curve given in fig. 2 illustrates the behaviour of such apparatus in the hands of an ordinary workman.

The process of determining the correct size of motor for any particular fly-wheel machine is fairly complicated, and it is necessary to possess full details of the fly-wheel, time of each operation, time between the completion of one operation and the commencement of the next, power required for each operation, power required to accelerate fly-wheel, and power required to run the fly-wheel light, *i.e.*, friction loss, and maximum load on motor.

Now, the energy stored in a fly-wheel is given by the formula—

$$E = \tfrac{1}{2} M V^2. \qquad (1)$$

where E = energy stored; M = mass; W = weight in lb.; V = velocity of the *centre* of gyration in feet per second; and

$$\text{H.P.-seconds} = \frac{W \times V^2}{550 \times 32{\cdot}2 \times 2}. \qquad (2)$$

Since the energy delivered by a fly-wheel depends on the fall in speed during a complete operation, and the motor must restore a corresponding amount to the fly-wheel during the intervals in addition to supplying the friction losses, we can by using suitable instruments arrive at the correct size of motor and necessary characteristics to meet a particular combination of conditions.

The energy delivered by a fly-wheel during a certain fall of speed may be calculated thus :—

$$\text{H.P.-sec.} = \frac{W\,(V_1^2 - V_2^2)}{550 \times 32{\cdot}2 \times 2}, \qquad (3)$$

where W = weight in lb.; V_1 initial velocity in feet per second of centre of gyration of fly-wheel; V_2 final velocity in feet per second of centre of gyration of fly-wheel.

Formulæ frequently used for calculating the torque and H.P. are as follows :—

$$\text{H.P.} = \frac{T \times \pi \times (N_1 + N_2)}{33{,}000}, \qquad (4)$$

where T = lb. at 1 ft. radius; N_1 = initial R.P.M.; N_2 = final R.P.M.; K is a constant depending on design of fly-wheel, and

$$T = \frac{{\cdot}00329\,W K^2 (N_1 - N_2)}{t\ (\text{in seconds})}. \qquad (5)$$

To determine approximately a suitable motor for a given fly-wheel and load, the following method may be used. The average power required for friction is obtained thus: run the fly-wheel up to speed with working parts in gear, observe speed on a tachometer, disconnect from source of power and observe the time taken to come to rest; knowing the constant K, and the R.P.S. = S—

$$V^2 = 2\,\pi\, K^2\, S^2.$$

Formula (1) thus becomes—

$$E = \tfrac{1}{2} M \times (2\,\pi \times K^2 \times S^2),$$

and the total energy expended on friction is obtained by means of formula (2).

To obtain the useful load proceed as before, but allow the machine to perform a given number of complete work operations over a measured interval of time; the results obtained, minus the friction load, give the useful load. The values of the total and useful torque may be obtained from formulæ 4 and 5.

This method gives sufficiently good results for moderate powers, and enables the engineer to decide on the size of the motor and the approximately correct speed characteristics suitable for the work—in other words, the compounding required, or "slip" necessary as the case may be, between friction load and working load. The temperature rise of a motor in such cases is, of course, proportional to the R.M.S. values of the load, and not the average values. For a complete discourse on fly-wheel and motor capacities the reader is referred to Mr. Ablett's paper in the I.E.E. *Journal*, Vol. 48.

The cropping machine is one that requires some little care in adopting a suitable motor to drive it. The process of cutting a girder, for instance, by this means, is carried out in a series of "crops" at a frequency of about 3·2 per sec. Obviously the function of the fly-wheel is two-fold, namely, to take up a proportion of the useful load during the complete operation, and to supply the energy for the blow delivered on each individual crop. A comparatively long interval between successive operations is taken up in changing the girder. In order to keep up the output, it is quite allowable to use a shunt motor that will take 50 per cent. overload momentarily, the resulting armature drop allowing the fly-wheel to do a proportion of the work.

The following observations were made on a machine driven by a 9-H.P. shunt interpole motor, cutting a 10-in. girder :—

Initial start on fly-wheel and gears ...	21	amps.	at 500 volts	
Starting current varied between	18-14	„	„	
No load (friction loss)...	5	„	„	
Load current rose to	22	„	„	in 6 sec.
Time to cut girder	15 sec.			
Time of starting	35 sec.			

The peak load of 22 amperes is reached twice, at points where the blade encounters the web and flange simultaneously. The full-load current of the motor is 16 amperes, and in this particular test the overload was 37 per cent. approximately.

Another example of individual drive is the shearing machine driven by a compound 10-H.P. motor. The machine possesses two fly-wheels, and performs three operations at one revolution of the tool operating shaft. The observations were as follows :—

Initial starting current ...	25 amps. at 500 volts
Average	10 amps.
Time of start	19 sec.
Friction load	2·5 amps.
Total load current	6 amps.

In the case of the cropping machine, a smaller fly-wheel could be used, but the advantage is scarcely worth the expense of changing the wheel.

CHINA—AND BRITISH ENGINEERING.

By ERNEST T. WILLIAMS.

Only a year ago I was in Peking, and on every hand there was evidence of Manchu dominion. I was to have continued my journey by the weekly fast train to Hankow *en route* for Shanghai, but there were rumours of trouble in the former place, and, as my time was limited, I perforce had to travel to Shanghai by sea, whilst my friend caught the train—the last that got through from Peking to Hankow for weeks—and saw something of the revolutionary outbreak and fighting there ; we met later at Shanghai. Thousands of refugees were coming down the river ; each boat was packed with passengers. I saw several banks with closed doors, and hundreds of Chinese crowding round in hope of their opening for business again. Foreign sympathy was generally with the revolutionists, but it was thought that they had little chance of success. Was it the beginning of the break up of China, the oldest Empire in the world? Those who know China best felt the least inclined to give decided opinions ; all seemed to think that it would take years before the country was settled again and credit firmly established.

A year has passed since then, and I might quote here extracts from a leading article in the *Hong Kong Daily Press*, showing how marvellous a change of attitude on this subject has come over those responsible for conducting a well-established daily ; their observations reflect the enlightened opinion of those who are in regular contact with China and the Chinese.

It would be foolish to overlook that the new Republic is still in deep water, and many difficulties will have to be faced and conquered in coming years before the complete confidence in China of the business world is gained, but it would be none the less foolish to overlook or belittle the remarkable progress that has already taken place, and the spirit of amity and co-operation which is prevailing in the councils of the country's real rulers.

The appointment of Dr. Morrison as Political Adviser, and of Sir Francis Piggot as Legal Adviser, to the Chinese Government, also the rumoured appointment of an Adviser on Railways, are marked indications, to those who know something of China, of the real beginning of a period of advance and reform, the more so when it is remembered what momentous questions the Government has had to deal with during the last few months.

Now what does all the wonderful new policy of progress and development mean? Again it is most difficult to prophesy, but certain clear lines stand out of which the wise will take careful note, for those who take advantage of the present golden opportunity will undoubtedly reap a golden reward. These points may be summarised as follows :—

1. Here we have a vast country, with enormous mineral wealth, which has hardly been touched.

2. There is a population whose numbers are unknown, but are estimated to exceed 400,000,000.

3. The country has an old civilisation, and the people are intelligent, sober and industrious, and amenable to authority and discipline.

4. The people are wakening up to the realisation that the West has much to teach them, and they are now as anxious to learn as previously they were ready to despise and ignore foreign knowledge.

5. The leading Chinese are alive to the potentialities of this great Republic and to the possibility of its taking its rightful position in the family of nations.

6. Remembering the unique progress made by the Japanese in a short period, it is not unreasonable to expect a similar progress in China during the next few decades.

7. The leaders of the people realise that they cannot undertake the rapid development of the country themselves, and that foreign aid and capital, and the giving of concessions to foreigners, are essential.

8. The country most urgently requires :—Good roads, extensive railways, afforestation, irrigation, mining schemes, electric light and power, telegraph and telephones, tramways, manufacturing machinery, &c., to mention only those items of interest to engineers.

9. It can now almost safely be predicted that the "boom" in trade, long expected by those dealing with China, may take place within a few years. If the country is really opened out, this boom is likely to be even greater than is anticipated.

10. With the exception of the depletion of the forests, we have, from the standpoint of development, almost as virgin and wealthy a country as North America was a century ago, but with this great difference—that whereas the one had practically no population, and many tracts of land dangerous and unexplored, the other has a great population to supply cheap and intelligent labour to work the country's resources, and the Government are ready to protect foreign life and capital.

Then there will be the increased needs of these millions to be supplied as soon as they adopt a higher standard of living, which will inevitably follow on the opening up of the country.

There are other dominant factors in the situation which could be added to the above summary, but enough will have been said to show that we are on the eve of big things in the old Celestial Empire. The possibilities of China have long been realised, hence the proposals for the "Partition of China," "Spheres of Influence," &c., of which one often hears. It is also the realisation of these possibilities which has made the great nations walk warily, and which has had the happy consummation of their working together to avoid the dangers which must arise from other than mutual and concerted action.

But if China opens up as is expected, there will be enough for all who take the trouble to obtain their share. Though such a boom would increase trade all over the world, it can be taken as a *sine quâ non* that the greatest and most direct result will accrue only to those who are going to study the problem and deal with it in a comprehensive manner.

With the passing of the Manchu *régime*, the great obstacle to the country's development has been removed, and with it we hope the deplorable system of "squeeze," a half-recognised system of dishonesty which sapped at the very roots of sound finance so essential to real progress.

In any case there is a spirit abroad, with which all honourable people will be in agreement, that China's resources shall be exploited for the advantage of the Chinese, and the participation of Chinese capital and straight dealing are essential to continued success.

Now, *is British engineering going to rise to the occasion?* The prospect is big—very big—far too large to be dealt with extensively by individual firms. It would appear that there are two ways of dealing with the problem. The first of these is by the formation of a company, not necessarily with large capital, but with powerful financial backing, to seek out and obtain concessions and float these on the market.

The second way would be the amalgamation of several large firms—so far as their interests in China are concerned—who would obtain the concessions direct from the Chinese Government, or indirectly from the holders, and develop them into working concerns. China is such a vast country, and business transactions in the past have been so slow, that success on any large scale necessarily implies considerable initial expense and possible outlay before an adequate return might be expected; this is one reason why an amalgamation of interests is so desirable. Then, almost certainly, it will be necessary partly to finance any scheme. The need for united action has been previously insisted on in the writer's article on "Extending British Engineering Abroad," published in the ELECTRICAL REVIEW on November 25th, 1910, page 851, reference to which is suggested to those interested.

The agents sent to China should be the best men obtainable, of undoubted integrity, capable as engineers, with sound business instincts, and able to consider problems from China's standpoint. They should be very well paid to compensate for the many disadvantages of their offices, and must not be treated parsimoniously as regards either staff or expenses. They must receive ready and sympathetic support from their principals.

Finally, *is British engineering*, and the electrical and allied branches in particular, *going to grasp the opportunity—an opportunity which, once lost, may never come again?*

THE NATIONAL INSURANCE ACT, 1911.

THE STAMPING OF INSURANCE CARDS AND BOOKS.

By JOS. J. H. STANSFIELD, F.C.I.S.

A COMMON ground of objection to the collection of contributions payable under the National Insurance Act by means of deductions from wages, was that this method would entail upon employers additional expense in consequence of the records necessary, and the necessity to take charge of, and stamp from time to time, the cards required under the Health, and the books necessary under the Unemployment, parts of the Act.

In order to meet these difficulties so far as is possible under the provisions of the Act, the National Health Commissioners and the Board of Trade have issued circulars giving methods by which the requirements of the Act may be complied with with greater ease and less expense than would otherwise be the case.

The methods so far approved are three in number: (1) stamping during the week after payment of wages, (2) quarterly stamping, and (3) arrangements with Labour Exchanges.

In manufactories and workshops where there are a considerable number of employés, no time must be lost in the collection of time-sheets and the making up of wages sheets or wages books, if all is to be ready for the payment of wages at the proper time, and the extra time taken up in consequence of the entries necessary under the Act, and the stamping of cards and books before such payment, may in some cases be found to be that last straw which brings the camel to its knees.

To meet this difficulty employers have in some cases lengthened the period between the end of the working week and the payment of wages, but this may not in all cases be feasible, and to meet such cases the Health Commissioners have issued Circular No. 127 A.G.D., entitled "Special arrangements for stamping during week after payment of wages," stating that the Commissioners are prepared to consider applications from employers for permission to adopt the arrangement indicated by the title of the Circular.

This arrangement only applies to Health cards, and cannot be made for less than 100 persons, and it is only applicable where employés have agreed to deposit their cards with their employers during the period of currency, though it may apply to the whole or a part only of such employés.

Careful records must be kept readily showing, week by week, the contributions payable, and the reason for non-payment should no contributions be payable. If it be found on inspection that the number of employés whose cards are not stamped before payment is greater than the number in respect of whom the arrangement is made, the permission of the Commissioners to the arrangement will be at once withdrawn.

Employers will be required to deposit an amount sufficient to cover the contributions for one week or other period for which contributions are payable, the deposit remaining with the Commissioners so long as the arrangement continues. The initial deposit should be forwarded not later than four days before the first pay-day under the arrangement.

The circular sets out conditions applicable where there may be an increase in the number of employés to which it is desired to apply the arrangement, the stamping of cards, and the refund of deposits.

Any employers in England desiring to adopt the arrangement, should obtain a form of application (127 b.A.G.D.) from the Accountant and Comptroller-General, National Health Insurance Commission (England), 29, Queen Anne's Gate, London, S.W., marking the envelope "Circular 127." Information as to similar facilities granted by the Scottish, Irish and Welsh Commissioners can be obtained on application to the respective Commissioners.*

In some cases, employers may desire to stamp their cards quarterly, and in such cases the conditions of Circular 105, A.G.D. apply in respect of English employers.

The general arrangements as to quarterly stamping are very similar, *mutatis mutandis*, to those applicable to stamping after payment of wages, the form of application being numbered 106 A.G.D.

The methods by which deposits may be made are five in number (1) a deposit sufficient in amount to cover the whole of the contributions payable during the quarter in respect of the maximum number of employés to whom the arrangement applies; (2) an instalment equal to one-thirteenth of the amount required under method (1) payable four days before each pay-day; (3) a deposit paid four days before the first pay-day in each quarter thereafter, remitting each week a cheque covering the amount actually payable in the previous week; (4) a similar arrangement to (2), applicable where wages are paid fortnightly or monthly; and (5) an arrangement similar to (3), also where wages are paid fortnightly or monthly.

Special high-value stamps are issued in connection with quarterly stamping for 13, 10 or 2 weekly contributions at the various rates payable under the Act.

Under the provisions of the circular, where the wages of any employé are paid before the ordinary pay-day, or where an employé terminates his employment, or wishes to have his card stamped to date, the cards must be stamped in the ordinary way with stamps obtained from a post office.

A careful consideration of the two circulars leads to the conclusion that, on the whole, the quarterly arrangement is the better, particularly if method 3 or 5, whichever may be applicable, be adopted, as no interest or discount can be allowed on deposits.

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* The addresses for Scotland are 42, Frederick Street, Edinburgh; for Ireland, Pembroke House, Upper Mount Street, Dublin; and for Wales, City Hall, Cardiff.

Communications in respect of this arrangement should be made to the Accountant and Comptroller-General at the address as before stated, marking the communications "quarterly stamping."

The Insurance Act is divided into three parts; but, although Part 2 applies to unemployment insurance, Sec. 99 of the Act enables the Board of Trade to make arrangements with employers in respect of both the health and unemployment parts of the Act where workmen are engaged through a Labour Exchange, and where any such arrangement is made, all the periods of employment during which a workman is employed by one or more employers may be treated for the purposes of the unemployment part of the Act as a continuous period of employment under one employer, a provision which is exceedingly valuable, as will shortly be explained.

A circular has been issued by the Board of Trade stating the conditions upon which Labour Exchanges will undertake the custody, stamping, distribution and exchange of Health Insurance Cards and Unemployment Books, but this arrangement is, as a general rule, only possible in areas served by Labour Exchanges in which the necessary accommodation is available, and can only be made in respect of workmen who are employed at the time the arrangement is entered into, and such additions to the staff as are subsequently engaged through Labour Exchanges.

Engagement through a Labour Exchange necessitates notification of the vacancy to the Exchange when any workman sent from the Exchange may be engaged, or the employer may send down to the Exchange for registration any workman whom he desires to engage to fill the vacancy. This provision will, no doubt, do much to increase the number of appointments filled through the Exchanges.

Deposits to cover stamps for the whole of the workmen for not less than two weeks must be made, and a three months' agreement at least be entered into, terminable by either party by one month's notice.

No charge is made for work done in connection with unemployment books, but a minimum payment of £1 for each four calendar weeks, and 2s. per 100 workmen after the first 1,000, must be made in respect of Health Insurance. For casual engagements a minimum of 25 per cent. extra will be made, the actual amount depending upon the work necessary. A group of employers may combine to make up 1,000.

In addition to being relieved of the custody and stamping of the cards and books, groups of casual employés may have their contributions under both parts of the Act pooled, and so pay only in proportion to the actual labour of a week, instead of paying the full rate of contributions which would be payable by an employer who engaged a workman for the first day of the week for which he was employed. This means a big saving in respect of employés such as dock labourers; and arrangements of this kind have already been made in several towns. It also means fairly continuous employment for workmen, though it will probably have the effect of restricting the work to a smaller number.

Under some of the decisions of the Umpire appointed under the unemployment part of the Act, it not infrequently happens that workmen may be employed for a whole week but be only liable for insurance for a part of the week. In such cases, the number of days for which contributions are liable are added together by the Exchanges and divided by six, the result being the number of weeks for which contributions are payable by the employer. To take a case: If 60 workmen are engaged for an average of three days only in one week, the employers' share of the contributions would be 60 contributions at 2½d. each if stamped in the ordinary way, but if the Labour Exchange deals with the stamping, only half that amount would be payable.

A similar advantage may be obtained in mechanical engineering and other establishments where two shifts are worked, the second shift being for five nights only per week. The employer would, if dealing with his own stamping, pay 2½d. per week per employé as his share of the contributions, whilst the Labour Exchanges would call for only five contributions for every six workmen.

Under Sec. 94 of the Act an employer may within one month after the end of any period of 12 months fixed by the Board of Trade, apply for a refund of one-third of the contributions paid on his own behalf in respect of employés who have been engaged for the whole year, and for whom not less than 45 contributions have been paid. Arrangements through Labour Exchanges will facilitate the collection of these refunds.

In the first instance books will be stamped for the full amount of the contributions payable by both the employer and the employé, but the workman may ask for his own contributions to be pooled, and any over-deductions that may be made through employment for less than six days, or with more than one employer, may be refunded. In order to facilitate these repayments, special stamps have been issued upon which the figures 1 to 6, representing the number of days worked per week, appear in the space where the figure 5 appears on the ordinary stamp, each of these figures being reckoned as one-sixth of 2½d., for the purpose of arriving at the amount of the contributions payable by the workmen.

Where employers wish to deal with their own Unemployment Insurance Books, arrangements may be made with the Board of Trade for stamping at extended intervals, these arrangements being somewhat similar to those made by the Health Commissioners for quarterly payments, stamps being issued in due course covering the whole quarter's contributions.

Applications for particulars of the arrangements made by the Board of Trade should be made to the Board of Trade, Central Office for Labour Exchanges and Unemployment Insurance, Queen Anne's Chambers, London, S.W.

BUSINESS NOTES.

Consular Notes.—Italy.—The British Consul at Milan, in a recent report, states that the diminution in the imports of electrical machines, &c., which was noticed in preceding years, continued in 1911, and became more marked. It is the same with detached parts and working machines forming part of electrical motors. In 1911 Italy imported, on the whole, 75,000 quintals, against 83,300 quintals in 1910, and 90,700 quintals in 1909. Germany sent 2,000 quintals less, and Switzerland 8,000 quintals less, but other countries benefited slightly. On the other hand Italy has been producing more electrical machinery; 85,000 quintals are reported as having been produced in 1911, against 77,000 quintals in 1910, and as the quantity produced in 1909 was 67,000 quintals, it must be concluded that the demand in Italy is practically stationary, and the output compensated for the decrease in imports. Three years ago the home industry supplied 42·5 per cent. of the total requirements, in 1910 it supplied 47·5 per cent., and in 1911 53 per cent. The total quantity has risen gradually from 158,000 to 160,000 quintals. Imports from Germany meanwhile descended from 35 to 33·8 per cent., and then to 31·5 per cent. A confirmation of the rapid extension of installations for electric lighting is found in the returns of imports of electric lamps of all kinds. While arc lamps have risen again to 1,000 quintals, incandescent lamps have risen from 6,838,000 to 7,647,000, an increase of nearly 1,000,000 lamps, without taking into account home manufacture, which is reckoned to be close upon 2,000,000 lamps, and is expected to reach 6,000,000 or 7,000,000 lamps. In the matter of accessory apparatus for electric installations, Germany sold to Italy 9,503 quintals in 1911, against 10,000 quintals in 1910. Here, again, it would seem that Italian industry is developing. As regards electrical measuring apparatus, indicators, recorders and meters, Germany sold Italy 2,211 quintals in 1911, against 2,503 quintals in 1910, thus indicating a revival of national industry.

Russia.—The American Consul at Batoum, in a recent report, points out that there is a big market in Baku for oil and gas engines. These engines have been used in the Baku oil-fields for several years, and their use is rapidly extending. It is estimated that 2,000 engines are now in use in Baku, and they are being sold at the rate of 400 or 500 a year. One firm claims to have sold 135, valued at about £100,000, during the past year, and altogether a total of about 700 valued at about £400,000 during the past few years. A Baku firm has just sold for the use of the electric tramway at Tiflis an oil engine of 1,750 H.P. of Belgian manufacture, for which a price of about £25,000 was received. The engines are used both for baling the oil wells and for running compressors. The popular sizes range from 35 H.P. to 150 H.P. for gas engines, and from 24 H.P. to 66 H.P. for oil engines. Oil and gas are rapidly replacing steam throughout the oilfields, and large numbers of steam engines and boilers are being dismantled. Motors for crude oil and gas are the types in demand. Some of the oil wells produce gas, and whenever possible this gas is used for water power and furnishes a fuel without cost to the operator. When the wells of a property produce insufficient the operator uses his own crude oil for fuel. At present crude oil has a market value of 35 copecks per pood. The majority of the wells are without gas, but gas is produced in sufficient quantities to create a big demand for gas engines. By using their own gas or oil the operators of wells are thought to have effected a sufficient economy over steam to pay within two years the original cost of an engine. Gas engines are used principally in the Bibi Eibat fields, where the wells produce gas in sufficient quantities for the purpose. The Balakhani wells have little gas, and crude oil motors only are used in this district. About 80 per cent. of the motors used in the Baku oil fields are of British manufacture, and these sales are confined principally to four makes. From the beginning the gas and oil engines of English manufacture have enjoyed a practical monopoly. Belgian, Swedish and German engines are coming into use, but do not compare in popularity with those manufactured in England. Engines of Russian manufacture are now being put on the market, but experts consider them inferior to those of British and European make. The past three years has witnessed the greatest development in the use of such engines at Baku. Despite the large number already sold at Baku, a larger future market remains. Many firms have been slow to discard their expensive steam plants, but are now doing so. Nobel Bros., for instance, one of the largest oil producers in the region, have just purchased their first oil engine. For their various wells Nobel Bros. could use about 600 engines should they decide to substitute gas and oil motors for their steam equipment. The present tendency is to use motors of high horse-power, and those of 40 to 60 H.P. are supplanting the 20 to 30-H.P. motors formerly used. As the oil wells become exhausted they are driven deeper and higher-powered engines are required. The price of the motor is of little importance to the operator so long as he obtains an engine that will accomplish satisfactorily the work required of it.

It is noted that some of the European manufacturers sending engines to Baku are having some of the heavier parts, such as fly-wheels, made in Russia, thus effecting a considerable economy in freight and duty charges. The duty on these engines coming into Russia is 3.20 roubles per pood.

Terms of payment are usually one-third of the price paid with the order as "hand-money," and the rest from 6 to 18 months. For cash on delivery there is a discount of 5 per cent.

The use of oil and gas engines in the regions around the Caspian Sea is not confined to the oil-producing fields. Engines using crude oil are in demand for all purposes. Crude oil is cheap and easily procurable throughout the countries bordering the Caspian. The oil, cotton and agricultural districts of the trans-Caspia are supplied from Baku, as are also the cotton and agricultural districts of northern Persia and the trans-Caucasus. The demand for gas engines is limited to those wells actually producing sufficient gas for fuel purposes. The crude oil engine finds a market wherever power is required, and in the countries bordering the Caspian Sea it is used for driving cotton and agricultural machinery, mills, and irrigation plants.

About 400 ships of 500 to 5,000 tons are in service on the Caspian Sea. These boats use crude oil under the boilers, but efforts are being made to adapt crude-oil engines. One boat of 5,000 tons has been equipped with a Diesel engine. The captain reports that there has been a big saving of fuel, but the initial price of the engine is so high that the question of actual economy is still open.

France.—The British Consul at Paris, in a recent report on the economic development of France, points out that the census of 1906, gave figures of the development from 1901 to that year for different classes of motive-power. The figures of last year's census have not yet been published. Agrand total of 12,150,000 H.P. was obtained for the whole water-power in France at the beginning of 1906. The results of the 1906 census showed a great increase during the previous five years, especially in the employment of water power. It is expected that the census of last year will show a far higher increase of motive power in all directions.

The subject of the electrification of parts of the French railways has recently been much before the public. As long ago as 1899 proposals of this kind were brought forward for short suburban lines. They were soon afterwards carried out, and further short sections have been electrified in different directions. A further extension is about to take place on the State railways, formerly the Western line, and work has already been begun without waiting for the decree which will officially sanction it. At present, however, it appears to be the intention of the Government only to electrify certain local lines.

Formosa.—The British Consul at Formosa reports that the Government electric power station at Koresho was completed in the summer for the supply of electricity to Taichu, the chief city in the centre of the Island, and Shoka. A dynamo of 500 H.P. is sufficient for lighting purposes, but there are two of these. Water is led from the Daian River along a canal to a place where a fall of 130 ft. is obtained to the river bed, and here the turbine is placed, the flow being 300 cb. ft. per second; a flow of 100 cb. ft. suffices to obtain electricity of 1,000 H.P. from the dynamos, and the surplus flow of 200 cb. ft. per second is sent for irrigation. There is, therefore, a large reserve of motive force should occasion arise for the supply of electric power for manufacturing purposes in the central district of Formosa.

Spain.—The American Consul at Barcelona, in a recent report, states that in 1910 there were 1,696 electric plants in the Spanish Peninsula and the Balearic and Canary Islands, with 2,685 generators and 277,907 H.P. Barcelona heads the list in the number and size of plants, followed by Madrid. There were 1,030 installations for commercial purposes, with a capacity of 127,103 KW. For public lighting throughout the Peninsula, 164,136 incandescent and 2,142 arc lamps were used. There were 1,737,341 incandescent and 9,720 arc lamps in private use. The motors numbered 4,745, of a total of 30,012 H.P. The use of electricity is rapidly increasing for all purposes. A number of electric railways are projected in various parts of the country, the centre of the movement being in the Catalonia district, where several strong companies are constructing and operating electric railways and power plants.

The British Consul at Malaga reports that the local telephone system was extended in 1911 by the establishment of an exchange whereby Malaga is now connected with a large number of centres within the kingdom, including Madrid. The long-distance service is to be further extended so as to give within a few months direct communication with about 53 important towns, the project including places as far distant as Barcelona and San Sebastian. In connection with the above service, a new system has also been inaugurated for the transmission of telephone messages. A 15-word message destined for any place outside the province may be sent for about 9d., or to any place within the province for about 4½d. These messages are received on forms similar to these in use for telegrams, but the service is generally far more rapid.

The British Vice-Consul at Almeria reports that during the past summer the Inter-Urban Co. of Telephones, whose central station is at No. 1, Calle Alcala, Madrid, extended their connection to Almeria. Up to the present it has worked well, messages having been promptly transmitted, and conversations carried on with Madrid and other cities and towns with ease and profit.

Bavaria.—The British Consul at Munich, in a recent report, states that unexampled progress has been made during the past few years in the development of the electrical industry. As regards turnover and profits of the large electrical concerns, each new financial year puts the preceding one into the shade. Nevertheless, the question is constantly cropping up whether the world's market is not sufficiently supplied for a long period with the products and producing power of this industry, and whether the available funds at disposal will not be exhausted. Considering, however, that the large companies are constantly obliged to extend their works to be able to cope with fresh orders, and that the electrical industry has problems before it, the solution of which will employ engineers and technicians for a long time to come, such doubts may apparently be waived. In the near future progrèss in the electrification of railways is to be expected. This would facilitate the supply of cheap electric current to industry, agriculture and handicraft, especially in such cases where the electrification of railways can be furthered by utilisation of water power. The current could be also carried to such places where up to now it is impossible to take advantage of this power. The use of electric motors and dynamos is gaining ground in all branches, and hence the demand for these in all sizes has up to now increased from year to year. The latest branches of the electro-technical industry, such as obtaining nitrogen from the air, improvements in water supply through erecting ozone works, and wireless telegraphy are sure to mean more work. The prospects opened out to the electrical industry in connection with power generating stations, are no less important. Adequate work is on hand, and more is expected owing to the draining machines and ventilating apparatus, &c., required in mines, the installation of larger gas engines and generating plant in the iron industry, and the increasing use of polyphase electric motors in the textile industries. Machine, turbine, and apparatus works of electric companies are using electricity on a large scale. The departments making electrical and mechanical block-houses, switches, transformers, and the outfit of railway signal-boxes are especially busy. The same applies to turbine works. The supply of the most important centres of Bavaria with electricity for power and lighting purposes by central stations has been considerably advanced in 1911. Not only the interest of the larger towns, but also the small parishes, agriculture as well as industry, are being taken into consideration. The current is at present to be generated by motor power. In due course, however, and when all arrangements have been carried through, it is intended to have these central stations supplied by electricity generated by water power in the Alpine district of the country. In October, 1911, the following companies were floated:—(1) Pfalzwerke (the Palatinate of Bavaria Works). For the first building section the following has been agreed upon as to the participation of share capital:—Municipalities and parishes, 30·6 per cent.; the District Council, 46·9 per cent.; consequently public corporations, 77·5 per cent.; the Rheinische Schuckert-Gesellschaft (Rhenish Schuckert Co.), participate with 22·5 per cent. of the capital, and act as building contractors. (2) Frankenwerke (Franconian Works). The city of Nuremberg subscribed 51 per cent., the sister town, Fürth, 23 per cent. of the share capital; therefore, the municipalities together 74 per cent., the building contractors, Schuckert & Co, 26 per cent. Towards the end of November, 1911, a central power and lighting station—on a similar basis to that at Nuremberg—was agreed upon at Munich. In conjunction with several bankers it was floated by the corporation of Munich. The capital of the company with limited liability is to be £450,000, and the firm styled Leitzachwerke A.G. The central power stations are to be produce electric current and to supply it to the shareholders (for instance, the Franconia Works will supply the cities of Nuremberg and Fürth and the Schuckert Co.) cheaper than they have been able to produce it hitherto at their own works. Owing to participation in these central power stations, the financial burdens of the municipalities will individually not be heavy. In the case of Nuremberg, for instance, the city will for a long time to come only have to provide about 2,000,000 marks (£100,000). If the town itself built new or additional works, it would have to provide more capital, perhaps 5,000,000 to 6,000,000 marks (£250,000 to £300,000). Furthermore, Nuremberg, as already mentioned, receives the current cheaper than it could ever be produced in its own works. Lastly, there need be no fear that any works or factories will have cause to leave the town or the district, as other districts cannot offer lower current prices than Nuremberg. All this applies equally to other towns connected with the Franconian or any of the other above-mentioned works.

Book Notices.—*Portable Wireless Telegraph Stations.*—A volume recently issued by Marconi's Wireless Telegraph Co., Ltd., with this title, deserves to be regarded rather as a treatise on portable wireless stations than a manufacturer's private publication. After a brief sketch of the history of the subject, which dates back some 10 years, various technical subjects are discussed in detail, and the best conditions for the working of wireless stations in warfare—the principal requirements being that the transmitter should not be sharply tuned, the receiver should be capable of very sharp tuning, and that changes of wave-length should be effected with a single handle. All these conditions are satisfied by the Marconi field stations. Secrecy is secured by quick change of wave length. The different types of portable stations which have been developed by the company are then described, ranging from the 1½-KW. "F" (cart) station with a range of 150 to 200 miles to the "K" type knapsack station, with a range of 5 to 7 miles, of which extreme portability and ease of manipulation are the leading characteristics. This apparatus can be carried by four men in loads of 20 lb. each, and can be erected by two men in five minutes. Cavalry and airship equipments, and various accessories, are also described, and the book, which is beautifully illustrated with half-tone views and diagrams of connections, concludes with a very short account of the company's present organisation. It is certainly an admirable production.

"Atti della Associazione Elettrotecnica Italiano." October 31st, 1912. Milan: Stucchi, Ceretti & C.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 8. October, 1912. New York: The Society.

"*Bulletin* of the Association des Ingenieurs Electriciens." July, 1912. Liége: The Association. Price 4 fr. 50 c.

"The Science of Illumination." By Dr. L. Bloch. 1912. London: John Murray. Price 6s. net.

"Primer of Scientific Management." By Frank B. Gilbreth. 1912. London: Constable & Co., Ltd. Price 4s. net.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 7. September, 1912. Chicago: The Society. Price 50 cents.

"First National Mine-Safety Demonstration, Pittsburg Pa., October 30th and 31st, 1911." By H. M. Wilson, A. H. Fay and G. S. Rice. "Notes on Mineral Wastes." By Charles L. Parsons. "Electrical Symbols for Mine Maps." By H. H. Clark. "Mine Fires. A Preliminary Study." By George S. Rice. "Methods of Determining the Sulphur Content of Fuels." By I. C. Allen and I. W. Robertson. Washington: Government Printing Office.

"The Arbitration Clause in Engineering and Building Contracts." By E. J. Rimmer. 1912. London: Constable & Co., Ltd. Price 2s. net.

"*Mechanical World* Pocket Diary and Year-Book for 1913." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Science Abstracts." October 25th, 1912. Vol. XV, No. 10. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Manuel Pratique de Soudure Autogène." By R. Granjou and P. Rosemberg. Paris: Office Central de l'Acetylene. Price 5 fr.

A Coming of Age.—On Saturday, October 26th, the shareholders, staff and employés of Messrs. T. W. Broadbent, Ltd., of the Victoria Electrical Works, Huddersfield, together with their wives and families, met for a tea and social evening, at the invitation of Mr. T. W. Broadbent, the managing director of the firm, to commemorate his having been in business 21 years. Mr. Broadbent was supported by his co-directors, Messrs. G. A. Broadbent and F. W. Davies, and amongst the guests were Mrs. F. W. Davies, Mr. L. F. Senior (solicitor to the firm) and Mrs. Senior, and Mr. John D. Mackenzie (the Scottish agent of the firm) and Mrs. Mackenzie. The gathering was held at the Fields Congregational School, Kirkheaton, and was well attended, only three employés being absent. Mr. L. F. Senior proposed the toast of "The Firm," and after remarking that he was called in at the inception of the company, referred to the very satisfactory growth of the business, and predicted a bright future for it. In replying, Mr. T. W. Broadbent referred to his first start in business on his own account, 21 years ago, and the way in which, at the outset, he himself had often put in 15 or 16 hours a day on the bench and on outside work. The business had grown, and was in 1907 taken over by the present company. The past financial year had been a record one for the company, and he encouraged all the workmen present to continue to do their best for the firm, and promised that they should share in its prosperity. Mr. J. L. Stokes proposed the toast, "The Ladies," and Mrs. J. Holroyd suitably replied to the toast. After the tables had been cleared, an excellent programme of vocal and instrumental music was given. Dancing and games were also indulged in till a late hour. During the evening, Mr. G. A. Broadbent made a few encouraging remarks to the employés, and promised that, in commemoration of this event, he would give every employé over 18 years of age 2s. 6d., and every employé under 18, 1s., at the New Year. After various votes of thanks, the proceedings terminated.

Dissolutions and Liquidations.—Typewriting Telegraph Corporation, Ltd.—A meeting is called for December 5th, at 87, Bishopsgate Street, London, E.C., to hear an account of the winding up from the liquidator, Mr. C. S. Beale.

Electric and General Assurance, Ltd.—A meeting is called for December 9th, at 5, London Wall Buildings, London, E.C., to hear an account of the winding up from the liquidator, Mr. L. Maltby.

Imperial Electric Lamp Co., electrical engineers, Market Street and Great Western Street, Moss Side, Manchester.—Messrs. T. Graham, J. Young, G. Artingstall, and F. A. Pidding have dissolved partnership.

Trade Announcements.—The Electrical Co., Ltd., have opened an office at 32, County Buildings, Corporation Street, Birmingham (telephone No. 3498 Central), with Mr. F. R. Unwin as representative engineer.

We are informed by Mr. F. E. Phillips, of 53, Victoria Street, S.W., that he has taken over the London agency of the St. Helens Cable and Rubber Co., Ltd.

Mr. Lionel Morrison, for over 14 years with Mr. Emanuel Spence, has commenced business at 371, Linthorpe Road, Middlesbrough, as an electric bell fitter and lighting engineer.

Auction Sale.—Messrs. Wheatley Kirk, Price and Co. will, on November 26th and 27th, offer for sale by auction the electrically-driven rolling mill plant, machine tools, rails, loose tools and other effects of the English McKenna Process Co., Ltd. at Birkenhead, by order of the Receiver. The plant includes three 750-KW. Siemens-Willans three-phase turbo-generators, two 50-KW. D.C. exciter sets, a 150-KW. rotary converter, 54 motors (7·5 to 125 B.H.P.), switchboard, crane, B. & W. boilers, six 28-in. rolling mills and 500-B.H.P. motor, and various other electrical and other equipment, particulars of which are given in a list and brochure which may be obtained from the auctioneers (46, Watling Street, E.C.).

Bankruptcy Proceedings.—Joseph Arthur Procter, formerly electrician, but now warehouseman, late of Bradford and Shipley.—Receiving order made at Bradford on October 29th on debtor's own petition. First meeting, November 9th; public examination, November 13th.

The Ignition Magneto Industry.—Quite a large industry has sprung up in connection with the manufacture of magnetos for ignition purposes on motor-cars. One of the largest undertakings of the kind is that of the Bosch Co., at Stuttgart Germany. Started in a small way 25 years ago, by Herr Robert Bosch, this concern now employs about 6,000 persons, and turns out no fewer than 1,200 complete magnetos per day, this not including the production of the separate factories which have been established in France and the United States to supply the demands of those markets. No fewer than 160 different varieties and sizes of magnetos are manufactured, ranging from a miniature machine suitable for a motor-bicycle up to one for an internal-combustion engine of 2,500 H.P.

Catalogues and Lists.—The Holmquist Electric Co. (1911), Ltd., 27, Kingly Street, Regent Street, London, W.—Illustrated and priced leaflets relating to the "Holmquist" replacement heater, electric hat pads, bed-warmers, irons, toasters, hair-drying apparatus and vibro-massage apparatus.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—November stock list of A.C. and D.C. motors.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park.—Illustrated and priced leaflets relating to their small electric motors, with particulars of some typical ratings.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Illustrated leaflets respecting aluminium battery connections and aluminium in the automobile industry.

The Diamond Coal-Cutter Co., Stennard Works, Wakefield.—Eight-page pamphlet respecting the safety of the Diamond electric coal-cutter, and giving a description, with diagrams, of the Crossland patent automatic feed regulator for regulating the feed or forward travel of an electrically-driven coal-cutter.

Messrs. Arch. J. Wright, Ltd., 41, Beech Street, Barbican, London, E.C.—Price lists of the "Daylight" electric cycle lamp and of electric pocket lamps, torches and other novelties.

The Essex Accumulator Co., 497-9, Grove Green Road Leytonstone, N.E.—Twenty-page catalogue containing full particulars, with illustrations and prices of their latest types of portable electric hand lamps (unspillable accumulator and dry battery types), also of the "Essex" dry battery and accumulator inspection sets and inspection torches, also dry and accumulator torches.

Messrs. Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Advance copy of 12-page booklet entitled "The Survival of the Fittest," in which a comparison, with diagram, is made with a view to showing the superiority of the arc lamp over the metal-filament in the production of comparatively large quantities of light. Copies of the booklet will be sent to contractors on application.

Messrs. W. H. Palfreyman & Co., 17, Goree-Piazzas, Liverpool.—Folder relating to their hydro-carbonated bone-black for case-hardening.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Christmas trade publication No. 714, relating to "Aston" decorative lighting sets—miniature electric candle sets, flexible lighting strips for dining tables, festoon chain lamps, pocket and portable hand-lamps, electric torches, hair driers and vibrators, also electric radiators and table standards. This list is being distributed broadcast in view of the approaching season.

Messrs. D. H. Bonnella & Son, 58 and 60, Mortimer Street, Cavendish Square, London, W.—List No. 401 (20 pages), being Section B of their bell accessories catalogue. It contains prices and illustrations of wood, china and brass pushes, and door and window contacts.

Messrs. Falk, Stadelmann & Co., Ltd., 83/87, Farringdon Road, London, E.C.—36-page catalogue (No. 350) (supplementary to catalogue No. 302) giving prices and illustrated information relating to a variety of electrical accessories, including "Efesca" tumbler switches, art metal switches and pushes, lampholders, shade-carriers and ceiling roses, "anti-shock" wall and floor sockets, safety hand-lamps, knife switches, ironclad switches and fuses, "Regal" lighting strip, electric light wires and cables, vacuum cleaners, and many other lines.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Mailing Card No. 193, drawing attention to their Mosaic silk shades of new design, which may be seen at their showrooms.

THE FOSTER ENGINEERING CO., LTD., Wimbledon, London, S.W.—The company are issuing an arc lamp catalogue (flame, enclosed, photographic and open types), and copies will be sent on application. We have received a leaflet describing and giving prices of their "Regulus" single enclosed arc lamp.

THE RADIUM ELECTRIC CO., 82, Hatton Garden, London, E.C. Illustrated leaflets, giving latest prices of "Radec" metal-filament and carbon-filament lamps (pear, round, candle and tubular-shaped bulbs).

For Sale.—The buildings, tools, stores, stocks, &c., of the Sunbeam Lamp Co., Ltd. (in liquidation), Gateshead, are offered for sale by private treaty. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Acton.—The Metropolitan Electric Supply Co. has informed the Council of its decision to reduce the price of current supplied to all Council buildings from 5d. to 4d. per unit (except to the Council Offices, Baths and Library, which are all lighted from plant installed at the Baths).

Australia.—The report prepared by Mr. G. A. Julius, the electrical expert who was commissioned by the North Sydney Municipal Council to inquire into the five proposals received by the Council for the installation of an electricity supply plant and distributing system throughout the municipality, also for the erection of a garbage destructor, has been placed before the Council. Mr. Julius stated that he understood that the Council had decided merely to enter into a contract for a supply of electric current for street lighting under some definite scheme, and also for the destruction of the municipal garbage at a fixed price. That decision eliminated almost the whole of the offers submitted. Had that course of action not been decided upon, he would unhesitatingly have recommended the continuation of negotiations with the City Council, and the ultimate acceptance of its offer. The only proposal which conformed to the conditions laid down was that submitted by the Northern Suburbs Electric Lighting and Power Supply Corporation, Ltd., and he recommended that its offer be provisionally accepted, final acceptance to be held over pending the completion of an agreement fully protecting the interests of the ratepayers.

It is reported that active steps are being taken in connection with the proposed scheme for a power plant at Bulli (N.S.W.), near the mines, for the supply to the Sydney City Council's undertaking, over some 45 miles of transmission line.

Bacup.—The Corporation has decided to apply for sanction to the borrowing of £1,000 for the extension of the electricity service.

Beckenham.—The U.D.C. has decided to apply to the B. of T. for a provisional order to enable it to supply electricity in the parish of Wickham.

Bentley.—The U.D.C. has passed a resolution consenting to the application of Doncaster T.C. for a prov. order for E.L.

Bettws-y-Coed.—The L.G.B. has sanctioned the obtaining of a loan in connection with the electric lighting undertaking.

Beauly.—The Beauly Electric Supply Co., Ltd., has been formed with a share capital of £1,000, divided into 1,000 shares of £1 each. The following are directors:—Messrs. Daniel M'Garth, Beauly; E. G. Williams, Waterloo Place, Inverness; James Menzies, Blairich, Sutherlandshire.

Bootle.—The report of the borough electrical engineer, presented by the Electric Light Committee at the meeting of the T.C. on October 30th, included the statement that the existing sanction to loans for mains was obtained for meeting the normal development of the L.T. system for a period of three years from September, 1911, and that the requirements for H.T. mains are very uncertain. The Committee recommended that the sum of £3,200, approved for H.T. conduit line and cable, be included in the extension scheme, and that the material be not ordered until some definite information as to the Mersey Dock Board's requirements for the supply of current to the Gladstone Dock, Seaforth, is obtained. The recommendation was approved, and the resolution of the Committee of September 20th, 1912, approved by the Council on October 2nd, was varied accordingly.

Bradford-on-Avon.—Messrs. J. and W. Purves, of Exeter, have informed the U.D.C. that they intend applying to the B. of T. for a prov. order for E.L. The scheme has been explained to the Council, which has adjourned consideration of the matter.

Caldy (Cheshire).—The residential village of Caldy, in Wirral, affords an instance of what enterprise can accomplish in the matter of public lighting. This question has been under consideration for some time, and an estimate for gas illumination was obtained from the Hoylake and West Kirby Gas Co. There was, however, a power station, erected by the owners of the estate now being developed, for the supply of electricity for domestic purposes. The Hoylake Urban Council suggested, seeing that the Caldy Estate Co. was supplying electric light to its tenants, that public street lighting by this method would be preferable if the cost was reasonable. The surveyor has now reported that the estimated difference in cost would be £10 only in favour of gas. So it has been decided by the owners of the property to lay their own mains and to supply the current from the power station.

Canada.—In the new grain elevator for the Harbour Commissioners of Montreal, which will have a total capacity of 2,622,000 bushels, some 80 induction motors of 4,680 H.P. are installed, and the operation of the elevators and conveyors is controlled by a system of electric signals.

According to the *Standard*, the Calgary authorities have a proposal in hand to install a plant utilising natural gas for the production of electricity, at a cost of £100,000. With gas at 7½d. per 1,000 cb. ft., it would be possible to generate power at £2 1s. 3d. per H.P.-year, which is cheaper than hydro-electric power is sold at Niagara.

Colne.—The T.C. has decided to apply to the L.G.B. for further borrowing powers to the extent of £2,000 for the purpose of extensions to the electric mains.

Continental Notes.—AUSTRIA.—During the month of August, 36 power schemes were laid before the Austrian Hydrographic Department, of which 24 secured concessions. The most considerable of the schemes were those of the Syndicat Donau-Kraftwerk Wallsee, situated at Perg, in Upper Austria, the gross capacity of which will be equal to 30,000 H.P., and the "Malserheide" Electricitätswerk, at Schlanders, in the Tyrol, with a gross capacity of 2,400 H.P.—*Elek. und Masch.*

FRANCE.—La Société Union Electrique, which has already a large generating station at Saut-Mortier, proposes to establish a new plant near Doucier, in the Jura, to utilise the power of the overflow water from Lake Chalain. It is estimated that about 2,000 H.P. is available. The current generated will be distributed for lighting and power purposes to Lous-le-Saulnier and other small towns in the district.

The Société Anonyme Energie Electrique de Mons-en-Pévèle has been formed at Lille to generate and supply electric current to a number of communes in the Department du Nord.

SWEDEN.—The Stora Kopparbergs Bergslags A.-B., which possesses a power station at the Bullerfalls of a capacity of 24,000 H.P., now proposes to develop the Forshufudfall, the estimated output of which is 20,000 H.P. The company lately placed an order for a Helferstein silicious iron-ore furnace, for the former station, equal to 12,000 H.P., for the electric smelting of iron ore.—*Affärsvärlden.*

SWITZERLAND.—The T.C. of Zurich has applied to the Federal Council for a loan of £78,400 for the establishment of a power house to act as a reserve to that situated at Gugach.—*Revue Pratique de l'Electricité.*

GERMANY.—An agreement has been come to between the Bavarian Government and the A.E.G., of Berlin, whereby the east and north of Upper Franconia will be supplied with electricity, in which two administrative districts of the Upper Pfalz will participate. The cost of the scheme is put in round figures at £2,500,000.—*Zeit. des Oest. Ing. u. Architektenwesens.*

Crewe.—The electrical engineer has been requested to report upon the question of lighting Bradfield Road, Broughton Road, and part of Mablin's Road with gas or electricity. At present oil lamps are in use.

Deal.—An extension of time for carrying out the E.L. order has been granted to the Sandwich, Deal and Walmer Electricity Co. Another order is being applied for by Mr. W. T. Presland, and the T.C. has applied for full particulars before coming to any decision.

Dover.—The Electricity Committee has agreed, subject to confirmation by the T.C., to offer to supply current to the War department for various buildings in the town, including Fort Burgoyne and Castle Barracks, not at present connected, at the following alternative rates:—Up to 15,000 units per annum, 4d. per unit; 30,000 units, 3½d.; beyond, 3d.; or up to 20,000, 3¾d.; 30,000, 3½d.; beyond, 3d.

Epsom.—The B. of G. has decided to obtain expert advice on the question of electric lighting at the Workhouse.

Guatemala.—The municipality of Palin has taken steps to arrange for the lighting of that town with electricity. The principal square, opposite the municipal building, is to be furnished by the electric company with powerful arc lights, and light and power will be at the disposal of the town and its inhabitants at very reasonable rates.

Hamilton.—The remarkable progress which has been made in the use of electricity was very interestingly illustrated by an exhibition at Almada Hall last week under the auspices of the Hamilton Electricity Supply Co. Three apartments were used in giving a display of the many useful domestic services to which electricity can be applied. In one room it was demonstrated that the "Tricity Cooker" can perform with satisfaction everything that the best fire or gas oven can accomplish in the way of preparing meat for the table. The Carron Co.'s electrical cooking stove was also a wonderfully useful arrangement, performing all the duties that the cook demands at a small cost and with great dispatch. In another room was exhibited the efficiency of electricity for ironing purposes. As another example of the usefulness and capacity of the electric cooker, tea was served to the visitors in a third apartment. Mr. Salter, the local manager of the Hamilton Electricity Supply Co., is to be congratulated on his enterprise in arranging the exhibition.

Hornsey.—The rate of charge for current for outside lamps is in future to be 3d. per unit in cases where there are three points of not less than 200 C.P. each or one point of 500 C.P. It has been considered inadvisable under the existing conditions to modify the present rate of charging for current for power.

Hove.—With reference to the recommendation to purchase the undertaking of the Electric Supply Co., previously referred to in the ELECTRICAL REVIEW, the T.C. has decided to defer further action until the matter has been considered at a ratepayers' meeting.

Kingstown.—Last week a meeting was held to discuss some scheme which would result in the town being properly lighted. A resolution to approach the Tramway Co. having been proposed and seconded, and an amendment proposed and seconded, the chairman said that different companies had offered to light the town. It was for themselves to say whether they would give themselves over to the new company with its capital of £42,000, or to the Tramway Co. with its enormous power, a company which was not only progressive, but had its electric mains running past their doors. The amendment was lost, and the resolution to approach the tramway company was carried. A joint deputation of the residents of Kingstown, Blackrock and Dalkey was appointed to wait upon the company.

Leicester.—On the recommendation of the Finance Committee, it was decided at a special meeting of the T.C. that additional provision should be inserted in the proposed Bill for the purpose of obtaining authority to extend the area of supply of electricity so as to include certain parishes adjoining the borough.

Leicestershire.—The Leicestershire and Warwickshire Electric Power Co. has applied to the B. of T. for consent to erect overhead lines for the transmission of current at a pressure of 6,600 volts for the purpose of supply under the Acts of 1902 and 1904. One line will run from Burbage Common *viâ* Huncote to the junction of the Enderby Railway, and the other from Elmesthorpe station to Earl Shilton.

Littleborough.—With reference to our note on page 657, it should be stated that at the Greenvale Mill, owned by Messrs. Fothergill & Harvey, 20 of the motors installed were supplied by Messrs. Siemens Bros. Dynamo Works, Ltd., and amongst these are the earliest motors installed in this mill.

Maidenhead.—The T.C. has applied to the L.G.B. for a loan of £1,700 for electricity purposes.

Manchester.—A L.G.B. inquiry was held on the 1st inst. into the application of the City Council to borrow £87,160 for the purposes of the electricity department, £68,820 being required for extensions of plant at Stuart Street station where it is proposed to install a 15,000-KW. turbo-alternator (particulars of which were given last week, on page 710). Other expenditure was in respect to distributing stations and hired motors.

The Manchester Ratepayers' Association opposed on the ground that power consumers were being given a preference over others, and that the demand for power supply would not arise if a fair rate were charged. Mr. Howarth, chairman of the E.L. Committee, said the result of the year's working was proof that satisfactory profit was being earned. The Corporation had special contracts with about fifty firms, who were supplied on similar terms, no preference being shown. The secretary of the Association objected to "secret prices," suggesting that in some cases energy was being sold at a loss; he also criticised the view that the sinking fund was available for depreciation, which altered the whole basis of cost, and left him certain that losses were being incurred. It was pointed out by the town clerk that £816,000 had been paid to sinking fund and £182,735 to depreciation and renewals, and Mr. Pearce stated that there was a margin of profit on all their sales. He also pointed out that the methods of the department were just as effective as those of a private company. They paid off their capital by the sinking and renewals fund, where the private company set aside part of their profits for renewal. Reference having been made to the gas undertaking, it was pointed out that that had been in operation for about 100 years, and had done a large amount of work out of revenue.

Mansfield.—The B. of G. has decided not to alter the specifications for the electric light installation at the workhouse, reference to which was recently made in the ELECTRICAL REVIEW. Further tenders are to be invited, and a loan for the additional cost involved has been applied for.

St. Helens.—The Corporation's application for sanction to borrow £5,000 for purposes of the electricity undertaking has formed the subject of an inquiry by the L.G.B. The amount named represents excess expenditure on three accounts of the Electricity Committee. It was stated that loans had been sanctioned for mains and new machinery, and the increased demand for electricity had caused the Committee to overspend. The electrical engineer (Mr. E. M. Hollingsworth) said it was intended to ask the Council for a further loan which would date from March last; £400 or £500 had been spent in excess, but he would like to have £4,000 to go on with.

The B. of T. has consented to the Council giving a supply of current at a pressure of 500 volts to the British Electric Detonator Co., Ltd., by means of an overhead line. A similar supply is to be afforded to the works of the Ravenhead Sanitary Pipe and Brick Co., Ltd., and to the glass works of Messrs. Mooney, Hall Street.

Sevenoaks.—The U.D.C. on October 29th, at a special meeting, sealed an agreement transferring the E.L. order, 1910, to the newly formed Sevenoaks and District Electricity Co., Ltd.

Sheffield.—A deputation representing the E.L. Committee visited London this week to interview the local members of Parliament, with a view to obtaining their support in the direction of restoring the clauses which were cut out of the Sheffield Bill by the House of Lords. As the Commons passed the wiring and fittings clauses, it is hoped that they may agree to restoring them.

Shipley.—The U.D.C. has applied to the L.G.B. for an additional loan of £1,000 for a new condenser for the electricity works. The Council has obtained a new customer for a large use of current for power. The Scott Engineering Co., which intended taking a supply of current from the Council, has intimated that it has had to obtain power from another source, as the Council could not give an immediate supply.

Southborough.—The Gas and Water Committee has unanimously recommended the U.D.C. to apply to the B. of T. for a prov. order for electric light.

South Africa.—On October 15th, the stores at the Johannesburg electricity works caught fire and were burnt out, large quantities of cable, oil, tar, meters, &c., being destroyed. Owing to the position of the burning building and the direction of the wind, the power station and gasometers were in considerable danger, but were saved in the end.

Stoke-on-Trent.—A L.G.B. inquiry was held on October 29th into an application by the T.C. to borrow £16,969 for extension of the electricity undertaking. Dealing with the application, the town clerk said the amount asked for was in respect of various sums overspent on the undertakings between October, 1908, and March 31st last. As for the future, the Committee was having to expend considerable sums on mains and other things—sometimes amounting to £1,000 a month—and it understood that the board would not be averse to giving a prospective sanction. With the permission of the Inspector, therefore, he would make a further application for sanction to prospective expenditure of £10,000, of which £7,000 was for extension to mains and £3,000 for transformers and sub-stations.

In the case of the original application, permission was given to amend the amount from £16,969 to £17,196, the difference being made up of a sum of £227, a balance from the old sanction on the Burslem undertaking which was not required.

Mr. Yeaman stated that the £17,196 was divided among the towns as follows:—Burslem, £5,539; Hanley, £7,785; Stoke, £3,132; and Longton, £739. The money was to be spent upon: Buildings, £1,119; machinery, £2,291; accumulators, £19; transformers £1,809; mains and services, £11,539; switchboards, £194; instruments, £82; general expenditure, £35; sinking well, £104.

Reverting to the supplementary application of £10,000, the engineer, in reply to the Inspector, said that from April 1st to September 31st, £3,440 had been actually spent, £2,660 on mains, and £800 on transformers. He estimated that the balance of £6,500 would last 12 months.

Surrey.—If sufficient support is forthcoming, steps will be taken to supply Clandon, Horsley, Effingham, Bookham, Cobham and Oxshott—all Surrey villages—with electricity. Preliminary steps to put the scheme in operation have, it is understood, already been taken.

Sunderland.—The town clerk has received a letter from the L.G.B. as to the recent application by the Council for powers to borrow the sum of £37,200 for the purposes of extension and new plant. The Board sanctions the loan, but the letter states that the obsolete machinery at the Dunning Street station, which is used as a stand-by in case of a breakdown of the tramway supply plant, must be got rid of in the course of a year or two, as it cannot be allowed to remain in the balance-sheet of the undertaking.

Taunton.—A demonstration of electrical cooking with "Tricity" appliances was given last week by Mr. F. S. Grogan, who lectured before interested audiences at the Victoria Rooms. During his stay, the members of the Electricity Committee were entertained to an electrically cooked luncheon by the chairman, Mr. Grogan personally superintending the preparation of the meal.

U.S.A.—The *Globe* describes a small wind-power installation at an American dairy farm—a 12-ft. windmill being used to work a drill press, grindstone, corn-sheller, saw, washing machine, and feed grinder, and a 6-ampere, 35-volt dynamo at the base of the tower.

The dynamo is solely used to charge a battery from which the farm and outbuildings are illuminated. The mill, generator, battery, wiring lamps, &c., could, it is stated, be duplicated for $250; but surely this should read £250.

Watford.—The B. of G. has decided to have the electric light installed in the old buildings at the workhouse.

Whitworth.—At a special meeting of the U.D.C. on Friday last, it was resolved that the Council be recommended to enter into an agreement with the Rochdale Corporation providing for a supply of electricity in bulk upon the best terms that can be secured from the Corporation, and that such supply be distributed throughout the district for lighting and power purposes, and that the necessary steps be taken for putting into operation the powers contained in the Whitworth Electric Lighting Order, 1905. A deputation was appointed to interview the Rochdale Electricity Committee to discuss terms with reference to the supply of electricity.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—With a view to improving the car service to Torry, the T.C. has agreed to carry out an extension of the double track at the corner of Guild Street, at an estimated cost of £540.

Australia.—It is stated that the direct-current system of traction at 1,500 volts, with overhead trolley construction, has been definitely decided on for the Melbourne suburban railways electrification, and that well-known British manufacturers are to receive the orders for turbine, electrical and railway plant.

In connection with the electrification of the Melbourne suburban railway stations, the Victorian Government has agreed to erect a station forthwith at Yarraville for dealing with the peak loads for railway and other purposes. If satisfactory offers are obtained, tenders are to be invited for the balance of power required generated at the coal-fields. These offers may be for 5,000 KW. and upwards, not exceeding 25,000 KW., to be supplied at a load factor of from 50 per cent. to 75 per cent. per annum. Tenderers will also be asked to state the price at which they are prepared to distribute power to manufacturers outside the existing Melbourne area.

The Prahran and Malvern Tramway Trust has received permission from the Government to extend its borrowing powers from £300,000 to £500,000.

The annual report of the Adelaide Municipal Tramways Trust for the year ended July 31st last shows gross earnings amounting to £282,120, and working expenditure amounting to £189,231. The balance for appropriation, after meeting certain expenses, was £93,047.

Blackpool.—In a recent speech, Alderman Brodie foreshadowed the introduction of motor-'buses for the out districts, and stated that a scheme was in preparation for the illumination of the whole of the Promenade next year.

Canada.—A survey is being made for an electric line from Port Haney (B.C.), on the Canadian Pacific, and on the Fraser River, to Lilloset Lake. It is suggested that the British Columbia Electric Railway Co. is responsible for the work.

Colne.—At the T.C. on October 31st, Alderman Hewitt-Dean moved, "That the T.C. do agree to purchase the undertaking of Colne and Trawden Light Railways Co., under the provisions of Colne and Trawden Light Railways Act, 1901, the amount of purchase money to be fixed by arbitration, and that the Town Clerk be instructed to take steps to obtain the necessary powers, by provisional order or otherwise, to complete the purchase." He explained that the resolution was a culmination of a series of negotiations with the railway company extending over 12 months. He said no doubt under arbitration the purchase money would be a fair one, and he trusted that when it came under their control the undertaking would prove a good investment. The resolution was adopted.

Colwyn Bay.—The Llandudno and Colwyn Bay Electric Railway Co., Ltd., has given notice of its intention to apply to the B. of T. for an extension of three years of its powers to construct an electric tramway from the present terminus in Colwyn Bay to its authorised termination near the Dingle, and for sanction to abandon the portion of the line previously authorised from Dale Street, Llandudno, to the Deganwy Promenade. The part of the authorised line which it was now proposed to abandon is practically all within the Conway borough area, and the Conway T.C. has decided to make an objection to the company's action.

Continental Notes.—AUSTRIA.—So far the motor fire engines employed in the Vienna Fire Brigade have been electrically propelled. The Austrian Daimler Motor Co., of Neustadt, has, however, just supplied a new petrol-electric motor fire engine to the brigade.

ITALY.—It has been definitely decided, says the *Giornale dei Lavori Pubblici*, to convert to electric traction the line from Monza to Lecco. The State Railway Administration is about to call for tenders for the work in three sections. In addition orders have been placed for 58 electric locomotives, which will serve partly for this line and partly for the Giovi tunnel line. The locomotives will be capable of a speed of 120 km. per hour. The section from Monza to Milan will be subsequently electrified. The conversion of the Monza-Lecco line is excepted to be completed by the end of 1913.

The isolation of Cortona from the State railway system is now about to be remedied by the construction of an electric tramway between the city and the railway.

La Societá Subalpina di Imprese Ferroviarie, of Turin, has secured a concession for the construction and working of a narrow gauge electric railway between Domodossola and Corfine and Svizzero (Locarno).

The report first current that the generating station at Bardonnechia, which serves the Mont Cenis line, had fallen a prey to the flames, involving a loss of 2,000,000 fr. and an interruption to the traffic of several months is, happily, found to be overstated. According to the *Giornale dei Lavori Pubblici*, electric traction will be resumed in the course of a few weeks, and the damage, although considerable, will be covered by a sum much less than that named, which is double the first cost of the entire installation. Bardonnechia is a station of the second order only, the chief station being Chiamonte, the property of the Municipality of Turin. The fire is attributed to the accidental ignition of some oil containers in the neighbourhood of the switchboard, where the most damage was done.

RUSSIA.—The Committee for New Railways, after investigating plans, has decided to recommend the construction of a railway from Lodz to Lenchitza, passing by way of Alexandrov, Egerzh, and Ozorkov. At the same time the Committee examined plans for the construction of various electric tramways in the district of Lodz.—*Board of Trade Journal.*

In connection with the International Automobile Exhibition which is to be held in St. Petersburg next year, the Standing Exhibition Committee for German Industry points out that the types of motor-cars for which the Russian Minister of War would become a purchaser should be capable of carrying radiotelegraphic apparatus, radiographic appliances, and field telegraphic installations. *Elektrotechnische Zeitschrift.*

GERMANY.—The Senate of Hamburg has introduced a Bill for the building of an electric express line from Hamburg to Langenhorn, one of its most distant suburbs. The line is estimated to cost 7,160,000 marks, besides 5,166,000 marks for sundry technical material already acquired. The line is to be worked by the High Level Railway. This will make the fourth electric railway scheme which the Hamburg authorities have now under construction, and with the just completed high and low-level electric railways, afford striking evidence of the wonderful expansion which is taking place in the traffic arrangements of this old free port.—*Elek. u. Masch.*

SWITZERLAND.—A joint stock company is to be formed at Basel for the construction and working of an electric railway to run at first to Liestal, and eventually to Sissach. Its estimated cost is 2,200,000 fr.—*Elek. Zeit.*

TURKEY.—According to the *Times*, the Belgo-German financial group formed at Constantinople, is reported to have obtained definite authority to construct the Metropolitan line from Paxim to Badagiz. The group was formed to take over the principal Constantinople tramway system and the railway from Galata to Pera. The group proposes to acquire the monopoly of electric lighting in the capital also.

FRANCE.—Further details are to hand of the large electric tramway scheme projected in the Department of the Manche. It comprises 10 different lines, of an aggregate length of 238 km., for the construction of which sums totalling 20,585,000 fr. have been allocated. This is exclusive of a line, Mortain to Juvigny, added to the list by the Conseil Général, which will be the object of a special disbursement.—*La Lumière Electrique.*

Delagoa Bay.—In the course of his speech at the annual meeting of the Delagoa Bay Development Corporation, Ltd., held in London last week, the chairman, Mr. H. K. Heyland, referred to the tramway receipts, and said that the passenger and goods traffic had increased by 9 per cent., the number of passengers carried having increased by 131,285, or nearly 14 per cent. Electric power supplied from the tramway station for railway and wharf purposes and for other consumers had increased by 49 per cent., which was considerably in excess of their expectations. They had ordered further generating plant up to modern requirements of 400 KW. to be installed at the tramway station, the estimated cost, including erection, being £3,000. When completed it was anticipated that an economy in working would result of about £1,000 per annum. The increase in gross receipts from tramways and power supplied amounted to £3,238. On the other hand, expenditure in operating costs had increased by £3,927, largely due to an expenditure of about £1,000 in overhauling the whole of the rolling stock.

Dewsbury.—The Corporation has under consideration a communication from the Huddersfield Corporation, asking for the consent of the Corporation to the construction of a tramway within the borough for which powers are being sought in the Huddersfield Corporation Tramways Bill. The route of the proposed tramway is from the existing terminus at Bradley, along Cooper Bridge Road, through Mirfield to Steanard Lane, in the borough of Dewsbury. Certain recommendations were made by a sub-committee, but the General Purposes Committee has deferred further consideration until the next meeting, the sub-committee in the meantime to watch the proceedings and report thereon.

Doncaster.—In connection with the extension of the Bentley tramway route, particulars of which are given in our "Contracts Closed" column. The estimated cost of the extension is £3,650, and other electrical work about £1,400. A further £2,550 will be required for additional cars, bringing the gross cost up to £7,600.

Edinburgh.—Most of the tramways in the East of Scotland are already municipalised, and now Edinburgh, which has been a notable exception, will shortly open negotiations with the object of taking over the control of the tramway service. At last week's meeting of the Town Council, the recommendation of the Tramway Committee that the Corporation "should resolve that they shall themselves undertake the working of the tramway system on the expiry of the present lease of the tramways to the Edinburgh and District Tramways Co., Ltd.," was agreed to without discussion. It is worth recalling that Leith, Edinburgh's near neighbour, acquired the tramways within its own territory, and later electrified that portion of the system, but throughout Edinburgh the cars are all on the cable principle.

Leeds. The Tramways Committee has decided to apply for authority to continue the railless service to Drightlington and thenceforward to the existing tramway at Morley. It is also proposed to run a railless service from Low Road, Hunslet, to the Crown at Wortley.

London.—The Highways Committee of the L.C.C. is recommending that Parliamentary sanction be obtained for the construction of a railless traction system from Lee Green to Eltham, the estimated cost of the equipment (exclusive of cars, sheds, &c., being £7,380. The line is a necessary link between two tramway termini.

A rather serious collision occurred on September 29th between two L.C.C. cars at Brockley, involving injuries to 17 persons. The particular place was the scene of an accident in September last year, when a car overturned; in this case the collision was due to one car overtaking another standing at the bottom of a gradient, the brakes apparently failing to act.

Middlesex.—At the last meeting of the C.C. it was decided to raise no objection to the Metropolitan Electric Tramways Ltd., promoting a Bill in the ensuing Session of Parliament for the purpose of obtaining powers to work a railless traction system in Broad Lane, Ferry Lane, and West Green Road, Tottenham, provided that a clause is inserted empowering the C.C. to take over the powers of the company under the Bill.

Nottingham.—The Notts. County Council has provisionally approved of a scheme of road widening which has been submitted by the promoters of the Notts. and Derbyshire Tramways Co., with a view to the laying of tramways between Langley Mill and Nottingham.

Rochdale.—The Tramways Committee has declined to construct and run electric tramways in the Wardle district, but it was stated at the T.C. that, if the Wardle Council would lay the track itself, the Tramways Committee would be prepared to run electric cars at cost price.

Salford.—The Tramways Committee has decided to grant increased pay to the staff. The concession means an increased yearly expenditure of £2,100.

Stainland.—The Huddersfield Corporation has intimated to the D.C. that at present it cannot see its way to extend its tramway system to Stainland.

Tasmania.—It is proposed to extend the Hobart tramways, and the cost is estimated at £17,300, including four cars.

U.S.A.—It is proposed to operate electrically the 38 miles of the Ocean Shore Railway from San Francisco along the coast. In this connection, it is stated that if the experiment now being made by the Pennsylvania Railway in running a train with Edison-Beach storage battery cars is successful, this method will be adopted on the Shore line. The latter has up to the present been steam operated, but this has proved expensive, and the heavy cost of electrification on normal lines was also prohibitive.

The trial trip of the train, consisting of three battery cars, on the Pennsylvania, showed that for the round trip of 49 miles, 136,800 units were consumed (battery output), or ·040 unit per ton-mile, and ·926 unit per car-mile. The weight of the battery is 4,600 lb., and of the complete car 38,700 lb., 200 cells per car being installed.

West Bromwich.—A special meeting of the Council is to be held to determine upon the expediency of promoting in the next session of Parliament a Bill empowering the Council to provide and work a railless traction system, to provide and work motor-omnibuses, and to effect street improvements, &c.

TELEGRAPH and TELEPHONE NOTES.

Australia.—In view of the position assumed by the Commonwealth Government in connection with wireless matters, and particularly having regard to the building of stations on a system which is alleged to be an infringement of patents now existing, the two companies principally interested, viz., Marconi's Wireless Telegraph Co. and the Australian Wireless Co., Ltd. (Telefunken system), have agreed to sink their differences and take joint action to secure their rights and the future protection of their patents.

The work of erecting wireless stations on the west coast has now been taken in hand seriously. The station recently completed at Pinkemba, near Brisbane, has been opened, and the Adelaide and Fremantle stations are expected to be opened shortly.—*Australian Mining Standard.*

Canada.—The contract between Marconi's Wireless Telegraph Co., Ltd., and the Canadian Government for the operation and maintenance of nine additional stations on the Great Lakes of Canada has been signed. When these stations are completed the Canadian Co. will receive an additional subsidy from the Canadian Government of $31,500 per annum. The agreement is for a period of 19 years.

France.—The Under-Secretary of Posts and Telephones paid a visit recently to Antwerp with a view to inspecting the semi-automatic telephone exchange of the Bell Telephone Co. there. The visit is supposed to be connected with an intention to introduce into Paris this system, which, says the *Elek. Nachrichten*, is superior to that of the Siemens & Halske Co. in essential technical particulars, affords greater security in working, and is considerably cheaper.

Germany.—A great central wireless station is to be built at Düsseldorf, after the style of, but on a larger scale than, the Eiffel Tower at Paris. The engineering firm of Dech & Paetz have the contract in hand. The iron tower will rise 200 m. higher than the Eiffel Tower, and will have an opening of 195 m. between the pillars. At 95 m. from the ground will occur the first arch, and at [illegible] m. the last platform. From this platform the highest point will be reached by a spiral staircase.—*Industria e Invenzioni.*

Imperial Wireless System.—On Wednesday last week, as briefly mentioned in our last issue, Sir A. F. King was further examined by the Select Committee on the Marconi agreement. He said that the Admiralty were capable of erecting 2,000-mile stations, though they had no experience beyond 1,000 miles. In January last the War Office objected to delay. A Sub-Committee of technical experts was appointed by the Imperial Wireless Committee to investigate the Poulsen system, which reported that the system was fully capable of doing the work, but that the necessary staff and experience were lacking, and that the stations could not be erected at the price quoted. Their estimate was £53,700 per station, which compared with the Government estimate of £60,000 and the Marconi estimate of £82,000. The Sub-Committee asked for further information, but it was not supplied. The report was very important, but it was entirely theoretical, and it was never communicated to the Wireless Committee; he had no doubt that it would not have modified their decision, because they had already made up their minds. In his opinion, the technical Sub-Committee was appointed merely to satisfy the experts. The Wireless Committee having come to a decision, the Treasury would not attach much weight to anything the experts might say. The report was not presented to any of the Government departments.

The right of inspection could not be exercised by the Marconi Co., except in the case of entirely new stations; and even then the company would have to show good cause for suspicion of infringements of their patents. The company had experienced great difficulty with the War Office in obtaining information for this purpose in past years. There would be no right of inspection of Admiralty stations. The German Government had placed a contract with the Telefunken Co. for long-distance communication up to 1,900 miles between the Caroline and Solomon Islands and Samoa. It was doubtful whether the National Electrical Signalling Co., of America, could cover a distance of 2,000 miles, as they claimed. The Poulsen system had not been proved capable of working over a distance of 2,000 miles, or of working by day at all. The Marconi Co. were ready to guarantee key working, but not automatic working, during violent atmospheric disturbances, an had proved their ability to overcome such disturbances in South America. The adoption of duplex working had necessitated the rearrangement of the whole scheme of Imperial wireless communication, and the duplex system was not regarded with favour by either the War Office or the Admiralty, as the use of two separate stations connected by telegraph laid the apparatus open to derangement. He thought the real cost of the Marconi system would come out at £90,000 a station. If the Poulsen system proved to be the best, as it was the cheapest, they would cease using the Marconi system.

On Monday the Committee resumed the examination of Sir A. F. King, who stated that the cost of the Marconi system exceeded that of the Poulsen system by £180,000, exclusive of the 10 per cent. royalty.

It appeared that certain documents had been sent to some members of the Committee and not to others, and the Committee announced that all communications must be sent to the clerk to the Committee.

Sir A. F. King, in reply to questions, said that the cost of converting a Marconi station to the Poulsen system would be only £13,000. As long ago as 1907 the Poulsen representatives said they were arranging for a satisfactory service to America, and expected to send 100 words a minute, but nothing had been done that he knew of. The War Office and Admiralty were quite agreeable to the agreement as concluded.

Mr. Isaacs agreed that the company should lose the royalty if the Government ceased using the Marconi system, but requested that this important condition should be kept secret; it was, however found to be impossible to comply with his wish.

The witness admitted that the suppression of the report of the Technical Sub-Committee might have been an error of judgment but when the Poulsen people failed to meet the conditions that had been laid down, the Postmaster-General thought it was hopeless to send forward the report, which recommended the Poulsen system. It would certainly have made no difference whatever. The Poulsen Co. had no just cause for complaint: the department gave them a station in Ireland five years ago, and another in Northumberland, and had never refused them any licence they had asked for. No pressure had been put upon him with regard to the contract from any quarter, nor had there been any leakage of information. The Attorney-General was absolutely in ignorance of the whole thing. He thought there would be a loss on the system for a few years, but its strategic value was so great that, no matter what the loss, the stations must be erected. It was a more favourable bargain than they might have expected, seeing that the Marconi Co. was the only one that could show working at 2,000 miles. It was at present a choice between Marconi and no one.

Japan.—Arrangements are said to be in hand for the establishment of a wireless telephone service between Tokio and Yokohama.

There are now 4,100 telephones in use in Yokohama, and owing to the steady increase, it is proposed to establish, next year, a new exchange in the suburbs of the city.

Military Wireless Telegraphy.—A committee has been appointed by the Secretary of State for War, to consider the use of wireless telegraphy in the Army. The chairman is Sir Henry Norman, M.P. The proceedings of the Committee are confidential.

New Italian Cable.—The Italian Government has ordered from an English works a cable about 30 km. in length, with continuous loading on the Krarup system. The cable has two conductors each consisting of seven copper wires 0·7 mm. in diameter, upon which is wound a continuous layer of soft iron wire 0·2 mm. in diameter. The cable is made in lengths of 300 m. At 15° C. the copper resistance with continuous current is 11·745 ω per km., and with alternating current of 1,000 cycles 12·546 ω. The capacity is 0·0894 mfd. per km., and the inductance with alternating current of 1,000 cyles 5·872 millihenrys. The specific damping coefficient $\beta = 0{\cdot}024$ per km. of double conductor at 1,000 cycles, which is 58 per cent. less than that of the same cable without loading.—*Journal Télégraphique.*

New Zealand.—The chief electrical engineer of the New Zealand Post and Telegraph Department, Mr. T. Buckley. says the *Australian Mining Standard*, has recommended that the more extended use of the telephone should be promoted as far as possible; that the automatic system of telephony should be adopted for Auckland, Christchurch, Dunedin, and Wellington; and that the Western Electric Co., London; Messrs. Siemens Bros., London, who supply the Siemens-Halske system; and the Automatic Electric Co., Chicago, who supply the Strowger system, be invited to tender for a full automatic equipment for Wellington.

Switzerland.—Since the middle of October the Federal station at Zurich has been in wireless communication with the Eiffel Tower and with the Norddeich station. It receives daily from the Eiffel Tower the international time signal, and a series of meteorological communications regarding the condition of the weather on the coasts of the North Atlantic. The wireless connection with the Eiffel Tower has proved to be excellent, and not the least disturbance has occurred. The station was equipped by the Gesellschaft für Drahtlose Telegraphie. Berlin, under the leadership of Dr. Eichhorn-Zurich.—*Elek. Nachrichten.*

Wireless in the Antarctic.—The *Australian Mining Standard* states that faint signals have been received at Macquarie Island from the wireless station in Adelie Land, in connection with Dr. Mawson's Antarctic expedition. Apparently the apparatus, which was damaged on landing, has been put in repair.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — South Australia. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" November 1st.

December 18th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

December 17th.—Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

Victoria.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

November 8th and 12th.—(*a*) 340 A.C. and 800 D.C. electricity meters; and (*b*) insulated copper cables, for the Melbourne City Council. See "Official Notices" October 25th.

New South Wales.—December 11th. Telegraph cable. for the P.M.G.'s department. See "Official Notices" November 1st.

December 23rd.—An Australian exchange states that the Sydney Harbour Trust is inviting tenders for electric cranes and geared pulley blocks, for handling cargo at Nos. 8 and 9 berths, Dawes' Point to Miller's Point.

The Sydney Municipal Council, acting upon the recommendation of the city electrical engineer (Mr. H. R. Forbes Mackay), has decided to invite tenders for the supply of two electrically-driven motor lorries, at an estimated cost of £825 each. Charging apparatus and switchgear is also to be purchased, at £130.—*Tenders* (*Mining and Engineering Review*).

Birmingham. — November 25th. Electric motors (various), for the City Electric Supply Department. See "Official Notices" to-day.

Dover.—November 18th. Two centrifugal pumps, with electric motors, for the Corporation baths. Mr. W. C. Hawke, Borough Engineer, Maison Dieu House, Biggin Street.

Greenock.—November 18th. One 3,000-KW. three-phase turbo-alternator, with condensing plant, &c., for the Corporation. See "Official Notices" November 1st.

Hull.—November 20th. Electric lighting, fittings and bells, for the Teachers' Training College, Cottingham Road, for the Education Committee. Particulars (deposit £1 1s.) from the City Treasurer, Guildhall, Hull. Drawings to be seen at the Education Offices, Albion Street.

November 13th.—Best South Yorkshire screened hard steam coal (1,000 tons), South Yorkshire double screened hard nuts (3,000 tons), and unwashed slack, for the Corporation electricity works. Mr. H. Bell, Electrical Engineer, Sculcoates Lane.

Italy.—Vicenza.—November 12th. International tenders are invited for the supply of an electrically-worked hydraulic press. also of a wheel-riveting machine, for the State Railway workshops at Vicenza. Particulars of the Direzione Generale delle Ferrovie dello Stato, Rome.

Carrara.—Tenders are required for the supply of an electric crane for the Carrara Railway Station. Particulars of the Direzione Generale delle Ferrovie dello Stato, Rome.

Keighley.—November 11th. One 2,000-KW. steam turbo-alternator, for the Corporation. See "Official Notices" October 25th.

London.—L.C.C.—November 13th. Electric lighting installation at the Ricardo Street School, Poplar. See "Official Notices" November 1st.

November 19th.—Electric lighting, bells and telephones, at the "Strand" School, Brixton Hill, S.W., and electric lighting at the Southern Outfall Works, Crossness, Abbey Wood. See "Official Notices" to-day.

Manchester.—November 19th. The Corporation Tramways Committee is inviting tenders for (*a*) tramway rail bonds; (*b*) block tin; (*c*) karri or jarrah wood paving blocks. Specifications, &c., J. M. McElroy, General Manager.

Manchester. — November 19th. One 650-800-KW. rotary converter and transformer, for the City Electricity Committee. See "Official Notices" to-day.

Newcastle-on-Tyne.—November 13th. Stores, including incandescent lamps and arc lamp carbons, for the Tyne Improvement Commission. The Engineer, Clarendon House, Clayton Street West.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture only. Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

Rawtenstall.—November 15th. Lancashire boiler, with superheater and mechanical stokers, for the Corporation Electricity Department. See "Official Notices" November 1st.

Rotherham.—November 13th. Electrical installation at the Kimberworth Higher Standard and Infants' Schools, for the Education Committee. See "Official Notices" to-day.

Roumania.—The municipal authorities of Targu-Ocna (Bacau) are inviting tenders until the 25th inst. for the establishment of a central electric lighting station in the town.

South Africa.—The *British and South African Export Gazette* states that orders for electrical machinery, &c., for a lighting and power station to be erected at Winburg, Orange Free State Province, will shortly be on offer. The electrification of the plant of the Susanna mine, Rhodesia, is under consideration, and valuable orders may result shortly.

Spain.—November 18th. Tenders are being invited by the municipal authorities of Calatayud (province of Zaragoza) for the concession for the electric lighting of the town during a period of six years.

Wakefield.—November 9th. Slack and smudge coal, for a year, for the Corporation electricity works. Electrical Engineer, Calder Vale.

Warrington.—November 15th. General stores and permanent-way materials (steel fishplates), for the Cheshire Lines Committee. Specifications obtainable from Stores Superintendent, Cheshire Lines, Warrington.

York.—November 16th. Construction of about 1¼ miles of light railways, for the T.C. Mr. H. Craven, Town Clerk. Returnable deposit of £5.

CLOSED.

Birmingham. The tender of Mr. Geo. Law, of Kidderminster, amounting to £16,85[illegible] for the laying down of the Hagley Road tramway (2¼ miles), and the repaving of a portion of the road, has been accepted by the City Public Works Committee. The Tramways Committee will provide the rails, and Mr. Law the remainder of the plant.

The Electric Supply Committee has accepted the tender of the British Thomson-Houston Co. for two [illegible]-kw. turbine sets for the Summer Lane generating station.

Doncaster.—The Tramways Committee has accepted the tender of Mr. J. W. Pearce, of Morecambe, amounting to £2,125 for the extension of the Bentley tramway route to the new colliery village, the rails, fishplates, and bolts, being supplied by the Corporation.

Hanwell.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude, Ltd., for a two-cell refuse destructor at £1,333.

Horsham.—The U.D.C. has resolved to order a refuse destructor to be erected at the electricity works. Messrs. Heenan and Froude's tender is to be accepted, at £1,450.

Houghton-le-Spring.—For installing the E.L. at the infectious diseases hospital the B.G. has received the following tenders:—

S. Stobart & Co.	(accepted) £[illegible]
Robson & Coleman	1[illegible]
Falconer, Cross & Co.	12[illegible]

Leek.—The U.D.C. has accepted the tender of Callender's Cable, &c., Co., at £576, for pilot cable to be laid from the generating station to St. Edward Street.

Liverpool.—The following tenders for special steel rails for the tramways have been accepted by the Corporation:—

Walter Scott, Ltd., Leeds, 2,000 tons of "Sandberg Sorbitic" rails, Liverpool section (with royalty to Mr. C. Sandberg, of Westminster), and 100 tons "Titanium Alloy" steel rails, Liverpool section.

Llandudno.—The Council has accepted the tender of Messrs. Babcock & Wilcox for a chain-grate mechanical stoker, for the electricity works at £115.

London.—L.C.C.—The Highways Committee recommended the acceptance of the tender of Messrs. John Batt & Co. (London), Ltd., for 6,000 driving wheel and 5,000 pony wheel steel tires for electric cars (with a guaranteed mileage of 5,000 per ⅛-in. radial reduction), required during 1913, at 22s. each for driving wheel tires, and 18s. 10d. each for pony wheel tires. The firm were to be allowed to sublet their manufacture to the Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten, Cologne, and to Gutehoffnungshütte Actienverein für Bergbau und Hüttenbetrieb, Oberhausen, Germany. When the matter came before the Council on Tuesday, the recommendation was referred back, with a suggestion that the contract should be placed with a firm who would carry out the work in England.

Maidenhead.—The T.C. has accepted the offer of the Diesel Engine Co., Ltd., to supply a 220-kw. Carels slow-speed Diesel engine and dynamo, at £2,600, the company to take the salvage of the recently-damaged engine and dynamo. The Council has also purchased from the Piggott Electrical Co., of London, a Willans & Robinson 150-kw. steam engine and General Electric Co.'s dynamo (lately in use at Wigan).

Manchester.—Mr. George Ellison has received the contract for the 12 months' supply of "Drum" type "Star-Delta" starters required by the Corporation electricity supply department.

Simla.—A contract has been given to Messrs. F. & C. Osler, Ltd., of Calcutta, for a Rees-Roturbo turbine pump for 1,310-ft. head, direct-coupled to a 230-b.h.p. Siemens motor, together with all control gear, for the Cherot Nala pumping station of the Simla waterworks.—*Indian and Eastern Engineer.*

Stafford.—The T.C. has accepted the tender of Messrs. J. Wooldridge & Son for 2,500 tons of Littleton slack and 500 tons of Littleton steam nuts for the electricity works.

Stoke-on-Trent.—The B.C. has accepted the tender of the Bastian Meter Co., Ltd., for 2½, 5 and 10-amp. meters.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, November 11th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 12th.—"B" Company. Recruits' instruction, 7 to 10 p.m.; company instruction, 7 to 10 p.m.

Thursday, November 14th.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 15th.—"D" Company. Recruits' instruction, 7 to 10 p.m.; company instruction, 7 to 10 p.m.

Saturday, November 9th.—Headquarters will be opened from 10 a.m. till 12 noon for the transaction of regimental business.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Section).—Friday, November 8th. At 7 p.m. At [illegible]. Paper on [illegible] by Mr. W. M. Thornton. [illegible] At 7.30 p.m. At [illegible] College, Newcastle. Paper on "The [illegible]," by Dr. W. M. Thornton.

Physical Society.—Friday, November 8th. At 8 p.m. At the Imperial College [illegible]. Papers on "A Method of Measuring the [illegible]," by [illegible]; "An Improved [illegible] and its Applications," by Mr. [illegible]; and "The [illegible] magnetic Study of Steel," by Dr. S. W. J. Smith.

Junior Institution of Engineers.—Friday, November 8th. At 39, Victoria Street, S.W. Paper on [illegible] by Mr. J. W. Wainwright.

Wednesday, November 13th.—At 7 p.m. At the I.E.E. Annual general meeting.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—Monday, November 11th. At 6 p.m. At the I.E.E. Paper on "Alternate Current Measurements," by Mr. [illegible].

Institution of Electrical Engineers (Scottish Section).—Tuesday, November 12th. At 8 p.m. At 207, Bath Street, Glasgow. Opening meeting. Inaugural address by Mr. W. M. Winter, chairman.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, November 13th. At 7.30 p.m. At the University, Birmingham. Opening meeting. Inaugural address by Mr. A. M. Taylor, chairman.

Institution of Electrical Engineers (Dublin Section).—Thursday, November 14th. At 8 p.m. At the Royal College of Science, Dublin. Paper on "The Equipment of the Electro-Technological Laboratories of the Royal College of Science, Dublin," by Prof. W. Brown.

Institution of Electrical Engineers (London).—Thursday, November 14th. At 8 p.m. Opening meeting. Address by Mr. W. Duddell, president. Presentation of premiums.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, November 16th. At 4.30 p.m. Meeting at the Royal Technical College, Glasgow.

NOTES.

The Ferrantians.—The date for the second dinner of past and present Ferrantians has been fixed for Wednesday, November 13th, at Waldorf Hotel, Aldwych, London. Mr. A. Bruce Anderson will occupy the chair, and Mr. S. Z. de Ferranti will be the principal guest. Ferrantians, who have not yet signified their intention of being present, should communicate at once with the hon. secretary, Mr. W. E. Warrilow, 40, Mildred Avenue, Watford.

Curious Workmen's Compensation Case.—According to the *Daily Mail*, William Daws, farm labourer, was at Newark County Court on Monday, awarded 8s. 3d. a week compensation from his employers, Messrs. Harrison, of Grantham, for injuries received by being struck by lightning while on a cart holding a forkful of hay. An electrician said that standing on the cart with the fork raised, the plaintiff constituted a natural lightning conductor. The judge held that the plaintiff was exposed to a special risk, and that, therefore, the accident arose out of his employment.

German Safety Lamp Competition.—The Verein für die Bergbaulichen Interessen, of Dortmund, is offering a prize valued at £1,250 for a miner's electric lamp provided with a reliable fire-damp indicator. The lamp and indicator must be safe against fire-damp even after damage, and after running at least 12 hours, must possess a lighting power of at least one Hefner candle. The prize will be awarded by a board, and may be divided if more than one suitable lamp is submitted, or may be awarded in part to lamps which more nearly fulfil the stipulated conditions. Three lamps, with drawings, descriptions and directions in triplicate (in German) are to be forwarded to the Verein at Dortmund by October 1st, 1913.

Ventilating and Heating Systems.—In a letter to the *Times* of November 1st, on the ventilation of the House of Commons, Prof. J. B. Lock gives some interesting particulars of experiments that have been carried out at Cambridge during recent years in connection with the heating and ventilation of large lecture rooms and halls. Various systems have been tried, and have led to the conclusion that a crowded room should not be warmed by heated air; the fresh air supplied for breathing should be cooler than the air in the room, and the room should be warmed by other means. A large hall seating 1,000 persons is heated with hot-water radiators near the walls at the floor level, and fresh air is introduced by a fan through two rows of gratings 8 or 9 ft. above the floor level; an exhaust fan withdraws the air through openings in the ceiling. Two years' observation has established the fact that the cooler the fresh air sent in, the pleasanter is the atmosphere in the hall; when the hall is full it is difficult to obtain air cool enough, even when the outside temperature is 40° F., and the installation of ice coolers is under consideration.

In the case of laboratories warmed by hot air, which is passed over heating pipes, the oppression and discomfort experienced by the occupants are much greater when steam-heating pipes are used than in the case of hot-water pipes, and it appears that "cooking" fresh air destroys its invigorating qualities.

Consulting Engineer Wanted.—The Nenagh (Ireland) Urban District Council has been inviting applications for the position of a consulting electrical engineer, "at a bulk sum," for the preparation of plans and estimates of the cost of an electric lighting scheme. "Applications to be lodged not later than 8 p.m. Wednesday, November 6th."

Institution and Lecture Notes.—Institution of Electrical Engineers (Birmingham Section).—The chairman of the Section (Mr. A. M. Taylor) will deliver his address on 13th inst. Other fixtures before Christmas include:—November 27th, Mr. J. S. Peck on "Earthed *v.* Un-earthed Neutrals on Three-phase A.C. Systems"; December 4th, Messrs. J. G. and R. G. Cunliffe, on "Street Railway Feeding Networks." The following are the prospective arrangements thereafter:

G. Kapp, D.Eng., "On the Improvement of the Power Factor in Asynchronous Machinery."

T. F. Wall, D.Sc., "The Circle Diagram for Synchronous Motors."

A. R. Everest, "Parallel Operation of Alternators."

J. P. Wilmshurst, "Electrical Power, Heating and Cooking."

J. Sayers, "Wireless Telegraphy."

E. B. Wedmore, "Protective Switch-Gear."

W. E. Milns, "The Economical Use of Electric Power."

W. F. Bolton and L. D. Morphew, "Recent Developments of Rail-less Electric Traction."

Institution of Electrical Engineers (Manchester Section).—The opening meeting of the above Section was held on Friday evening last week. The reading of Mr. Day's inaugural address by Prof. Marchant was followed by a smoking concert, which was arranged by Mr. W. J. Smith, hon. musical director of the Manchester Electro-Harmonic Society. The entertainment was very much appreciated by those present. Vocal items were contributed by Mr. A. J. Holt and Mr. G. H. Ditchburn, of the Manchester Cathedral Choir, and Mr. H. Albiston Gee gave some admirable humorous selections.

Physical Society.—At the meeting on October 25th, 1912, a paper entitled "Note on the Mutual Inductance of Two Coaxial Circular Currents," by Prof. H. Nagaoka, was read by Dr. A. Russell. Methods were given for the rapid calculation of the mutual inductance of two coaxial circular currents. A paper on "The Absorption of Gases in Vacuum Tubes" was read by Mr. S. E. Hill, giving an account of experiments carried out to determine whether the absorption of gases caused by passing a discharge for some time through vacuum tubes was the result of a chemical action or a mere physical absorption. The conclusion was that the disappearance was due to definite chemical action.

Institution of Electrical Engineers (Western Section).—The reading of Mr. Chamen's inaugural address at Cardiff on Monday, November 18th (at 4.30 p.m.) is to be followed by a dinner at the Park Hotel at 6.15 p.m. (tickets, 5s. each). The secretary of the Section is Mr. S. B. Haslam, 11, Windsor Place, Cardiff.

Institution of Municipal Engineers.—A joint Southern and South-Eastern district meeting will be held in the Council Chamber, 4, Southampton Row, London, W.C., on Wednesday, November 27th, at 8 o'clock, when a paper on "The Effect of Recent Decisions upon the Arbitration Clause," by Mr. W. Valentine Ball, M.A., barrister-at-law, will be read.

Royal Institution.—The Christmas course of juvenile lectures will be delivered this year by Prof. Sir James Dewar, F.R.S., Fullerian Professor of Chemistry, the title being "Christmas Lecture Epilogues." The lectures will be experimentally illustrated, and the subjects are as follows: "Alchemy," Saturday, December 28th; "Atoms," December 31st; "Light," January 2nd, 1913; "Clouds," January 4th; "Meteorites," January 7th; "Frozen Worlds," January 9th. The lecture hour is 3 o'clock.

Society of Engineers (Inc.).—At a meeting of the Society on the 4th inst., Mr. William P. Durtnall read a paper on "The Generation and Electrical Transmission of Power for Marine Transportation." The "Paragon" system of electrical propulsion was described in detail, and it was shown that this method met all the requirements which had been laid down as necessary for an efficient motive force for driving ships' propellers.

Institution of Electrical Engineers (Dublin Section).—The first meeting of this Section will take place at the Royal College of Science, Dublin, on Thursday next, November 14th, for a paper by Prof. W. Brown, B.Sc., as stated in our "Forthcoming Events." Other fixtures announced by the Section are:—January 9th, 1913, Mr. J. P. Tierney on "Notes on Self-Propelled Cars for Light Railway Work;" March 13th, "Recent Developments in the Application of Electricity to the Textile Trades," by Mr. S. F. Crowley. For December 12th, February 13th, April 10th and May 8th papers are wanted.

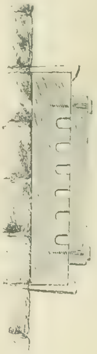
The Brush Supplies Department.—It is announced that the business of the Brush Electrical Engineering Co., Ltd., in electrical apparatus, which has been carried out by the company's supplies department at 1, Kingsway, London, W.C., has now been transferred to the Victoria Works premises, London, S.E., where there is much larger office accommodation and immediate access to the company's stores. Further, in order to avoid the loss of time through the direction of correspondence to the Brush works at Loughborough and the central London office, it has been decided to give a more distinctive title to the department, viz., the London Electric Warehouse Co. The department has already been installed at the warehouse in Manners Street, York Road, London, S.E., and all inquiries relating to lamps, fans, heaters, wires and cables, and accessories, &c., should be so addressed.

A Curious Failure.—Occasionally accidents occur which are not without their use in warning engineers of the pitfalls into which they may fall, and the following example of breakdown of a hydro-electric generating set used for the supply of a gold mine is a case in point. The exciter was fixed on an extension of the main generating shaft, the armature overhanging from one of the main bearings, and the field carcass being bolted to the side of this bearing pedestal. It was discovered on one occasion, after a long period of working, that the generator could not obtain any field, owing to the fact that the exciter, which was of the shunt-wound type, could not be got to excite itself when the main set was started up from rest. This occasioned a good deal of perplexity, until at last the true cause of the difficulty was discovered. It proved to be due to the fact that the main bearing of the generating set had gradually worn and allowed the shaft to drop through a distance which, although inconsiderable as regarded the clearance on the main machine, was quite sufficient to disturb the working of the exciter, owing to the displacement of the armature mounted on the end of the main shaft with relation to the field. Owing to this cause, the armature had been let down so as almost to touch the bottom pole-piece, and was therefore a good distance away from the top pole. The course adopted was to take off the pole-pieces and adjust them by means of liners until the clearance was the same all round, as ascertained by feelers in the air-gap. When this had been done and the machine was started up again, it was found that the exciter picked up its field without difficulty, and the generator was excited up to full voltage without any further trouble.

Copper.—Considering the uneasy state of the money market during the past month, copper has maintained a very steady position. The European visible supplies, as shown by Messrs. Merton's circular, dropped during October by 1,604 tons. Of this, 1,172 tons were withdrawn from English ports, the stocks in Havre decreased 661 tons, and in Hamburg 946 tons. Against this there are larger quantities afloat from Chile and Australia, and an increase in the stocks at Rotterdam.

Supplies from North America to Europe were rather below the average. Spain and Portugal only contributed 685 tons, the usual quantity being from 1,200 to 3,000 tons. This refers, however, to England and France only, the supply from these sources to other countries being high. Chilean shipments were well over the average, and Australian the same. The total deliveries were decidedly good under the circumstances, at 37,216 tons, an increase over those for last month. American visible supplies increased during September by 7,306 tons, a very considerable quantity in a total of 28,158 tons (end of September). The world's visible supplies stood at 76,100 tons at the end of September, an increase of 4,919 tons over the preceding month.

Wood Casing for Electrical Conductors.—Mr. Edward Vigers, the well-known architect, has been kind enough to furnish us with some interesting particulars of the use of wood casing for electrical conductors exactly 50 years ago. He claims, and we have little doubt that he is right, that this is the first instance of their use. In 1862 Mr. Spagnoletti, the consulting electrician to the Great Western Railway Co., and the inventor of the special electrical block signalling system which was to be used on the Metropolitan Railway, then under construction, wanted a protection for his insulated electric wires from the dampness of the tunnel. He applied to Mr. Vigers's father, whose sawmills were on the site of the present Edgware Road Station, for a suggestion and a price. Even in those days price ruled! Mr. Edward Vigers himself made the drawing, and he has been good enough to furnish us with a sketch, which we reproduce, showing the section of the casing. The casing was of yellow deal, 9 in. × 1⅓ in. in section, with six grooves, measuring ⅜ in. wide × ⅝ in. deep, for the reception of the insulated wires. The wooden cover to the casing was 7 in. broad × ⅞ in. thick, and was fixed by square-headed coach screws. A special bit with a square sinking to fit the head of the coach screws was used in the same stock that was used for boring the holes. The casing was fixed to the wall of the tunnel by dog spikes driven into the joints of the brickwork. The whole of the woodwork was creosoted before fixing. The design was approved by Mr. Spagnoletti, and the casing was first installed for the protection of the wires from Bishop's Road to Farringdon Street, and afterwards in the extensions of the Metropolitan Railway.



(*Continued on page 753.*)

WILLIAM DU BOIS DUDDELL, President of the I.E.E.

It will be no easy task for the new President of the Institution of Electrical Engineers to live up to the reputation achieved by Mr. Ferranti, but it would be difficult to find in the profession a representative more worthy than Mr. Duddell on whom the mantle of Elijah should descend. To a pioneer and inventor of the first rank succeeds an inventor and discoverer of hardly less eminence. We may look forward with confidence to Mr. Duddell upholding with dignity the record created by past presidents, and may congratulate ourselves that the profession can still produce engineers of such distinction to hold the highest office and receive the greatest honour that it can offer.

Mr. Duddell was born in London in 1872, and has therefore attained his present office at the early age of 40. After a general education in England and France, he served his apprenticeship with Messrs. Davey, Paxman & Co., of Colchester, from 1890 to 1893. From then until 1900 he took special courses at the Central Technical College, whilst there obtaining first a Whitworth Exhibition in 1896 and then a Whitworth Scholarship in the next year. While Mr. Duddell was there, the Central Technical College was perhaps at the height of its reputation; the four brilliant professors who had created it were still guiding its course, and the changes brought about by its incorporation with the University of London had not yet arrived to tend to cause it to lose its individuality. Mr. Duddell had the advantage of working under the late Prof. Ayrton, and he would probably be the first to admit that it was Prof. Ayrton's inspiration and guidance that largely influenced the direction of his own work. It was whilst at the College that Mr. Duddell laid the foundations of his reputation.

Photo by [Lafayette, Ltd.

W. Duddell, F.R.S.

In 1898 he read, in conjunction with Dr. Marchant, now Professor at Liverpool University, the paper on "Experiments on Alternate Current Arcs by Aid of Oscillographs," which is in many ways characteristic of the nature of much of his later work. Mr. Duddell and Dr. Marchant had set out to investigate the characteristics of the alternate-current arc, and had found it necessary to construct a new instrument for their purpose. To this end Mr. Duddell was able to bring not only knowledge and originality in instrument design, but a mechanical ability which enabled him to construct instruments of extreme delicacy entirely by his own handiwork. The research produced two results. First, an exhaustive examination into the properties of the alternating arc, and, second, a new instrument of great delicacy and power which has since proved of the highest utility in numerous branches of electrical engineering, and has won several Gold Medals at International Exhibitions. Those who remember the reading of this paper before the Institution will not readily forget the extreme beauty of the demonstration given, and will appreciate it more when they remember that the instruments used were entirely of Mr. Duddell's own construction. The double trend which we see indicated in this first paper of importance published by Mr. Duddell has been pursued in his later work. On the one hand, he has added largely to the number of instruments available for the electrical engineer in his work, succeeding in producing instruments which satisfy the purpose for which they are required, as much by his ability to test the result of his own calculations as by his power of design itself. On the other hand, genius for investigation, for experimentation, and for pursuing a problem until it is cleared up, has led him to the publication of many important researches, and to the carrying out of equally important investigations which, for various reasons, have not been published.

Notably, we may refer to the paper on "Rapid Variations of Current Through the Direct-Current Arc," which Mr. Duddell presented to the Institution in 1900. The paper dealt with what was a side issue in a more elaborate research, the discovery of the means of producing rapid alternating currents by shunting the direct-current arc with capacity and self-induction. The musical arc which Mr. Duddell showed on this occasion was then no more than a curiosity, but it has since become the basis of one of the most important of the systems of wireless telegraphy. Later, Mr. Duddell read before the Royal Society, of which he is a Fellow, his paper on "The Resistance and E.M.Fs. of the Electric Arc," which is the fullest solution that has so far been put forward for this exceptionally intricate problem.

To his scientific activities Mr. Duddell has always added a keen and active interest in the doings and welfare of scientific societies. In 1908 he held the office of vice-president of the Physical Society, and has since then acted as hon. treasurer to that Society. In 1907 he was president of the Röntgen Society. In 1905 he was elected a member of the Council of the Institution on which he had previously served as an Associate Member of the Council in 1901. In addition to these offices he acted in 1904 as hon. secretary to the delegates to the International Congress at St. Louis, and in 1908 as one of the secretaries to the International Conference on Electrical Units and Standards. We cannot, however, name here all the duties of this kind which Mr. Duddell has undertaken, but merely quote these as evidence that his outlook is not confined to scientific and engineering research itself. He has always been active in any movement which tends to benefit our profession, and the keenness which he has shown to undertake work of this description may render us all confident that the interests of our Institution and profession will be safe in his hands during his term of Presidency.

THE CHAIRMEN OF THE LOCAL SECTIONS OF THE I.E.E.

To **Mr. A. A. Day, A.M.Inst.C.E., M.I.E.E.,** the chairman of the **Manchester Section**, and to the Section itself, we extend our sympathy in view of the illness which prevents the former from active participation in the meetings at present. He has been for many years borough electrical engineer and tramway general manager at Bolton, but he has been unable to attend to these duties lately owing to a severe illness, which came on very suddenly. His inaugural address to the Manchester Section was read in his absence by Prof. E. W. Marchant, the vice-chairman, and it appears in abstract elsewhere in this issue. Prof. Marchant said that the members would be pleased to know that Mr. Day was progressing as well as could be expected, and the secretary was asked to send a letter expressing regret at his enforced absence.

Mr. W. C. Mountain, M.I.Mech.E., M.I.M.E., M.I.E.E., the chairman of the **Newcastle-on-Tyne Section**, was born in 1862, and served his apprenticeship as a mechanical engineer with Messrs. May & Mountain, of Birmingham. In 1883 he took up electrical work, being appointed engineer to the Gulcher Light and Power Co. Shortly afterwards he was made general manager, and finally managing director; but he resigned this position at the end of 1888, in order to join Mr. Ernest Scott, of the Close Works, Newcastle-on-Tyne, who was then engaged in the manufacture of marine engines and auxiliary work in connection with warships. Mr. Mountain introduced the electrical department of the business shortly after joining, and finally that department became the principal interest of the firm, who combined the electrical with the mechanical work required in connection with the installation of electrical plant in mines, their specialities comprising three-throw horizontal mining pumps, haulage machinery of the main and tail, main rope and endless rope types, electric winding gears, centrifugal pumps, and also portable three-throw and centrifugal pumps and haulages. He first introduced electricity into mines about 24 years ago at the Cowpen Coal Co.'s North Seaton Colliery, when a large electric pumping installation was installed 1¾ miles in-bye. This example was followed later by the Lothian Coal Co. deciding to adopt electric pumping for their new Victoria Pit at Newbattle, the work being carried out to the specification of Mr. John Morison, mining engineer, to whom the credit is given of being the first to recognise the advantages of electricity for main shaft pumping. Afterwards the Hickleton Main Coal Co. installed a large endless-rope haulage, and their lead was followed by the Plas Power Co.

The business of Messrs. Ernest Scott & Mountain, Ltd., developed very rapidly, and became one of the largest in the country, and so continued for some years. Mr. Mountain resigned his position last year in order to take up consulting work, principally in connection with the introduction of electricity in mines, and we understand that he has a very large amount of work in hand at present, being consulting engineer to the Warwickshire Coal Co., Ltd., Houghton Main Colliery, Waleswood Colliery, Walter Scott, Ltd., Bedlington Collieries, Charlaw and Sacriston Collieries, Hemsterley Colliery, and several others.

Mr. Mountain's inaugural address was printed in abstract in our last issue.

Mr. A. M. Taylor, M.I.E.E., is the chairman of the **Birmingham Section** of the Institution. After completing his general education at Bute House School, Richmond, Mr. Taylor passed through the Finsbury Technical College, and consequent upon that, entered the shops of Messrs. Siemens Brothers, Woolwich.

After three years with Messrs. Siemens he was sent out by them on various breakdown jobs and installation works, both at home and on the Continent, and eventually represented them as their engineer in India for three years, during which time he worked out several important town lighting schemes and carried out numerous large installations.

On returning from India, Mr. Taylor still remained with Messrs. Siemens, and was for some time in charge of their traction work. Soon after leaving them he received an appointment in Birmingham under the late city electrical engineer, and prepared the early plans for a large development in the lighting and traction requirements of the city.

When Mr. Chattock went to Birmingham, Mr. Taylor assisted him in the preparation of the very large scheme which he brought forward, and in the drawing up of the specifications, &c., especially in connection with the switchgear at the Summer Lane station and the various substations.

In 1910 Mr. Taylor contributed a paper to the Municipal Electrical Association on the subject of "Batteries for Peak Loads," which directed the attention of engineers to this matter both at home and abroad, and caused more than one engineer to put down such batteries on a large scale. He has also contributed several papers to the Institution of Electrical Engineers, of which, perhaps, the best known is that read a little over a year ago, entitled "Batteries and Battery Discharge Arrangements."

Mr. W. J. U. Sowter, M.I.E.E., chairman of the **Dublin Section**, was born at Margate, and educated there. In 1889 he entered the works of Messrs. S. Z. de Ferranti as a pupil, and went through the shops and testing department, studying also as an evening student at Finsbury Technical College. From 1893 to 1896 he held the appointment of resident engineer at the Lancaster County Asylum, having charge of the steam and electrical plant. From 1896 to 1897 he acted as assistant in the distribution department of the St. James's and Pall Mall Electric Light Co., and from 1897 to 1898 he was mains superintendent with the Aberdeen Corporation. Here he conducted the change in pressure from 220 to 440 volts under Mr. A. S. Blackman, the city electrical engineer. Mr. Sowter's next appointment (1898-1900) was that of assistant engineer to Ealing Corporation, after which he spent some years (1900-1903) as deputy electrical engineer to the Coventry Corporation. In that capacity he carried out the scheme for changing the system over from single-phase 83 cycles to two-phase 50 cycles. He also inaugurated and had charge of the department for hiring motors to consumers. In 1903 Mr. Sowter was selected for the post of borough electrical engineer at Dorchester, which office he held until 1904, when he left for Bray, Ireland, where he was appointed engineer and manager to the Urban District Council. There he has had charge of water, steam and oil generating plant. During the time Mr. Sowter has held the above position he has almost entirely reconstructed the Bray undertaking, an important part of the scheme being the eventual supersession of steam engines by internal-combustion engines. One Diesel set has already been installed, and a second set of 100 KW. is now on order.

As our readers are aware, on July 10th Mr. Sowter met with a serious accident, the cause being the bursting of a compressed-air cylinder connected with the Diesel engine. Unfortunately, while Mr. Sowter's medical advisers are quite satisfied with the progress that he is making, it will be about three months before he is able to get about and resume business. To his own and his fellow members' regret, he has, therefore, been unable to prepare an address as chairman of the Dublin Section, and will be deprived for the present of the pleasure of presiding over the meetings.

Mr. Sowter is the author of papers on "Gas-Producer

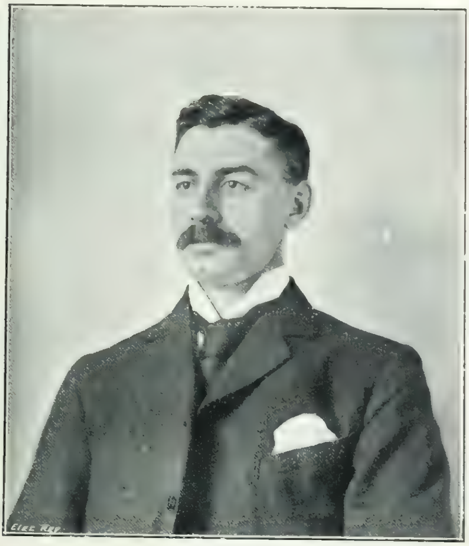
Plants for Central Stations," and "The Diesel Engine from the User's Standpoint," both of which were read before the Dublin Local Section. He has acted as consulting engineer to the Larne U.D.C., and other authorities and firms.

Photo by *N. S. Kay.*

A. A. Day.

Photo by *[illegible] Bros.*

W. C. Mountain.



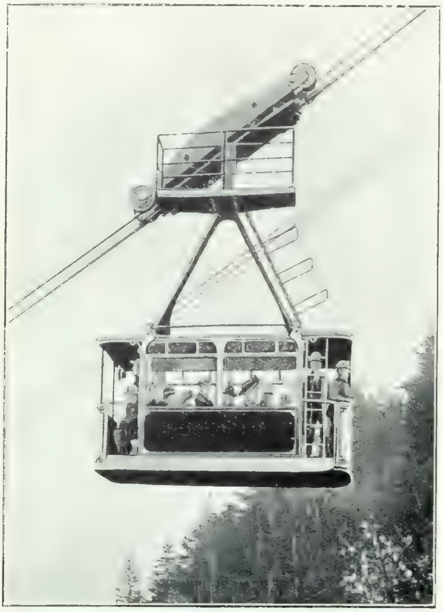
A. M. Taylor.

W. J. U. Sowter.

Chairmen of Some of the Local Sections of the I.E.E.

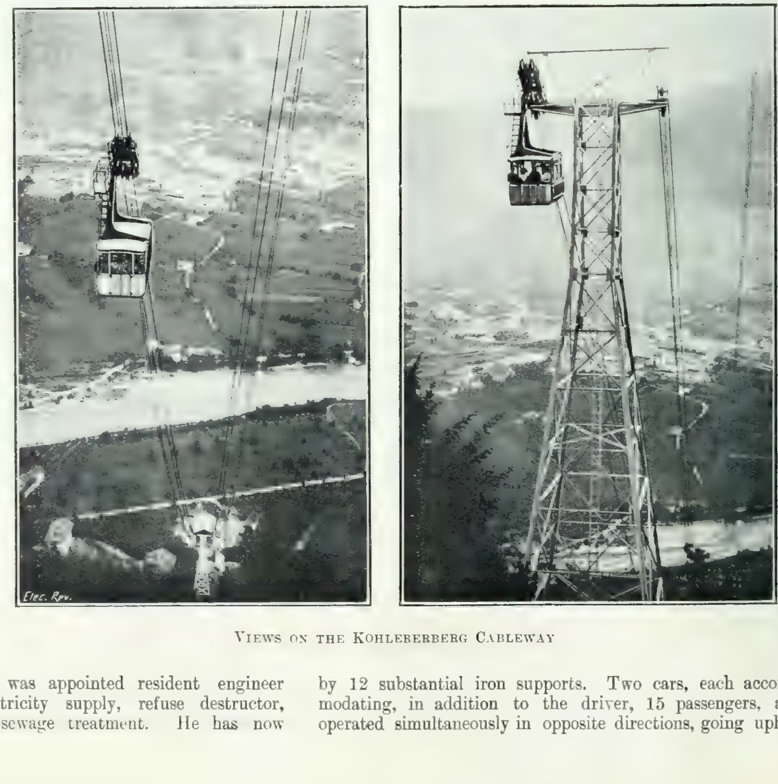
Mr. W. A. Chamen, M.I.E.E., M.I.M.E., the first chairman of the new **Western Section**, was born in London in 1863, and at the age of 18 years he entered the employ of Mr. Crompton, and later took charge of installation work for the firm at home and on the Continent, following with personal supervision of the incandescent electric lighting installation at the Law Courts. He served Messrs. Crompton in these and other capacities, including that of chief outdoor engineer, until in 1898 he took the position of chief engineer to the Glasgow Corporation electricity supply undertaking. Our readers will remember that it was seven years thereafter that Mr. Chamen went to South Wales to tackle the difficult problem of bringing the South Wales Electric Power undertaking through the technical and commercial reorganisation which was inevitable if the system was to be continued. He has maintained his connection with the matter as general manager of the concern (and the Treforest Electrical Consumers' Co., Ltd.) ever since; he also carries on practice as a consulting engineer, with offices in Cardiff. Mr. Chamen during his term as chief of the Glasgow electricity undertaking acted as chairman of the Local Section of the I.E.E., so that he will not be performing unaccustomed duties in presiding over the work of the new Western Section. We hope to hear of very active work in progress in this Section before long. The inaugural address will be delivered on the 18th inst.

Mr. S. D. Schofield, M.I.E.E., M.I.Mech.E., who was elected chairman of the **Yorkshire Section**, delivered his address (which appears in abstract on another page) at Leeds



Kohlererberg Cableway: Side View of Car and Carrier.

on Wednesday evening, but as he is leaving for Norway at once his duties as chairman ceased after that meeting, and Mr. Wilson Hartnell, a former chairman, will again preside over the deliberations of the Section, for the 1912-3 session. Mr. Schofield was born at Guiseley, Yorkshire, and was educated privately and at Bradford Technical College under Dr. Dale and Prof. G. F. Charnock. He served his apprenticeship with Messrs. J. Perry and Sons, Shipley, and afterwards gained experience with Thos. Smith & Sons, Rodley, Leeds; S. Sutcliffe and Sons, Bradford; S. Clayton, gas engineers; Rosling and Matthews, electrical engineers; and Sir Titus Salt, Bart., Sons and Co., Ltd., Saltaire, obtaining an all-round experience of gas, steam and hydraulic engineering and textile machinery. In 1900 Mr. Schofield entered the service of the Shipley Urban District Council as works manager, and in the following year he was appointed resident engineer and manager for electricity supply, refuse destructor, sewage pumping and sewage treatment. He has now resigned his position with the Shipley Council to take up an appointment with the Thelma Syndicate, Ltd., at their copper mines in Norway. We understand that the employés at the works presented Mr. Schofield with a fitted dressing case, and other officials and friends presented him with a cabin trunk, kit bag, and other gifts. He leaves Newcastle to-morrow, November 9th, and after that date his address will be Sulitjelma, Nordland, Norway.



Views on the Kohlererberg Cableway

Mr. William McWhirter, M.I.E.E., chairman of the **Scottish Section**, is one of the pioneers of electrical engineering on the Clyde; as long ago as 1880 he was an Associate of the Institution, and in 1883 he became a full Member. Not one of his fellow-chairmen was even an Associate at that date, when electric lighting was only beginning to be seriously regarded, and the dynamo was a very primitive machine. But Mr. McWhirter had confidence in the new industry, and played a leading part in its development in Glasgow, keeping himself abreast of electrical progress in all its branches, and frequently supplying thoughtful and practical contributions to the discussions of the Institution, which has now awarded him the highest honour that the Scottish Section has at its command.

A NEW SUSPENDED RAILWAY IN THE TYROLESE MOUNTAINS.

[By our Berlin Correspondent.]

A new suspended railway up the Kohlererberg has been installed by Messrs. Adolf Bleichert & Co. Comfortable cars travelling along steel cables rise smoothly and steadily from the Eisack, overcoming in 13 minutes a difference of level of 840 metres, and opening up an ever extending panorama which, among other mountains, comprises the whole of the Ortler range.

The suspension cables, 1,650 metres in length, are carried by 12 substantial iron supports. Two cars, each accommodating, in addition to the driver, 15 passengers, are operated simultaneously in opposite directions, going uphill and downhill respectively. Each car is suspended from a travelling gear which is carried by eight pulleys on two steel cables 44 mm. in diameter. The suspension of the cars is pendulous, any oscillations of the car body being damped by a brake, while the carrying cables take part in any oscillations at right angles to the track, so that there is no risk of derailment.

Each car is hauled by two traction cables operated from a driving station alongside of the line. As both the traction and carrying cables are duplicated, the safety required for a passenger service is fully ensured.

It is interesting to note what further safety devices have been provided to protect passengers against any risk of breakdown. Into the travelling gear of the cars have been fitted two self-contained braking or catching devices, which are operated automatically as soon as a carrying cable or one or both of the traction cables are broken or the normal maximum speed is exceeded. These devices can also be actuated by the driver, being released by a simple manipulation. As soon as the catching device is operated, steel jaws firmly grip the carrying cables at eight different points, maintaining the car in position with absolute safety by the friction thus produced. At the same time the electric supply to the driving motor is stopped, and the brake of the latter is actuated.

This suspended railway is operated by electricity. As a buffer battery is provided at the driving station in parallel with the main generators, operation can be kept up for hours in the event of a breakdown of the latter. Should a car, however, in the event of a breakdown of the driving gear be stopped on the open track, an emergency capstan would (if a single traction cable were left uninjured) allow of its being hauled into the station. Furthermore, there is at each station an emergency car for fetching any passengers left on the open track, and, finally, each car is provided with a special device, a kind of bag with a floor, which, being lowered through the car bottom, allows passengers in cases of emergency to get safely to the ground. As the rope carrying this bag passes through a brake, any dangerous increase in speed is guarded against.

The driving stations likewise are provided with various safety devices. At each driving station there is a mechanic, who commands a ready view of the track; there are, further, two brakes automatically operated in the event of a breakdown or actuated by hand. The upper and lower stations communicate with one another by telephones and electric signals. The cars cannot be started before the stations have communicated by optical and acoustical signals, or before these signals have been confirmed. Furthermore, there is a telephone line arranged alongside of the track, by means of which the driver, from any point of the line, can communicate with the terminal stations.

NOTES.

(*Continued from page 748.*)

Marconi Libel Action.—Reuter states that a libel action has been brought by Mr. Marconi and Mr. Godfrey Isaacs, a director of the Marconi Co., against Alfred Scholz, the responsible editor of *Die Welt am Montag*, in Berlin. The paper declared that at the time of the *Titanic* disaster Mr. Marconi permitted his company to exploit the catastrophe for selfish ends, and stated that the operators in the *Carpathia* withheld news in order that the company might thereby profit. Counsel for the defendant announced that the defence would maintain all the charges made. The hearing was postponed for the production of the American Senate Commission's report, as it is alleged that Mr. Marconi admitted before that Commission that he withheld news for three days. It was also decided to examine the chief telegraphist of the *Carpathia*, Mr. Cortham, either personally or by commission. Mr. Bride, the wireless operator on the *Titanic*, is also a witness. The allegation of the defence is that Mr. Marconi withheld news in order to sell it to the *New York Times* for a large sum.

A Birmingham Exhibition.—It is stated that a 10 weeks' exhibition is to be opened in March next at Bingley Hall, Birmingham, among the features of which will be displays of gas and electrical illumination for industrial and domestic purposes, cookery lectures and demonstrations.

Appointment Vacant.—Clerk of Works, for the Hackney B.C. electricity works extension (£4 4s.). See our advertisement pages in this issue.

Electricity Supply Rifle League.—The following are the results of the matches shot during September and October in connection with the [illegible] League: Central [illegible] v. Hackney (Self, Smith 95) 540; Ilford (McKelvey 99) 553 v. Hackney (Self [illegible]) [illegible]; [illegible] Brown [illegible] Stepney [illegible] Central [illegible] v. [illegible] Westminster [illegible] Hackney [illegible] Stepney (Young 97) 559 v. Hackney (Smith 96) 549; Westminster (H. A. Pearman 96) 562 v. Hackney (Hilling 98) 541.

[illegible]

	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3,408	3,278
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Central	7	[illegible]	2	[illegible]	[illegible]	3,887	[illegible]
Stepney	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]
Ilford	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3,872
Hackney ..	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Electrical Workers' Demands.—The *[illegible] Citizen* states that an application for an advance of [illegible] per hour in wages is being made by the Clyde district of the Electrical Trades Union, and as the men are thoroughly organised they have every hope of the concession being granted. Twelve months ago the Glasgow branch of the Union was split up into three branches, and as the central branch also has grown very rapidly, there is a proposal to take similar action with it."

Fatalities.—The *Daily Express* reports that on Tuesday Mr. J. C. M. Thompson, solicitor, was killed by electric shock while taking an electric bath at an establishment in Cavendish Place, W. He had previously taken baths for rheumatism, and went to the baths apparently in good health, with the view of having a bath as a tonic. While he was in the bath, and the electric current was turned on, the man who regulated it heard the telephone bell ring, and left the bathroom to answer the call. A few moments later he heard a cry, and, running back to the bathroom, found Mr. Thompson dead. It is understood that Mr. Thompson touched the electric regulating handle with his foot while he was still in the bath, and, as the water in which he lay was charged with electricity, the contact somehow completed a circuit. An inquest was to be held yesterday.

A few weeks ago a woman died in an electric bath in the same district, but the cause of death was not definitely ascertained.

A correspondent states that a fatality occurred at the Manchester Corporation generating station, Stuart Street, at 1 o'clock on Wednesday morning, resulting in the death of Wm. Henry Pickwell (24). It appears that Pickwell was assisting a man named Willis to repair a switchboard, which had been allowed to become "dead" for the purpose. He was going round the switchboard, which was one of the ordinary ones used to supply the tramway and general services of the city, when he put his hand on a live wire. He was killed instantly; the pressure was over 3,000 volts. Artificial respiration was tried at once without avail.

Electrically-Driven Cogging Mill.—We understand that the electrically-operated 28-in. reversing cogging mill at Messrs. Dorman, Long & Co.'s Britannia Works, Middlesbrough, to which we referred in our account of the I.M.E.A. Convention in June last, is operating to the entire satisfaction of the management. The electrical equipment consists of a mill motor of 1,200-3,600 H.P. at 70-120 R.P.M., directly connected to the rolls, and supplied with direct current at 0-440 volts by a fly-wheel equaliser set. The motor of this set is fed from a 2,750-volt 40-cycle three-phase supply, and is mounted on the same base-plate as and directly coupled to a generator rated at 1,000-3,000 KW. The speed of the set is 480 R.P.M., and the fly-wheel, which weighs 33 tons, and is 11 ft. in diameter, runs in its own bearings, and is connected to the generator by a special compression-type flexible coupling.

The plant has proved itself capable of outputs considerably in excess of the guarantees given by the makers (the British Thomson-Houston Co., Ltd., Rugby), and in practice the mill motor is subject to overloads greatly in excess of the maximum rating given above. It has not been found necessary to give any special attention to the commutators of the D.C. machines, in order to ensure satisfactory operation. That of the mill motor has not been ground or trued up in any way since its installation, and the commutation of the generator is sparkless, although more than two years have elapsed since the commutator was ground up. These results clearly show that electrical machinery is perfectly capable of tackling even so difficult a proposition as a large reversing mill with success.

Some Notes on Aluminium.—To blacken aluminium alloys, immerse the article in a boiling hot solution of caustic soda of 30 per cent. strength, for a few seconds; wash off the excess of caustic, dry in sawdust, and polish with a plumbagoed brush. When blackening pure aluminium by means of the usual ferrous sulphate, arsenious oxide, and hydrochloric acid mixture, the deposit is non-adhesive; the addition of an ample proportion of ammonium molybdate and yellow prussiate of potash gives a solution, in which the article, dipped and kept for a few minutes at boiling temperature, becomes coated with a permanent black. Aluminium is to a certain extent acted on by ammoniacal vapour; in the case where copper is present, in contact with it, the preferential action of the ammonia on the copper preserves the aluminium from attack. To solder aluminium, Richard's solder—tin 69, zinc 26·2, aluminium 2·4, 5 per cent. phosphor-tin 2·4 parts—is a useful material. To cover the appearance of application of solder, the ordinary aluminium paint is quite suitable.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Liverpool City Council at the final meeting of the municipal year, on October 29th, formally approved the appointment of Mr. Harold Dickinson, as city electrical engineer, at a salary of £1,000 per annum, increasing to £1,500 by such increments of not less than £100 per year as may be from time to time decided by the Tramways and Electricity Committee.

The position of Mr. Alfred Clough, resident electrical engineer, was also considered on the following recommendation:—"That, in view of the appointment of a chief electrical engineer, the Tramways and Electricity Committee be authorised to arrange for the retirement of Mr. Clough, at such date as may be mutually agreed, and that in the special circumstances of the case a superannuation allowance, equal to one-half of his present salary, be paid to him from the date of his retirement, and the difference between the amount of such allowance, and the amount of the superannuation to which the resident electrical engineer would be otherwise entitled, be paid out of the revenue of the electric supply undertaking." Ald. Fredk. Smith, in moving the adoption of the recommendation, pointed out that Mr. Clough was at an age when it was desirable that he should take things a little easier, and it had been thought advisable on the appointment of a new man to retain Mr. Clough's services for one or two years, or until the new man had got thoroughly into harness. An amendment was moved by Mr. Hickling to have the matter of superannuation referred back for a report by the controller giving a proper return of the actual service of Mr. Clough and the amount of the pension to which he was entitled in the proper course. Sir Charles Petrie (chairman of the Committee), in resisting the amendment, explained that Mr. Clough entered the Corporation service when it took over the electrical undertaking some 16 years ago. The amount of superannuation to which he was entitled was £352, and in 12 months' time he would be entitled to £374. Mr. Clough had been of very valuable service, and the gentlemen who wished to pose as economists in the Council ought to see that it was but justice that he should get the amount proposed. The amendment was withdrawn, and after further discussion, the recommendation was confirmed.

Shipley U.D.C. has appointed Mr. J. P. Robson, senior shift engineer, at the Colne Corporation electricity works, as assistant electrical engineer.

On the occasion of his wedding, Mr. Henry Lister, shift engineer at the Close power station of the Newcastle and District Electric Lighting Co., Ltd., was presented with a technical work on the "Steam Turbine," together with a fountain pen and a slide rule, by members of the staff. Mr. Lister leaves England for Melbourne to-day, 8th inst.

At a dinner given to the employés and their wives by Mr. Wm. Sillery, burgh electrical engineer, Partick, and Ex-Bailie Jackson, convener of the Electricity Committee, in the Whiteinch Burgh Hall, on Monday, 28th ult., Mr. Sillery was made the recipient of a gold hunting lever watch, as a token of esteem, from the employés and friends, while Mrs. Sillery was presented with a gold pendant set with pearls and amethysts. In making the presentation, Ex-Bailie Jackson spoke in eulogistic terms of the good qualities and capabilities of Mr. Sillery, and gave details of the progress the station had made since Mr. Sillery took up office in 1907. Mr. Sillery replied, thanking the employés and friends on behalf of Mrs. Sillery and himself. During the evening a number of the employés of the department rendered a programme of music and song.

Mr. Stanley Pollock, on leaving the service of the Aberdeen Corporation electricity department for an appointment at Broughty Ferry electricity works, was presented with a purse of sovereigns.

The salary of Mr. H. P. Stokes, borough electrical engineer and tramways manager of Ilkeston, has been increased at the rate of £15 per annum.

Mr. H. J. Jackson, of the Salford Corporation electricity department, has been appointed to the position of canvasser to the Cheltenham Corporation electricity department.

Mr. J. Williams, assistant electrical engineer to the Rotherham undertaking, is to have his salary increased from £175 to £187 per annum, with a further advance of £12 10s. at the expiration of 12 months.

Mr. N. C. Rowan has resigned his position with the Cleveland and Durham Electric Power, Ltd., having been appointed assistant engineer to the River Plate Electricity Co., Ltd.

General.—On October 30th, Mr. H. B. Mitchell, who has resigned his post as shift engineer at the Grimesthorpe Works of Messrs. Cammell, Laird & Co., Ltd., Sheffield (having been appointed electrical engineer to the French Society of Copper Mines, Chile), was the recipient of a cabin trunk and vacuum flask from the staff of the electrical department. The presentation was made by Mr. H. West, chief electrical engineer. Mr. Mitchell expects to leave England during this month.

Mr. Arthur H. Jeans informs us that he has now severed his connection with the General Electric Co., Ltd. (for the last five years in charge of the Robertson lamp department), and he is now representing Messrs. Pope's Electric Lamp Co., Ltd., for the London district.

An inquest was held last week into the death of Mr. R. M. Barley, aged 49, a canvasser in the Islington municipal electricity department, who was knocked down by a motor-bus in Upper Street and died as the result of injuries received.

The *Indian and Eastern Engineer* states that by the retirement of Mr. E. J. Lopez, after over 46 years' service, the Indian telegraph department loses one of its most distinguished officials. "Mr. Lopez is the inventor of several systems of telegraphy which have proved of great technical and commercial value."

The *Times* announces that the President of the Board of Trade has appointed Mr. G. T. Milne to be His Majesty's Trade Commissioner for the Commonwealth of Australia, in succession to Mr. C. Hamilton Wickes, who, as our readers know, is now in Canada. "Mr. Milne is at present completing an inquiry on behalf of the Advisory Committee to the Board of Trade on Commercial Intelligence into the conditions and prospects of British trade in Central America, and will proceed to Australia early next year."

Mr. P. S. Brook, electrical engineer, has been re-elected a member of Chester City Council.

Mr. Harold Bentham, manager since 1902 for the Birkdale Electric Supply Co., Ltd., has accepted a position under the Electrical Federation of the Birmingham and Midland Joint Committee. Mr. Bentham's successor at Birkdale is Mr. G. L. Kirk, of the staff of the Sheerness and District Electric Power and Tramways Co.

Councillor James Heald, electrical engineer, Lancaster, and chairman of the Lancaster Corporation Electricity Committee, has been returned by a large majority in the municipal elections.

The General Purposes Committee of the L.C.C. recommends the promotion of Mr. G. W. Humphreys, M.I.C.E., the present deputy chief engineer of the Council, to be chief engineer and county surveyor, at a salary of £2,000.

Consequent upon the resignation of Mr. Bernard Holland from the L.C.C. Special Committee on London Electricity Supply, it is recommended that Mr. R. C. Norman be appointed a member.

Mr. Fred. S. Sells, for the past 10 years manager of the Manchester branch of the General Electric Co., Ltd., has just returned from a trip to South America, where he has completed the work entailed in connection with the formation of the Anglo-Argentine General Electric Co., Ltd., and has also improved the organisation of the company's interests in Brazil. In addition to resuming his former work, Mr. Sells has accepted a seat on the board of the General Electric Co., Ltd.—this having been offered to him some few months ago in recognition of his long and useful services to the company.

Messrs. P. L. Dwyer and P. R. Winterson, late with the Armorduct Manufacturing Co., Ltd., have commenced business as wholesale electrical supplies agents, under the title of P. L. Dwyer and Co., at 66, Victoria Street, S.W. Mr. Dwyer was presented with a gold watch by Mr. Marchant (secretary) on behalf of the London office staff, on the occasion of his relinquishing the post of London sales manager to the Armorduct Co.

Obituary.—We regret to hear of the death of Mr. Cecil Burman Callow, of Messrs. Kohler Bros., which took place at North Side, Clapham Common, London, on 31st ult., at the age of 47 years.

We desire to express our sympathy with Mr. Samuel Lees, of the Stretford (Manchester) Electricity Works, on the death of his wife, which occurred on October 29th, after prolonged suffering.

The death has taken place at Rhyl of Mr. Evan Meredith Evans, senior partner in the firm of E. M. Evans & Son, electrical engineers, of Manchester and Oswestry. He was 71 years of age.

NEW COMPANIES REGISTERED.

J. W. Middleton & Co., Ltd. (125,044).—This company was registered on October 29th, with a capital of £2,000 in 1,990 ordinary shares of £1 each and 200 management shares of 1s. each, to carry on the business of manufacturers of and dealers in electric light fittings, metal workers, electrical and mechanical engineers and contractors, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus, &c., and to adopt an agreement with H. M. Burr, J. E. Barber, W. F. Merry and C. W. Brown, trading as J. W. Middleton & Co., at 147, Wardour Street, W. The subscribers (with one share each) are:—W. F. Merry, 38, Florence Road, Wimbledon, S.W., art metal worker; H. W. Burr, 22, Ravenscourt Gardens, Hammersmith, W., art metal worker; J. E. Barber, 54, Browneker Road, South Acton, art metal worker; C. W. Brown, 339a, Hither Green Lane, Hither Green, S.E., traveller. Private company. The first directors are W. F. Merry and R. M. Aldred (nominees of vendors), B. S. Miller (chairman) and E. J. Beard (nominees of Miller & Sons). Two directors are to be nominated by the vendors, H. M. Burr, J. E. Barber, W. F. Merry and C. W. Brown, and two by Miller & Sons; qualification, £25 ordinary or 25 management shares. Remuneration as fixed by the company. Registered office, 147, Wardour Street, W.

Dublin Southern District Electric Supply Co., Ltd. (3,900). Registered in Dublin on October 31st, with a capital of £40,000 in £1 shares, to carry on the business of electrical engineers, electricians, practical engineers and contractors, carriers of passengers and goods, manufacturers of electric apparatus, &c. The subscribers (with 50 shares each) are:—W. M. Murphy, 39, Dame Street, Dublin, civil engineer; W. A. Evans, 27, Longford Terrace, Monkstown, insurance and mortgage broker; G. V. Murphy, 7, Anglesea Street, Dublin, commission agent. Private company. The first directors are W. M. Murphy, W. A. Evans and G. V. Murphy; qualification, 50 shares; remuneration as fixed by the company. Registered office, 16, College Green, Dublin.

Russian Wireless Telegraph Trust, Ltd. (125,011).—Registered October 26th, by A. Benjamin & Cohen, College Hill Chambers, College Hill, E.C. Capital, £100 in £1 shares. Objects, to purchase, or otherwise acquire, sell, hold, issue, dispose of, deal in and generally turn to account any shares, scrip or other securities of, or interests in, any company, society, corporation, association or firm engaged in, or carrying on, in the Empire of Russia or any other foreign country or State, or in the United Kingdom, or any Colony, State, Province or Dependency thereof, the business of telegraphy and telephony, whether wireless or otherwise (in particular but without restricting the generality of the foregoing powers, to so acquire, dispose of and turn to account any shares, stocks, bonds or other securities of a company incorporated under the laws of Russia, and known as the "Société Russe de Télégraphiques et Téléphones Sans Fil"); to lay down, equip, maintain and work telegraphs and telephones, or other means of communication, and to carry on in any part of the world the business of wireless or other telegraphy in all branches (but so that the company may not carry on wireless or other telegraph or telephone business in the United Kingdom without the sanction of the Postmaster-General, except so far as it may lawfully carry on the said business without such consent), to generate, accumulate, supply and distribute electricity, electrical energy or other power or force for lighting, heating, communication, traction, motive power, industrial and other purposes, and whether for public or private use, &c. The subscribers (with one share each) are:—T. M. Norris, 25, Ingersoll Road, Uxbridge Road, W., secretary of a private company; A. E. Lees, 2, Livingstone Road, Palmer's Green, N., director of companies. The company is a private one within the meaning of the Companies' (Consolidation) Act, 1908, and accordingly (a) the number of members (exclusive of employés) is not to exceed 50: (b) no invitation may be made to the public to subscribe for any shares, debentures or debenture stock of the company; (c) no share warrant to bearer may be issued unless the company shall first have complied with the provisions of Sec. 121, sub-Sec. 2, so as to turn itself into a public company; and (d) the board may, without assigning any reason, decline to register any transfer of shares. The first directors (to number not less than two or more than seven) are to be appointed by the signatories to the memorandum of association. The first directors have power, *inter alia*, to appoint any person, whether a director or not, to hold in trust for the company any property belonging to the company, or in which the company is interested; (b) to appoint any person as the attorney of the directors, with such powers as they think fit, including power to appear before all proper authorities and make all necessary declarations, so as to enable the company's operations to be validly carried on abroad; and (c) borrow, raise or secure any moneys and create and issue perpetual or redeemable debentures or debenture stock, or any mortgage or charge on all or part of the company's undertaking or property, present or future, or its uncalled capital. No notice of registered office appears on the file to October 29th.

Commercial Electric Co., Ltd. (125,000).—This company was registered on October 26th, with a capital of £[illegible],000 in £1 shares, to take over the business of an electrician, mechanical engineer and manufacturer carried on by J. H. Kloet, at 18, King Street East, Manchester and elsewhere, as the Commercial Electric Co. The subscribers (with one share each) are:—J. H. Kloet, 29, Tatton Road, North Heaton Moor, Stockport, electrical engineer; E. Oldfield, 3, Stockton Road, Chorlton-cum-Hardy, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. H. Kloet, managing director, and E. Oldfield; qualification, £50; solicitor, J. A. Orrell, 18, St. Ann Street, Manchester. Registered by Waterlow & Sons, Ltd., London Wall, E.C.

G. H. Turner & Co., Ltd. (125,025).—This company was registered on October 28th, with a capital of £1,500 in £1 shares (100 preference), to take over the business of electrical engineers carried on at 2, High Street, Willesden Junction, N.W., and at 41, Cheapside, E.C., as G. & H. Turner and G. H. Turner & Co., together with certain assets and liabilities, and to carry on the same and the business of motor car, motor and other cycle manufacturers, agents or dealers, &c. The subscribers (with one share each) are:—G. A. Turner, 2, High Street, Willesden Junction, N.W., electrical engineer; A. Green, 5, Moorgate Street Buildings, E.C., chartered accountant. Private company. The number of directors is not to be more than three. G. A. Turner is first managing director; qualification, 100 preference shares: remuneration of G. A. Turner, £25 per annum, together with an additional £5 per week for his services as managing director. Registered by A. H. Green, 5, Moorgate Street Buildings, E.C.

Armature Repairing and Supply Co., Ltd. (125,060).—This company was registered on October 30th, with a capital of £500 in £1 shares, to carry on the business of electrical engineers and manufacturers of and dealers in all kinds of electrical plant, machinery, instruments, &c. The subscribers (with 10 shares each) are:—J. Forrester, 24, Glanmor Crescent, Swansea, electrical engineer; W. Mitchell, 21, Victoria Terrace, Swansea, electrician. Private company. The first directors are J. Forrester and W. Mitchell. Solicitor, R. F. Gee, Llanfair Chambers, St. Mary Street, Swansea. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Egham and Staines Electricity Co., Ltd.—Particulars of £12,000 debentures, created September 25th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £11,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and debts due to the company. No trustees.

Anglo-Argentine Tramways Co., Ltd.—Acknowledgment of indebtedness dated October 18th, 1912, supplemental to trust deed dated June 15th, 1910, to secure £1,500,000 5 per cent. debenture stock, ranking, *pari passu*, with £3,000,000 similar stock secured by principal deed, charged on the company's undertaking and property, present and future, including uncalled capital subject to charge dated January 9th, 1905, securing £71,060, reducible to £70,660, charges dated June 2nd, 1908, and January 22nd, 1909, securing £4,465,674 5 per cent. debenture stock and indenture dated July 1st, 1909, securing £1,733,380 4½ per cent. debenture stock. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Mexican Fuel and Power Co., Ltd.—Particulars of £5,000 debentures, created September 24th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,050. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

E. Brook, Ltd.—Debenture dated October 18th, 1912, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: G. V. Laycock, 146, Poplar Villas, Halifax.

Direct West India Cable Co., Ltd. (53,956).—Return dated September 19th, 1912. Capital £120,000 in £5 shares. 12,000 shares taken up. £2 10s. per share called up on 12,000. £30,000 paid. Mortgages and charges: £22,000.

Electrical and Engineering Supplies Co., Ltd. (99,423).—Return dated August 27th, 1912. Capital, £1,000 in 950 preferred ordinary shares of £1 each and 1,000 founders' shares of 1s. each. All shares taken up. £1,000 paid. Mortgages and charges: Nil.

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—Return dated [illegible] 1912. Capital [illegible] 2,0[illegible] [illegible] £2,629 15s. 6d.

W. Sisson & Co., Ltd. (82,295).—Return dated October 17th, 1912. Capital [illegible] 13,000 [illegible] 7,000 [illegible] mortgage on works.

Ridings Arc Lamp Co., Ltd.—Particulars of £5,000 debentures, created October 16th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Altrincham Electric Supply, Ltd.—Particulars of £35,000 debentures, created by resolutions of June 7th, 1898, and April 18th and October [illegible], 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, [illegible]. Property charged: The company's undertaking and property, present and future. No trustees.

CITY NOTES.

La Plata Electric Tramways Co., Ltd.

THE adjourned annual general meeting of the shareholders of the above company was held on Wednesday last at Winchester House, Old Broad Street, E.C., Mr. W. F. Hamilton, K.C., in the chair.

The CHAIRMAN, in proposing the adoption of the report, devoted the major portion of his speech to an explanation of the defalcations which were referred to in the report. In the course of his remarks, he said that when he left England, it was estimated that the amount of the defalcations by their accountant was about £1,000, and it was not until some little time after he had landed in the country that he ascertained them to amount to a little over £10,000. Their accountant came to them with a good character, and he had a good reputation, but the defalcations would not have been possible had their local auditors, Messrs. Fowler, Scroggie & Co., done their duty, or had their late manager himself checked the monthly cash balances. Mr. Dawe, their manager, of course, had implicit confidence in Mr. Allen, the accountant and the auditor. Having personally investigated the accounts, he (the chairman) had no hesitation in advising the board that the local auditors were legally liable in damages to the company for breach of duty as auditors, and an action had been commenced for the purpose of enforcing that liability. Under those circumstances, he refrained from saying anything more about Messrs. Fowler & Co., except to mention that they were the auditors of the old horse tramway company, and that at the time the board appointed them local auditors for this company they were acting in the same capacity for many well-known companies carrying on business in the Argentine, and had a good reputation as accountants. As they knew, he (Mr. Hamilton) was entrusted by the board with full powers to take such steps as he thought necessary to prevent a recurrence of such defalcations. It was suggested that a local board, consisting of three members, should be appointed, but he did not think that was the best course to pursue. What was really needed was a reliable and capable manager solely responsible to the board for the working and management of the tramways, skilled and reliable auditors, with a local representative. As to the latter, they could not have a better representative than the gentleman who at present acted for them in that capacity—Mr. Boutell—for besides being a considerable shareholder, he took a great interest in the company. Mr. Dawe, their manager, had resigned just before he (the speaker) arrived on the spot, having been appointed traffic manager to another company, and the board, upon his (Mr. Hamilton's) recommendation, appointed Mr. Valentine Brown in his place, and he was satisfied that Mr. Brown was exceptionally well qualified for the position. It was with some concern that the board observed that the receipts for this year showed for some months a falling-off, while at the same time the ratio of expenses had increased, thus reducing the profits. The principal cause of that decrease was the wet weather and the interference with traffic caused by the paving works and the completion of the electrification of their competitors' lines. The weather had, however, improved since August. Various alterations were made by him in consultation with the manager, with the view of reducing working expenses and obtaining increased receipts. Their new manager was a very capable man, with large experience of the working of tramway systems, and there were reasonable grounds for anticipating a progressive increase in their net profits not only on the Ensenada section but also in the city of La Plata. They would be glad to hear that their traffic receipts for October were £5,007, as compared with £4,060 for the same month last year. That was an increase of nearly £1,000 for the month. He stated at the last annual meeting that it would be necessary to make an issue of debenture stock some time this year to provide for the extra expenditure incurred in buying additional rolling stock, doubling their car-shed accommodation, taking up and relaying the track rendered necessary by the new paving works, and paying the difference between the amount allowed for electrifying their old Ensenada horse tramway, and the amount expended on their longer and better new Ensenada route. As they might imagine, owing to the war in the Near East and the high bank rate and their losses by defalcations, the board had found it impossible to issue the stock except at a considerable loss. The stock was only to be offered to their shareholders, that they would save the cost of a public issue. They had found it necessary to issue the stock at 90, and to have it underwritten at 2½ per cent. They intended to issue £70,000 of this debenture stock, making in addition to the £30,000 already issued, £100,000. They had spent £196,000 already on the electrification and equipment of their line, so that the security offered to the shareholders was ample. In conclusion, the chairman said that much as they regretted their losses by embezzlement, it was to be remembered that the earning capacity of the line was not in any way diminished. He had given them as full information as he possibly could, and he confidently expected that at the next annual meeting they would find that the growth in their receipts and the diminution in their expenses which they anticipated, would be realised.

MR. W. T. WESTERN seconded the motion.

A somewhat lengthy discussion ensued, in which several shareholders suggested that the board had been remiss in not seeing that they had a banker's certificate from the Argentine every month.

The CHAIRMAN, in reply to the criticisms, said that they got every month from the other side a balance-sheet, which was certified by the auditors as being correct, and also certified by the manager. They also received correct copies of the accounts. If the accounts had been kept in the same way in the cash book at La Plata as they were kept in the accounts sent to them, it would have been all right: but as it was, they were deceived, and it was impossible for them to have known that these frauds were going on. He quite agreed that the ideal, and it was that at which they were now aiming, was to have the London auditors responsible to them for the audit in the Argentine, so that if anything went wrong, they would not have to resort to the local auditors. The board now got a regular banker's certificate each month. In conclusion, the Chairman said that personally he felt extremely sorry to have to record such a lamentable state of affairs, and as far as he and his colleagues on the board were blameable, they took the blame, but he still said that if the local auditors had done their duty, the defalcations would never have occurred.

The report was then adopted.

Cuba Submarine Telegraph Co., Ltd.

THE eighty-second ordinary general meeting of the shareholders of the above company was held on Wednesday, at 58, Old Broad Street, E.C., Mr. George Keith presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 714), said the traffic for the past six months had been more favourable than last year. They would see by the report that they had had to sell some of their securities to pay for a new cable. The total receipts for the six months were £23,721, being £2,947 better than last year. The London expenses had not increased, but those of the stations had largely increased. The depreciation of stores and stock amounted to £300. Of the total profit £4,000 had been placed to general reserve, £2,000 to reserve against loss on investments, and £2,000 to establish a pension fund for their employés. The general reserve fund now stood at £92,000. The dividend on the preference shares was £3,000, leaving £12,543, out of which the directors recommended the payment of a dividend of 6 per cent. on the ordinary shares. The cables of the company were in excellent working condition, and the shareholders would be pleased to know that the traffic receipts up to the present compared well with the same period last year. Subject to the approval of the shareholders, the directors had considered the advisability of forming a pension fund for their employés, and giving them a pension for long service. The pension system had been adopted by nearly all telegraph companies, and it was of vast importance to the company that they should have such a fund. The principal feature of the fund was that when an employé left the company at the age of 60 he would receive a pension if he had served 20 years with the company. No pension would exceed £200 a year. The scheme when it was in full working order would not cost the company more than from £400 to £500 for the half-year.

MR. CHARLES W. PARISH seconded the motion, and the report was adopted.

Amazon Telegraph Co., Ltd.—The directors' report for the year ended June 30th, 1912, states that the gross revenue was £104,444, and the working expenses were £51,199. After providing £15,000 for debenture interest and carrying £15,000 to the general reserve and £12,000 to the reserve for the renewal and maintenance of cable steamers, the directors recommend a dividend of 4½ per cent., free of income-tax, on the share capital, leaving £5,664 to be carried forward. The s.s. *Ramos*, the new small steamer specially built for repairing the company's cables in the shallow side waters of the river, was completed early this year and despatched to the Amazon in June last, and arrived safely under her own steam. The annual meeting is called for November 18th.

R. & J. Dick, Ltd.—After paying the preference dividend, the directors proposed to carry forward £4,199. The year's results showed improvement over those of the previous 12 months.

Stock Exchange Notices.—Applications have been made to the Committee (1) to appoint a special settling day in and to grant a quotation to :—Anglo-Argentine Tramways Co., Ltd.—Scrip fully and partly-paid for a further issue of £1,500,000 5 per cent debenture stock.

West India and Panama Telegraph Co., Ltd.

THE meeting of this company was held on Wednesday at Winchester House, E.C., Mr. W. B. Kingsford presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 713), said that the total revenue for the half-year amounted to £46,718, being £600 less than for the corresponding period in 1911. The traffic receipts were £486 less, which accounted for the greater part of the net loss of £600. The expenditure was £1,780 more than for the June half of 1911, having amounted to £27,109, against £25,329. During the half-year under review, 42 knots of cable were used in repairing and renewing the two Porto Rico sections, which had been charged to the reserve fund. Nearly the whole of the extra outlay during the half-year was incurred by the repairing ship, the *Henry Holmes*, chiefly in connection with the repairing operations. Including the time spent on the Porto Rico repairs, the *Henry Holmes* was engaged in cable work for 120 days in all, against 75 days in the corresponding half-year. Having given an account of the various cables owned by the company, the chairman said that, as a result of the half-year, the directors were able to add £2,000 to the reserve fund, and to recommend the same dividend on the ordinary shares as a year ago, carrying forward £2,791. As to the receipts for the current half-year, he might mention that, according to the cable returns brought down to the end of October, there had been a falling off of £367, as compared with the corresponding four months of last year.

MR. HENRY HOLMES seconded the motion, which, after a short discussion, was adopted.

Eastern Telegraph Co., Ltd.—The directors report that for the six months ended June 30th, 1912, the revenue amounted to £746,710, from which are deducted £261,490 for the ordinary expenses, and £44,597 for expenditure relating to maintenance of cables, sundry differences in exchange, and income-tax payable abroad, leaving a balance of £440,623, plus £23,882 brought from the preceding account, making a total available balance of £464,505. After providing for income-tax payable in England, interest on mortgage debenture stock, and for two quarterly dividends on the preference stock, which in all absorb £82,087, there remains a balance of £382,418, out of which the directors have placed £230,000 to the general reserve fund, and have allocated £100,000 to meet the two interim dividends of 1¼ per cent. each on the ordinary stock, the balance of £52,418 being carried forward. The meeting is called for November 13th.

Continental.—BELGIUM.—Le Syndicat de Signaux pour Chemins de Fer, of Brussels, reports a profit of £1,365 for the last financial year.

FRANCE.—A company has just been formed in Paris (48, Rue Richer), with a capital of £12,000, and the title La Société de la Lampe Philips.

RUSSIA.—The Russian A.E.G. Co., of St. Petersburg, owing to the increasing business, is raising its capital from 8 to 12 million roubles.

Western Telegraph Co., Ltd.—The directors recommend a final dividend of 3s. per share, making 6 per cent. for the year ended June 30th, and a bonus of 2s. per share.

Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share (5 per cent. per annum), less income-tax, for the three months ended September 30th.

Eastern Extension, Australasia and China Telegraph Co., Ltd. The directors' report states (says the *Financier*) that the gross receipts for the half-year to June 30th amounted to £367,785, against £329,709 for the corresponding half-year of 1911. The working expenses, including £28,452 for maintenance of cables, absorb £166,232, against £151,618 for the corresponding period of 1911, leaving a balance of £201,552. From this is deducted £3,648 for income-tax, payable in England, and £15,048 for interest on debenture stock, leaving £182,855 as the net profit for the half year. After adding £23,829 brought forward there is an available balance of £206,684. Two quarterly interim dividends of 1¼ per cent. each, amounting to £75,000, have been paid for the half-year, leaving £131,684, from which £75,000 has been transferred to the general reserve fund, and the balance of £56,684 is carried forward.

Hong Kong Tramway Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum is announced for the six months ended June 30th.

Western Union Telegraph Co.—The report states (says the *Financier*) that the accounts for the year to June 30th shows gross earnings amounting to $41,661,400, while expenses, including taxes, absorbed $36,063,800, leaving a balance of $5,597,600, making with $1,326,400 in respect of income from loan and investments, together with rentals from real estate, a credit balance of $6,924,000. Bond interest has absorbed $1,670,400, a sum of $1,250,000 has been written off against repairs and reconstruction of landlines, while dividends amounting to $2,991,800, or 3 per cent., have been paid, leaving a surplus of $1,011,700. The gross earnings from the company's telegraphs and cables during the past year show an increase of $6,182,000, while the expansion in landline message tolls was $4,357,373, or 15·57 per cent.

Barbados Electric Supply Corporation, Ltd.

The directors report that the results for the year ended June, 1912 are not considered unsatisfactory. The revenue derived from supply was naturally very small during the early part of the financial year, when few consumers were connected to the mains. The total income from that source during the six months to the end of December was less than half the income during the following six months, to June 30th, 1912. Revenue charges, on the other hand, are for a full normal year's working. The number of consumers connected to the mains at June 30th, 1912, was 247, as compared with about 100 at the close of the half-year to December 31st, 1911. Since the close of the year under review, the company has been successful in obtaining a contract for a portion of the public lighting of Bridgetown. Capital expenditure during the year, amounting £3,167, represents principally the supply and part erection of a storage tank for oil fuel, the completion of the construction contracts and expenditure for house services and connections. Further expenditure has already been authorised in connection with the public lighting contract, and for the extension of the mains into districts from which it is anticipated a reasonable revenue may be obtained. To provide additional working capital, a temporary loan of £3,000 was arranged in the early part of the financial year. Since the close of the accounts, and in connection with the additional capital expenditure referred to above, a loan of £10,000, secured by an issue of debentures, has been raised, the previous loan of £3,000 having been repaid out of the proceeds. In March, 1912, Mr. Gerald H. J. Hooghwinkel was elected a director of the company. Mr. Leslie Whittem Hawkins has resigned his seat on the board, and does not seek re-election.

The second annual general meeting was held on October 31st, at Basildon House, E.C., Mr. A. W. Tait presiding.

The Chairman, in moving the adoption of the above report, said that at the last general meeting, the shareholders were informed that supply was only commenced at the beginning of July, 1911, also that the construction as originally planned was not completed until the middle of September, 1911. Very little progress in the way of wiring premises was made during the period of construction, as the residents would not enter into definite contracts with them until the business was a going concern. Consequently, when they were in a position to supply, they had few customers. Nevertheless, those few scattered consumers necessitated the generation of current considerably in excess of what they actually required. They would see from the report that at the end of the first six months about 100 consumers were connected, the number of lamps being roughly about 1,100, the total equivalent of 25-c.p. lamps, including motors and fans, being at that date about 1,700. At the end of the year, viz., on June 30th last, the number of consumers was 247, the lamps connected 2,857, and the total equivalent of 25-c.p. lamps, including motors and fans, &c., 5,201. It was true that those figures were not up to the estimate of 4,000 lamps for lighting purposes only, mentioned at their last meeting, but several reasons could be advanced for that. The principal reason was the difficulty they had so far experienced in completing installations quickly. There were no outside wiring contractors in Barbados, and consequently all the installations had to be done by the company. That necessitated the training of men for the work, but as the wiring business was naturally very brisk at the start, their staff of trained men was really inadequate. That difficulty had already disappeared to a certain extent, and they hoped to encourage local tradesmen to take up the business of wiring and fitting, in order that consumers could be connected quickly to the company's mains. They also had to face the competition of the gas company, a very keen competition at the present time. In fact, they were led to believe, by the reduction the gas company had made, and the terms on which they sometimes supplied fittings, that the advent of electric light was seriously felt by them. But the keener the efforts of the gas company to secure new business became, the more sure might they be that they were making progress. The shareholders might be interested to know the corresponding figures to those given above for the period which had elapsed since the close of the year under review. The only figures available were for the months of July and August. During those two months, 27 new consumers had been connected, the additional number of lamps being 345. Another 2-h.p. motor and some fans, &c., brought the total additional equivalent of 25-c.p. lamps connected during the two months to 472. Since the close of the year they had succeeded in securing a contract for an extension of the public lighting of Bridgetown. That was important for the company in two ways; firstly, from the important point of view of the revenue to be derived from the contract, and secondly, because of the continual public advertisement which such public lighting afforded. They were convinced that many residents would be persuaded to adopt electric light when they saw it in the streets. The contract was equivalent to an addition to the mains of 360 25-c.p. lamps. They were hopeful that, in time, that contract would lead to a still larger contract for public lighting. They were gradually securing a number of consumers for power purposes also. The installations of that nature were mostly small. Motors for a total capacity of 77 h.p. were connected at June 30th—that compared with 25 h.p. at the close of the half year. A further total of 36 h.p. had been ordered during the current year. The profit and loss account showed a loss on trading for the year of £467d. That was made up of a loss on the supply of power, less profit on installation. Dealing with the revenue from sale of power, that had been considerably lower than should have been the case if they based their calculations of consumption per lamp on home experience. The time of the year, however, when their installations were few, was really the season which should have shown them the best results. Other causes had also contributed to the low consumption. The residents in Barbados were, he understood, noted for the early hour at which they retired but with the prospect of better lighted streets, and, perhaps, electric tramways, they might look in the future for later hours, and a consequently greater demand for light. The expenses during the year were stated in the report to have been for a full normal year's working. That did not mean that they had reached the highest level to which expenses might mount, but they might appreciate the force of the statement when it was pointed out that double the current could have been sold without, possibly, a penny increase in the expenses. Local administration and general expenses could not vary very much. The only other heavy revenue charge was for power expenses, and it was not anticipated that that would increase materially during the present year, as last year's account had had to bear the cost of experimenting with different classes of oil fuel. They were still paying a high price for that fuel, but it was hoped that in time they might be able to get a better supply at cheaper rates. They hoped to be in a position when submitting the accounts for the current year to report a small profit, but although the directors had every confidence in the future of the undertaking they wished the shareholders to appreciate that progress would not be so rapid as was originally anticipated. With the acquisition of the Barbados Tramways Co. by an American syndicate, and the granting of a concession for electrifying the system, they had hoped to come to arrangements with the syndicate for the supply of the power required. Negotiations had been carried on for some time with the parties interested, but they had not yet made up their mind what policy they intended to adopt, and it was probable that they might have difficulties under their concession unless they decided at an early date what they proposed to do. The balance-sheet showed that a further 1,503 preferred shares had been issued during the year. Those represented a portion of the amount agreed to be subscribed for by contractors in respect of construction work. A still further amount would be issued in a similar way during the current year, when a final settlement was made with the contractors and retention moneys paid. The item of £3,000 loan which was appearing in the balance-sheet was explained at the last general meeting. The report told them that that loan had been paid off since June 30th, and a new loan of £10,000 secured by an issue of debentures had been raised. The rate of interest was 7 per cent., and they had the power under the debentures to raise a further £5,000 on similar terms should it become necessary. The additional moneys were required for the extensions and the supply of fittings necessary for the public lighting, the laying of further mains on the road to Hastings and St. Lawrence, a district which was rapidly developing, and in other directions. The extension of the mains for public lighting would naturally secure for them other consumers in the districts where the mains were laid.

Mr. W. F. Leese seconded the motion, and the report was adopted.

Perth Electric Tramways, Ltd.

An extraordinary general meeting of the above company was held at the offices of the London Chamber of Commerce, Oxford Court, E.C., on Friday last, under the chairmanship of Mr. Oliver Wethered, for the consideration of two resolutions. The first resolution provided that subject to the second resolution being passed, the provisional agreement dated May 23rd, 1912, and made between the company of the one part and the Hon. Sir Newton James Moore on behalf of the Government of Western Australia of the other part, providing for the sale of the company's tramways and part of its other property to that Government, be approved, and that the directors of the company be authorised to carry the same into effect. The second resolution provided for the alteration of the Articles of Association so that on the completion of the sale and the winding up of the affairs of the company, the remaining assets should be applied as follows:—First, in repaying to the holders of the preference and ordinary shares of the company the capital paid up on such shares respectively, and subject as aforesaid, one equal tenth part of the balance of such assets to be paid to the directors of the company as remuneration for their services in negotiating the sale, and the remaining nine equal tenth parts of the balance to be distributed among the holders of the preference and ordinary shares *pari passu* in proportion to the amounts paid up on the preference and ordinary shares held by them respectively.

The Chairman explained that he occupied the chair at the request of the board, as Mr. Stoneham was a very large shareholder, and preferred to be present in his capacity as a shareholder. With regard to the resolutions, he intended to leave the matter entirely to the shareholders, but he ought to tell them that proxies representing 62,233 ordinary shares and 82.515 preference shares had been received in favour of the scheme. He would leave it for some shareholder to propose the resolutions.

Mr. Bailey formally proposed the adoption of the first resolution, and Mr. Dudley Ward seconded the motion.

Mr. Francis said he did not think it was a right thing for the board to have called an informal meeting of the preference shareholders, who had practically arranged for the way in which the ordinary shareholders were to give up their surplus rights. He should have thought that directors of responsibility and honesty would in such a case have conferred with the ordinary shareholders as well. It seemed to him that the whole of the circular was drafted in such a way as to prejudice the position of the ordinary shareholders, for the future of the company had been set out in the blackest light. The circular said that if the ordinary shareholders did not consent to pay what was practically blackmail the company was to be carried on in the future for the benefit of the preference shareholders. He approved of the sale of the undertaking, but he considered the proposed division of the assets was preposterous. They knew one of the directors was largely interested in the preference shares, and he did not seem to be content with the honorarium he would get, but wanted his pound of flesh. He believed if the ordinary shareholders who had given proxies knew the truth, they would not have given them.

Mr. Ward: The preference shareholders have found as much capital as the ordinary, and should have an equal voice in the matter.

Mr. Jacobs proposed an amendment in the wording of the first resolution with the object of leaving it open for the directors to amend the second resolution later.

The Chairman said he considered Mr. Francis's remarks as to honesty distinctly offensive, and most uncalled for. The board had done their very utmost to bring about a just position. A week ago the ordinary shares stood at 14s., and they now stood at 24s. or 25s. Such remarks as those made by Mr. Francis were not in the interests of other ordinary shareholders whom he did not represent. The object of the board was to do the best for both classes of shareholders.

Mr. Lock said he represented about 800 preference shares, and attended the meeting of the preference shareholders referred to. The company had been running a considerable time, and they knew what the result had been. In 13 years the ordinary shareholders had received 25 per cent., whilst the preference shareholders had received three times that amount. At the 1911 meeting the chairman referred to a conversation he had had with the Premier of Western Australia, who told Mr. Stoneham frankly that the public in Perth would not allow their means of locomotion to be in the hands of a private company, and that view had been borne out by the fact that the Perth City Council had adopted an obstructive attitude towards the company. Quite recently the Government with great difficulty got a Bill passed for the purchase of the undertaking, and in his judgment the board of the company had shown great skill in negotiating the provisional contract by which they got £475,000 for the property. After paying off the debenture stock, that would permit of the payment of 27s. or 28s. to each class of shareholders. At the 1911 meeting the Chairman told the shareholders that the preference shareholders would not come into the scheme unless they had a substantial inducement to do so, and he also said that considering the small value attaching to the ordinary shares, it would be a fair thing if the interests of the preference shareholders were capitalised on a 4 per cent. basis, or in other words, that the preference shareholders might reasonably expect 30s. per share as an inducement to consenting to give up a valuable investment. Mr. Francis was present at that meeting, and spoke, but he offered no objection to the suggested appropriation. At the informal meeting of the preference shareholders, it was made abundantly clear that they had no desire to sell, but rather than stand up against a good sale they agreed to come in on terms. If the preference shareholders declined to come in, there could be no sale, but the brunt of further obstruction and hostility on the part of the Perth local authority would fall on the ordinary shareholders. If the ordinary shareholders wanted him to come in as a preference shareholder, his figure was that mentioned in the resolution.

Mr. Andrews pointed out that the ordinary shareholders might have received more dividends in the past had further capital been raised, instead of undivided profits having been applied to extensions. He would be quite willing to give the preference shareholders a bonus of 1s. or 2s. a share.

Mr. Ward: At the preference shareholders' meeting you agreed to equal division.

Mr. Andrews said that since then he had had time to reflect. He thought the policy of the preference shareholders was a selfish one. The sale could not take effect yet, and he asked if the board contemplated paying a larger dividend this year. He suggested a dividend of 10 per cent.

The Chairman said they could hardly expect him to discuss what dividends would be paid.

Mr. Jacobs spoke in support of his amendment, and complained that the board had broken their trust in calling the meeting of preference shareholders. He did not say the board had not acted perfectly honestly, but they had been misguided. He considered that 2s. 6d. was sufficient bonus for the preference shareholders and appealed to fair-minded men to accept that compromise. He also pointed out that the preference shareholders could not veto the sale if a sufficient number voted for it.

Mr. Francis seconded the amendment.

Mr. Bailey said he understood that the preference shareholders had certain rights and were determined to exercise them, and he proposed the resolution because he thought they had no power to help themselves. Having heard the discussion, he did sincerely ask the preference shareholders to have some regard for the ordinary shareholders. He had stuck to the ship from the start and had got very small dividends.

Mr. Lock: We are helping you to get a very substantial sum for shares worth 14s.

Mr. Booth, as both an ordinary and preference shareholder, supported the sale, as he did not think Australia offered a good field for them in the present state of public feeling. As a preference shareholder, however, he felt he was squeezing the ordinary shareholders, and he did not think the preference shareholders were standing on a moral basis.

Mr. King asked if the Western Australian Government were not told that the preference shareholders would require about 30s., and was it not on that ground that the company obtained the magnificent sum of £475,000?

Mr. Stoneham (chairman of the company) said the negotiations were very difficult and lasted for weeks. When they commenced, the preference shareholders were in a good position and the ordinary shareholders were in a bad one. Before the meeting in 1911 he saw several of the largest preference shareholders about the matter, and they said they would not sell except on a 4 per cent. basis, which meant 30s. a share, and he told the shareholders of this at the meeting. The offer from the Western Australian Government was a very great deal less than £475,000, and he said it was impossible to accept such a price, for he knew the views of the preference shareholders. It was only by pressing that that he obtained the £475,000 on the distinct understanding that the preference shareholders would get 30s. a share. He approached the preference shareholders, and tried to get them to take a more moderate view, and ultimately they agreed to take the equal share. At that time it looked as if each class of shareholders would get about 25s. a share, but now it looked as if it would be considerably more. They consulted counsel as to procedure, and the resolutions were drafted on the advice of counsel. The circular was an absolutely correct statement of the facts. They had everyone antagonistic to them. The conductors, drivers, the local Council and the Government were all against them. He never minded a fight when there was a chance of success, but to fight against tremendous odds like that was absurd. He held over 10,000 ordinary shares, and speaking as an ordinary shareholder, he would say it was absolute madness to refuse the offer.

Mr. Bailey said that after hearing Mr. Stoneham's remarks, he was perfectly satisfied.

The amendment was rejected by 13 votes to 7, and the resolution was carried by 14 votes to 4.

Mr. King, in proposing the adoption of the second resolution, said that there had been a good deal of ethereal sentiment talked, but they had to look at the question from a business point of view. He doubted whether the receipts of the tramways would continue to increase. They knew the effect of motor-'bus competition on the London tramways, and the threat had been made that the Perth Council would run motor-'buses to depreciate the value of the tramway undertaking.

Mr. Beddow seconded the motion.

Mr. Jacobs again criticised the action of the board in consulting the preference shareholders, and said Mr. Stoneham had gone a long way out of his way in referring to the position of the preference shareholders in his negotiations with the Agent-General.

Mr. Stoneham: The man who conducts a sale has the right to use the best means he can to get the best offer he can. Otherwise I should have got £50,000 less. Instead of criticising me you ought to be jolly thankful.

A further amendment to reduce the price which the preference shareholders would get under the scheme was defeated, and the resolution was carried.

A meeting of the ordinary shareholders was then held, and a similar resolution was proposed.

Mr. Francis moved an amendment to the effect that the preference shareholders be paid 25s., and that the balance of the assets should go to the ordinary shareholders.

This was defeated by 17 votes to 4, and a poll was demanded. The poll was taken immediately, and the amendment was rejected by a considerable majority, and the resolution was carried.

A meeting of the preference shareholders was subsequently held, and the resolution passed.

Norwich Electric Tramways Co.

The report of the directors for the year ended June 30th, 1912, contains the following comparative figures for the years 1911 and 1912:—

	1911.	1912.	
Total receipts	£35,644	£36,713	Inc. £1,069
Total expenditure ..	27,159	26,730	Dec. 429
Net profit	£8,485	£9,983	Inc. £1,498

The above amounts for expenditure include debenture interest, donations, and London expenses. To the sum of £9,983 is added £1,013 brought forward, making a total of £10,996 to be dealt with. The directors recommend that this amount should be appropriated as follows:—£2,500 to reserve fund account; £7,920 to the payment of 3 per cent. dividend on the shares for the year ended June 30th, 1912: £576 to be carried forward.

	1911.	1912.
Car-miles run	1,039,385	1,050,453
Passengers carried . ..	8,490,019	8,817,953
Earnings per c.m. .	8·23	8·39
Expenses per c.m. . ..	5·65	5·50
Earnings per passenger	0·99	0·97

Mr. George M. Chamberlin, the representative of the City of Norwich. retired, and the directors proposed to reappoint him, subject to the approval of the Corporation of Norwich.

The sixteenth annual general meeting was held on October 31st, at 8, Crosby Square, E.C., Baron E. B. d'Erlanger presiding.

The Chairman, in proposing the adoption of the above report, said he was pleased to say that the accounts showed some improvement over those for the preceding year. There was an increase in the gross receipts of £1,069, and a decrease in the expenditure of

£429 giving a net increase of profit of £1,498. He was pleased to say that the company's relations with the Norwich Corporation continued to be of the most cordial character. The receipts for the portion of the year that had elapsed since the closing of the accounts had been considerably interfered with by the disastrous floods that occurred in Norwich in the summer. Notwithstanding that they lost a good deal of traffic during the flood period, progress had been made since, and the receipts for the year up to date only showed a falling off of £850; therefore, unless some unforeseen circumstances should occur, they hoped that the deficiency might be made up before the end of the financial year.

Mr. E. A. Hopkins seconded the motion, and the report was adopted.

New General Traction Co., Ltd.

Baron Emile B. d'Erlanger presided on Thursday last week over the 16th annual meeting, held at the offices, 8, Crosley Square, E.C.

The Chairman, in moving the adoption of the report (see Electrical Review, page 629), said that the accounts represented the results of 16 months' working, but as the situation had been completely altered by the sale of the Coventry tramways to the Corporation under the arbitration award, it would be no use talking of the past. As to the future, after the reconstruction, the capital of the company was now £262,000, represented by 262,000 shares of £1 each, all of the same category and enjoying the same rights. They had already received the purchase price under the award, and as soon as the formalities were completed, what was left of it, after paying the debenture debt and other debts of the Coventry Co., would be paid over to the shareholders of that company—in other words, to the New General Traction Co. When they had got that money in hand, it was their intention to pay off the balance of the £80,000 4 per cent. prior lien bonds—£68,000—and the whole of the floating debt, and a substantial part of the 5 per cent. mortgage debentures. He thought the minimum amount of debentures they would be able to pay off would be £60,000, so that the total capital of the company afterwards would be £262,000, with a debt of some £140,000 in 5 per cent. mortgage bonds. When they were at liberty to do so, tenders would be invited for those bonds, and the lowest would be accepted. In looking to the future they had to count upon their Philadelphian enterprise, which yielded them a fixed sum per annum, viz., £14,000. They would also have the dividends on their holding in the Norwich Tramways, which this year had yielded them £5,700, and they were in hopes that the yield would not be less in the future. They might also count upon certain dividends from their holding in the Douglas tramways, which would bring them in about £700, so that approximately they would have a total revenue of £20,500. From that would have to be deducted the expenses of the company, which were estimated at about £2,000, and 5 per cent. on the mortgage debentures, if there were about £140,000 of them in circulation, would require £7,000, so that the total deduction from the profits would be about £9,000, leaving about £11,500 for distribution. A dividend of 4 per cent. would absorb £10,480, and leave a small balance to be carried over.

Mr. E. A. Hopkins seconded the motion.

The Chairman, in reply to a shareholder who asked for an explanation of an item of £1,448 appearing in the balance-sheet as the cost of shares in the Light Railways Syndicate, Ltd., said that the company had a small interest in some light railways in Essex, which they sold for a certain amount in cash, and they also received a certain number of shares. Personally, he did not think there was much prospect of the shares ever being of any value.

The report was then adopted.

German Electrical Companies.

The accounts of the *Deutsche Elektrizitats Werke Garbe, Lahmeyer and Co., of Aix-la-Chapelle*, show that the sum of £11,000 has been allocated to the depreciation fund in 1911-12, as compared with £8,500 in the preceding year. Including the balance forward, the net profits amount to £40,000, as against £38,000 in 1910-11, and a dividend of 5 per cent. has been declared on the share capital of £150,000, being the same rate as in the previous 12 months. The special reserve fund receives £5,000 and the dividend equalisation fund £15,000, as in 1910-11, leaving a balance of £12,000 to be carried forward.

The *A.G. für Stickstoffdunger, of Knapsack*, reports profits on manufacturing of £25,000 in the financial year comprising the six months ended with June, 1912, as compared with £21,000 in the 12 months ended with 1911. After placing £9,800 to depreciation and making other allocations, the net profits are returned at £11,900, which sum permits of the payment of a dividend for the six months at the rate of 6 per cent. per annum on the share capital of £150,000. In 1911 the share capital was reduced from £180,000 to £120,000, in order to extinguish the deficiency incurred in 1910 and to provide for depreciation, and it was then raised to £150,000 for the extension of the power plant, whilst the net profits of £87 in 1911 were carried forward. The directors' report states that the production of sulphate of ammonia in the first six months of the present year yielded suitable profits, but the prices for cyanamide were unsatisfactory, although the conditions for carbide slightly improved.

The results of the *Bayerische Stickstoff Werke, of Munich*, in the year 1911-12, which ended on May 31st, 1912, were unfavourably influenced by an explosion which occurred in the cyanamide works in June, and operations had to be suspended until the middle of November. During the succeeding four weeks, carbide alone was produced, the output of cyanamide only being able to be resumed in December. The low water level of the Alz caused through the drought in 1911 also rendered it impossible to work at full power, and, in the circumstances, the period of production in the financial year only comprised 4½ months. The sale of cyanamide in agricultural circles increased, and the extraction of sulphate of ammonia had been commenced. After providing for depreciation, losses by fire, and extinguishing the deficit brought forward, the accounts exhibit net profits of £123 on a share capital of £330,000, which sum has been placed to a reserve fund.

The report for 1911-12 of the *Berliner Electrizitäts Werke*, which control the supply of light and power in Berlin, states that the number of consumers increased by 3,744 to 36,909, and the value of the connections advanced by 9·8 per cent. to 226,940 kw., of which 86,252 kw. devolved upon lighting, 119,279 kw. on power supply, and 21,409 kw. on high-pressure current for industrial purposes. Including the consumption of the company's own works, the output amounted to 223,370,000 kw.-hours, as contrasted with 198,030,000 kw.-hours in the previous year. Lighting absorbed 54,260,000 kw.-hours, power supply 75,650,000, railways 69,850,000, and high-pressure supply 23,610,000 kw.-hours, as against 9,820,000 kw.-hours in 1910-11. The maximum demand at any one time reached 94,570 kw., as compared with 87,685 kw. in the preceding year. As a consequence of the augmentation in the output for railway working and of high-pressure current, which at the same time caused a reduction in the cost of production, the average price realised in Berlin, after deducting local taxes, declined from 15·36 pfennigs per kw.-hour in 1910-11, to 14·75 pfennigs last year. If the gross profits did not increase in the same degree as the number of connections and the supply of energy, the report states that this is due, apart from the advance in the cost of materials, to the progressive participation of the industries of Berlin and suburbs in the purchase of current. The accounts show the following figures for the past two years:—

	1911-12.	1910-11.
Ordinary share capital	£2,207,000	£2,207,000
Preference 4 per cent. shares	1,000,000	1,000,000
Loan debt	2,847,000	2,874,000
Gross profits	910,000	877,000
Renewals fund	28,000	20,000
Depreciation	238,000	222,000
Municipal share in profits	187,000	174,000
Net profits	747,000	725,000
Dividend on ordinary shares	264,000	264,000
" " " per cent.	12	12

The report mentions that the turbine of 20,000 kw. for the Oberspree station is nearly ready, and a second for the Rummelsburg station is in course of construction. Including balances at banks the accounts indicate debtors for £242,000 as compared with £244,000 in the previous year, whilst creditors have increased from £335,000 in 1910-11 to £756,000 in the past year. On the other hand, securities and other investments represent £1,512,000, as compared with £1,278,000 in 1910-11.

Buenos Ayres City and Suburban Tramways Co., Ltd.—Mr. George Kitching, the chairman, presided on Wednesday over an extraordinary general meeting of the shareholders of this company, held at 2, Broad Street Place, E.C., when the following resolution, which was passed at the ordinary meeting held on October 18th, was confirmed as a special resolution: "That Article 4 of the company's articles of association be altered by deleting therein the figure '77,001' and substituting therefor the figure '1,' and also by deleting therein the figure '192,000' and substituting therefor the figure '115,000.'"

STOCKS AND SHARES.

Tuesday Evening.

Markets are swayed so much from day to day by the number of cross-currents, that it is impossible to say there is any definite tendency. On Tuesday it is Austria which provides the nigger in the hedge; on Friday morning the whole set of conditions may have been kaleidoscoped, and the considerations of the earlier part of the week lost in oblivion. Members of the Stock Exchange just grope their way in the twilight, with little to guide them in answering the innumerable inquiries from clients as to what ought to be done in markets such as these.

The only advice which experience knows to be correct is that good stocks should be held until more settled times. Even this, however, does not necessarily apply to such securities as Consols, which are overburdened by an ever-increasing volume of new competing issues. In the electrical markets, however, quotations, as a rule, are well held, and excitement is confined to an extremely limited circle.

One of these circles is that for Underground Railway stocks; the temptation to descend to an extremely obvious pun must be manfully resisted. Metropolitans have fluctuated violently. From 52½ the price jumped to 55¼, and after receding a little, it finishes with a rise of 2¼ on the week. Districts are quieter, and of late the speculation in them has died down considerably, but Underground Electric Railways spurted, the Ordinary shares rising to 4, while the 1s. shares advanced to 13s. The reason for the Metropolitan's acquisition of the Great Northern and City Company remains a cause of much perplexity and curiosity. Nothing has transpired to account for this deal at present. Rumours of the Midland taking decisive action brought about a jump of 2 points in City and South London Ordinary, but the improvement did not last. Great Northern and City Preferred remain at 2⅝. East Londons eased off to 8¾ before rallying to 9⅛. Central London Ordinary and Deferred are both a little better.

No improvement has occurred in British Electric Traction issues —in fact, the 7 per cent. Preference stock is down another point. London United Tramways Debenture after being better, eased off again; the Preference kept steady at 5⅜ middle, and expectation is keen as to the announcement which is looked for with reference to some kind of working agreement between this Company, the Metropolitan Electric Tramways, and the London County Council.

Liquidation in other parts of the House brought a few sellers into the English Electricity Supply market, with the result that three or four falls have occurred. The principal is a drop of 10s. in City of London Preference; the Ordinary retain their comparative steadiness at 17. Counties, however, are ¼ easier at 11½. Chelseas again shed ⅛, and Metropolitans are an equal fraction lower at 3¾. In consequence of this, the yield on the last-named company's Ordinary shares is now the level 5 per cent. The dulness of the market during the past two or three weeks affords some evidence that the recent attempt to make capital out of a possible amalgamation or working agreement between the various companies, local authorities and others was at least ill-timed: for, as we ventured to observe last month, the information is at all events premature. Those who bought shares on the anticipation of early and substantial advances in prices must be somewhat disappointed.

The Colonial and Foreign group of supply and power undertakings has not attracted much attention. Good stock is scarce, as may be exemplified by reference to an order given the other day to a broker for the purchase of River Plate Debenture stock, an order which the broker had to return because he was unable to find any on offer. River Plate Preference, by the way, is *ex* dividend, and the price is 3 points lower in consequence. Northern Light and Power bonds are also quoted *ex* dividend, the distribution taking the shape of deferred interest warrants, as before. The Mexican issues are quietly steady, with two or three rises to their credit. Monterey Fives recovered ½. Mexican Light and Power Common gained 1, and the three bond issues of the Mexican Light and Mexico Tramways Companies are all harder. On the other hand, Mexico Tramways Common shares fell 2, the market being influenced by depression in Brazilian Traction shares, which have given way by reason of selling from Paris and Brussels. British Columbia descriptions moved up on Monday last, the 5 per cent. Preference stock putting on 1½, and the Deferred stock rising 2. Rio Trams, Montreals, and Shawinigans are comparatively steady, though the last-named seems to come on offer as soon as buyers make their appearance. A good rise has been secured by Toronto Power 4½ per cent. Debenture stock, which at 100½ is 3 up, and the honour is shared by Canadian General Electric Common with a similar gain at 120.

National Telephone Deferred is still on the sliding scale, the price falling back to 153, which is some 10 points below the highest touched recently. Probably some of the stock which has come to market during the last fortnight is for account of weak holders forced to realise, because people who profess to have an intimate acquaintance with what is going on, maintain that the stock is well undervalued at 160. Still, it is not the thing which the cautious buyer would touch unless he knew something of what was taking place behind the scenes. Marconi's, after being 5¼ bid, eased off to 5⅛. The evidence which is being taken before the Select Committee of the House of Commons is declared in the market to be favourable to the price of the shares, but the reasoning which leads to this conclusion may be more clear to our readers than it is to us. The market position in Marconi's, as in other speculative shares, is a good deal clearer than was the case a week or two back: and part, at any rate, of the improvement in the price of the shares is simply the result of bear purchases.

Success attended the issue of the £60,000 6 per cent. Debentures offered by the Indian Electric Supply and Traction Company, and the price in the market is 1 to 2 premium. Manufacturing shares as a whole are steady. Brush Second Debenture has been marked down 3½ points. Edison & Swan hardened to 8s. 9d., but reverted to 7s. 6d. middle. Rubber shares remain dull on the sagging of the price of the raw stuff, and at this week's sales in Mincing Lane about a penny per pound less was obtained than was the case a fortnight ago.

Grassington Electric Supply Co.—At the annual meeting held at Grassington last week, Mr. C. E. Lowcock, chairman, presiding, the accounts for the year ended August 31st, showed that the revenue from light supplied was £154. It was reported that a considerable extension of plant had been made during the year, and arrangements had been made with the Linton Mills Estates Co. on favourable terms for the acquisition of additional power, not only for present needs, but for extensions.

Edmundson's Electricity Corporation, Ltd.—The petition for the confirmation of the reduction of the capital from £800,000 to £640,000, is to be heard by Mr. Justice Neville on Tuesday next, November 12th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, November 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£26	..
a Lead, Nitrate	,,	£29 10	£3 inc.
a ,, White Sugar	,,	£25 10	..
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3¼d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£85	.
b ,, Wire, in ton lots	,,	£112	.
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	..
c ,, Tube (brazed)	,,	11¼d.	.
c ,, ,, (solid drawn)	,,	9¾d.	..
c ,, Wire, basis	,,	9½d.	..
c Copper Tubes (brazed)	,,	1 0⅛d.	..
c ,, ,, (solid drawn)	,,	11½d.	..
g ,, Bars (best selected)	per ton	£92	£1 inc.
g ,, Sheet	,,	£92	£1 inc.
g ,, Rod	,,	£92	£1 inc.
d ,, (Electrolytic) Bars	,,	£82	..
d ,, ,, Sheets	,,	£99	..
d ,, ,, Rods	,,	£87	..
d ,, ,, H.C. Wire	per lb.	$10\frac{3}{16}$d.	..
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	4/3½	2¾d. dec.
l Iron Pig (Cleveland warrants)	per ton	66/9	7d. inc.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 15	17/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 12 6	7/6 dec.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11½d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£231	dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/2	1d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£31 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co.

Prospectuses. — *The Indian Electric Supply and Traction Co., Ltd.*—The list closed on Wednesday in an offer of £60,000 6 per cent. debentures at 94 per cent. The proceeds will be applied first in paying off an existing issue of £48,296 of 6 per cent. debenture stock, thus freeing the company's assets from all existing charges.

Mexico Tramways Co.—It is announced that for the purposes of providing funds for extensions to the tramway system, for advances to subsidiary companies in connection with the developments of their plants and business, and for repaying temporary loans, and for other purposes, the board have decided to offer for subscription at par, the balance remaining unissued of the share capital of the company, viz., 35,000 shares of $100 each.

West African Telegraph Co., Ltd.—The directors have declared an interim dividend at the rate of 4 per cent. per annum for the six months ended at June 30th.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9½— 10½	..	5 4 9
Do. 4½ % Pref...	10	4½	4½	8¾— 9¾	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord...	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½— 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4¾— 5¼	.	4 13 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4½— 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	5†	4½— 4¾	⅛	5 5 3
Do. 4½ % Deb...	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	⅛	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122		4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	6	4†	11 — 11½	⅛	5 4 4
Do. 6 % Pref.	10	6	6	11¾— 12¾	..	4 19 0
Do. 4½ % Deb...	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101 xd	..	4 8 3
Edmundson's, Ord.	5	Nil		1⅛— 1⅜	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾— 5¼	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4¾— 5¼	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½— 7¾		5 14 3

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
	*	1911	1912			£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½— 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½		1¾— 2¼		3 10 8
Do. 6 % Pref.	5	6	6	4¾— 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4	3½— 4	⅛	5 [illegible]
Do. 4½ % Cum. Pref... ..	5	4½	4½	4½— 4¾	..	4 17 4
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4¼— 4¾	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 18
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	9½— 10½	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb...	100	3½	3½	85 — 88		3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅝— 1⅞	..	..
South London, Ord.	4	5	..	3 — 3½	.	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛— 1¼	.	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord...	£3	Nil		½— ¾	..	..
Do. 5 % Cum. Pref.	5	2		2⅞— 3⅛		..
Do. 4½ % First Mort. Deb...	100	4½	4½	84½— 88½		5 1 8
Westminster, Ord, ...	5	10	9†	8¾— 9¼		5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾— 5¼	..	4 [illegible]

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends 1911	Dividends 1912	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5½— 5¾	..	5 4 4
Calcutta, Ord.	5	8½	..	7 — 7½	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½— 94½	..	5 5 9
Canadian Gen. El. Com. ..	$100	7	7	118 —122	+3	5 14 1
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	¾— 1	..	8 0 0
Do. 5 % Deb.	100	5	5	94 — 97		5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	+1	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	½— ⅝	..	Nil
Do. 6 % Pref.	1	6	6	⅝— ¾	..	8 14 6
Kaministiquia Power, 5% G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½— 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	86 — 88	..	5 13 8
Mexican Lt. & Power, Common	$100	4	4†	84 — 87	+1	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105 xd	..	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	+1½	5 3 1

NAME.	Stock or Share.	Dividends 1911	Dividends 1912	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83½— 86½	+ ½	5 15 7
Montreal, Lt., H. and Power ..	$100	8	9†	231 —236 xd	..	3 16 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	39 — 42 xd	..	..
River Plate, Ord.	Stock	10		240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	108 —111 xd	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	140 —144	1	3 11 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108		4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½		4 6 2
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½— 101½	+ 3	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅞d.	13/16— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	.	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends 1911	Dividends 1912	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4	..	7¾— 8¼	..	4 18 6
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	145½—147½	..	5 8 6
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	8	[illegible]	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½—111½	..	5 7 7
Do. Def...	Do.	30/-	..	25¼— 25¾	½	5 17 1
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	[illegible]	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½— 7¾	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	..	4 16 8
Cuba Telegraph	10	6	..	9½— 10½	..	5 14 3
Do. 10 % Pref...	10	10	10	16½— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3½— 4	..	5 0 0
Do. 10 % Cum. Pref... ..	5	10	10	6¾— 7¼	..	6 18 0
Direct United States Cable ..	10	5	4	7⅛— 7⅜ xd	..	6 11 2
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	129 —132	..	5 6 1
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79	..	4 8 1
Do. 4 % Mort. Deb.	Do.	4	4	98 —100	..	4 0 0
Eastern Extension	10	7	7†	12⅞— 13⅛	— ⅛	5 6 8
Do. 4 % Deb.	Stock	4	4	99 —101 xd	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101 xd	+2	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10¾— 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12¾— 13¼	..	4 10 7
Great Northern Telegraph ..	10	18	18	28 — 29	..	6 4 2
Indo-European Telegraph ..	25	13	5†	56½— 58½ xd	— ⅛	5 11 1
Mackay Companies Common ..	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 1/16— 5 3/16	+ 1/16	3 17 0
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅜— 4⅝	..	3 14 0

NAME.	Stock or Share.	Dividends 1911	Dividends 1912	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Monte Video Telephone, Ord...	1	6	5†	15/16— 1 1/16 xd	..	5 13 0
Do. 5 % Pref.	1	5	5	¾— ⅞ xd	..	5 14 8
National Telephone Def. ..	Stock	6	..	152½—154½	—1½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	97¾— 98¾ xd	..	4 11 2
Oriental Telep. and Elec. ..	1	8	6†	1¼— 1⅜ xd	..	4 9 9
Do. 6 % Cum. Pref.	1	6	6	1 3/16— 1 5/16 xd	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10½— 11½	..	8 16 2
Submarine Cables Trust ..	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼— 7½	— 3/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅜— 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3¼— 3¾	⅛	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10¾— 11¼	..	5 7 10
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¾— 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	13¼— 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	96½— 98½	..	4 1 3
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 — 101	— ½	4 9 1

Unless otherwise stated, all shares are fully paid. * Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16 — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½ — 13½	..	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	36 — 39	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	90 — 94	..	5 11 1
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81 xd	..	5 7 2
Central London Railway, Ord.	100	3	3†	73 — 75	+1	4 0 0
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	..	72 — 74	+1	2 14 1
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1½	1¼†	42 — 43	..	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	106 —108	+1	4 12 7
Do. Do. 1901	100	5	5	106 —108	+1	4 12 7
Do. Do. 1908	100	5	5	106 —108	+2	4 12 7
Do. 4 % Deb.	100	4	4	97 —99 xd	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32 — [illegible]	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5⅛ — 5⅝	..	..
Do. 4 % Deb.	100	4	4	70 — 74	—2	5 8 1

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	55 — 55½	+2¼	2 19 1
Do. Surplus Lands	100	2⅞	2¼†	63 — 65	..	4 4 7
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	84 — 86	..	4 1 5
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	39 — 39½	+ ¾	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	97 — 99 xd	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	87 — 90	+1	5 0 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅛ — 1¼	..	4 16 0
Do. Def.	1	Nil	..	[illegible]	..	Nil
Do. 5 % Pref.	1	5	5	[illegible]	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9
Do. 5 % Deb.	100	5	5	96 — 99	..	5 1 0
Potteries, Ord.	1	3½	..	¼ — ⅜	—1/16	..
Do. 5 % Pref.	1	5	5	[illegible]	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	—3	5 11 1
Underground Elec. Railways	10	..	..	3⅞ — 4⅛	+ ⅛	Nil
Do. "A"	1/-	..	..	[illegible]	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	87 — 89	+1	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4 11/16 — 4 13/16	— ⅛	5 17 4
Do. 4 % Deb.	100	4	4	91½ — 93½	..	4 5 7
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Auckland Trams, 5 % Deb. ..	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	[illegible]	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16 — 7 5/16 xd	..	5 9 5
Do. 5 % Pref.	5	5	5	4⅞ — 5¼ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	144 —149	+2	5 7 5
Do. Pref. Ord.	100	6	6	116 —120	+ ½	5 0 0
Do. 5 % Pref.	100	5	5	106 —109	+1½	4 11 9
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb. ..	100	4¼	4¼	101 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	6 — 6½	..	5 7 8
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 8
Cape Electric Trams	1	2½	..	11/16 — 13/16	..	..
City Buenos Aires Trams (1904)	5	5	5†	5½ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97 xd	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
La Plata Elec. Trms, Ord. ..	1	Nil	..	½ — ¾	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼ xd	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	91 — 94	..	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	111 —115	+2	6 1 9
Do. Gen. Con. 5 % Bonds ..	..	5	5	95 — 97	+2½	5 3 1
Do. 6 % Bonds	100	6	6	97 —100	+ ½	6 0 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7 3/16 — 7 9/16	..	6 12 5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½ — 6	+ ¼	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	—2	4 9 1
Rio de Janeiro Trams	$100	5	5†	145 —155	..	3 4 6
Do. 1st Mort. 5 % Bonds ..	..	5	5	100½ —102½	..	4 17 7
Do. 5 % Mort. Bonds ..	100	5	5	96 — 98	+ ½	5 2 0
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	255 —265	..	3 15 6
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 14 4
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102 xd	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	6	..	½ —	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	1/16 — 3/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝ — ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	½ — ¾	..	Nil
Do. Deb...	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	32 — 36	—3½	12 10 0
Callender's Cable	5	15	10†	10¾ — 11 xd	..	6 16 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	2⅝ — 3⅞	..	5 8 1
Do. Deb...	100	4½	4½	105 —108	..	4 3 4

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 5th.	Rise + or Fall —	Present Yield p.c.
Crompton & Co.	8	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16 — 13/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	¼ — ½	..	Nil
Do. fully paid	5	Nil	..	1¼ — 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	¾ — 1	..	7 10 0
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12¾	..	6 13 4
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	10½ — 11½	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	94 — 96	..	6 13 4
Do. Deb...	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13

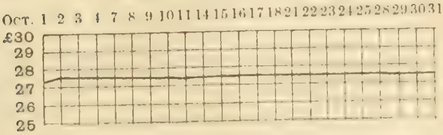
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

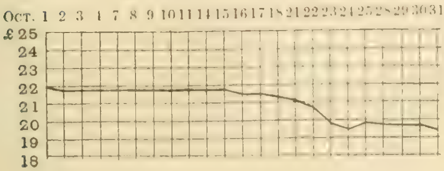
METAL MARKET.

Fluctuations in October.

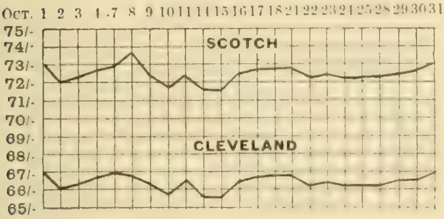
SPELTER (G.O.B's.).



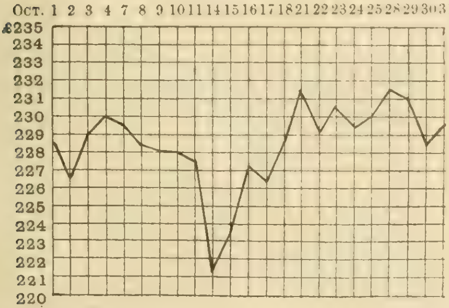
LEAD (ENGLISH).



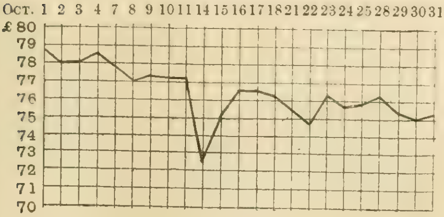
IRON.



TIN.



COPPER (G.M.B's.).



Dundee Electric Lighting.—In connection with the recently authorised extension of equipment for the local power stations, the Electricity Committee of the T.C. have agreed to Mr. Nairn, the convener, and Mr. Richardson, the engineer, visiting various electricity stations and manufacturers' works throughout the country. London, Manchester, Sheffield, and possibly Rugby, will be visited by the deputation.

SWEDISH EXPORTS OF ELECTRICAL GOODS.

The following statistics of the exports of electrical and similar goods from Sweden in 1910 are very interesting as revealing a continuance of the development of the Swedish manufacturing position; figures for 1910 are given for purposes of comparison, and notes of increases or decreases have been added:—

	1909.	1910.	Increase or decrease.
	Kroner.	Kroner.	Kroner.
Electric incandescent lamps.—			
To Finland	30,000	31,000	+ 1,000
,, Russia	51,000	106,000	+ 55,000
,, Denmark	18,000	33,000	+ 15,000
,, Germany	11,000	47,000	+ 36,000
,, Great Britain	33,000	22,000	— 11,000
,, Argentina	38,000	26,000	— 12,000
,, Other countries ...	21,000	16,000	— 5,000
Total ...	202,000	281,000	+ 79,000
Dynamos and parts thereof.—			
To Norway	183,000	564,000	+ 381,000
,, Finland ...	80,000	149,000	+ 69,000
,, Russia	56,000	53,000	— 3,000
,, Germany	36,000	39,000	+ 3,000
,, Great Britain	27,000	93,000	+ 66,000
,, Spain	26,000	63,000	+ 37,000
,, Australia	43,000	113,000	+ 70,000
,, Canada	182,000	127,000	55,000
,, Other countries ...	94,000	32,000	— 62,000
Total ...	727,000	1,233,000	+ 506,000
Electric motors and parts thereof.—			
To Norway	2,000	302,000	300,000
,, Finland	19,000	27,000	8,000
,, Denmark	1,000	61,000	+ 60,000
,, Great Britain	59,000	119,000	+ 60,000
,, Spain	5,000	20,000	+ 15,000
,, Brazil		29,000	+ 29,000
,, Argentina	43,000	77,000	+ 34,000
,, Other countries ...	92,000	37,000	— 55,000
Total ...	221,000	672,000	+ 451,000
Transformers and parts thereof.—			
To Norway	6,000	75,000	+ 69,000
,, Russia		15,000	+ 15,000
,, Denmark		33,000	+ 33,000
,, Australia		37,000	+ 37,000
,, Canada	11,000	200,000	+ 189,000
,, Mexico		19,000	+ 19,000
,, Other countries ...	1,000	13,000	+ 12,000
Total ...	18,000	392,000	+ 374,000
Telephone instruments.—			
To Norway	51,000	77,000	+ 26,000
,, Finland	236,000	279,000	+ 43,000
,, Russia	719,000	1,372,000	+ 653,000
,, Denmark	595,000	224,000	— 371,000
,, Holland	65,000	160,000	+ 95,000
,, Great Britain	794,000	1,933,000	+ 1,139,000
,, Mexico		116,000	+ 116,000
,, Other countries ...	138,000	54,000	— 84,000
Total ...	2,598,000	4,215,000	+ 1,617,000
Petroleum and benzine motors.—			
To Norway...	359,000	477,000	+ 118,000
,, Finland	170,000	244,000	+ 74,000
,, Russia	1,808,000	2,527,000	+ 719,000
,, Denmark	86,000	206,000	+ 120,000
,, Germany	258,000	461,000	+ 203,000
,, Holland	64,000	292,000	+ 228,000
,, Great Britain	18,000	190 000	+ 172,000
,, Italy	162,000	150,000	— 12,000
,, Austria...	130,000	346,000	+ 216,000
,, Other countries ...	146,000	283,000	+ 137,000
Total ...	3,201,000	5,176,000	+ 1,975,000
Turbines.—			
To Finland...	42,000	41,000	— 1,000
,, Great Britain	1,000	72,000	71,000
,, Canada	11,000	236,000	+ 225,000
,, Other countries ...	18,000	31,000	+ 13,000
Total ...	72,000	380,000	+ 308,000
Cranes, &c.—			
To Finland...	26,000	58,000	+ 32,000
,, Russia	9,000	186,000	+ 177,000
,, Other countries ...	62,000	66,000	+ 4,000
Total ...	97,000	310,000	+ 213,000

	1909. Kronor.	1910. Kronor.	Increase or decrease. Kronor.
Copper wire covered with textile threads			
To Russia	62,000	207,000	+ 145,000
,, Denmark	101,000	131,000	+ 30,000
,, Great Britain	99.000	96.000	— 3,000
,, Other countries ...	34,000	22,000	— 12,000
Total ...	296,000	456,000	+ 160,000
Steam engines.			
To Russia	177,000	365,000	+ 188,000
,, Denmark	62,000	26,000	— 36,000
,, Argentina		23,000	+ 23,000
,, Other countries ...	59,000	39,000	— 20,000
Total ...	298,000	453,000	+ 155,000
Steam turbines.			
To Russia	192,000	171,000	21,000
,, Finland	10,000	38,000	+ 28,000
,, Holland	20,000	35,000	+ 15,000
,, Other countries ...	47,000	19,000	— 28,000
Total ...	269,000	263,000	— 6,000

Krona = 1s. 1¼d.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers.—Manchester Local Section.

The inaugural address of the chairman, Mr. Arthur A. Day, was read on Friday last by Prof. E. W. Marchant, vice-chairman, Mr. Day being prevented by illness from attending. Mr. Day expressed the hope that, during his year of office, which coincided with a change of policy of the Institution under new articles of association, the Section would increase in numbers and importance, and that, under the new *régime*, they would experience that renewed vitality which the alterations had been designed to effect. As commercial and political considerations very materially affected the prosperity and progress of electrical engineering, it would generally be admitted that the change which had taken place was in the right direction, and he hoped it would lead, in the immediate future, to an enlarged prosperity for all branches of the electrical industry.

The application of electricity to everyday life was of national importance, inasmuch as it involved such large issues as the abolition of the smoke nuisance in our large towns, the conservation of our national supply of fuel, the utilisation of waste products, and many other problems of a like nature.

In making comparisons with other large industries, one was struck with the relatively small amount of export business done in English electrical machinery. This was one of the directions in which our Institution, in conjunction with the Government, might be able to help the manufacturers considerably.

The first essential to the increased use of electricity was a cheap and efficient supply; this they were now in a fair way to attain in large towns and cities, but notwithstanding this the increase in output was not advancing as it should. The main problem was commercial rather than technical, and it was in this connection that the importance of the change of their articles of association was shown.

The increased use of electricity involved doing everything on a larger scale, from power station to publicity.

In England there were far too many generating stations, and too great a variety in the types of current supplied, necessitating different classes of apparatus for its application. This prevented the manufacturer from producing in quantity, and so increased the cost of apparatus, and, moreover, it confused the ordinary man. Simplicity was undoubtedly a large commercial asset.

With the example of the different gauges of railways and tramways before them, was it not of the utmost importance that some effort should be made to ensure uniformity, if not in detail, in main essentials? Even in smaller matters very large economies were to be obtained by uniformity. Mr. Watson, in his address to the Section in 1909, pointed out that a capital saving of £500,000 could be obtained by the interconnecting of the electric supply networks of the towns just round Manchester.

Their supply stations and networks were going to be, in the future, infinitely larger than they were that day, and if extensions, when made, were controlled by certain general considerations, and plant, when replaced, was similarly dealt with, they would soon see a great difference, and a greater tendency to uniformity. It would not be necessary to aim at uniformity of the whole country on one system; the system most in use in any given area would, he supposed, be generally accepted as the system for that district.

If it were conceded that these things were desirable—viz.:—

1. Large generating stations with large units, &c., in the interests of low cost of production;

2. Co-operation between existing systems of supply, with a view to economising in the cost of station plant, and also in the cost of distribution;

3. Uniformity of systems of supply as far as practicable, and at any rate in adjoining districts, in the interest mainly of the manufacturer, but incidentally also of the consumer, by reason of the reduced cost of apparatus—

was it not within the scope of the Institution to do anything towards attaining these objects eventually, and moving in that direction now?

He suggested that committees should be formed of members of the Institution representing each interest involved, viz., supply authorities, manufacturers, contractors and the commercial community. They would obtain all information necessary for a thorough consideration of the question in the area they were appointed to inquire into, and would recommend the lines on which existing supply authorities should extend, and so on to a main committee, consisting of delegates from the sectional committees, who would consider and revise the whole of the recommendations, if necessary. Having through these Committees obtained the lines on which progress should be made, the Institution could approach the Government of the day, and seeing that the movement would be in the interests of all concerned and also in the interests of national economy and system instead of chaos, he saw no reason why the said Committee should not be allowed to co-operate with the Board of Trade and the Local Government Board, as these Government departments were important factors in the starting or extending of any supply undertaking, and would be able to influence considerably the type of supply started or extended.

The whole process would be gradual, and would be intended to prevent the extension of the present want of uniformity and cohesion between systems rather than the enforcement of any particular system.

It was essential that the Institution should be recognised more by the Government departments and taken more into their confidence. Without the assistance of the Government it would be practically impossible to carry out such a scheme as was suggested by Mr. Ferranti. Before such a scheme could be carried out it would be necessary, for example, to have compulsory powers for obtaining wayleaves; in the case of other interests such as railways and canals, it was recognised that private interests must, under proper regulations, take a secondary place, and the same principle ought to be recognised where energy was transmitted instead of goods and passengers.

Those who had had the responsibility of maintaining the continuity of electric supply during the past 12 months or so, had had brought home to them more forcibly than ever before the importance of electric supply to the community; and how much more important would it become in the case of the larger schemes foreshadowed. It would, indeed, be a matter of national concern. The Government seemed to realise the seriousness of the position judging by the anxious inquiries which they made during the strike as to how long the public supply was able to last. It seemed, therefore, a proper time to put forward a plea for a greater amount of co-operation with the Government. The danger was that, the cause of anxiety having for the time being more or less ceased, the matter would be shelved, and the obvious lessons to be derived from the strike lost sight of.

It should be a national matter to encourage any system of intensive culture of land, which would tend to lessen our dependence on foreign food. Electricity could be used in this direction. Was it too much to ask the Government for a grant, and to help generally to start this system on a large basis, seeing the national importance that the food supply might assume at any time? A larger production of the national food supply at home would enable a larger proportion of our fleet in time of war to be used in direct hostilities, instead of having to be employed in keeping our trade routes open.

A comparatively small sum would effectually prove its profitable nature to the farmer, who would then adopt it from commercial motives, and if not, it would be the Government's business to see that it was done. Was it not possible for our Institution, in conjunction with the Government, to do something in this direction?

Not only could electricity, from a nationally controlled scheme, be used directly in the interests of agriculture, but, by its use in the chemical production of artificial fertiliser by the fixing of the nitrogen of the atmosphere, or by its use in chemical processes generally, as in the manufacture of electrolytic bleaching powder, or for the production of disinfectant or the sterilisation of water, and generally by its use in processes which would be continuous, but which could be temporarily interrupted if necessary, a load factor hitherto undreamt of could be obtained for that scheme, with results in the cost of production that would be of the utmost importance nationally, and which, besides saving our national asset, coal, would probably lead to the introduction of other industries, which, without such a scheme, could never be started.

He did not plead for Government ownership; he did not believe that that would be beneficial, but he thought they should have more recognition and help from the Government, seeing that the application of electricity was so vital to public interests and touched national interests at so many points, and he hoped that, with their new articles of association, much more would be able to be done in the direction of influencing the Government to give to the science of the application of electricity to modern needs in every direction more consideration and encouragement.

Undoubtedly great advantages would accrue from a larger recognition of the value of original research in connection with the electrical industry. It would therefore interest them to know that the Institution of Electrical Engineers was taking this matter up seriously, and that that section was taking a prominent part in it. They in England were not getting the share which they had been accustomed to get in the large industries of the world. The Institution of Electrical Engineers, representing the profession and industry of electrical engineering in England, had a responsibility in this matter that it dare not shirk, and whatever there was that they could do, must be done to keep the electrical industry in England in the front rank of the industries of the world.

A smoking concert was held after the reading of the address.

Yorkshire Local Section.

On Wednesday, the Chairman (Mr. S. D. Schofield) delivered his inaugural address at Leeds.

Proceeding to consider a few points in connection with electricity supply, he said that one lesson to be derived from the coal strike in the early part of this year was that it was incumbent upon all supply authorities to hold very large stocks of coal; six months' reserve stock was by no means excessive. It was becoming a common practice for large works to fall back on electricity supply undertakings when they found themselves unable to obtain coal for steam raising, and when breakdowns occurred, and temporary consumers thus secured often became permanent, and turned out quite profitable ones. This made it necessary to hold larger stocks of fuel than were formerly required. In providing for these contingencies it might, under certain conditions, be sound policy to supplement a coal reserve by storing low-grade oils. This might be done by using obsolete Lancashire boilers as storage tanks, fixing them in such positions as would allow the oil to gravitate to the front of the furnaces.

At their annual dinner in February, 1910, Dr. Kapp remarked upon the tremendous developments that were taking place in the electrical driving of textile factories; since Dr. Kapp first stimulated inquiry upon this subject, the manufacturers had found where their interest lay, and were adopting electric driving as quickly as it could be installed.

One of the main things to be considered in the future was the fixing of standard pressures and periodicities. Engineers interested in the manufacture of motors or incandescent lamps well knew what a boon this would be to them. The day of small supply stations was passing away, and if electrical energy was to be universally adopted for industrial purposes, at prices which would be profitable alike for the producer and consumer, it could only be done when generating with large units at stations where fuel could be obtained easily and cheaply, and where an abundant supply of water for condensing purposes was available.

The jealousy so often existing between local authorities might be a stumbling block in the way of group control. In past years this jealousy had often acted to the disadvantage of the community.

The practice of taking large sums of money from the profits of trading departments, said Mr. Schofield, was a very dangerous one. Let the prices in each trading department be adjusted to leave a fair margin over production or operating costs, as the case might be. If any sum had been taken from the rates in support of an undertaking in its early days, by all means let them return such sum to the rate fund. After providing for interest and sinking-fund charges, repairs, maintenance of plant, &c., let them provide a fund for replacing obsolete or uneconomical plant by more efficient units. Let them create and maintain a reasonable reserve fund, but not too large, as it offered too big a temptation to local chancellors of the exchequer, who naturally wished to keep the rates as low as possible. When all this was done, such short-life apparatus as meters, services, street-lighting equipment, motors and switchgear, cooking stoves, &c., should be paid for out of revenue. In his judgment, any undertaking which did that could be considered on a sound financial footing, and if there was still a large balance left it would be high time that a "Consumers' Protection Society" was formed.

One result of the very excellent plant now provided for electricity generation and distribution was a tendency on the part of engineers to become stereotyped in their methods, and in too many cases to refuse new business because it did not fall in with "red tape" conditions.

Additional consumers had often been obtained by the readiness of supply authorities and companies to step in and supply electrical energy at short notice, when the ordinary power units (steam or gas) had broken down. Apart from the particular advantage to the firm in difficulties, these cases were striking advertisements of the manifold advantages of electric driving, and of the ease with which electrical energy could be obtained in emergencies.

Supply engineers should be always open for business if there was a margin on the right side in it, even if it compelled them temporarily to overload plant and mains. In these days of first-class plant and standardisation, there was a tendency to practise caution until it ceased to be a virtue. The human element was an important factor in securing continuity of supply. In order to obtain the best results, diverse methods were necessary with different men. With one man the best method was stern discipline; with another, persuasion; another, "chaff"; while there was always that type of man known as a "sea lawyer" to contend with, and the busier this one was kept at work, the less time he had to interfere with others. Let them discourage favouritism and encourage ability. If a man was competent, steady and reliable, let them give him a certain amount of responsibility and latitude, make his position comfortable, and encourage him to think about his work. The average man would value his position all the more, and in an emergency would respond for all he was worth to get this machine ready, or that joint made, or the other motor fixed, or keep steam up, &c., as the case might be. Moreover, an appreciable amount of a chief's time in superintendence was saved, and the work went on as well and as quickly when the foreman's back was turned as when he was watching. It was a good thing for a junior to obtain a reputation as one who could be relied upon. There was no easy way to obtain it; it could only be acquired by hard work every day. He should study his own work until no one else could do it better, and very few as well; then study the work of the next man above him until he could do it better than the former.

He was now leaving electrical supply, and taking up an appointment of an entirely different kind, and he very much regretted that this, the first meeting of the session, was the last meeting of the Section which he would be able to attend.

A smoking concert was held after the meeting.

The Turbo-Converter: A High-Speed Direct-current Generating Unit.

By F. Creedy, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, November 7th*, 1912.)

The present paper describes an attempt to supersede such a mechanical monstrosity as the high-speed commutator of the ordinary direct-current turbo-generator by a construction which, though differing from current practice, is far less objectionable.

The fundamental difficulty in the design of a direct-current turbo-generator is the collection of the current from the rapidly revolving commutator, and for this in spite of the engineering skill lavished on the subject there would appear to be no remedy, except reducing the rate of revolution of the commutator. Mr. H. M. Hobart proposed the use of an alternating-current generator driving a rotary converter of the ordinary type.

The present paper describes a new method devised by the writer, in which an alternating-current generator of the induction type feeding a rotary converter is employed, the induction generator being used at the same time as a species of electromagnetic gear. By this means it is possible to reduce materially the size of both the rotary converter and the alternating-current generator, since the output of the system is the sum of the outputs of the component parts, each of which therefore need only have half the capacity of the set.

The turbo-converter, then, in the form in which it has so far been developed by the writer, consists of an induction generator combined into one machine with a rotary converter, one member (preferably the primary) being mounted on the converter shaft and revolving with it, and the other, usually the squirrel-cage rotor, being mounted on the turbine shaft. Fig. 1 shows a diagram of connections of the device.

By mounting the generator primary on the converter shaft, instead of having it stationary as in Hobart's proposal, we make use of the driving torque required by the induction generator, or, in other words, the resistance which its rotor opposes to being revolved by the turbine, in order to drive the converter, which is thereby caused to generate direct-current in addition to its function as a converter.

Let us take, by way of example, a four-pole generator and four-pole converter. Let the converter be running at 1,500 r.p.m., and let the three-phase induction generator be connected to three-phase tappings on the converter armature through the hollow shaft.

At 1,500 r.p.m., three-phase currents at 50 cycles will flow through the tappings on the converter armature. These tappings are so connected that the revolving field of the induction generator rotates the same way as the converter armature. In a four-pole machine with 50-cycle excitation, the revolving field will also go at 1,500 r.p.m. relatively to the primary winding which produces it. Hence the total speed of the revolving field will be 3,000 r.p.m., the sum of its speed relative to its primary and that of the primary itself. The squirrel-cage rotor, and therefore the turbine, will go at approximately the same speed as the field. Hence we have obtained an apparatus in which the generator only runs at a fraction of the speed of the turbine.

In addition to its function as a direct-current generator, the converter changes the power of the induction generator, equal in amount to its own, into a direct-current form, and the total power flows out of the commutator of the set.

The reader will remark the analogy between the present apparatus and the well-known and very successful motor-converter of Bragstad and La Cour.

The reasons for the use of an induction rather than a synchronous generator, which would appear at first sight to be equally applicable, are few but conclusive:—

1. If a synchronous generator were employed, it would be necessary to synchronise the two revolving elements every time the set was started.

2. Owing to the presence of two sources of magnetisation in the set—one in the converter and one in the generator field—it would be possible for the set to "hunt" if overloaded, and for it to fall out of step if accidentally short-circuited and be incapable of picking up again.

3. Collector rings would be required on the high-speed element to excite the field.

The converter portion of a turbo-converter set will be distinguished from an ordinary rotary converter by a number of peculiarities of design:—

1. Owing to its function as d.c. generator, it will require more copper on the armature than a standard converter—exactly the

same amount in fact, as the converter portion of a motor-converter.

2. As the field of the converter has to perform the double function of magnetising both converter and induction generator, it will necessarily be somewhat heavier than that of an ordinary converter.

The magnetising current of the induction generator, in fact, differs 90° in phase from the working current, and circulates in the converter armature in such a position as directly to demagnetise the field of the converter. This field, therefore, must be supplied with an extra number of ampere-turns sufficient to counterbalance the magnetising current of the induction generator.

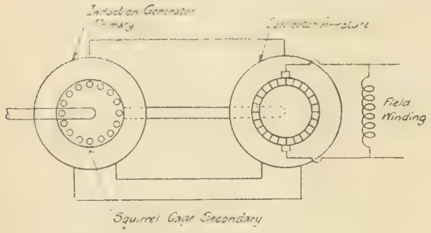


Fig. 1.

3. The drop in speed of a turbo-converter set from no load to full load would at first sight appear to be considerable, as the "slip" of the induction generator is added to the drop in speed of the turbine.

However, if the ratio of speeds of the turbine and converter is, say, 2 : 1, the effect of the slip on the speed of the converter is reduced in the same ratio, so that the resultant drop in speed is much less than might have been anticipated.

If we neglect the slip, the general rule for finding the "gear ratio" of a set having any numbers of poles is as follows:—

"Divide the number of poles on the induction generator by the sum of those on the converter and the induction generator, and the result will be the ratio of the converter speed to that of the turbine on no load."

There should be no difficulty in a machine of any size in reducing the slip of the squirrel-cage induction generator to 2 per cent., so that its effect on the converter speed will be very slight.

The slip in the induction generator might appear to have a seriously injurious effect on the regulation of the set. However, investigation shows that while the series field of such a set requires to be a little stronger than on an ordinary generator in order to offset this, the effect of the slip is of quite small magnitude.

4. Such a set can very readily be employed as a three-wire set. All that is necessary is that the induction generator be connected in "star" and a tapping led from the neutral point to a collector ring, the brushes on which are connected to the neutral wire of the system.

5. The turbo-converter cannot be started from the steam turbine end without auxiliary means. The steam turbine and squirrel-cage rotor attached will start up alone, while the converter portion remains stationary without showing any tendency to start. It is necessary to bring the converter up to a sufficient speed to generate enough voltage to excite the induction generator before the primary and secondary of the latter can get into step.

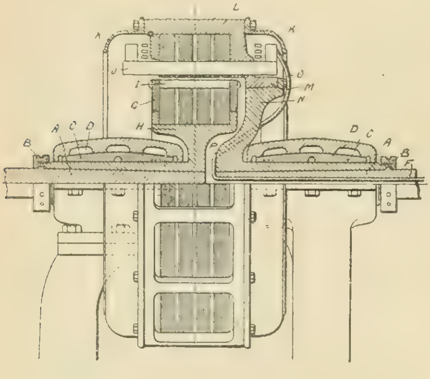


Fig. 2.

If a supply of direct current is available, the converter may be started up as a direct-current motor, when it will bring the turbine up with it to its rated speed of twice or more that of the converter. Steam can then be admitted, and the set will be ready for load. This is by far the best plan where applicable, but of course it requires an appreciable supply of electric power to enable it to be used.

One of the best mechanical methods is the following:—By means of an auxiliary idler shaft the turbine is belted on to the converter by the use of pulleys, which may conveniently be arranged to give the same velocity ratio as the induction generator. On starting the turbine, the converter is brought up to its correct speed by the agency of the belts, and as soon as the field switch is closed will be ready for load. The belts may then be run on to loose pulleys and the idler shaft stopped. This may be done by hand, or automatically by means of a solenoid operated by the voltage across the converter brushes.

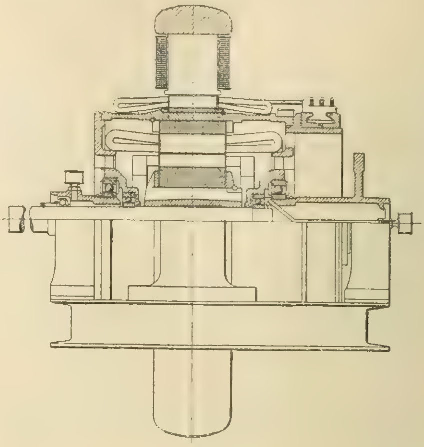


Fig. 3.

Various other methods have been devised, but entail the risk of raising the converter to an excessive speed.

Two different forms of mechanical construction are possible for the turbo-converter. First, the type illustrated herewith (fig. 2), which may conveniently called the "fly-wheel" type; or, secondly, the "spinner" type, like the multiple-speed induction motor made by Mavor & Coulson, of Glasgow. In this type (fig. 3) the squirrel-cage rotor forms the inner element, and is driven direct by the turbine. Surrounding this is a second element, the "spinner" capable of free rotation and also supported by means of ball bearings or the like on the same bearing pedestals in which the squirrel-cage rotor runs. This element bears the primary winding of the induction generator on its inside surface and the armature winding of the converter on its outside surface, being fitted with a commutator and brushes in the usual way.

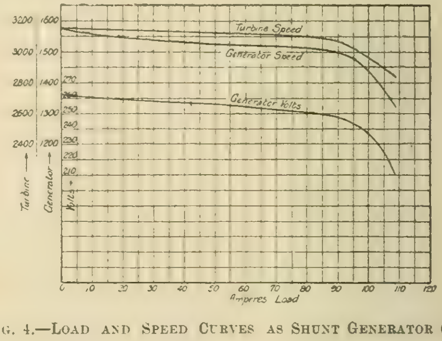


Fig. 4.—Load and Speed Curves as Shunt Generator (no Compounding).

Outside of this again is the field ring of the converter, carrying the pole-pieces and their windings, &c.

The author, however, has hitherto devoted his attention chiefly to the other or "fly-wheel" type of design, perhaps chiefly because it permits of the use of a standard design of converter.

The cardinal feature of this is that both primary and secondary are "overhung," or, in other words, supported by a single bearing. The most essential feature of any single-bearing construction is to reduce the overhang of the centre of gravity of the overhung mass beyond the bearing-nose as much as possible. It will be found in every case that the design adopted enables us to reduce this overhang to a matter of a few inches beyond the bearing nose even in the most extreme cases, and for sizes of 500 kw. In order to do this, an induction generator design of large diameter and short length must be adopted.

We need have no anxiety as regards the effects of centrifugal force on the primary. It is merely necessary to take care that the primary end connections are well anchored in any convenient way. The peripheral speeds of the secondary are also quite moderate. A squirrel-cage rotor is, of course, ideal for high-speed designs. As there is only one bar per slot, which can be pushed through from the end, there is no difficulty in thickening the overhanging lip of the slot sufficiently to take care of the centrifugal force of the bar.

The only point which need cause us any anxiety is the short-circuiting ring of the squirrel cage. This cannot be made of steel, as it must consist of a high-conductivity non-magnetic material. In this connection I wish to draw attention to the properties of aluminium for high-speed work. It will be found, on calculation, that for all high-speed work aluminium gives a factor of safety only inferior to that of good steel, on account of its extreme lightness. Probably some of the new light alloys are still better in this respect. At present prices, moreover, aluminium is, volume for volume, cheaper than any other material except cast-iron and an ordinary grade of steel, again on account of its lightness.

Hence, if we adopt the end-ring construction, in which the end ring G is made of rolled aluminium sheet, we have an ample factor of safety against centrifugal force.

Fig. 2 is a sketch, approximately to scale, showing the mechanical design of a 500-KW. induction-generator. It will be seen that the centre line of the secondary only overhangs the bearing nose by little more than an inch, while the slowly-revolving primary is overhung by approximately 9 in. We may estimate the weight of this, including everything, as not over 3,500 lb., so that with an overhang of 9 in. only and a speed of 600 R.P.M. we are well within the range of fly-wheel practice.

The cardinal features of the design used to obtain these results are two in number.

1. The primary frame is made of a non-magnetic material, in which a number of holes are cast corresponding to the stator slots. Through these holes the stator bars are brought, and so the stator winding is kept outside the frame.

By this means the overhang of the primary is reduced very much, as we do not have to allow space for the end connections inside the frame. The frame abuts solidly on the punchings all round, and there is no hollow space to cause mechanical weakness. There is ample room for the end connections, and they do not have to be cramped in any way; and there is ample ventilation for the end connections.

2. The other important feature of the design is the arrangement by which the joint between the two hubs on which the primary and secondary of the induction generator are built up is made inside the bearing instead of on the projecting part of the shafts in the usual way. This enables us to have a quite ample and rigid bearing surface, and yet only have a shaft extension of about 3 in. in the set considered. The distance between the ends of the two bearing brasses is only about 11 in., scarcely more than it would be with an ordinary flange coupling.

The machine, in general, consists of two forced lubrication, water-cooled bearings of large size, supporting respectively one end of the turbine and the secondary of the induction generator, and one end of the converter and the primary of the induction generator. Mounted on the turbine shaft A by a very long taper fit and keyway is a steel hub H on which the secondary of the induction generator is built up of punchings in the usual way, the end rings of the squirrel-cage winding G being of aluminium, in which holes are punched for the bars I, these being afterwards riveted over on the outside. The primary is built up within a frame L, provided with holes on one side, through which the insulated stator bars J pass. This frame is mounted by a taper fit of ample area and keyway on another steel hub N, similar in general design to that used for the secondary, which is again mounted by a taper fit within the bearing on the converter shaft A. In order to save the space taken up by a nut on the front end, these taper fits are arranged to tighten up from the back, as shown at B B.

The leads O F are brought from the primary winding through the hollow shaft to the converter.

Fig. 4 shows load and speed curves for the experimental machine as shunt generator. In these curves the turbine speed is shown to one-half the scale of the generator speed. Since half the speed of the turbine is the synchronous speed of the generator, the difference between the turbine and generator speeds read off on the generator speed scale is the slip in revolutions per minute of the induction generator. It will be seen that the load was limited by the capacity of the turbine, as this began to fall rapidly in speed above 90 amperes load with the set arranged as a three-wire machine in the manner described above. Load was applied to one side of the system only, the other side being left entirely unloaded. The maximum difference in voltage between the two sides corresponding to full-load current on one side and no load on the other was 3½ per cent.

Ghent Exhibition.—We have received a copy of a French booklet of 50 pages containing the complete regulations controlling the supply of electricity and lighting at the above exhibition. Anybody interested in the matter can peruse the publication at this office.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Alternating-Current Network Protector.

The alternating-current network protector herewith illustrated has been designed to disconnect a defective transformer instantaneously, thus protecting the secondary network by preventing an overload on the remaining transformers and consequently any interruption of the service. The device is entirely electrical, being free from moving parts, and requires no adjustment or attention. In principle it is a series transformer possessing three windings—a primary connected in series with the primary of the step-down or service transformer, a secondary connected in series with the secondary of the service transformer, and a tertiary or auxiliary winding consisting of a few turns of heavy wire so designed that the ratio of current that will flow in them during short-circuits is high as compared with the current in the other coils. The primary and secondary windings of the device are provided with the same ratio of turns as the primary and secondary of the step-down transformer with which it is to be used. The protector is connected in line with the step-down transformer, so that during normal operation the currents in its primary and secondary windings oppose each other in direction, and as the ratios of the windings in the device and in the step-down transformer are equal, the excitation in the two windings of the device is also equal, and, the latter being connected in opposition, no current is produced in the short-circuited coil. A diagram of connections for a three-wire secondary main is shown in fig. 1. One terminal of the primary of the step-down transformer is connected in series with the primary winding of the device. The terminals of the secondary of the step-down transformer are connected to the distribution main through the secondary windings of the device, as shown. In the engraving it will be noted that there are two V-shaped fuses, the bottoms of which are connected to the outer wires of the three-wire secondary network. One of the upper prongs of each of the fuses is connected to the end of its respective secondary coil, while the other prong of each of the fuses is attached to the third and heavy auxiliary winding as shown. The fuses act as a short-circuit connection on these auxiliary secondary coils, and the function of the combination is such that under normal conditions the currents in the primary and in the secondary coils of the protective device neutralise each other, so that there is no MMF circulating in the core of the series transformer to energise the auxiliary or heavier secondary winding. This balance is maintained at all loads and is upset only by a reverse current from the secondary network into the transformer, such as is occasioned by a short-circuit in the latter. This condition immediately reverses the relative polarity of the secondary coils, thus energising the core and causing a heavy short-circuit current through the heavier or auxiliary secondary winding by way of the short-circuiting fuses. The short-circuit current through the fuses immediately ruptures them and isolates the main terminals, so that the defective transformer is instantly cut out and disconnected from the line, thus permitting the remaining transformers connected to the network to continue their function of taking up the load of the defective transformer, without any resultant interruption to the service. The device is made by the Metropolitan Engineering Co., Brooklyn, N.Y.—*Electrical World.*

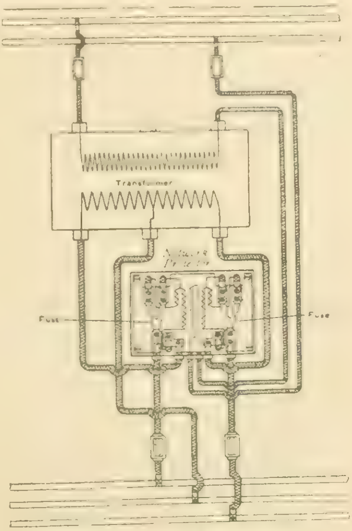


Fig. 1.—Diagram of Connections.

Wardle Lanterns.

A well-illustrated 24-page catalogue for 1912-13, which has been issued by the Wardle Engineering Co., of 196, Deansgate, Manchester, contains very full particulars of the "Streetlite," Watertight, "Beatark," "Onelite," "Drawlite," and "Vertolite" fittings, and brackets and accessories made by the firm. Views showing typical Wardle installations are also included. Our view, fig. 2, shows a 100-c.p. watertight fitting made in spun zinc or copper of heavy gauge; fittings of this type are made for single lamps of up to 1,000 c.p. and for clusters. Fig. 3 shows the "Vertolite" fitting for four 50-c.p. lamps.

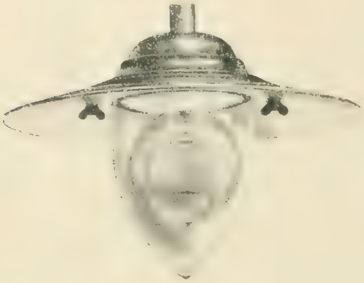


Fig. 2.—Wardle Watertight Fitting.

This type of fitting is claimed to be the cheapest on the market, and is particularly suitable for interior illumination owing to the combination of direct and indirect lighting. An effective advertisement can be displayed on the bowl.

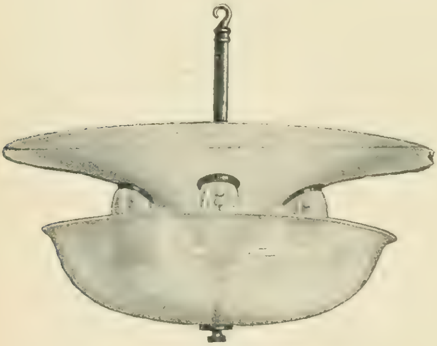


Fig. 3.—Wardle "Vertolite" Fitting.

The Wardle Engineering Co. are the actual manufacturers of the various fittings which they list, and have, we understand, built up a big home and foreign trade in their specialities.

The company has taken offices at 53, Victoria Street, S.W. (Tel. 5688 Vic.), where Mr. F. E. Phillips will continue to represent them.

New Simplex Oven.

Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., have introduced a modification of their well-known "Combination Cooking Outfit," in the form of an improved oven, which is designed to give an increased rate of cooking with a decreased consumption of current by conserving all the heat and providing special means for circulation of the air. The case of the oven is made of highly polished metal, which successfully prevents any loss of radiation, and the heating element is the standard 10-in. size of boiling plate; the boiling plate is, when in use, enclosed in a separate chamber at the base of the oven, which practically forms a false bottom, the bottom itself being suitably heat insulated. In order to increase the top heat by circulation of the air, the sides of the oven carrying the shelves are fitted about ¾-in. away from the actual sides of the oven, giving a duct through which the heated air in the bottom chamber can circulate upward and around the dishes to be cooked.

It is found that this design increases the rate of cooking up to 20 per cent. over the ordinary form of oven, whilst the circulation of the air results in the temperature at the top of the oven being maintained at a temperature within a few degrees of the air at the bottom of the oven.

The price at which it is retailed is well within the reach of the average consumer, whilst the consumption is 1,000 watts with a three-heat control provided for by means of a switch. The internal dimensions are 15 in. × 12 in. × 10½ in., and it is therefore of ample size for a family of six or eight persons.

Electric Window-Display Devices.

To give point to the printed statement near by that his phonograph records are "entertaining," a St. Louis dealer in talking machines has a window exhibit with two round-ended cylindrical record boxes which follow each other with a succession of somersaults around the inclined table top. This odd effect is accomplished by rotating a pair of magnets inside the table beneath the path of the capsule-shaped tumblers, each of which contains a small iron ball, fig. 4. As the balls are drawn around under the attraction of the magnets, the capsules advance with a peculiar somersaulting action that arouses the curiosity of every passer-by.

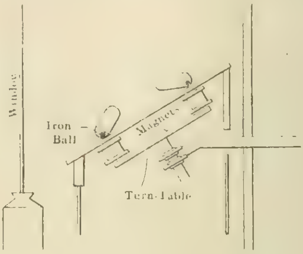


Fig. 4.—Window-Display Device.

Another curiosity-provoking stunt seen in a local drug-store window is a "perpetual-motion" machine made up of four widely advertised razors stuck into a large cork, the whole rotating on a nail point which bears on an inverted glass tumbler. Loiterers in front of the window offer many wise explanations of concealed magnets, commutating devices, &c., but the secret of the continued motion is an 8-in. electric fan hidden among some boxes at the rear of the window.—*Electrical World.*

E.A.C. Testing Rheostat.

The Electrical Apparatus Co., Ltd., of Vauxhall Works, South Lambeth Road, London, have introduced a new testing rheostat, by means of which a current can be regulated and held between full load and 1 per cent. of full load, in steps of 1/300th of 1 per cent. of the full load current. There are five 8-way regulating switches, each having a total resistance of ⅛th of the previous one, so that the sub-divisions of the last switch are one 1/30,000 of those

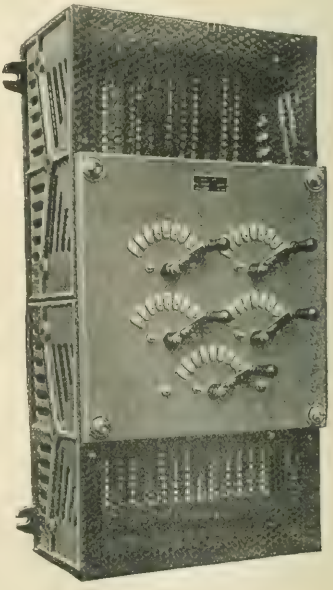


Fig. 5.—E.A.C. Testing Rheostat.

of the first. Owing to the negligible resistance temperature coefficient of the materials employed, a current once set will not alter appreciably. Every rheostat is arranged so that it is impossible to damage it on the voltage for which it is designed. A number of these rheostats have been supplied to central-station test rooms, factory testing departments, and standardising laboratories.

Galalith.

We recently visited the offices of the International Galalith Co.'s London agency, 6-8, Crutched Friars, E.C., to inquire into the electrical properties and capabilities of "Galalith"—that remarkable substance which is manufactured from skimmed milk, and consists of casein. In the simplest form, it is of the colour of cheese ("blonde" Galalith), and partakes of the nature of ivory, ebonite, celluloid and bone, in that it is elastic, tough, practically unaffected by acids, untouched by alkalis and ether, and quite non-inflammable. It appears, therefore, to combine many of the most advantageous features of the very dissimilar substances mentioned above. It can be turned and otherwise tooled with ease, taking a clean thread and a high polish, and it can be pressed and embossed whilst hot. Besides the natural colour, it can be had in over 80 tints, including excellent imitations of ivory, tortoise-shell, and coral, and in transparent qualities. It is not brittle like ebonite. The electrical properties of Galalith are also satisfactory, its resistivity dry being 13,500 megohms, and after soaking for 24 hours in water, 2,300 megohms per centimetre cube, as measured at Faraday House. The dielectric strength of a sheet 0·312 cm. thick was 11,000 volts.

On the other hand, its disadvantages are that, as indicated by the resistance test, it absorbs water, to the extent of 4·6 per cent. in 24 hours; there is no known solvent for it, and therefore, presumably, like ebonite, it cannot be perfectly joined by cement. These, however, are not serious drawbacks, and for parts of switches, &c., for use indoors, and similar purposes, it is an admirable substitute for porcelain, being practically free from risk of breakage, and being made in so many colours and patterns that it can be had to match almost any decorations. The raw material is supplied in long rods up to 18 mm. diameter, and in flat sheets up to 50 × 40 × about 15 mm. thick.

LEGAL.

The National Telephone Arbitration.

(*Continued from page* 726.)

Mr. Andrew Ogilvie, third secretary to the Post Office, in charge of the administration work of the telegraph and telephone branches of the Post Office, gave evidence as to the purchase of the Glasgow municipal telephone system by the Postmaster-General for some £305,000 on May 31st, 1906, and of the Brighton system for £49,000 on October 13th, 1906. In the case of Glasgow, the number of stations taken over was 12,821, a charge of £23·79 per station. In the Brighton case 2,000 stations were taken over at a cost of £24·5 per station. The Glasgow Corporation had a license running up to 1913, and the Brighton license ran to 1926, so these were both taken over as going concerns, and the price paid was for something beyond the mere value of the plant. A comparison of the number of stations on the two systems might not be a bad way of comparing the amount of traffic on the one system and the other, but it was a bad way of comparing the cost of the two systems. In the first place, in making such a comparison it would be assumed that the expenditure on each station represented the cost of construction, not more and not less, and that the quantity of plant in the stations of both systems was the same. In neither respect could there be any comparison in the case. Witness explained by detailed reference to the accounts of the Post Office how it came about that the amount given as capital expenditure greatly exceeded the cost of construction. So far as the amount of plant on the two systems was concerned, he agreed with Mr. Slingo's evidence that there was a much greater quantity of plant installed in the Post Office stations than in those of the company, and the quality was superior. Referring to the Glasgow installation, witness said it was opened in 1901, and a considerable portion of it was underground. Being a municipality, they had no difficulty in giving themselves wayleaves. The Brighton installation was also opened in the same year or in 1902. In 1911 the Glasgow stations numbered 11,843, or a reduction of nearly 1,000. This was owing to a cessation of competition between the business of the Corporation and the National Telephone Co. The competitors had offered their service at a rate of 25s. a year. When the competition ceased, however, and the agreements at this rate terminated, they were not replaced by new subscribers. From 1906 to 1912 out of 12,821 stations, no less than 5,172 stations were given up. Some 4,000 stations, however, were replaced by new subscribers at a higher rate, so that the net loss was a little under 1,000 stations. They were more successful in getting new subscribers at Brighton at the higher rate than they were at Glasgow. In the London system the company's figure for the number of exchange stations was 84,751, but witness said the correct figure was 79,342. On March 31st, 1911, the number of Post Office stations in London, including private wire stations, was 79,342, and in the provinces 42,388, a total of 121,730. On the same date in London the number of private wire stations was 5,192, and in the provinces 5,738. The capital expenditure on these was £818,504 in London, and £235,196 in the provinces. This expenditure made a total of £1,054,000, as compared with £991,000, the calculation made by the company. The number of wires on the Post Office system was 68 per cent. of the number of stations, and the wires of the company to its own stations only, were 56 per cent. That showed that the quantity of plant in use on the Post Office system was greater than that used by the company. In answer to further questions, witness said the estimated capital expenditure on telephone construction for the current year was £968,691, of which £449,408 was for London, £283,546 for the provinces, and £235,737 for trunk lines. That was exclusive of any expenditure on lands and buildings. To that there was to be added £1,831,000 for telegraph construction and maintenance. The ratio of cost of supervision to the cost of construction and maintenance together, was 12½ per cent. on the cost of labour and materials, but in that there was included the cost of the engineering supervision of the Post Office electric lighting plant, and other work which could not be properly debited to telephone construction and maintenance. Witness did not agree with the contention in the company's claim that the cost of obtaining subscribers' agreements should be reckoned as part of the working expenses of the service.

Cross-examined by Sir A. Cripps, Witness admitted that after the Post Office took over the municipal telephone service of Glasgow and Brighton, they had to raise the rates in order to make the service remunerative.

Re-examined, Witness said there was no basis for the assumption that Glasgow was carrying on its telephone system at a loss, or that it was glad to get rid of it to the Post Office.

Sir W. B. Peat, of the firm of W. B. Peat & Co., chartered accountants, was called on behalf of the Postmaster-General, and gave expert evidence respecting the calculations submitted by the company. He said he had not been able to ascertain the exact amount spent by the company out of revenue for capital construction, as he had only had access to the printed balance sheets. He should, however, very much doubt whether they had spent anything out of revenue on capital construction.

Mr. Danckwerts, K.C. (for the company): Well, really, how can Witness say that?

Witness replied that he based his assumption on the speeches of the chairman of the company, which were printed and circulated amongst the shareholders. In regard to depreciation, Witness said the company's tables were arithmetically correct, but he did not think they showed in a fair measure the amount of depreciation. The calculations were all right as a money table. They stated that in 20 years an instalment of £80,243 would, with interest at 5 per cent., yield £1,000,000. That was perfectly true, but that did not mean that within a period of 20 years the figures so given truly represented the actual amount of depreciation which would take place. Such a calculation would be all right if they were dealing with an annuity, which was a fixed amount recoverable from the person who had to pay it, or a lease which terminated on a fixed day. Both were capable of determination to an hour on a particular day, and the yield was a certain regulated sum, but a piece of plant was in an entirely different category. It might yield a profit on one day and a loss the next. It might live for 20 years or only 15; on the other hand, it might live for 25 years. A piece of plant did not pay interest unless it earned it, and then it was profit.

Mr. Buckmaster, K.C. (for the Post Office): And is this table of the company based on the assumption that a certain piece of plant will yield a certain percentage, viz., 8 per cent., throughout a fixed term of years?—Yes, there is the assumption that this 8 per cent. will be yielded with mathematical regularity throughout a period of 20 years. Five per cent. of this 8 per cent. was allotted for interest and 3 per cent. for sinking fund.

Witness added that a table of the character for the purposes of depreciation was perfectly useless. Secondly, even if it were useful, the 5 per cent. allowed for interest was unattainable with safety; and thirdly, assuming that the property was sold at the end of 10 years half of the life of the plant was gone, and if half its life was gone then half its value was gone.

Have you found this to be the case with commercial undertakings of which you have had experience?—Absolutely. I have had 35 years' experience and have never known a case where depreciation has been calculated on this basis.

Witness, continuing, said that a commercial company writing off depreciation could not afford to deal with the sinking fund in the way that had been suggested. A commercial company had to maintain its plant in an efficient state, and to do that it must employ the depreciation fund.

Mr. Buckmaster: You have to provide sums to keep the plant efficient?—Quite so. You have to write off an amount for depreciation in order to maintain the plant in an efficient manner and not put it into the sinking fund. My view is that the sinking fund in itself is an unnecessary element of speculation. To adopt the method of a sinking fund in order to ascertain depreciation is unjust as between buyer and seller.

Continuing, Witness said the balance-sheet for 1911 showed that a total sum expended on construction, exclusive of land and buildings, was £15,677,810.

Mr. Buckmaster asked if any of that sum was represented as purchase money for patents and goodwill of the business?—That was so.

How did you ascertain that?—By referring to the company's accounts, the speeches of the chairman, &c.

Mr. Danckwerts, K.C., said it would be better if the parties were to go into the figures relating to the expenditure on the purchase of patents, &c., and endeavour to agree as to a figure.

Mr. Justice Lawrence said it would be more agreeable if the Court could have an agreed figure.

The Solicitor-General said he assented to Mr. Danckwerts's suggestion. The parties could meet and endeavour to agree upon a figure.

Further examined, Sir William Peat said the original figure put forward by the company as representing the cost of constructing its undertaking was £20,931,042, but the value was rather less There was a difference of upwards of £5,000,000 between the original claim of the company and the amount which its accounts showed had been expended on construction, exclusive of land and buildings. The sum spent on this latter item was £841,000. According to the company's figures, the value of the plant was £18,287,790, which meant that the company had realised that sum on an expenditure of £15,677,810, or a surplus of £3,000,000 odd. Assuming those figures were correct, then the company need not have written off any depreciation at all ; on the contrary, it might have written on an appreciation.

Mr. Buckmaster : In other words, the plant increased in value rather than decreased, as the years went on ?—The claim would certainly lead one to that inference.

Continuing, Witness said he had examined the company's table with reference to the depreciation of the plant, and, in his opinion, it did not disclose a proper measure of depreciation.

Mr. Percy Leake, of the firm of Messrs. Leake & Co., chartered accountants, Abchurch Lane, E.C., was then called. He said he was the author of a work entitled "Wasting Assets." He had estimated the value of the N.T. Co.'s plant at £11,146,621, after allowing for various considerations for and against the company's estimate, and taking the life of the plant at 30 years. Taking the 13·3 years of life assumed by the Post Office, he estimated the value of the plant at £6,914,232, the Post Office estimate being £7,334,794. In his opinion, if the company had spent the whole of its revenue on capital account, the value of the plant could not exceed £14,971,000. The method of estimating depreciation should be fixed by having regard to the length of life of the plant and the cost of construction, and reducing the cost of construction *pro rata* by the number of years of life that had expired. This was what was known as the "straight line" method. He agreed with the previous witness that the method of estimating depreciation of plant by a sinking fund was fallacious, because, taking an estimated life of 20 years for the plant, its maximum value would have been reached by the tenth year, and would be overstated by 25 per cent. as compared with the "straight line" method. Throughout many years of experience he had never heard of an industrial undertaking that invested money in a sinking fund to meet depreciation of plant. The original claim of the company was for £20,900,000, which at 3 per cent. would produce £615,000 per annum. Its dividends from 1907 to 1911 averaged 5 per cent. upon its capital.

Cross-examined by Mr. Danckwerts, Witness said that even on the highest estimate of the company, the valuation of the plant could not be more than £14,296,000.

Sir Hugh Bell, chairman and managing director of Messrs. Bell Bros., ironmasters and colliery proprietors, of Middlesbrough, stated that he was associated with a good many industrial enterprises in the North of England. His company had invested capital of about £1,500,000, and their output of steel was 1,000 tons a day. They consumed about a million tons of coal a year.

Sir J. Simon : Has your attention been called to the sinking fund method suggested for adoption by the company, in order to arrive at the measure of depreciation ?—Yes.

In your experience, have you ever heard of any sale of plant which has been conducted on that basis ?—I do not remember any.

Do you think that such a method is a true guide ?—No, because it assumes that at any moment during the currency of the sinking fund, the fund will be sufficient to meet requirements. It is obvious that the sinking fund only suffices to meet requirements at the termination of its purpose, and not during its currency.

If you wanted to ascertain the value of a plant which had reached some intermediate stage of its life, do you think you could apply the sinking fund method ?—No, I do not.

Cross-examined by Mr. Danckwerts : Suppose the earning power of a piece of plant increased, how would you deal with it then ?—I am at a loss to understand how it could increase.

Well, take a telegraph pole ; supposing you put an extra arm or an extra set of wires upon it, then you would increase its earning power ?—If you did that you would not have the same piece of plant. You would have altered its character. But even then, although you may have succeeded in making it do more work it would not be worth any more money to buy.

Is it not common experience that plant decreases more rapidly in value towards the end of its life than in its earlier stages ?—Oh, yes, of course it does. As a matter of fact, one maintains one's plant so that it will do its work until it is pulled out. It might, perhaps, not do its work so well in the twentieth year of its life as in its fifteenth, but substantially it does its work until the end, and you may disregard that progressive deterioration which obviously must be admitted.

Sir Geo. Gibbs, chairman of the Road Board, said he was the general manager from 1891 to 1906 of the North-Eastern Railway Co. In 1906 he took over the control of several London underground electric railways. During the time he was manager of the North-Eastern Railway Co. the aggregate capital expenditure of the company was £17,000,000, and the aggregate expenditure on working, maintenance, &c., £75,000,000. The capital expenditure of the three underground tubes—the Bakerloo, the Piccadilly and Brompton, and the Charing Cross, Euston and Hampstead Railways—between 1906 to 1910, when he severed his connection with the undertakings, amounted to about £16,000,000. In the course of his experience he had often had to consider problems which arose in connection with arriving at the value of plant. He was constantly concerned in arranging for contracts for the construction of works, and had had to consider the question of proper charges to be made in respect of them.

Sir J. Simon : The method adopted by the Post Office, as you have doubtless seen, in arriving at the reinstatement cost, was by means of allowing a percentage for administration, an additional percentage for the further element of contractors' profits, and then 5 per cent. for what was known as employers' burden. Is that, in your opinion, a proper method to employ ?

Mr. Danckwerts (to Witness) : Have you had experience as a contractor ?—No, not as a contractor.

Mr. Danckwerts (to the Commissioners) : Then I submit that the witness is not competent to give evidence as to what a contractor would do.

Sir J. Simon : Throughout witness's business life he has had to consider the way of arriving at the value of the employers' burden.

Witness said he understood he was asked his view as to the method in which the claim in the present case was dealt with, viz., by taking a complete total to cover everything and for the purposes of examination and investigation dividing that total into four elements : the fundamental cost, the contractors' management and supervision charges, the contractors' profit and the employers' burden. He considered that the division of the total into these four heads was a very convenient method of analysing the cost and forming a judgment upon the matter.

Sir J. Simon : Take the last item ; the addition of 5 per cent. upon what would be the contractors' charge, have you had to consider over and above the contractors' price what is the burden which falls upon employers ?—Yes, in fact the underground enterprise was just such a case. It comprised the contracting for and building an amount of work running into an expenditure of 18 millions of money, and composed of a great variety of elements. The Underground Co. was in the position of the assumed employer, and the kind of questions I had to consider in connection with that work were exactly on all fours with the questions we are dealing with now, namely, to ascertain upon what terms practically and commercially you could secure contracts for the carrying out of a telephone system, the agreed fundamental cost of which was £10,000,000.

Did you in all your tube work place the construction work out to contractors ?—Yes, the Underground Co. was just in the position of an employer, or the owner and financing company for the concern. All the contracts had to be placed with various contractors.

And over and above the total sums paid to the contractors you had to consider what was a proper sum in addition ?—Yes, I had to consider every branch of expenditure in estimating the total.

Witness said that the amount of 5·61 per cent. worked out in the Post Office figures to represent the expenditure which fell upon the employer, known as the employers' burden, was quite a sufficient allowance. That percentage represented a figure of £578,000, which was ample to cover administration and supervision of construction, payment made to consulting engineers, &c. To that figure was to be added the total contractors' charges which made up an absolutely exhaustive classification.

Sir J. Simon : If the materials and labour up to gang foreman cost £10,000,000 odd, would a charge of £7,800,000 for local supervision, engineering, contractors' profits and employers' burden be reasonable ?—All I can say is, I should like to be the contractor. The mere statement of such a figure is sufficient to show that there has been an extraordinary over-estimate.

What do you say to the reasonableness of the charge of £4,300,000 for contractors' supervision and profit ?—It seems utterly unreasonable.

Have you ever come across such a charge as that before ?—Never.

Witness, continuing, agreed with previous witnesses—that the method of arriving at the value of plant by means of a sinking fund was fallacious. Nor did he think that the cost of raising capital should be regarded as part of the cost of construction.

At this point Sir A. Cripps said that if it were convenient for the Solicitor-General, he being himself at saturation point, would suggest that at the close of the evidence they should proceed with the argument on the main part of the case. In the meantime, he thought a considerable advance might be made in the endeavour to arrive at an agreement on outstanding matters. If that were done, he had every hope that in, perhaps, three weeks, the Court would be in a position to consider a lump sum award.

The Solicitor-General said he had still some evidence to call ; it was mainly corroborative, and after that he agreed with his learned friend that it would be most convenient to proceed with the main argument, because if there were an interval they would probably forget more about the evidence than they were ever likely to learn from a study of the shorthand notes.

Mr. Justice Lawrence said that when counsel had finished, the Commissioners would have to put their heads together, and it would be very convenient to have the arrangement about outstanding matters before them, including the question of land and buildings, so that they might all be put into the judgment.

Sir A. Cripps said the parties were trying to see how near they could come to each other on outstanding matters, and both the Post Office and the company were doing their best in that direction.

Sir George Gibb, in cross-examination by Sir Alfred Cripps, admitted that nowadays Parliament, in the construction of a new line, allowed interest to be paid out of capital during the construction work. Until recently, however, it was illegal. That charge for interest, said witness, would count as part of the capital, but not as part of the capital cost, because it did not represent any asset, and capital cost applied only to money expended on usuable and realisable assets. The other was a mere book-keeping entry, which did not add to the value of the plant in the least.

At a later stage in the proceedings, the Attorney-General said he had had an opportunity of discussing and carefully considering with those associated with him, the body of evidence which had been called, and they had come to the conclusion that they would jettison a fair body of the general evidence which it was intended to call. They, therefore, hoped to conclude the evidence on the valuation of the plant that day. In regard to the conclusions the Court might arrive at, he was anxious to have a reasoned judgment on the mains heads.

Mr. Justice Lawrence said they were bound to give a reasoned judgment. If both sides wanted items dealt with specially, the Court would do their best to do so. It had never been his intention since the Attorney-General protested against a lump sum award to abstain from giving a reasoned judgment. It would be more convenient to give a sum in one amount, but he would hear any arguments upon adopting that course at a later stage.

Referring to other particulars in the company's claim, Sir Rufus Isaacs said they were small matters upon which it was impossible for his clients to arrive at a conclusion in their own minds until they had more information supplied by the company. He had mentioned the matter to Sir A. Cripps, and he had no doubt they would be able to agree as to what particulars should be given by the company, but should any question arise during the time the Court was considering its award as to the further information that they were pressing for, he would suggest that the parties might approach the Commissioners in chambers.

His Lordship said it would take some days before the Court could deal with the mass of figures presented and come to a conclusion. If during that time any assistance could be given by the Court, they would be happy to give it.

Sir A. Cripps agreed with the suggestion, and said he would endeavour to supply further information required.

Evidence was then given by Mr. Henry Sparks, a staff officer in the Stores Department of the Postmaster-General, to show that according to the contention of the Post Office, there was little or no charge that could properly be levied for storage during construction.

(*To be continued.*)

Edinburgh Tramways Co. Sued.

"If the notice board says a car will stop and it does not, then it is a delusion and a snare," remarked Sheriff-Substitute Guy, in giving decree for £10 to a cab proprietor who sued the Edinburgh and District Tramways Co., Ltd., for damage done to a cab, which was run into by a cable car. The driver of the cab said that, owing to a notice board at an "island" stating that cars stopped, he thought he was safe, but the car did not stop, and the collision occurred. The cable car driver, on the other hand, asserted that the drivers had no instructions to stop at any "island" unless they got the "bell" to do so.

Tramway Obstruction.

A point in an alleged tramway obstruction case was decided last week by Sheriff Shennan at Hamilton. The Lanarkshire Tramways Co. brought a complaint against J. Wilmot & Sons, showmen, for having, with a traction engine, obstructed the tramway line at Blantyre for 40 minutes. The Sheriff dismissed the complaint, holding that it was wrongly brought, in respect that the essence of the charge was wilfulness, which could not apply to the firm, but to the manager or servant of the respondents.

Weber & Co., Ltd.

In the Companies' Winding-Up Court, Mr. Justice Neville heard a petition by the County of London Electric Supply Co., Ltd., for the compulsory winding-up of the above company.

After hearing Counsel, his Lordship thought no case had been made out for going against the wishes of the majority of the creditors, and dismissed the petition.

Indo-European Telegraph Co., Ltd.

In the Companies' Court, Mr. Justice Neville heard a petition by the Indo-European Telegraph Co., Ltd., asking the Court to sanction a special resolution passed by the company for the alteration of its memorandum of association for the purpose of extending its objects. The proposals were reported in our issue of August 9th last, p. 227. There was no opposition to the petition, and his Lordship sanctioned the alteration of the memoradum as proposed.

Darwen Electricity Supply.—An inquiry has been held into the application of the Corporation for sanction to borrow, among other amounts, £6,650 for the purpose of extending the plant, &c., at the electricity works.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NEW ZEALAND.—The New Zealand Customs Authorities have decided that shaft couplings (to couple a steam engine to an electric generator) are to be dutiable at the rate of 20 per cent. *ad valorem* if of British origin, and 30 per cent. *ad valorem* if foreign.

The Board of Trade have received a cable from H.M. Trade Commissioner in New Zealand, reporting an alteration in the Customs Tariff with regard to the duty leviable on telephones imported into the Dominion. The effect of this alteration is to admit free of duty, telephones which are the produce of some part of the British Dominions, and to levy a duty of 10 per cent. *ad valorem* on all foreign telephones.

SOUTH AFRICA.—The Union of South Africa Customs Authorities have decided that railless trolley 'buses are to be dutiable at the rate of 12 per cent. *ad valorem* if of British origin, and 15 per cent. if foreign.

DENMARK.—The Danish Customs Authorities have decided to levy duty at the rate of 28 öre per kg. on the following goods:—Lamp-shades or globes, consisting of pieces of coloured glass framed with lead and furnished with a metal rim; lamp globes, colourless, but with completely opaque ground.

FRENCH WEST AFRICA.—A new tariff is to come into force on January next. The items in this new tariff which particularly interest readers of the Electrical Review are the following:—

Boilers, steam engines, other motive machinery, motor and engineering apparatus of all kinds, detached parts of such machines and apparatus...	3 % ad val.
Iron and steel for constructional works	5 % ad val.
Fixed and rolling stock for railways and tramways, except articles of woodwork for fitting up the inside of carriages, imported separately	3 % ad val.
All other articles not separately mentioned in the tariff and not included in the free list	10 % ad val.

The free list includes scientific and precision instruments and apparatus (not including photographic instruments or medical and surgical instruments and apparatus).

Note.—The value of goods on which duty will be calculated will be the value in the country of origin, plus cost of packing, freight, insurance, and other expenses up to the port of arrival.

BARBADOS.—*The Board of Trade Journal* publishes a notice calling attention to an Act passed by the Government of Barbados to establish a preferential tariff in favour of British goods. This Act will come into force at the same time as the Canada—West India Treaty. The preferential rates of duty provided for will be applicable to goods, the produce or manufacture of any British country if imported directly from that country, which have been landed only for transit and kept in bond for that purpose. Proof of origin will be required with the bill of entry at the Customs House. Every manufactured article to be admitted under the preferential tariff must be *bona fide* the manufacture of a British country and a "substantial portion" of its value must have been produced by labour in one or more of such countries. The following are the chief proposals of interest to readers of the Electrical Review:—

	Proposed rates. Br. pref. tariff.	Proposed rates. General tariff.	Present rates, applicable to goods of whatever origin.
Copper in sheets, rods, bars, &c., per 100 lb.	4/2	4/2	4/2
Yellow metal in sheets, per 100 lb.	4/2	4/2	4/2
Electric dental appliances ...	8%	10 %	10%
Lamps and lamp chimneys ...	9%	11¼%	10%
Wire	9%	11¼%	10%
Machinery, including motor and other engines, steam boilers, and electric machinery (mentioned in the free list) ...	free	2 %	free
Ditto, not mentioned in the free list	8%	10 %	10%
All other articles not mentioned in the Tariff or in the free list	10%	10 %	10%

Advertising in China.—As our readers are well aware, trading conditions in China demand a style of advertising different from our own. We have before us an illustration of an Osram lamp advertisement published there by the General Electric Co., Ltd., and we hear that circulars and pamphlets regarding Osram lamps are also now drawn up in characteristic Chinese style. Already excellent results have been obtained.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,977. "Electric illuminated revolving advertising apparatus." J. W. Horton. October 21st.

23,993. "Apparatus for automatically operating gas or electric lamps." C. R. Oliver. (Addition to 23,789, 1911.) October 21st. (Complete.)

24,021. "Electric burglar alarm for doors." J. Gabriel. October 21st.

24,023. "Fittings for electric lamps." H. Garde. October 21st.

24,032. "Electric switching devices." H. S. Hatfield. October 21st.

24,043. "Electrical relays." S. G. Brown. October 31st.

24,046. "X-ray apparatus." H. C. Snook and E. W. Kelly. (Convention date, October 27th, United States.) October 21st. (Complete.)

24,051. "Electrodes for use in producing endothermic gas reactions." H. Pauling. (Convention date, October 24th, 1911, United States.) October 21st. (Complete.)

24,058. "Manufacture of wire." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 21st.

24,059. "Resinous condensation products." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 21st.

24,060. "Resinous compositions." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 21st.

24,066. "Electric propulsor." B. P. Gomez. October 22nd.

24,071. "Protectors for incandescent electric lamps." D. L. J. Broadbent. October 22nd.

24,073. "Electrically-operated suction cleaners for the extraction of dust and the like." Armorduct Manufacturing Co., Ltd., P. W. L. Camps, and W. Schmahl. October 22nd. (Complete.)

24,089. "Electromagnetic apparatus applicable for telephonic and the like signalling and other purposes." M. S. Conner and A. R. Kahl. October 22nd.

24,097. "Parallel working of synchronous machines." E. C. R. Marks. (Akt. Ges. Brown, Boveri et Cie., Switzerland.) October 22nd. (Complete.)

24,131. "Electric heaters." J. Nathan. October 22nd.

24,136. "Method and means for the intensification of intermittent impulses." A. M. Nicolson. October 22nd.

24,142. "Electric organs and other musical instruments." J. R. C. Gale. October 22nd.

24,154. "Base fittings for electric incandescent lamps." W. E. Lake. (Geb. Jaeger, Germany.) October 22nd. (Complete.)

24,180. "Controlling switch." J. Pihlens. October 23rd.

24,183. "Electrical step-by-step mechanisms." I. H. Parsons and A. E. J. Ball. October 23rd.

24,203. "Cold electrolytic process for the recovery of tin from waste tinned metal and alloys." A. L. C. Nodon. October 23rd. (Complete.)

24,237. "Metallic armouring of insulated electric cables." A. H. Howard. October 23rd.

24,243. "Arc lamps." H. Weiss. October 23rd.

24,254. "Resinous condensation products and process of making the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 23rd.

24,255. "Plastic condensation products." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) October 23rd.

24,260. "Rheotomes." R. Eisenmann. October 23rd.

24,263. "Trolley arms used in electric tramcars, telphers and the like." R. Dempster & Sons, Ltd., and J. W. Broadhead. October 24th.

24,274. "Secondary electric clocks." W. J. Parker. October 24th.

24,289. "Electrical fittings, stoppers for jars, and the like." A. Waltho. October 24th.

24,313. "Electromagnetic apparatus for driving the pendulums of electric clocks." A. Jabs. (Convention date, October 25th, 1911, Germany.) October 24th. (Complete.)

24,317. "Sterilising appliance for application to telephone mouthpieces and the like." C. W. Akers and S. L. Lightfoot. October 24th.

24,343. "Brushes or collectors for electrical machines." W. E. Lake. (Société Anonyme le Carbone, France.) October 24th.

24,345. "Aerials for use in wireless telegraphy." E. Girardeau. (Convention date, October 25th, 1911, Germany.) October 24th. (Complete.)

24,349. "Electrical deposition of metals and apparatus therefor." C. D. Burnet and A. P. Stohmenger. October 24th.

24,353. "Hinge-lock, specially adapted for controlling an electric switch or switches." H. W. Firth and F. W. Leake. October 24th.

24,361. "Manufacture of metal-filament electric lamps." W. L. Pakenham. October 24th.

24,372. "Switches for overhead trolleys." J. Straiton. October 25th.

24,384. "Switches for overhead trolleys." J. Straiton. October 25th.

24,389. "Electrical resistances or current-graduating devices." Dimming Switches, Ltd., and W. L. Barber. October 25th.

24,404. "Electrodes for secondary or storage batteries, and the manufacture and construction thereof." G. Horley. October 25th.

24,406. "Electrical resistances and condensers." H. W. Sullivan, C. E. Hay and A. D. Hughson. October 25th.

24,408. "Electric telephones." L. G. Hammer. October 25th.

24,409. "Impulse transmitters for electrical circuits." (Convention date, December 7th, 1911, United States.) W. M. Bruce, Jun. October 25th.

24,435. "Electromagnetic ore separators." G. Rietkotter and P. Claes. October 25th. (Complete.)

24,438. "Miners' electric safety lamps." O. Oldham. (Addition to 24,787, 1911.) October 25th.

24,439. "Contact-breaker for electric bells and the like." Sterling Telephone and Electric Co., Ltd., and F. G. Bell. October 25th.

24,443. "Component parts of electric batteries." H. F. Joel, sen. October 25th.

24,484. "Arrangement of the exciting windings of the rotating field systems of electric machines." F. Ljungstrom. (Convention date, October 26th, 1911, Sweden.) October 26th. (Complete.)

24,492. "Pipe unions or couplings for electric conduit junction boxes and other purposes." F. H. Terry, H. M. Bigwood and Brotherton Tubes and Conduits, Ltd. October 26th. (Complete.)

24,499. "Electromagnetic suspension devices." B. Graemiger. (Convention date, October 27th, 1911, Germany.) October 26th. (Complete.)

24,502. "Circuit connection for electrical installations, with mixed loads." Landis & Gyr. (Addition to 22,591/12. Convention date, November 23rd, 1911, Switzerland.) October 26th. (Complete.)

24,503. "Tariff electricity meter." Landis & Gyr. (Convention date, October 27th, 1911, Switzerland.) October 26th. (Complete.)

24,516. "Portable automatic electromagnetic lampholder." F. D. T. Cameron and R. Law. October 26th.

24,540. "Switch for battery of lamps." C. Carangelo. October 26th. (Complete.)

24,541. "Electromagnetic suspension devices." B. Graemiger. (Addition to 24,499 of 1912.) (Convention date, July 3rd, 1912, Germany.) October 26th. (Complete.)

24,550. "Electromagnetic ratchet feeding devices." G. A. Vassberg. October 26th. (Complete.)

24,563. "Ignition devices." W. M. Mordey. October 26th.

24,571. "Renewing metallic-filament incandescent electric lamps." F. Harrison and F. L. Harrison. October 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Circuit Interrupters. F. W. Harris. 21,903. October 4th. (October 8th, 1910.)

Alarm Signalling and Controlling Devices. A. Richter and E. H. Bock. 21,959. October 5th.

Telephone Switchboards. E. S. McLarn. 22,046. October 6th. (October 7th, 1910.)

Couplings for Electric Conductors. A. J. Buckland. 22,188. October 7th.

Electrically-Driven Receipting and Cash-Registering Till. Mrs. H. Godefroid. 22,232. October 9th. (October 10th, 1910.)

Electric Signalling Apparatus for Telephones and the like. G. H. Nash and Western Electric Co. 22,238. October 9th.

Signals for use in Wireless Telegraphy. O. Angelini. 22,443. October 11th.

Telephonic Transmitters, Receivers and other like Diaphragm Instruments. A. Marr. 22,582. October 13th.

Windings of Electric Generators and other Electrical Machines. P. R. Jackson & Co., Ltd., and R. Ainsworth. 23,548. October 25th.

Systems of Arrangements for Indicating the Names of Stations on Trains and for Analogous Purposes. Siemens Bros. Dynamo Works and E. P. Barfield. 23,998. October 30th.

Electric Water Heater and Steam Generator. A. P. Nichols. 24,436. November 3rd.

Electrically-Operated Motor Vehicles. Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. 24,778. November 7th.

Pawls of Electric Controller Regulators. S. Smith, A. Fleming and T. Guerin. 26,291. November 24th. (Cognate application, 29,060 of 1911.)

Electrically-Operated Motor Vehicles. Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. 26,408. November 25th.

Electric Welding Machines. British Thomson-Houston Co. (Allgemeine Elektricitats-Ges.) 26,645. November 28th.

Audible Electric Signalling Devices and the like. T. S. Rogers. 26,909. December 1st. (Addition to 23,802 of 1909.)

Dynamo-Electric Induction Machinery. Akt.-Ges. Brown, Boveri et Cie. 28,388. December 16th. (December 16th, 1910.)

Spinning or Twisting Machines with Separately and Electrically-Driven Flyers. H. Schneider. 29,145. December 27th.

1912.

Vapour-Electric Apparatus. P. C. Hewitt. 183. January 2nd. (January 3rd, 1911.)

Electric Power-Factor Indicators. British Thomson-Houston Co. (General Electric Co.) 193. January 2nd.

Contact Apparatus for Electric Indicators for Indicating the Direction of Rotation of a Shaft. P. Molinari. 2,355. January 29th.

Electric Heating Element. H. J. Dowsing and D. Huntley. 3,253. February 9th.

Electric Animal Exterminators. O. N. Calvert. 3,540. February 12th.

Transmitter for Printing Telegraph Systems. P. Etienne. 4,585. February 23rd. (February 24th, 1911.)

Time-Controlled Mechanism for Electric Switches. R. Haddan. (Copeman Electric Stove Co.) 5,985. March 9th. (Divided application on 22,001 of 1911.)

Electrically-Actuated Pumps for Elastic or Non-Elastic Fluids. W. Richardson. 6,004. March 11th.

Multiple Control of Electric Motors. R. Richter and Maffei-Schwartzkopff-Werke Ges. 6,624. March 18th. (April 21st, 1911.)

Automatic Protection Device for Electric Circuits. P. M. Levy and H. T. George. 8,690. April 11th.

Apparatus for Controlling Direct-Current Electric Motors. Siemens Bros. Dynamo Works and F. Lydall. 9,876. April 25th.

Electrically-Driven Developing Apparatus, chiefly for Writing Telegraphs. A. E. Rappenecker. 13,328. June 6th.

Protecting Devices for Telephone Apparatus or the like. Siemens and Halske Akt.-Ges. 13,853. June 13th. (December 22nd, 1911.)

Dynamo-Electric Machines. Allgemeine Elektricitäts-Ges. 15,589. July 3rd. (July 3rd, 1911. Patent of addition not granted.)

Method of Carrying out Chemical Gas Reactions by Means of an Electrical Discharge. H. Andriessens and J. Scheidemandel. 16,296. July 12th.

Telephone Mouthpieces. E. Björnson and J. Hilditch. 17,171. July 23rd.

Electrical Measuring Instruments. E. Fauvin, E. Amiot and E. Cheneaux. 18,214. August 7th. (September 6th, 1911.)

Mica in British Columbia.—The Provincial Government of British Columbia is about to investigate the commercial possibilities of the mica deposits on Mica Mountain at Mile 53, B.C., on the line of the Grand Trunk Pacific Railway. According to a Government official, the deposit is at a height of 5,000 ft. above the level of the sea on a mountain the summit of which is covered with from 4 ft. to 5 ft. of snow. With the advent of the railroad the development of the mica deposit becomes a matter of commercial importance. It is said that the beds on Mica Mountain will yield sheets up to 10 ft. sq.—*Financial News.*

Fire.—Messrs. Falk, Stadelmann & Co., Ltd., desire to acknowledge the sympathetic messages received in connection with the fire which occurred on Sunday morning last at their premises in Great Saffron Hill, London. Whilst the damage to the building involved has been very considerable, the bulk of the warehouses are intact, and they are, therefore, in a position to carry on business without any interruption, and are quite able to cope with all orders as received.

THE

ELECTRICAL REVIEW.

VOL. LXXI. NOVEMBER 15, 1912. No. 1,825.

ELECTRICAL REVIEW.

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1872—1912.

JUST 40 years ago to the very day—November 15th, 1872—from beneath the shadow of St. Paul's and within a stone's throw of the very place where these lines are now being written, there was " launched into the waters of scientific literature a new barque,"—a modest, unassuming, yet confident and determined little pamphlet of 18 pages ($6\frac{1}{2}$ in. × $9\frac{1}{2}$ in.) of editorial matter. Amid the good wishes of a number of men of eminence in those days it started out upon its voyage, and to-day, after most of those voices have become silent, it continues on its way, still fulfilling the purpose for which it first set out.

Issued first as a monthly paper, it became a bi-weekly in six months, and so appeared until a few years later, when, launching further out into the deep, it became a " weekly," of exactly the size of page on which these words are printed. In the words of its founders, " the applications of electricity had no special organ " then, and it was their intention to meet the want. Thus it has come about that, from 1872 until now, the ELECTRICAL REVIEW has been published regularly without intermission.

With most of us there are periods of life when we sit all-pensively looking backward, and the very atmosphere becomes filled with multitudinous forms and memories. We may be pardoned if, as a paper, we confess—in recalling our birthday—to have let the pensive spirit indulge her fancy. For, after all, papers are at heart really men—like men they breathe, speak, remember—do they not carry the thoughts, and even voices, of ten thousand minds, and hold them, perhaps still full of their old eloquence and verve, in the recesses of Time?

Recollections will crowd upon us of those early days, and of the intervening years—we cannot keep them back—recollections of the men who were in electrical science and industry at their very birth, and associated themselves with this journal when the old 'bus horse still took its measured tread, the aviator had not circled the Cathedral dome, nor had tubes pierced the bowels of London. We recall men who, though those were days of strain and vicissitude with us, had so confident a belief that that little publication had entered the field at the right time, and that a great future was in store for it, that they stood by it with sympathy and constancy. Those early workers have, one by one, passed out of this sphere of small affairs to more peaceful shores, and of those who know the inner history of the early building-up of the ELECTRICAL REVIEW and the sacrifice it compelled to some, but few remain. Distinguished among these is Sir William Preece, who, on a following page, is kind enough to wish us " Many Happy Returns."

Not many copies of the first volume are now extant, but those who have access thereto will find it interesting to compare the programme announced by the founders in simple but definite terms, with the tone and policy of the journal during the intervening years and the character of its contents to-day. Mark the courage of those present at the launching of that little barque of 1872! They had a "determination to overcome any opposition that might present itself." We have consistently endeavoured discreetly to continue that self-same policy, time and time again being called upon to "keep our end up" against schemers and charlatans and envious scribes, either with our pen or in the Courts, or by the adoption of a strong persistent attitude against everything that we suspected would belittle or besmirch electrical interests, or obstruct the progress of those associated with their conduct.

Many a sprightly stripling has since started out on similar purpose bent, but we have never had any reason to do other than wish them well. To quote again the foreword of our first number :—"Experience may prove modification to be desirable, and we shall gladly profit by the teachings of experience." We have always striven to adapt ourselves to the varied changing conditions of forty years, and in the course of our close observation of the doings of contemporary journals few things have stood out so plainly as the manner in which our arrangements, sections, and so forth have been followed. But on such an occasion as our birthday, how could we bring this thought to mind with any idea other than to raise a smile, and not to wound, for may not emulation of ourselves naturally draw from us satisfied and amused congratulations? Suggestions innumerable have been received respecting measures that we might adopt for meeting some detailed or local requirement or fancy. For all these good intentions we are grateful, for we are always glad to be kept closely in touch with the life and needs of the reader; it is not our practice to cast aside any proposal without weighing it in the light of prolonged and close experience of what the majority at home and abroad require. If the reader has been impressed with something in a contemporary that he thought we might imitate, either by way of frivolous jest or peculiarity of style, he may be pretty sure that there is a very good reason why it is in his own interests for it to be absent from the Electrical Review.

If we take pride in one feature more than another, it is, perhaps, in the continuity of proprietorship and editorial and business *personnel* of this journal—a feature which naturally has made for continuity of policy, both in our pages and in our relations with the industry.

We will resist the temptation to indulge in detailed reflection respecting the changes that have come over electrical science and engineering between 1872 and 1912, new developments following with swift-winged feet upon each other, for our readers are all busy with the affairs of to-day, and we ourselves have a journal to produce. Necessity reminds us that "life lies in the future, and not in the past," and we re-echo the words of our predecessors, and say that we are to-day ready as a journal for whatever the years may bring.

The early craft was launched upon an unknown and a troublous sea, and for 40 years that vessel has weathered the storm. We stand to-day—experienced pilot and hardy crew—prepared for any emergency that may arise in service to the industry, assured that with the continued co-operation and harmony prevailing within, and continued support from the leaders and the rank and file of the profession and industry, we shall be able to assist in promoting the best interests of all.

A Coal Engine.

The article which we publish in this issue describing a gas engine which is its own gas producer calls up an interesting picture of what we may yet see in the central station—a row of gas engines with a coal conveyor passing over their hinder ends, and supplying them with small or granulated coal. The picture is not one that will delight the station superintendent, who takes a pride in his humming turbines and spotless engine room, but æsthetics in the power house must necessarily give place to economics.

Is there not in this invention a useful hint for the inventors of gas turbines? One of their difficulties is to get the gas into the combustion chamber, which necessitates the use of pumps; if they can inject it in the solid form, *i.e.*, as coal, they will be relieved of this trouble at least, though they will still have to pump the air in.

The coal engine is really a natural development of the oil engine, and the idea, at least, is old; we remember an engine fed with powdered coal at the Glasgow Exhibition of 1901, made by Messrs. Stewart, but it was not a success. However, that is no reason why the present attempt should fail, and we shall observe its progress with interest.

"A Little Knowledge."

The inquest which took place last week on the death of Mr. J. C. M. Thompson in an electric bath, once more exemplifies the danger of playing with such edged tools as is the electric current, without skilled supervision. So far as the unfortunate victim of the accident was concerned, his action in taking the electric bath was innocent, and we could not reproach him even had he not paid with his life for his harmless indulgence; he had experienced good effects from the treatment, and he could not be expected to question the competence of the proprietors of the baths. But it cannot be too widely known that the electric current in its therapeutic applications, while capable of conferring immense benefits upon mankind when properly applied, is dangerous in unskilled hands. The words of the bath attendant, as reported in the daily Press, tell their own tale to any technical man :—"Through the water he administered an electric current of 400 milliwatts, which was equal to 10 volts, but only about 2 volts would go through the body." What could be more utterly nonsensical?

The facts appear to be that a current was passed through the water in the bath in series with an incandescent lamp, fed from the public mains at 240 volts; obviously a short-circuit in the lamp or the lampholder would immediately throw the full voltage upon the bath, and the patient lying in the water would be in an ideal position to receive a fatal shock. The precaution that was suggested, of substituting a number of small lamps for the single one, is quite inadequate; if the lamps were in parallel, it would multiply the risk, and if in series, there would still remain the fact that on a three-wire system, with the neutral earthed, the lamps might be inserted on the neutral pole, and the patient would be liable to receive a fatal shock between the live electrode and the waste pipe or the supply pipe.

The use of current from the main in this manner is clearly dangerous, unless suitable precautions are taken, and ought to be prohibited.

That ignorance still prevails regarding the danger of a shock from lighting mains is well illustrated by the evidence of an "inspector of installations" reported in our "Notes" to-day; he thought it impossible to be killed by a 200-volt shock. Yet readers of the Electrical Review are well aware that several cases have been recorded in our pages where death has resulted from a lower pressure than 200 volts.

MANY HAPPY RETURNS.

By SIR WM. H. PREECE, K.C.B., F.R.S.

The Electrical Review made its first public appearance on November 15th, 1872, exactly 40 years ago, as the *Telegraphic Journal*. In the following January were added to that title the words "and Electrical Review." I took a keen interest in the paper and for a short time edited it, but the transference of the telegraphs of the country from private companies to the State threw such a burden of work upon my energies that I had to clear away all other work. My telegraphic career commenced in 1852—60 years ago! In 1863 I married, and spent the honeymoon in Paris in a new splendid hotel (the Grand Hotel), which was the first building fitted up with electric bells by Breguet. It tempted me to write a series of articles upon the practical applications of electricity, describing Breguet's system. This attracted the attention of Sir James Truscott, who had just purchased a house in Park Crescent, Regent's Park, and determined to fit it with electric bells. There was no firm in London to undertake the job, so the apparatus complete was obtained from Breguet, and fitted in Park Crescent by two of my telegraph men employed in Southampton, under the direction of a man from Paris.

This was the commencement of the electrical era, which has since grown to such gigantic proportions and in such numerous directions, that the simple system which rang "the tocsin of the soul, the dinner bell," now records on the earth ethereal disturbances in the sun itself. In 1872 the applications of electricity were growing fast in number and importance, so that a periodical journal dealing with all branches became imperative, and the Electrical Review was launched under the title—The Telegraphic Journal and Electrical Review. The first part of the title was abandoned in December, 1891.

In the first number there were 18 small pages of printed journalistic matter. In the last number (November 8th) there are 44 larger pages. In the first number there were six pages of advertisements—in the last number 80!

The year 1872 saw the birth also of the Society of Telegraph Engineers, and the first number of the Review reports the seventh ordinary meeting of that Society under the first President, Sir William Siemens, when a paper was read by W. H. Preece, Esq., on "Lightning and Lightning Conductors." Curiously enough, it was also the year of the birth of that eminent electrician who now occupies the chair—probably our youngest President—of the Institution of Electrical Engineers, as it is now more properly called.

The prominent electrical industries in 1872 were electro-plating and the electric telegraph. What progress has since been made is all duly chronicled in the succeeding numbers of the Electrical Review, and thus your paper becomes a complete historical record, not only of the growth of the practical applications of electricity, but of the science itself upon which these industries are based. It indicates the rapid rate at which the electrical profession has risen to its present prominent position. In 1846, when the first Electric Telegraph Company was inaugurated, the only electric patents existing were those of Elkington for electro-plating (1840), and Cooke & Wheatstone's Telegraph (1837). The Electric Telegraph Co., however, made very small progress in the first few years of its existence, and it was not until Robert Stephenson, George Parker Bidder, and Edwin Clark joined the company in 1851 that it commenced to flourish and to go ahead.

Again, from the original company itself sprang the British and Irish Magnetic Telegraph Co., under the guidance of Charles Bright, and the United Kingdom Telegraph Co. under that of Andrews. Thus commercial rivalry ensured commercial progress in the same way that this progress had already increased the literature of the subjects upon which the industry was based. The growth of the industry as well as that of the Review went steadily on, and in all countries throughout the world the same causes have led to the wide distribution of these industries.

The Electrical Review led to the introduction of the *Electrician*, in 1878, the *Electrical Times* (which was first known as *Lightning*), *Electricity*, and many others at home, while in the United States the *Electrical World* and several other electrical papers flourish as much as our periodicals are flourishing at home. Indeed, there are many of us who find that there are too many publications pouring in upon us every week. Those who are in the van of the business have to study not only the running journals, but also the solid scientific work which is done by the Royal Society, the Physical Society, and other scientific gatherings. Based on the growth of the science, other Institutions and Societies are springing up all over the world. Thus electrical literature and electrical science are growing at lightning speed everywhere.

The activity of the workers and the publication of their works by the literature of the day, as well as the public utility raised by these inventions, have led to a very full and complete system of advertising. Indeed, advertising in these papers has become not only quite a science of its own, but also a necessity for those who are manufacturers and for users who have to pay as much heed to the advertising pages as to the literary pages. Manufacturers themselves must find this growth of advertisement a very considerable source of expense, but while it maintains and tends to maintain the publications in full swing, the public and the scientific world ultimately gain. We now can know everything that is original or novel, and we learn all the advances made in the growth of our science. The life of the Electrical Review is a history of the life of the electrical industry.

There is one point connected with the Review that is very marked—its unwavering adherence to the policy with which it set out when inaugurated in 1872, and which it has maintained to the present day. It caters for all branches of the industry and all classes of the science, but far more than that, we learn of the legal aspect of all the disturbances that arise, and can follow as well the finance of the question and the value of stocks. The proceedings of the innumerable institutions all over the country are published and we learn of the advances made by the municipalities, by the railway companies, and by the various branches of the industries of the country, and we learn, not only the history of what is going on in our own country, but also of the progress in every other country, and above all in the Colonies and outlying branches of the British Empire.

I must congratulate the Editors and Proprietors of the paper upon the position that they have so well maintained, and I trust that I may live long enough to compliment them at some future day on the jubilee of their achievement.

HONG KONG UNIVERSITY.

Since the publication of our last issue we have received from Prof. C. A. M. Smith further particulars regarding the needs and aspirations of the University, together with a photograph, which we reproduce herewith, showing the building as it actually appears. Already there are 35 first-year engineering students—an excellent start; the Chinese are determined to go in for Applied Science, and Prof. Smith believes that if the laboratories are properly equipped there will be at least 250 engineering students in four years. These men will be eagerly snapped up as soon as they have completed their engineering training by Chinese firms developing the resources of their country, and will thus become pioneers and leaders in the native industries; if we choose, by making them acquainted at first hand with the high qualities of our apparatus and machinery, we can make them also invaluable channels for our exports to flow into that vast and virgin area.

Prof. Smith informs us that the University has already received offers of help from enterprising German and American firms, but—as yet—nothing from home; no one ever caught our German or American friends asleep in such a matter, or found them indifferent to, or lacking appreciation of, the immense importance of training the young engineer on the lines most profitable to them, and if our firms are not wide awake, they will lose a unique opportunity, such as may never recur. The University has been founded in the interests of British trade; Prof. Smith is there to help British firms, and wants to have everything British; the laboratories of the University will be first-class showrooms, visited not merely by the students, but by everyone who visits Hong Kong, which is the only British Colony in the Far East; students are already enrolled from the Straits Settlements, Canton, Fuchow, &c., and will carry their impressions of the machines in the laboratories over an immense area. Let us see to it that those machines are all British, and of the first quality; it will be one of the finest investments conceivable.

Hong Kong University.

A British engineering firm of Tai Koo gave no less than £40,000, without which it would have been impossible to commence the University. We are morally bound to support that excellent lead, which in itself proves that there is abundance of trade awaiting us out there. Now let us do our share, and do it well—and, above all, quickly.

We have received from Prof. Smith a list of the apparatus required in the mechanical, electrical and civil engineering departments, which we print below, and we shall be glad to place on record the donations which we confidently anticipate.

List of Apparatus Needed.

Mechanical Engineering Department.

Heat Engines Laboratory.—(1) All kinds of oil engines, to use crude or refined oil, up to 10 H.P. An opportunity to exhibit engines suitable for motor-boats or electric lighting plants; (2) A gas engine and gas producer. The engine to have coupled to it a generator, D.C., 20-KW., 110 volts; (3) Small exhibition sets, steam turbines, say, 5 to 10 H.P., with condensing plant if possible; (4) Refrigerating plant; (5) A small oil-fired water-tube boiler; (6) Indicators for steam and gas engines; (7) Condensing plants; (8) Gauges; (9) CO_2 recorder; (10) Calorimeters; (11) Injectors.

Workshop.—(1) Small lathes; (2) Drilling machine; (3) Planing machine; (4) Small tools; (5) Any measuring appliances.

Electrical Engineering Department.

(1) Ammeters, voltmeters, wattmeters, range 50 amperes, 500 volts; testing sets generally; (2) Motors and generators. Motors of about 5 H.P. desirable; (3) Switches and switchgear; (4) Transformers (about 5 KW.); (5) Rheostats; (6) Telegraph and telephone apparatus; (7) Samples of wires, cables, and fittings generally; (8) Photometric apparatus.

Civil Engineering Department.

Strength of Materials Laboratory.—(1) A 10-ton testing machine; (2) Wire-testing machine; (3) Cement-testing machine; (4) Extensometers; (5) Hardness-testing appliances; (6) Impact testing machine; (7) Apparatus suitable for microscopic study of metals.

Hydraulics Laboratory.—(1) Centrifugal pumps up to 5 H.P.; (2) Pelton wheel up to 5 H.P.; (3) Turbines up to 5 H.P.; (4) Water meters; (5) Plunger pumps.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

The accompanying curves (p. 777) illustrate very clearly the imports of electrical apparatus into Canada, both as regards actual values and the relative proportions.

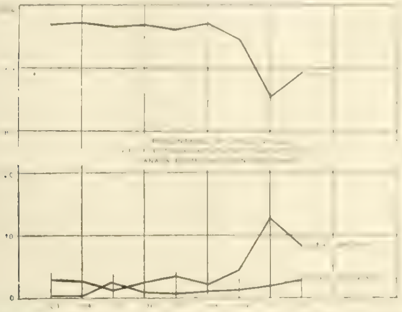
The most striking feature is, of course, the enormous lead which the U.S.A. have obtained over the rest of the world; for Great Britain the most satisfactory one is that while the total imports of this class are increasing at a tremendous rate, the Old Country is securing an increased percentage (see percentage curves) even in the increased import values; and seeing that the import trade of "Other countries" is, so far, almost negligible, it follows that the percentage values of the imports from America are falling in almost the same ratio as the British ones are rising.

As real efforts to secure a share of Canadian trade have only been undertaken during the last three or four years, it is evident that these efforts have been so rewarded as to make the outlook encouraging, and it will be extremely interesting to watch the results of the next few years.

During the nine years represented in the curves Canada's own producing ability has steadily increased, as is proved by the fact that her exports of "electrical apparatus" have multiplied sevenfold; but the fact, already stated in these notes, that her imports are bound to increase at a great rate for many years to come seems evident from a consideration of the Trade Returns, for, as yet, the value of her exports (of "electrical apparatus") is only about one-hundredth of that of her imports; it will, therefore, be a long time before she can keep pace with her own requirements.

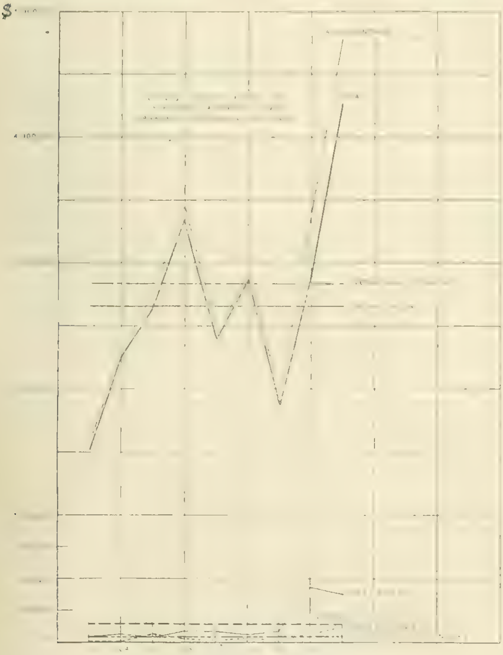
An incident which came under the personal notice of the writer only a few days ago is worth relating here.

The manager of a factory was discussing, with a couple of electrical engineers, the question of installing electric motors, and was quite evidently in favour of purchasing them from a British firm; knowing nothing of motors himself, he sought advice on this question, and was strongly advised against buying from Great Britain, as the engineers in question considered that motors made there were not so strongly made as those obtainable on this side of the water, the efficiency was admittedly slightly higher, but the air gap was so small and the bearings, &c., had so little metal in them, that troubles were soon apparent, owing to the rotor rubbing itself to pieces on the stator and other direful happenings, and that British motors were best left alone.



Percentage Values of Electrical Apparatus Imported into Canada.

The writer believes that the foregoing statements were made not out of any antagonism to British machinery, but due to complete ignorance of it, and a fear of recommending some unknown, and by the engineers referred to, untried articles; had the British motors been better known, there is not much doubt that the manager of this factory would have gone away with the impression that Old Country motors were at least as good as those to be had over here, and would in all probability have sent his order there, whereas it is not at all likely now that he will do this. Cases similar to the foregoing, no doubt, arise very frequently, and end in a like manner, and it behoves home firms to bestir themselves to make their products better known.



Curves Showing Values of Electrical Apparatus Imported into Canada.

CONSULTANTS v. CONTRACTORS.

A second edition has recently appeared of a popular handbook on electricity, in which the author, a consultant, reprints a reflection on contractors which appeared in the original edition. He says, in effect, that any householder considering the question of an electrical installation, big or little, in town or country, should employ a consulting engineer, as no contractor is to be trusted to carry out a satisfactory installation without supervision. This statement is made without any qualification. He might, with some truth, have said that some consultants are more to be trusted in the preparation and carrying out of an installation than some—or even many—so-called contractors. But so mild a statement would not have served his purpose—of bringing grist to the mill; and readers of his book are, therefore, left under the impression that *all* electrical contractors are cheats and rascals without engineering knowledge, who will charge him an extortionate price for bad work, and that salvation is only to be obtained at the cost of 5 per cent. and expenses to *any* consultant.

So broad an indictment is as unjust as it is obviously foolish. A better case, indeed, might be made out for the reverse proposition—that a man contemplating an electric installation will be better served by putting his work in the hands of a good contractor than he will be by employing any consultant. He will obtain a more modern and efficient installation, at something like two-thirds of the price, to say nothing of the 5 per cent. and expenses. More generous than the author referred to above, I will qualify this statement; for there are certainly some consultants—most contractors in a large way of business will be able to count them on their fingers—who do know how to specify a sound, up-to-date, installation. But there are none who can, or will, specify an efficient job, as cheaply as can an experienced contractor.

The reason is not far to seek. The consultant has not the inducement to economy that a contractor has. Apart from the lure, unconscious perhaps, of the 5 per cent., the consultant has no check on his fancy for expensive gear, beyond, may be, the generous approximation with which he has furnished his client. The contractor, on the other hand, is preparing his own scheme, and knows that he is probably in competition with others, and that it is up to him to keep his price down to the limit, unless he can show his layman client obvious value for the increased expenditure. The natural result is that the successful competitor provides his client with full value for his money: with an installation which, if he be a good contractor with a reputation to sustain, will be entirely satisfactory in capacity and efficiency.

The consultant has no such inducement. What consultant, to take a typical example from actual experience, would advise a client requiring an installation of about 40 lights to have a small petrol-electric plant put down which, with wiring and extras all told, only cost £130? Absurd! Too small and cheap! Bound to give trouble! Yet, as a matter of fact, the battery only requires charging twice a week in winter; the running costs for a year are only 70s.; and not a penny has been spent on repairs since the plant was put down.

Another case. Some time ago I submitted a scheme and an estimate, in competition with two others, for a fair-sized country house installation. The owner of the house, perplexed perhaps by conflicting schemes and costs, called in a consultant, who sent the three original tenderers his specification, in which I, for one, had the pleasure of recognising the main lines of my own scheme. But, thanks to the consultant's fancy free, the contract, happily secured at last, works out at over £1,000 instead of the original £600, although the battery capacity, the horse-power of the engine, and the total number of lights are practically identical.

A contractor gives the essentials. A consultant adds the generally unnecessary luxuries. He specifies marble bases to his fuseboards, and real ivory labels. He will want two voltmeters where the contractor would use one with a voltmeter switch. He will work in a booster, where the contractor who knows his business will put down a smaller generator and a larger battery. He will—or, perhaps, it would be fairer to say he did for at least two years after metal lamps were on the market—base his calculations on the use of carbon lamps. He revels in complicated switchboards performing all sorts of unnecessary functions. His main cables invariably have 100 per cent. overload capacity with a no-volt drop, although it is quite time he learnt that no respectable country house ever has more than half the lights on at once. And, generally speaking, he uses the Institution rules with a constant factor of 2 against the contractor. Indeed, there is hardly any imaginable folly which some who call themselves consulting engineers do not commit at the expense of their clients. This very week I have seen a specification in which it is stipulated that every one of some 600 switches shall be furnished with hammered oxidised silver covers, at a list price of 1s. 9d. each—for a workhouse!

To put it plainly, a man contemplating an electric light installation will find that in all cases a consultant is expensive, in most cases unnecessary, and in some cases incompetent. Some of them are ex-contractors who have failed; others are men who have had technical book training and no practical experience. Nearly all are out of touch with current practice. This is not to be wondered at. The average consultant, particularly in the provinces, is happy if he draws commission on half-a-dozen contracts in the year. The whole experience of many of them is limited to, say, a score of installations.

Electric Kitchen at Messrs. Siemens-Schuckert's Cable Works.

Contrast that with the experience of the despised contractors, who, the public are told, are not to be trusted to fix a ceiling rose except under the eagle eye of a 5-per-center or his half-baked draughtsman.

A dozen of the leading firms, known to every one in the trade, can count their hundreds of installations, going back to the "eighties"; installations of every size and description in every part of the country, while many of the individual employés of these firms, and many other of the smaller contractors, can reckon up their "century" of plant jobs. How can any consultant venture to pit his knowledge and experience against the accumulated knowledge and experience of such contractors as —— or ——? (Readers can fill in the blanks for themselves.) Yet our audacious author tells his public they are not to trust such firms. They may know, he says in effect, what they ought to do, even better than I, but do you really think they will do it, unless I keep my eye on them? But it is surely obvious that to firms such as these, whose names are household words, their reputations are their most valuable asset, and they cannot afford to save a few pounds by scamping their work, at the risk of losing a potential recommendation.

It need scarcely be said that none of the foregoing remarks apply to the big Westminster consultants and their like, who, for the most part, do not touch lighting work, and who fill a definite and valuable *rôle* in the electrical world. And of the other consultants who specialise in lighting, there are certain honourable exceptions to the general rule, that a consulting engineer called in to prepare a lighting specification doubles the cost and halves the efficiency. For the ordinary country house or private residence, a consulting engineer is absolutely unnecessary.

Let the householder wishing for a good installation only use the same common-sense that he applies in choosing his milkman, his builder, or his doctor, and choose a contractor who is a contractor only, and not a plumber or an ironmonger—he would not trust his affairs to a lawyer who kept a fried-fish shop—a contractor with a known reputation, recommended to him by his friends, and he may be confident that any work entrusted to such a contractor, with or without competition, will be carried out at least as efficiently, and certainly more economically, than it would be under any consultant.

Let him remember, too, that however good a consultant's specification may be, the merit of carrying it out properly is ultimately with the contractor. Whatever he may pretend to the contrary, no consultant can adequately supervise a job he only visits at intervals. His inspections and tests are, in most cases, mere farce. There are few consultants whom an intelligent foreman cannot hoodwink—and he often does. He dare not, and generally cannot, hoodwink his employer, who is a practical man like himself, if he is the right sort of contractor. There are black sheep in both folds; the layman runs at least as much risk of choosing a bad consultant as of choosing a bad contractor. Somewhat more, to tell the truth: apart from the fact that he is more likely to be in closer touch with contractors, as a class, than with fifth-floor-back consultants.

In fine, the average contractor is not the potential criminal which consultants' specifications assume him to be; he is, at least, as fair and honest as they, and not seldom more able.—H. R. T.

MESSRS. SIEMENS-SCHUCKERT'S ELECTRIC KITCHEN.

[By our Berlin Correspondent.]

The present tendency to transfer large engineering works to the periphery of cities entails a number of economical problems, foremost among which is the provision of a mid-day meal for the employés. Special restaurants with electrically-operated kitchens have therefore been installed in many cases, the electrical energy being available at cost price or at an extremely low rate.

An interesting electric kitchen of this kind has been recently installed at Messrs. Siemens-Schuckert's new cable works at Gartenfelde, near Berlin. This kitchen, which is designed to supply about 300 people, comprises:—

Eight pans, each of 15 litres, consuming	2·6	KW. each
Eight pans, each of 35 litres, consuming	4·2	" "
Three round frying pans, 35 cm. in diameter ...	2·2	" "
Three square frying pans, 40 × 25 cm. diameter ...	1·32	" "
Three square frying pans, 50 × 34 cm. diameter ...	1·76	" "
Two stoves directly connected with two heating cabinets, with a total consumption of	15	" "
One coffee machine of 35 litres capacity, using about	1·7	" "
One water kettle for same, of 35 litres capacity ...	3·8	" "

as well as various smaller pans, all of which were supplied by Messrs. Prometheus, of Frankfort a/M—Bockenheim. The total power consumption of all the apparatus would, at maximum load, be 95 KW. The average consumption, however, is considerably lower, the various apparatus above enumerated never being heated all at a time.

The pans are of a substantial and pleasing design, with double nickel-plated walls, designed for separate bottom and side heating, controlled in four steps. The round pans contain steel sheet vessels, whereas the square pans are made of non-oxidised iron castings. The stoves and heating cabinets are arranged either beside or above one another, thus reducing heat losses by radiation to a minimum; the outside walls are lined with white enamel, and the fittings are nickel-plated. The stoves are designed for both top and bottom heating, and are controlled separately. The coffee machine is combined with a coffee kettle kept permanently warm by the electrically heated water bath. The kitchen table is built of stonework covered with enamelled plates.

The flexible cords are arranged in a most convenient manner, being immediately at hand for use. Separate switches have been inserted in the various conductors, so as to reduce the wear on the contacts and in view of the considerable current intensities in all the larger apparatus. Slewing taps are arranged on a nickel-plated column in the middle of the kitchen table for supplying water to the pans.

All the auxiliary machinery is, of course, likewise operated by electricity, the kitchen being excellently ventilated by electric fans.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Speed of Signalling through Submarine Cables.

A paper by Mr. R. Appleyard in the Civils' *Proceedings*, Vol. CLXXXIV, describes an instrument for use in certain calculations relating to the speed of signalling through submarine cables. The same calculations can be done easily on an ordinary slide rule, with the accuracy specified in the paper cited. The slide rule has an additional advantage, that *the percentage error of reading is uniform throughout the scale.* This fact is not so well known, either by makers or by users, as it should be.

As an example of some of the many uses to which a slide rule can be put, it may be worth while to show how the calculations referred to in Mr. Appleyard's paper can be solved on a slide rule.

The main problem is to make a suitable selection of the innumerable possible pairs of values for D and d that suit a given value for $\log_{10} D/d$, where D is the diameter of the dielectric, and d the effective diameter of the conductor, both in mils.

Let $x = \log_{10} D/d$; then if $d = 10$, D is the antilogarithm of x. Set against the indicating mark, which is generally found in a little recess at the back right-hand end of most slide rules, the value of x read off on the uniformly divided scale marked along the middle of the back of the slide, and turn the rule face up again, when all suitable values of D and d will be found facing each other along the bottom of the slide rule.

Thus if $\log_{10} D/d = {\cdot}207$, we find the antilog of ·207 is 1·611, showing that if $d = 10$, $D = 16{\cdot}11$: and without any further shifting of the slide, we read off at once the following pairs:—If $d = 250$ mils, $D = 403$ mils; if $D = 500$ mils, $d = 310$ mils; and so on.

The capacity in microfarads, and the dielectric resistance in megohms per nautical mile, can also be obtained on a slide rule, using the simple formulæ given in the paper, viz., $c = 0{\cdot}1582 \div x$, and $r = 519{\cdot}8 \times x$; while the weight and resistance of the conductor and the weight of the gutta-percha can be obtained from the following formulæ, which have been deduced from the data shown on the drawing accompanying Mr. Appleyard's paper.

Weight of conductor per N.M. $= 0{\cdot}0145\, d^2$ lb.
Resistance of " " " $= 83{,}250 \div d^2$ ohms.
Weight of gutta-percha " " $= 0{\cdot}002076\, (D^2 - d^2)$ lb.

C. L. T. Griffith.

Madras, *October 24th*, 1912.

Motor-Hiring at Leeds.

The reference in your last issue to the Leeds Corporation motor-hiring proposal appears to have been made without a very clear knowledge of what has actually occurred, and the writer, who has had the privilege of dealing with most of the correspondence on the matter, ventures to think that if all the facts were placed before your readers, they would be convinced that the scheme fully deserved at any rate the temporary check which it has received.

In the first place, several of the leading electrical motor manufacturers in Leeds, including those most likely to be affected by it, knew nothing at all of the proposed scheme until within two days of the date when its sanction was to have been obtained from the City Council. The position with regard to the contractors was also very little better. Those who did know anything with regard to it had had vague promises of wiring held out to them, and at the same time had most carefully been told that the proposal was for the hiring of motors only, and that it did not in any shape or form permit of the actual sale of electric motors. The surprise of the contractors may, therefore, be imagined when they found that the following clause was included in the minutes to be passed by the Council:—

(*e*) That any hirer be permitted to purchase the motor hired to him at any time, at a price not lower than the net figure at which it stands in the books of the Corporation, and that the manager be and he is hereby authorised to sell such motors accordingly.

It need hardly be added that this clause aroused misgivings, for, in spite of all assurances to the contrary, it was felt that the scheme did really include the sale of motors, and that it would at any rate make it almost impossible for anyone else to sell motors in Leeds. After all, when it is looked into closely, this question of hire-purchase or sale almost resolves itself into the proverbial distinction without a difference.

At any rate, in order to avoid the litigation and trouble that has occurred at Leicester and Sheffield, prompt efforts were made to stop the scheme before it could pass the City Council, and after being sent back once, to save a second defeat at the same hands, the scheme has now been referred back by the party who originally brought it forward themselves, excuse being made that they wish to discuss the matter with the local firms.

That this wish for discussion is the merest excuse, will be gathered from the fact that already on two occasions deputations, including five or six principals from the firms interested, had attended on those responsible for the scheme, but the statements then made, and confirmed in writing, showing that the demand for motors on the hire and hire-purchase systems is adequately supplied by a number of firms in this city, have throughout been utterly ignored. Also, on the last of these occasions when we attended a meeting of the Electricity and Tramways Sub-Committee, which comprised two of the Labour Councillors, the Deputy-Chairman, Mr. Robert Armitage, M.P., and the Manager of the Electricity Works, Mr. Harold Dickinson (who was present *ex-officio*), no adequate discussion was permitted. The Deputy Chairman made a statement to the effect that the Corporation proposal related purely to the hiring of motors and had nothing whatever to do with the sale of motors or any other apparatus, or with the wiring. All attempts at discussing these aspects of the matter were at once silenced and ruled out of order.

To return to the position of the contractors, wishing to know their exact feelings in the matter, letters were sent to nearly all the branch secretaries of the E.C.A. in the northern towns, and numerous replies were received all showing the strongest desire that everything possible should be done to oppose the municipal scheme. There is really no question as to the wishes of the individual contractor on the matter.

In the letter to the contractors it was stated that:—"The powers under which the money is to be borrowed include specifically for electric fittings, and there is apparently nothing to prevent the Corporation from carrying out its own wiring if at any time it chooses to do so. It must be remembered that, although made in perfectly good faith, any understanding between the local contractors and the electricity undertaking on this point must necessarily be of only a temporary nature, liable to be changed with change of office, and with the sway of political power in the city."

Your readers will understand that this was not an idle word of warning when they hear that since the date of the letter, the manager of the electricity works, Mr. Harold Dickinson, on whom alone the contractors of Leeds were willing to place any reliance for the fulfilment of promises, has received an improved position as manager of the Liverpool undertaking. The party on the City Council bringing the scheme forward also lost its majority in the November municipal election. The contractors do not know who is going to be manager of the Leeds electric light and power station in the coming year, and, apparently, it is very doubtful whether we are even to have a duly qualified electrical engineer at the head of affairs.

On glancing through your article I find that mention has been made to the hiring out of gas stoves. Well, exactly the same point was brought forwards at Leeds, but it was stated authoritatively before the City Council that the Corporation were now losing thousands of pounds a year at this business. It was also vouched for at a meeting of the Chamber of Trades that there were thousands of obsolete gas stoves in the empty houses of Leeds not worth removing, but still figuring on the Corporation books. Really, this hiring does not seem such a good wrinkle to take from our gas friends, after all.

Henry S. Ingleby,
Ingleby & Co., Ltd.

Leeds, *November 5th.*

The Lighting of Bakers' Ovens.

As a reply to the query of "Blight" in your journal this week, we venture to offer a simple solution to his difficulty. Use the ordinary lamp that has an Edison screw cap, and place it in an air-tight fitting, the usual stock article to be had from all the leading houses. Then fix this to a swivel bracket made of barrel of the necessary dimensions, and wire the same with flexible copper conductors, either asbestos-covered or copper strands insulated with beads, in the same manner that many of the elements of heating apparatus are connected up. The mere fact of the lamp being screwed into position and not being held rigid by means of the plungers as in bayonet holders will minimise danger from parts coming unsoldered, as they will not be under any strain, if the solder does go. Also the encasing effect will save the actual lamp itself from the effect of such high temperatures.

A. C. Hands.

London, E.C., *November 9th*, 1912.

Your correspondent, "Blight," would do well to scrap the gas fitting to which he refers, and try asbestos-covered flex. inside a flexible metal tube, about 3 ft. 6 in. long. To this can be fitted a backplate and an ordinary bayonet lampholder, a 16-c.p. carbon-filament lamp and a wire guard, no part of which should be soldered. The lamp should have good clean contacts, with a minimum of solder.

The backplate can be screwed to a wood block (mounted well clear of the hot-oven front) outside the oven door, together with the controlling switch. The metal tube should, of course, be earthed. Connection from ceiling roses immediately above the ovens should be made by means of asbestos-covered flexible inside a braided asbestos tube. The general warmth will maintain the insulating properties of the asbestos.

This arrangement has been in daily and most successful use by the employés of a large bakery in this town for the last three years.

The ovens, four in number, were previously lit with gas, which was found useless, as some moist heat in the form of live steam is applied, which extinguishes the gas.

The weakest point is the lamp cap contacts, but the average life of the lamps used exceeds two months. Probably manufacturers could overcome the difficulty.

I understand that each lamp spends about 80 minutes of every 24 hours in the ovens, which work at temperatures of 550°-575° F.

Blighter.

Wimbledon.

Fuse Formulæ.

Mr. Murdoch's reply to my letter of the 28th ult. contains no references to the points I raised. I therefore conclude that I have convinced him that he had not understood the paper he set out to criticise.

Of course, if Mr. Murdoch is only out for "amusement," we may ask in vain, but, perhaps, some of your readers would like to know which formula he finally recommends. In his first letter he upholds the index 1·5, and in his second puts forward 1·0.

The hypotheses upon which the latter is based are certainly more extravagant than the supposition that ρ_θ is constant (I presume ρ_0 in the second letter was a slip of the pen), especially as the author of the original paper supposes that the current "is increased very slowly until the wire fuses." Naturally this cannot be absolutely true, but the fact that the current density will be greatest where ρ_θ is least has an obvious tendency to eliminate the small temperature gradient over the cross-section. Owing to the high thermal conductivity of copper, a very slight temperature gradient will cause a very rapid thermal flow, and to suppose that there is an appreciable thermal gradient when the current is increased slowly is in opposition to everyday experience.

If Mr. Murdoch will bring forward serious arguments, and not merely make wild assertions, his remarks will be read with great interest by many "poor electricians," who, like myself, are not connected with South Kensington, and who might be persuaded to "bow down and worship" with Mr. Murdoch at the shrine of his new theory (as he himself proposes).

It would be interesting to know, by the way, why Mr. Murdoch's obvious antipathy to South Kensington should be dragged into this discussion.

F. T. Chapman.

Hendon, N.W., *November 11th*, 1912.

Switchgear Drawing-Office Expenses.

Your correspondent, "C. D. L.," cites three cases where trouble has arisen through inadequate or incorrect drawings. From the information given, it would appear that in cases 1 and 3, correct drawings were not obtained after the order was placed, whereas in case 2, detail drawings of special interlocking gear were requested and refused in the tender stage. I have never known a manufacturer to refuse copies of working drawings when an order is placed, because such drawings have to be made for the works, and there is no trouble in obtaining blue-prints for the purchaser.

With regard to case 2, I fail to see why a manufacturer should be expected to develop and show in detail special interlocking gear in the tender stage. Generally speaking, the cost of designing such apparatus is more than one-half its selling price, so that virtually the manufacturer is asked to complete half the work before receiving the order, and then it may be unproductive. Surely this is most unreasonable. If six manufacturers are set on the same task, it means that the total expense incurred is three times the value of the apparatus.

Again, "C. D. L." does not consider a tender sufficiently complete unless the manufacturer has set out every detail. Here, again, I think he is unreasonable. To effect this work the manufacturer may have to expend 5 per cent. of the value of the job on drawings and estimates. If now 10 firms are tendering, and each does the same amount of work, it means that 50 per cent. of the value of the order is expended in tendering only. It is admitted that drawings are required to form the basis for a tender. The important point, however, is that such drawings need be made by one party only, and not by every tenderer. Tender drawings are never accepted as final, and are always subject to modification; therefore, if one party makes a diagram of connections and a general layout of the board, it is sufficient for all tenderers to quote the same, and to signify whether they can get their switchboard in the space available.

The question of who is to make the drawings depends on the capability of the purchaser. If he knows what is the most up-to-date practice as regards layout of gear, protective devices, measuring instruments, &c., then it is most economical for him to make the drawings. If, however, he is not a switchgear expert, it is much better for him to invite a capable manufacturer to inspect the site, and, after seeing local conditions, to prepare a scheme with drawings. The job could then be put out to open tender, and in order that the purchaser might not feel under any obligation to his adviser, he might ask tenderers to include an amount to cover the cost of this preliminary work. One great advantage of such procedure would be that all tenderers would be quoting for the same style of board and the same amount of gear, so that a fair comparison of prices could be made.

The engineer who wishes to make his own drawings will have no difficulty in getting dimensioned sketches of standard pieces of apparatus from manufacturers; in fact, these can often be taken from catalogues. What the manufacturer objects to is not the expense of sending blue prints off existing drawings, but the labour of making new drawings.

The purchaser might argue that there is an advantage in setting half-a-dozen manufacturers to work on his scheme, as he has then an opportunity of seeing which of their arrangements he likes best. This is all very well from his point of view, but it is not economical in the broadest aspect, and if it is persisted in manufacturers may find it necessary to charge for the advice given. Economy can be effected along two lines:—(1) By reducing the cost entailed by each tenderer; (2) by increasing the chance of each tenderer procuring the order, or, in other words, reducing the number of tenderers.

The amount a manufacturer has to add to his estimate to cover tendering expenses depends on the proportion of orders received to the jobs tendered for, and the amount expended on each. If he gets one job out of ten, and spends 2 per cent. on each job, it is obvious he should add 20 per cent. to each estimate. If now the expense is reduced to 1 per cent. the amount he has to include is reduced to 10 per cent., or, again, if he gets one job out of five instead of one out of ten, he can still expend 2 per cent. on each tender and have to add 10 per cent. only.

It is certain the purchaser has to pay in the long run for tendering expenses, and it is to his own advantage that he reduce the number of tenderers, also the amount necessary to be expended by each.

S. F.

Manchester.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The "Unica" Accumulator Sediment Pump.

THE "Unica" pump is a continuous action suction and force pump of very simple construction, and specially adapted to the conditions under which it has to work. The illustration herewith shows the corrugated india-rubber suction hose, and a suction tube nozzle attached thereto, as well as the delivery hose. Stuffing boxes and packings subject to wear are entirely avoided. The materials employed in its manufacture are acidproof, thus saving repairs and other inconvenience under normal working conditions. The pump lifts the lead sediment and other foreign matter resting on the bottom of the cells, such as solid lead or pieces of glass, without the necessity of shutting down any part of the battery. The removed sediment is replaced by a corresponding amount of acid.

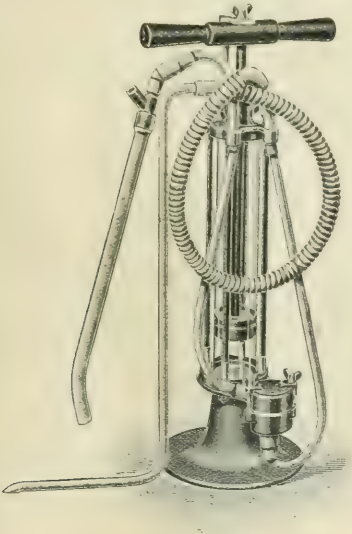


FIG. 1.—UNICA SEDIMENT PUMP.

Besides the necessary suction and delivery hose, flat suction tubes with enlarged outlets and round suction tubes with rectangular bends and suction holes suiting the cell dimensions, are supplied with every pump. These allow of convenient insertion even into fully built-in cells and between narrow standing plates, the pump thus having a wide range of application under all possible conditions.

All holes which the sediment passes through have a large section so as to avoid stoppage; owing to their special design, the simple clack valves are not liable to cause stoppage. It is an essential feature of the pump that the suction sets in with full atmospheric pressure from the beginning, so that the heavy lead sediment, and even solid lead pieces, are at once lifted. From each of two large batteries, consisting of 60 and 120 cells, one ton of solid lead sediment was removed within 8 and 15 hours respectively; these figures do not, however, represent the maximum outputs attained. This apparatus is supplied by the POLYSTAT ELECTRIC Co., of 222, Marsland Road, Sale, near Manchester.

New Prometheus Convector.

THE BRITISH PROMETHEUS CO., LTD., of 9, Newman Street, London, W., have brought out the new pattern of convector which is illustrated herewith. They are this season extensively adding to their numerous designs, and have on view at their London showrooms over 50 designs of convectors and lamp radiators. The Prometheus convectors are guaranteed for a period of five years.

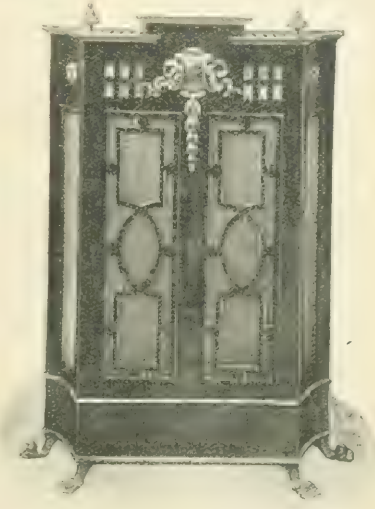


FIG. 2.—NEW PROMETHEUS CONVECTOR.

The "Dionic" Water Tester.

The introduction of a conductivity tube, suitable for measuring the conductivity of seawater without dilution, and the development of a new form of tube adapted for use in pathological research, where the quantity of material obtainable for tests is very small, has caused increased interest in this instrument. It will be remembered that the principle of the "Dionic" method is to ascertain the condition of a solution by measuring its conductivity. Where the material to be tested is a weak solution of any salt in water, the sensitiveness and accuracy of the method are remarkable, so that the "Dionic" method is very useful for testing steam condensers, priming in boilers, &c. It has been shown also that tests of the conductivity of blood have great value in diagnosis, as the conductivity is found to vary in different kinds of disease, even when these diseases have similar symptoms in other respects.

A new abridged list of the instrument is in preparation, and will be sent to anyone interested on application to the makers, MESSRS. EVERSHED & VIGNOLES, LTD., at Acton Lane Works, Chiswick.

"Scott" Electric Car Starter and Generator.

MESSRS. LAURENCE, SCOTT & CO., LTD., of Norwich, are showing at Messrs. Crossley's stand at the Olympia Motor Exhibition, an electric self-starter, combined with a generator for car lighting—a development which appears to find considerable favour with exhibitors this year.

Messrs. Laurence Scott employ a small machine, designed to give a powerful torque as a series motor when run off a small battery and by means of a 20 to 1 chain drive to turn the engine crankshaft for starting purposes; also as a generator (a shunt winding being provided which is not used when motoring) to satisfactorily charge the battery, the cells being then arranged in four parallels.

For motoring with, say, a 15-H.P. car, a pressure of 24 volts is used, the cells being in series; for lighting with the cells in parallel, 6 volts is obtained. The gearing of the starter is interesting; a pinion on the armature shaft *a* gears into three planet wheels *b* revolving on fixed pins in a disk wheel *d*, the planet wheel pinions gearing into a wheel *e*, the elongated boss of which carries the sprocket wheel for the chain drive to the engine shaft.

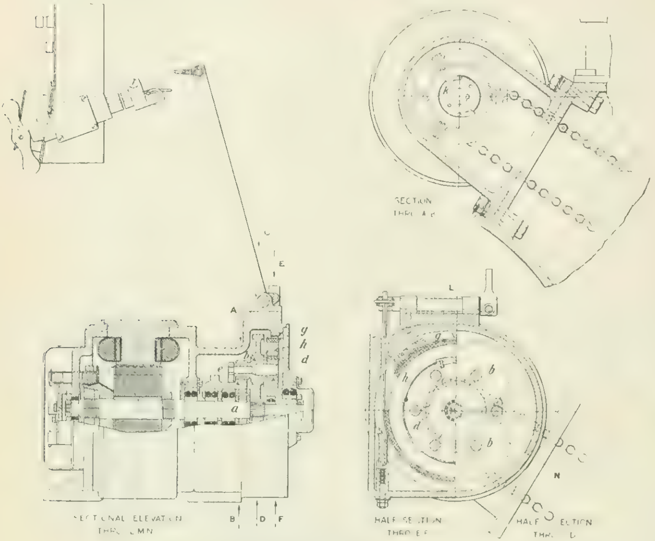


Fig. 3.—The "Scott" Motor-Car Starter.

The gear system is a free one until the disk wheel *d* is held by means of the bandbrake *g* on its circumference, in which case the rotation of the armature shaft drives the sprocket-wheel and chain.

In order to prevent the engine, when it starts from driving the armature back through the gearing, a free-wheel clutch *h* is interposed, which allows the disk-wheel gearing and armature to rotate as one piece in the opposite direction at chain-wheel speed. The band brake is released when the engine has started, and the driver then puts his starting switch into position for charging, the charging switch—a separate one—being put in as required.

When charging, the armature is driven direct at chain-wheel speed through the little free-wheel clutch *k*, which is free when the armature motors. It will be noted that in this starter the strain of a back-fire would come on the disk wheel in the same direction as the starting strain, and that in this direction the band brake tends to release itself under excessive strain and the back-fire spends itself in the usual way.

The free running planetary gearing (except at starting) also renders unnecessary any automatic cut-out.

B.T.-H. Veluria Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, 77, Upper Thames Street, E.C., have recently placed on the market a reflector under the name of "Veluria," in extensive and intensive patterns, of which the respective light distributions approximate closely to those given by the corresponding types of prismatic glass reflectors. Unlighted, Veluria glassware has the appearance of Italian marble: alight, it exhibits a warm, delicate alabaster glow, yielding a soft, mellow-toned illumination.

Instanta Adjustable Pendants.

Messrs. F. A. Wilkinson & Partners, Ltd., of Harpenden, Herts., have just placed on the market the "Instanta Adjustable Pendants," one of which we illustrate in fig. 4. The device consists of a fitting for attaching to any ordinary electric-light pendant, by means of which the advantages of indirect or reflected lighting are instantaneously obtained at will. In one form it is unnecessary to disconnect or re-wire the pendant fitting, the attachment enabling the consumer to make the alteration himself in a few moments. The fitting includes a length of split brass tube, bent to an easy curve. At one end is a split cord grip of vulcanite, and at the other a fork carrying a swivelling carrier for the lampholder. The flexible wire is laid in the split tube, and the lampholder is secured to the carrier by its shade ring. The clip is then joined up and grips the flexible, enabling the attachment to be turned vertically or in any direction without twisting the cord. An alternative design consists of a closed tube, which necessitates re-wiring the lampholder. The latter design is somewhat cheaper. There is no attachment to the ceiling rose or ceiling, frosted lamps are not required, and there is a saving in the cost of installation and current consumption, as it is only necessary to install a single pendant in certain rooms where two or more ordinary pendants would be required, as the light can be instantaneously directed to any required position.

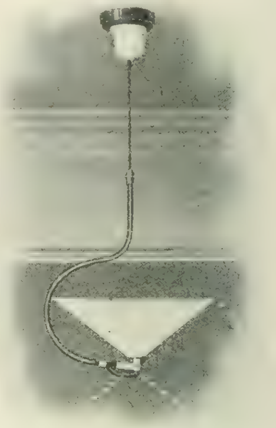


Fig. 4.—Instanta Adjustable Pendant.

Electric Heating Carpets.

A carpet heated by electricity has been devised by Messrs. Otto Baur & Co., of Zurich, which, it is claimed, by heating the floor, affords the most effective and rational system of heating. The carpet is so contrived that it cannot be overheated, and it is perfectly flexible; the heating element is protected by a stout covering which is also waterproof. Any size of carpet can be made, from small pieces acting as foot-warmers to large ones covering the

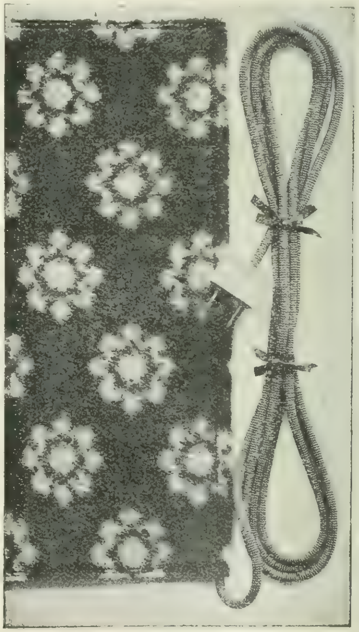


Fig. 5.—Electric Heating Carpet.

whole floor. The former are provided with flexible connections as shown in the accompanying illustration.

Bed warmers are also made on the same lines, as well as a variety of special medical appliances.

LEGAL.

THE NATIONAL TELEPHONE ARBITRATION.

(*Continued from page 771.*)

SIR JOHN GAVEY, M.I.C.E., Past President of the I.E.E., a former engineer-in-chief at the Post Office, stated in evidence that he considered a figure of 8s. per pole for the cost of obtaining wayleaves as simply preposterous. He quite recognised that the company might have more difficulty in obtaining wayleaves, because they had not the statutory powers which were possessed by the Postmaster-General. For Post-Office work he should consider that 1s. per pole was a high charge. He thought 2s. a pole might be allowed the company.

The SOLICITOR-GENERAL said that was the sum the Post Office had allowed.

Witness stated further that he was responsible for the expense incurred when the London telephone system was created. It was substantially an underground system, and the cost was necessarily higher than that in the outlying districts of London. The National Telephone Co. had not any corresponding work in the City of London, in fact he did not think they had any underground work in that city. The Post Office laid down 217 ducts before there was a single subscriber. They opened the first exchange in 1902, and to-day there were 20 per cent. of the ducts still quite empty, a further 20 per cent. only one-half filled, and 15 per cent. in which there was room for further cables. With regard to making a comparison of the cost of the stations belonging to the company and the Post Office, he mentioned that the length of the wires was greater in the case of the latter than in the former, especially in the provinces, because the Post Office had to serve the public, whether it was a profitable undertaking or not, and the company only served subscribers. If the National Telephone Co.'s system did not exist, he should have no hesitation in saying that it could be erected in 2½ to 3 years.

Cross-examined by SIR A. CRIPPS upon the report of the Postmaster-General concerning the life of the plant, counsel asked Witness if he was responsible for the figures supplied for that report.

Witness said that whoever drew up the report no doubt made use of his figures, but whether they were used judicially or not he could not say.

SIR A. CRIPPS: Do you suggest that the Postmaster-General took the figures from other sources?—No.

Then you, as engineer-in-chief at the time, are responsible for the figures in that report?—Well, if you put it that way, I will accept it.

Giving further evidence, SIR JOHN GAVEY said he thought that 40 years would be a very fair life to allow for cast-iron pipes. He gave 15 years' life for wrought-iron pipes.

Questioned with regard to the employment of cement blocks as the constructive portion of conduits, Witness said that years ago he had had to consider their quality, as compared with that of competing systems, and had rejected them. In regard to the cables, Witness said that, as a result of inventory, he had come to the conclusion that the National Telephone Co.'s cables had a life of only 20 years, because, when they had reached that age, they would have to be withdrawn and replaced by others. He endorsed practically all that had been said by previous witnesses concerning the life of exchange equipment, subscribers' apparatus, &c., as affected more particularly by the obsolescence brought about by improvement in the methods of using the service. Dealing with the respective values of wood and iron in relation to telegraph poles, Witness said that a well creosoted pole would last 28½ years, whilst an iron pole would only last 15 years. As to wire, the physical life of 100 lb. copper wire stretched from London to John o' Groats might be 25 years, because, although its life might be affected by storms at certain parts of its extent, it could not affect the whole.

SIR JOHN SIMON: What do you say the physical life of a wire would be if, say, it were stretched over London?

Witness said that in that case the physical life would not exceed 15 years, because there the influences affecting the life of the wire would be concentrated on a smaller area.

SIR JOHN next asked witness questions with regard to the common-battery exchanges.

SIR JOHN GAVEY said he estimated the life of a common-battery exchange at 15 years, and in doing so he had regard to the progress that was continually being made in the mechanical attachments of electrical science. The effective life of a magneto exchange he did not put at anything beyond 10 years. Personally, he was opposed to the use of the magneto instruments which the Post Office had taken over from the National Telephone Co. His experience taught him that the maintenance of plant increased from day to day with its age.

In answer to SIR A. CRIPPS, Witness said that the National Telephone Co. used 40 lb. phospor-bronze wire for its overhead bare wires, and the Post Office used 100 lb. copper wire. He estimated the latter's life at 25 years, and the life of the National Telephone Co.'s wire at 15 years. It was true that the equation value in the two cases might be the same.

Further cross-examined as to the advice given by him before the National Telephone undertaking was taken over, and the reports made by him to the Post Office when he was engineer-in-chief, and which seemed to conflict with his present support of the position taken by the Post Office against the company, Witness said he changed his opinion after he had visited America in company with another official of the Post Office, for the purpose of examining the telephone system there.

At the conclusion of Sir J. Gavey's evidence, the Solicitor-General recalled MR. SNELL, the Post Office expert. This witness, in conjunction with Mr. Gill, the engineer-in-chief for the National Telephone Co., was engaged in considering the question of subscribers' apparatus and other questions, which Sir John Simon said were not embraced in the main question to which he desired to address himself. If these two gentlemen did not arrive at an absolute agreement on these subjects, they would at least agree on alternative multipliers, either of which the Court might use to arrive at the life value of the plant affected. Proceeding to submit arguments to the Court on the main question, the SOLICITOR-GENERAL said that the parties had happily started with one or two matters fundamentally agreed, and these included figures which represented the fundamental cost of labour, material and freight. From that point of view there were two further stages to be traversed on the route to a decision in the case. They had, first of all, to ascertain how much it would cost beyond the amount of the fundamental agreement to replace anew the whole of the National Telephone Co.'s system. Having ascertained that cost, it then became necessary to learn by how much the plant had depreciated at the time it was taken over by the Post Office. The deduction of the amount of depreciation had then to be made from the cost of the replacement.

MR. DANCKWERTS, K.C., interposing, said it must not be understood that he assented to this argument of the Solicitor-General.

MR. JUSTICE LAWRENCE: We could hardly hope for that.

Continuing, SIR J. SIMON said that they had to bear in mind what it was the Court was aiming at, and the method to be adopted in order to arrive at it. The object was the lump sum award to be paid to the company by the Post Office, and the method was first to find the cost of replacement of plant, and then to determine the amount of depreciation upon it.

His LORDSHIP remarked that the reason that method had to be applied, was because there was no market gauge of value. The plant was useless except to one or the other of the parties. It would be unreasonable if the Post Office refused to take over the plant, because there was no other buyer, and if the company refused to sell that would be equally unreasonable. The sum, therefore, which one party had to pay to the other must be determined by the cost of construction. There was no other buyer than the Post Office.

The SOLICITOR-GENERAL said he agreed, but with one qualification, and an important one, viz., that it would not be right, in his opinion, to put the value of the undertaking at the cost of it to the company.

His LORDSHIP said he did not mean to suggest that. What he meant was to put the value of the undertaking at the cost to the person taking it over to replace it.

SIR JOHN SIMON, continuing, said he thought he could show that it was no longer of importance to consider whether the construction of the replacement work should occupy two, three or five years, because the fundamental cost of labour and materials having been agreed upon, there would be no sensible difference in the cost of supervision and in the other points now in dispute, even if the period of construction were protracted to a longer period, provided that were not beyond such an economic period as might be assumed to be necessary for the construction of the system without spreading out the cost of labour and materials, so as to entail a disproportionate cost of supervision. The company assumed for their economic period of construction 12 years, and gave the figures of cost on that basis. The Court, however, must observe that that was the cost to them and not the cost that would be involved in reconstructing the system in another and a different economic period under different arrangements. Their method of construction was piecemeal, and necessarily more expensive than if carried out as a whole, and they applied the figures of cost under this method to their hypothetical economic period, which, in his opinion, was a most fallacious way of dealing with two unlike processes. In estimating the period that a hypothetical contractor would take to recreate the system, there had to be borne in mind that he would start with a definite scheme in his mind, and could lay out his whole design for the purchase of the material, the employment of labour and supervision in the most economical manner. Proceeding to set before the Commission the difference between the charges beyond fundamental cost estimated on the one side by the Post Office, and by the National Telephone Co. on the other, learned counsel reviewed a great mass of the evidence given, with a view of showing that, beyond the 10 millions odd agreed upon for the cost of labour and material, the estimates made upon the basis of 20 per cent. for contractors' supervision, &c., 10 per cent. for contractors' profits, and 5 per cent. for what was called "employers' burden," were an ample provision for extra expenses, and that the company's extra charges for local storage, interest upon money during construction and for what were called "headquarters administration charges," were unreasonable. The company's claim for supervision had been made out without introducing the question of sub-contractors specifically, but including it in effect, and he (counsel) in arriving at the claim for supervision which the Court would have to consider, struck out all that might be ascribed to that account, making a difference of nearly £300,000 between the amount estimated by the Post Office and that estimated by the National Telephone Co. It had been argued by counsel for the company that if that deduction were made, the percentage of supervision to the plant cost would have to be arrived at in a different way. Under the circumstances that would be perfectly fair. In respect of local engineering supervision the company wanted to add about £2,000,000 to the fundamental cost of £10,000,000 agreed upon; for ordering and storing the company charged £471,614, which it could not be suggested were too small. Local administration, supervision, and local engineering supervision between them in the company's claim represented over £2,000,000, and wayleaves £169,368, which together made a total of £2,647,234, the whole of which hinged on an estimate of £592,000, the average plant cost during a composite year extracted by the company from an equation of the cost during 12 selected years assumed by them as an economic period. He contended that that figure was quite abnormal. In 1905 the company knew that it was condemned to death within a limited time; it knew that its corporate existence would come to an end on December 31st, 1911. For six years it was in the condemned cell and knew the way in which at the close of the stipulated period its executioners would dispose of its property; yet from 1905 to the end of its life it never kept any record of its affairs. It had constructed millions of pounds' worth of plant during that period, knowing all the time the terms upon which that plant would be taken over, but hoping to add to its value in the way which had been disclosed to the Court. At the close of the company's life the expenditure on construction naturally became smaller, and it was one of these abnormally small years which had been chosen to estimate the percentage of supervision to construction, the cost of supervision then being practically the same as during the years when construction was proceeding rapidly.

Continuing, the Solicitor-General dealt with the question of head office expenses, and submitted that the total charged by the National Telephone Co. under that head was too much because it had been arrived at upon a wrong basis. The Post Office figures generally, he said, were arrived at not only with the help of experience, but with the help of additional checks at their command. This fact made it more likely that their figures were reasonable and fair.

Sir Alfred Cripps, intervening, said he disputed the accuracy of the Post Office figures in the matter of materials and labour cost, &c., because they were arrived at on the assumption that 2½ years was a sufficiently long time in which to do the work.

Sir J. Simon occupied many hours in reading the evidence which had been given during the course of the case.

(To be continued.)

Edmundson's Electricity Corporation, Ltd.

Mr. Justice Neville, in the Companies' Court on Tuesday last, heard a petition by the above company for sanction to a reduction of its capital, as proposed in resolutions adopted by the shareholders and already reported in the Electrical Review.

Mr. Younger, K.C., appeared in support of the petition.

There was no opposition, and his Lordship sanctioned the reduction as proposed, directing the order to be advertised in the same papers as the petition, and the use of the words "and reduced" by the company for one month.

The National Telephone Co.

In the Companies' Court on Tuesday, an application was made to Mr. Justice Neville with reference to a summons taken out in the liquidation of the National Telephone Co. to determine questions that had arisen as to the distribution of the assets.

Mr. Percy Wheeler, who represented the liquidator, said that the company went into voluntary liquidation in January last, and the summons had been taken out to determine the rights of the ordinary shareholders and the various classes of preference shareholders. The summons was directed to be heard by his Lordship that day fortnight, but it was difficult to ask him to determine the matter, as when a member of the Bar he had advised on a number of questions concerning the company. It was therefore thought that his Lordship would prefer the summons being heard by Mr. Justice Swinfen Eady. The summons raised questions of some difficulty as to the construction of the memorandum of association, and there were many hundreds of shareholders interested.

His Lordship said he would communicate with Mr. Justice Swinfen Eady, who would no doubt fix a day for hearing the summons.

Gery v. Day Motor Co.

In the High Courts, on Tuesday, November 12th, the Official Referee, Mr. Muir Mackenzie, had before him an action by Mr. Alfred Robert Orton Gery, 7, Ormonde Terrace, London, N.W., against the Day Motor Co., Ltd., Riverside, Putney, claiming the sum of £52, money which plaintiff had paid the defendants in respect of the installation of an electrical generating apparatus at plaintiff's country house, Royston Court, Ferryside, Carmarthen. Plaintiff alleged that by a contract in writing made between defendants and his (plaintiff's agent), Mr. R. F. Browne, defendant company agreed to supply, in 1911, an electrical generating apparatus for use in Royston Court according to certain specifications and conditions, viz., that it should work direct, and that it should be efficiently governed automatically so as to permit of a momentary speed fluctuation of not more than 6 per cent. on a sudden alteration of the load to the extent of 25 per cent. between 50 per cent. and full load on the engine. On November 13th, 1911, defendants delivered the apparatus, which purported to comply with these conditions. Plaintiff paid £52 as part payment on delivery. Subsequently, he found that the plant did not comply with the conditions laid down, with the result that the apparatus was useless. By reason of breach of contract, plaintiff alleged that he had suffered loss, and he claimed damages in respect of such breach. Defendants denied liability, and counterclaimed for £21 11s. 6d., being the balance due on the price of the plant, also certain expenses.

Mr. Barrington Ward appeared for the plaintiff, and Mr. Colefax, K.C., and Mr. Walker were for the defence.

Mr. Ward opened the case, detailing the facts as given above. He stated that the plaintiff required the plant for the purpose of lighting his house with electricity. He consulted Mr. Browne, who was an electrical engineer, and subsequently the contract was placed with the defendant company. In conclusion, counsel submitted that the engine was sold for the purpose of supplying electric light, and if he could prove it failed to do this he then had a right to reject the plant. Counsel then read the evidence of Mr. Browne, which was taken on commission, the witness, who described himself as an electrical engineer of 16 years' experience, having been called to South Africa. He said he acted throughout the matter as plaintiff's agents.

The Plaintiff gave evidence, and said he gave the work to the defendants because their catalogue seemed to contain what he wanted; a very simple engine which could be managed by any unskilled artisan. The delivery of the plant was very late, and it was not complete. There was no representative of defendants present when it came, and the engine, &c., was eventually assembled by the firm who were wiring his house, Messrs. Brooking and Co. The engine driven by petroleum ran very badly, and as all the lamps in his house had been converted into electric lamps, the occupants of his house had to do the best they could with oil lamps and candles. The engine never was fit to supply his house with electricity. Eventually he was advised that the engine was not fit to do the work required of it, and after affording defendants every reasonable opportunity of putting the matter right, he finally rejected the engine altogether.

Cross-examined, Witness said he spent hours trying to make the plant run.

(To be continued.)

Long-Firm Frauds.

Before Judge Lumley Smith, at the Central Criminal Court on Tuesday, James Winslow, 39, merchant, Frederick Carrier, 37, accountant, and Frank Horace Hepden, 31, merchant, surrendered to their bail and pleaded guilty to an indictment charging them with conspiring together and obtaining quantities of goods by means of false pretences. Amongst the goods which the defendants were charged with obtaining were steel balls from the Hoffmann Manufacturing Co., electric lamps from Ward & Goldstone, and various goods from firms not connected with the electrical industry.

Mr. A. H. Bodkin and Mr. Percival Clarke prosecuted for the Director of Public Prosecutions, whilst the defendants were represented by Mr. Curtis Bennett, Mr. Eustace Fulton and Mr. Purcell respectively.

Mr. Bodkin said that the defendants had conspired to obtain goods by false pretences from persons who were induced to deal with a firm known as Darton & Co. The defendant Winslow was adjudicated a bankrupt in 1897 at Swindon, and Hepden, who was also known as Hampton, was adjudicated a bankrupt in January, 1910. Neither of them had ever obtained their discharge under those proceedings. The firm of Darton & Co., was established in the early part of the present year at 3, City Road, E.C. They described themselves as importers and general shippers and manufacturers' agents, and apparently the trading style of Darton & Co. was adopted, as a respectable and old-established firm of that name was in existence in the neighbourhood. The three defendants were associated in the firm of Darton & Co., and there were others in complicity with them. A large quantity of miscellaneous goods was obtained, but proper books were not kept, and there was nothing to show what became of the goods. At the same time as Darton & Co. was founded, a concern called "Hampton" was established at 54, Lower Thames Street, E.C., which was really Hepden. That business was created for the sole puropose of giving references to Darton & Co. Another business for the same purpose was established under the style of the Union Trading Co., at Finsbury Avenue, E.C., with which were associated men named Bird and Trueman, the latter also being known at Cattell. The Union Trading Co. occupied a room at 10s. a week, and left owing £5 10s. for rent. When the bailiffs went in all they found was an empty inkpot, a chair with the bottom knocked out, and a table consisting of some planks and a couple of boxes. Last March Darton & Co. wrote to the Hoffmann Manufacturing Co. for terms, and subsequently gave an order for 900 gross of steel balls. The Hoffmann Manufacturing Co. asked for references, and Darton & Co. gave the names of Anderson & Co., of 12, Aldgate, E., and Hampton, of Lower Thames Street. Anderson & Co. was another firm which was constructed solely for the purpose of giving references to Darton and Co. The reply of Anderson & Co. to the Hoffmann Manufacturing Co., was that the former had known Darton and Co., had done considerable business with them, received prompt payment, and regarded them as good for credit. That letter was signed "J. A.," but it was in the handwriting of Winslow. The other reference was given by Hepden, under the name of Frank Hampton, and he wrote, "The account is kept to my entire satisfaction." The premises occupied by Anderson & Co., were taken by Carrier, who was accompanied by Winslow, and the reference they gave to the landlord was Darton & Co. The address of Anderson & Co. was simply one for letters. On the references given, the Hoffmann Manufacturing Co. thought the matter was satisfactory, and supplied the goods, but never got paid for them. Darton & Co. gave an order for a piano to Musicus, Ltd. The references supplied were Anderson & Co. and Ray & Co. The reference from the latter firm was written by Carrier, and the premises occupied by Ray & Co. were held at a rental of £1 a month. As the references were satisfactory, Musicus, Ltd., supplied a piano, and were then applied to for three more instruments, which they declined to deliver. Mr. Bodkin said it was interesting to note that Carrier had obtained an Empire typewriter which was never paid for. The letters from Anderson & Co., Ray & Co., and some from Darton & Co., were written on that particular typewriter. An order was received from Hepden by Musicus, Ltd., for a piano, his reference being the Union Trading Co., from whom an excellent testimonial was received. He was supplied with the piano, which was not paid for. Proceedings were taken by Musicus, Ltd., against Darton & Co., an execution was levied, and Carrier then came forward with a bill of sale, which had been executed over the assets in favour of a man named Stephens. The latter was a man who had also given false references to the defendants. The bill of sale was created for the sole purpose of fraud, for when he was arrested Carrier admitted that it was not a genuine charge, and that it was arranged by him. In face of the bill of sale, Musicus, Ltd., had to withdraw their execution. The cases mentioned were not isolated ones, but were selected as typical of the methods employed.

The Judge: Were any goods paid for?

Mr. Bodkin: There are cases in which small trial orders were paid for, and afterwards large orders which were not paid for.

Counsel added that when the premises of Darton & Co. were searched, certain books with some leaves cut out were found. These books contained entries showing that Darton & Co. had done business with the other firms mentioned as reference houses. As a matter of fact, there were no such transactions at all. One of the serious features of the case was the concocting of the bill of sale which was used to defeat creditors who had obtained judgment against the firm and desired to levy execution.

The Judge: There is a good deal of that goes on nowadays, but particularly where a man gives a bill of sale to his wife. It is quite common.

Police evidence was called to prove that Winslow had carried on business in Swindon, but was made a bankrupt and then traded in his wife's name. When the defendants were arrested, Winslow had started trading with another man at Great Portland Street, under the style of J. Lockwood & Co. Hepden had been adjudicated a bankrupt, with liabilities of £3,859, and no assets. Before going to 54, Lower Thames Street, he was in business at 61, Chiswell Street, E.C.

Mr. Eustace Fulton said the cause of the trouble was that the defendants started the business with an inadequate capital. It was not the ordinary case of a long firm fraud, in which the partners disappeared after a few months' trading. They started a genuine business, but owing to lack of capital could not carry it on.

Mr. Curtis Bennett and Mr. Purcell also emphasised the remarks of Mr. Fulton, and pointed out that all the defendants held good characters.

The Judge said that the defendants had committed a serious offence. In the City business was very largely done on credit, and considerable attention was paid to the giving of references. Wholesale houses who took up references had a right to assume that the replies given to inquiries they made were correct. In the present case it had been shown that the references given to wholesale houses had been written in the office of Darton & Co. The least he could do was to impose a sentence of 10 months' imprisonment in the second division on each of the defendants.

Gott *v.* Veritys, Ltd.

An action in which Arthur Edgar Gott, A.M.I.E.E., electrical engineer, of Lanercost, Villiers Road, Southall, Middlesex, claimed damages for breach of contract from Veritys, Ltd., Birmingham, was heard by Mr. Pollock, K.C., sitting in the capacity of Official Referee, at the Victoria Courts, Birmingham, on Tuesday. Mr. R. M. Montgomery, on the instructions of Messrs. Sharpe, Pritchard & Co., London, appeared for the plaintiff, and Mr. Vachell, K.C., and Mr. Baber, instructed by Messrs. Ansell & Ashford, Birmingham, was for the defendants.

Mr. Montgomery explained that one part of the contract was for personal services, and the other part for the payment of royalties on certain patents of which Mr. Gott was the inventor. Counsel read the contract, which he said was contained partly in an agreement in writing of April 9th, 1907, between the plaintiff and the defendants, in which it was agreed that the defendants should manufacture and sell certain patented articles, and pay to the plaintiff the royalties. It was a further term of the contract that in the event of Messrs. Veritys desiring to discontinue the manufacture and sale of the articles, they should give to the plaintiff three months' notice to that effect. He (counsel) hoped to prove that the defendants, although they gave the plaintiff no notice whatever that they did not propose to continue to manufacture and sell, declined to allow their people to estimate for his patented articles. On the contrary, they did not give the notice which they were bound to give, and starved these patents instead of allowing them to remain as "live" patents on the market, at the same time preventing Mr. Gott from making any use of them. Motor starters and controllers were the two important patents. In the middle of October, 1908, when there was little more than three months to run of Mr. Gott's employment, he was dismissed. No cause was given, and he was paid salary up to January 31st, 1909.

James Young, electrical engineer, Erdington, stated that on October 17th, 1908, he was employed by Veritys, Ltd., and was in charge of the designing in their controller department. He remembered plaintiff, who up to that time had also been in the service of the company, leaving. Shortly after he was asked to get out a line of starters, which he distinctly understood were to replace the existing ones of Mr. Gott, which he was told were too dear, and did not sell well. He knew Mr. Gott's starters well, and knew the patents, and so he had no difficulty in knowing what he ought to avoid in regard to them. He quickly got out new designs, and Mr. Gott's stock gradually ceased to exist, the new articles superseding it. During the three months before the new goods were ready the firm used up Mr. Gott's in many cases, and put new windings to some. Large stocks of material for the making of plaintiff's articles were put on one side and scrapped. There was a continuous demand for starters, and it increased after Mr. Gott had left. When witness began to design the starters he proposed certain methods, and he was told that the firm did not wish to pay royalties if they could avoid it. Asked if there was any saving of cost with regard to the starters except the saving of the royalties, witness replied that the starters were made more cheaply altogether. They were not made so well. If they had wanted to make Mr. Gott's starters in a cheaper way they could have done so. He thought new designs were also got out for switches, but he did not get them out. New designs were immediately produced of a drum controller, witness making the design. After the new design had been got out, so far as he knew, plaintiff's design was not used again for tendering for contracts, or in fulfilling contracts. The firm tendered afterwards on witness's design. Many controllers were bought by the Admiralty after Mr. Gott left, probably hundreds.

Cross-examined, witness said his instructions were to make a much cheaper starter to enable the firm to compete with other people.

The plaintiff, giving evidence, said that if the defendents in the case of the starters had reduced the efficiency of his make to the efficiency of the substituted make, they could have made his as cheaply, substantially speaking, as the substitute.

The Referee: There would still be the royalty.

Mr. Montgomery: Apart from the question of royalty.

Witness further stated that assuming that the firm ceased at the end of 1908 to manufacture his articles, the royalties which he received after that was on the residual stock, which was necessary to carry on business. He claimed that by starving the patents out and withholding them from the market in the way they had, the firm destroyed the value of the patents themselves. He put approximately three years' value on to each.

What was the yearly value of these patents—the starters and the controllers—what could you have got for them if you had had them in a "live" condition?—If I had had them to sell at the time I left, I could have got an amount equal to three times their yearly value.

What would have been their yearly value?—About £45.

In further examination, Plaintiff said that up to the time he left, the amount of royalties had been rising, with the exception of the last year, which was a bad year for trade, when he thought there was a slight drop. The amounts were £80, £61, and then they went up to £117 to the end of January, 1909. The action of the firm also had an effect upon his earning capacity. When he went to Messrs. Veritys he took all his starter experience with him, and when he left, he left it all behind and had to start absolutely afresh.

So that if they were not going to manufacture, it would have put you into a very much better position if they had told you so, and you could have used the patents?—Most decidedly so.

Cross-examined, plaintiff admitted that competition in goods similar to those covered by his patents was very keen.

Mr. Vachell: If the firm found that some of these articles so skilfully designed by you could not be produced at their works at a price which would enable them to compete with others, were they not quite right in having articles designed cheaper to enable them to do so?

Plaintiff: My complaint regarding the firm always was that the difference between the prime cost and the selling price was greater with them than other firms.

Other evidence having been heard, plaintiff's case was concluded. The Court then rose, the hearing being adjourned until the following morning.

(*To be continued.*)

Sentence.—Sentence of three years' penal servitude was passed by Lord Coleridge, at the Liverpool Assizes, on Monday, November 11th, upon Arthur Evans Kennedy, electrician, formerly employed in the Liverpool electricity department, who was found guilty of sending a letter demanding money by menaces from Sir Chas. Petrie, chairman of the Corporation Tramways and Electricity Committee. Kennedy was dismissed from the Corporation's service in 1909, after a previous reprimand in 1907, given to him in respect of his work and conduct, and he imagined he had a grievance against Sir Chas. Petrie, Mr. Clough (electrical engineer), and other persons with whom he was associated at the works.

REVIEWS.

The Story of Wireless Telegraphy. By A. T. Story. London : Hodder & Stoughton. Price 1s.

This volume can be confidently recommended to the general reader and student requiring an easily intelligible review of the development of wireless telegraph theory and practice, up to the date of the first trans-Atlantic wireless message in 1903. For the benefit of readers who are not familiar with the first edition, we may mention that the progress of wireless telegraph theory and practice, from the middle of the nineteenth century to the first years of the present century, was there traced with a completeness which was extraordinary considering the small space occupied (183 pp.). Early experiments were practically confined to conduction methods, and aimed at securing wireless communication across rivers and straits, &c. (incidentally, it may be news to some readers to learn that water-conduction wireless telegraphy is still employed more or less regularly in communicating across various Indian rivers). The gradual improvement in submarine cable construction caused a temporary lull in the endeavours to realise wireless telegraphy, the chief application of which then appeared to be in maintaining communication with lighthouses and ships, &c. The conduction methods gradually gave way to induction methods, and finally the practical application and possibilities of Hertzian waves were realised. All these steps are clearly and cogently detailed by the author, who, very properly, lays frequent emphasis on the number of investigators who have contributed their quota to wireless telegraphy as now practised, and the number of men, chief among whom are Dolbear, Hertz and Lodge, who came within an ace of that practical triumph which was reserved for Marconi. There can be few fields in which so many brilliant investigators have been required to attain the goal aimed for, and in which the important significance of their work has been so frequently overlooked by the men themselves.

The enormous development in wireless telegraphy during the past decade has made the author's task in producing a revised edition most difficult. To bring the volume up to date, while adhering to the thoroughness of treatment adopted in the first edition, would involve at least twice as many pages, and hence a proportionate increase in the cost of the treatise. The production of a second volume, practically equal in size to the first, would doubtless have been very widely appreciated, but there are obvious difficulties and risks in extending a work of this class to two volumes and, while adhering to one volume, the author has probably pursued the best course in retaining the matter of the first edition *in toto* and adding 36 pages, reviewing broadly the technical developments and practical applications of wireless telegraphy since the epoch-making experiments of 1903.

In the original section of the work, a large proportion of the total space was naturally devoted to a description of the early attempts to realise wireless communication by earth conduction and by simple induction. This was as it should be in 1903, but now the rapid progress realised during the past 10 years should receive considerably more attention than is actually given, space being found if necessary by condensation of the earlier chapters. As a review of progress up to 1903, the work is exceptionally valuable, but the new section is much less complete and detailed. As already explained, there is considerable excuse for this fact, but a number of misprints in the original should certainly have been corrected in the new edition, and many of the original half-tone blocks are now so worn as to be practically worthless. There are several instances in which the statements in the earlier edition should be somewhat modified in view of recent developments, and one important omission is that no mention is made, in the chapter on telegraphic communication with trains, of the wireless system now in use on the Great Western Railway.

The supplementary section in the new edition recapitulates the historic instances in which wireless telegraphy has already proved so valuable in saving life at sea, and deals with the proposals for an all-British world radio-network. This review is thoroughly up-to-date, the *Titanic* disaster, the Marconi agreement and the use of wireless in Tripoli being all noted. A number of interesting photographs of notable marine and land stations are included, in addition to two excellent maps showing the sites proposed for the Imperial wireless stations and the stations at present in commercial operation.

It would have been well to have devoted a little more space to a statement of the numbers of land and ship stations at present in operation, and some mention should certainly have been included of the important applications of wireless telegraphy to storm warning and navigation in general (the latter application is briefly noted), of the wireless time services now established, and of the special wireless sets which have been devised for use by small fishing vessels, for the reception of time signals by private stations, and for use in cartography.

The author devotes a paragraph to emphasising the responsibility of the work of every wireless operator, and we here endorse his tribute to the merit and importance of the "small-wage-man," and add what encouragement we may to the latter to persist in his conscientious performance of duty, and endeavour to improve the details of construction and manipulation of the apparatus under his care.

Wireless Telegraphy and how to Make the Apparatus. London : Cassell & Co. Price 1s. net.

This work can be thoroughly recommended to amateurs and students interested in the erection and working of experimental wireless apparatus. Various chapters are written by different writers, each specially qualified to deal with his own section. The matter is well arranged, and is easy to follow, the earlier parts dealing with the construction of all the fundamental parts of the transmitting and receiving apparatus, and a final section dealing with more special apparatus, or what may be termed the refinements of apparatus and operation.

A popular introduction to the subject is given, in which, however, we should like to see space devoted to a consideration of the nature, effect and interrelation of damping, tuning, frequency and so forth ; a short theoretical section along these lines would greatly facilitate intelligent study of the later sections.

The instructions given for the manufacture and erection of the various pieces of apparatus are definite and well illustrated. The best apparatus from the amateur's point of view is always treated in detail, and materials are recommended which are easily worked and cheaply procurable (so far as is consistent with efficient working) ; more complex or otherwise less desirable constructions and methods are briefly mentioned when of sufficient importance. The dimensions recommended seem to be those covering the average needs of an amateur, but we would suggest that some space might well be devoted to a simple explanation of the methods of design of inductance coils, condensers, &c., so that readers could become more familiar with the subject and vary the proportions of the apparatus with some degree of certainty so as to suit any special conditions. Once embarked upon theoretical matters, however, it is easy to go beyond the limits desirable in a work of this class.

The construction suggested for a carborundum detector (page 18) is rather crude, and is not likely to give satisfactory results. The reviewer has found the best means of constructing electrolytic detectors to be to melt the drawn-out end of a small glass tube completely on to a fine platinum wire previously inserted in the bore of the tube. The latter is then ground on a fine oilstone till a sharp section of the platinum wire is exposed ; to save cost, a short length of platinum should be hard soldered to a bare copper lead supported by a small cork in the top of the tube. We do not notice any remarks as to the importance of an earthing gap or plug providing a direct discharge path to earth during storms, or when atmospheric electrical disturbances are specially violent. On observing more or less violent sparking across the earth gap, the latter should be plugged and experimental work stopped for the time being.

Considerable space is devoted to a description of the construction of an induction coil, and of the "Vril" trembling contact maker and a good type of mercury make-and-break. The instructions for the erection of the rest of the apparatus required are equally excellent, but readers would doubtless appreciate approximate estimates as to the cost of materials for the various parts of the equipments.

The value of systematic measurements of the currents in the various circuits and some form of record of the results obtained should be emphasised. The amateur experimenting with quite simple apparatus, having plenty of leisure, and exercising considerable patience, can quite well discover improved connections and types of detectors (to cite only two lines of research). Systematic procedure and infinite patience are very essential. There are so many variables in wireless transmitting and receiving circuits that considerable trial is required (particularly by an inexperienced operator working with a new equipment), to obtain satisfactory results. Residents near London, or near the large stations which now exist in considerable numbers round our coasts, will find the powerful signals emitted by these stations very useful in adjusting their own circuits to maximum sensitivity. Where such stations are not near by, work must be commenced over quite short distances (even from one end of a room to another), before sufficiently fine adjustment can be secured to allow of operation to the full range of the experimental station, and the detection of signals from remote powerful equipments.

Electric Traction and Transmission Engineering. By S. Sheldon and E. Hausmann. 1912. London : Crosby Lockwood & Son. Price 12s. net.

This book attempts to give a perspective view of the design of a complete railway installation, from the cars to the power station, to indicate the nature and sequence of the various problems entailed, and to consider appropriate methods for their solution. This somewhat ambitious task has been undertaken because, in the author's opinion, no single published text-book meets the multiplicity of facts and details to be considered in determining the final elements of a complete electric traction scheme. However true this may be in the United States, it certainly does not apply in this country.

Chapter I deals with the determination of the number and size of cars for an urban road. Some interesting results are established, but the data given refer entirely to American practice, sums of money are expressed in dollars, and so on.

Tractive effort required for car propulsion is discussed in Chapter II. By making some reasonable assumptions the author obtains a formula for train resistance which is quite interesting from the point of view of a student. This chapter also contains a quantity of elementary mechanics on accelerations, inclines, &c., which might quite properly have been supposed to be in the possession of a student at this stage of his work.

A good theoretical description of types of motors, both direct and alternating current, and their performance curves is given in the next chapter. Methods of driving, however, receive very scanty attention.

In Chapter IV adequate consideration is devoted to the important subject of speed curves, and the point to point method of pre-determining performances is well described ; but we are sorry to see the vital problem of choice of gear ratio dismissed in seven lines. A somewhat remarkable fact, if it is correct, is given in a table in this chapter. A 50-h.p. interpole motor by two different makers weighs more than a 60-h.p., the difference in one case being 235 lb., and in the other 25 lb.

Chapter V is one of the best in the book, and deals with the various types of controlling apparatus required for alternating and direct-current traction. The advantages and limitations of the different available systems are well and clearly described.

Energy consumption, root-mean-square currents and similar problems are next discussed, and a small amount of information is given as to the effect of different gear ratios on energy consumption and temperature rise.

The distributing system, classification of conductors, electrolytic surveys and kindred matters next receive attention. The matter, so far as it goes, is quite good. In this chapter, and, in fact, throughout the book, the rather weird unit known as the circular-mil-foot is used.

The design of sub-stations and the costs relating thereto are treated of in Chapter VIII. The part dealing with the design and arrangement of sub-station apparatus is decidedly good, but the sections dealing with costs give figures which are altogether higher than those obtaining in this country, and as far as English practice goes are rather misleading to a student.

Chapter IX deals with the large and complex subject of overhead transmission lines, and seeing that only 58 pages are occupied, a considerable amount of good and reliable information is given. In connection with this chapter, as with others in the book, a competent knowledge of determinants, hyperbolic functions and differential equations is a necessity.

The final chapter discusses the arrangement and costs of steam and hydraulic power stations. The usual types of apparatus are described, and the chapter is in no way remarkable.

On the whole, the book may be described as a fairly good one for the price. Since the book has been professedly written for students, it is well that specific forms of apparatus have been omitted as far as this is possible, an attempt having been made to concentrate attention on principles. In many colleges, far too much time is spent on particular forms of apparatus, and altogether too little on fundamental ideas, and we are glad to see that this book is free from this defect.

The literary and logical style of the book are deserving of the highest praise. The printing and binding of the volume are excellent.—H.G.S.

MONOPOLIES IN GERMANY.

A fresh chapter in connection with the electrical manufacturing industry in Germany and the supply of electrical energy has now been written by the Association of Electrotechnical Special Works, whose efforts to arouse the various Federal Governments as to the possible economic consequences to the small and medium-sized firms of the growing monopoly of the largest establishments, have previously been recorded in this journal. In the opinion of the Association, the danger exists of the creation of a monopoly also in the lighting and power supply business. The text chosen on the present occasion relates to the Bill introduced in the Prussian Parliament by the Minister for Railways, to authorise the substitution of electric traction on the Berlin City, Circle and suburban railways. The scheme provides for the purchase of power from two private works, which, it is said, are to be erected by the A.E.G. and the Siemens-Schuckert works respectively. The Association, in the course of a memorial on the subject, submits that the action of the Minister in deciding to requisition supplies of power from private works will strengthen the present monopolistic tendencies. The assertion is disputed that the cost of working would be greater if the State established power stations of its own, it being held that communal supply works are operated more favourably than private works, which are already burdened with intermediate profits. It is also contended that the same reasons are now adduced against the erection of State power stations for the railways as were brought forward many years ago against the nationalisation of the railways.

The memorial remarks that in the long run the State will be unable to refrain from securing an influence in the supply of electrical energy to the community if the establishment of a private monopoly is to be prevented. At present there are practically only two private undertakings which are engaged on the construction, financing, and working of electricity works for the supply of the public. In this connection the somewhat astounding statement is made that both concerns, partly as a result of the works in their own possession and partly through works in which they are decisively interested or which they have leased, control 35 per cent. of the public supply of electricity in Germany. Not only so, but the concerns are constantly endeavouring to extend their influence in this direction by the purchase or leasing of existing works, so as to obtain in a monopolistic manner the sway over wide districts, particularly of an industrial character. If the Government authorities do not occupy themselves in good time with the action of the large electrical concerns, the Association states that the most important portion of the supply of electricity to the public will be handed over to a private group of manufacturers within a conceivable period.

It appears that industrial establishments are continuing in an increasing measure to close down their own generating plants in order to obtain a supply from overland central stations. Where such substitution takes place, it is prompted by the knowledge that the service will be cheaper. The Association, however, submits that the establishments thereby become absolutely dependent upon private enterprise not only for the supply, but also in regard to the price, of electrical energy, as the right of making special agreements with large consumers is reserved. It is thus possible for a private undertaking of this kind to make a differentiation in the charges made to different establishments, and to grant special advantages to those which are closely associated with it. In support of this argument, reference is made to the agreement concluded between the A.E.G. and the Berlin Electricity Works Co. on January 10th, 1899. The agreement provides for the sale by the latter to the former, at cost price, of all the energy required for its own purposes on the works site at Wilhelminenhof, on the Oberspree, where the cable factory in particular is situated. Apparently this agreement was the result of the inter-connection between the manufacturing industry and the supply business in the earlier days of the electric lighting era. This relationship has been developed in the intervening years, and is still in the foreground of activity.

We now reach an interesting point in respect of one of the important parts played by the German banks in connection with the manufacturing industry. According to the Association, agreements exist between one of the largest concerns in Berlin and the banks of issue both in Berlin and the provinces, whereby the banks participate to a certain percentage in the new issues of capital made by the company. In return, it is said, the banks are under the obligation to look after the company's interests on every opportunity, particularly in the case of those industrial establishments on whose boards of directors the banks are either represented, or are otherwise able to exercise influence. The Association declares that these circumstances frequently render it impossible for the electrical firms, other than one large concern, to obtain orders from industrial establishments which even have no connection with the electrical industry, as the banking interests use the whole of their influence, so that the orders devolve upon the large concern. Although the German Association must accept the responsibility for these statements, it is a well-known fact that the banks in general possess immense power in connection with industrial establishments in that country. If their demands are not conceded, they may refuse credit or decline to float fresh share or loan capital, or they may bring pressure to bear in various other ways. A remarkable instance of the latter class occurred slightly over five years ago, when the directors of a leading iron and steel company were definitely opposed to the company becoming a constituent of the German Steel Syndicate. So great, however, was the influence of the banking interests that the directors were over-ridden, and the company compelled to accept membership. But the present year has witnessed the collapse of that portion of the syndicate which controlled the particular products made by the company, and the latter is now free, as are many others, to develop these manufactures without the restrictions to which they were subject until several months ago.

The Association of Electrotechnical Special Works further contends that it is impossible to reject the idea that in connection with the extension of private ownership of central stations, differential treatment will be meted out between those industrial establishments which do not belong to the sphere of interest of the electrical concerns, and those which are associated with it, and that the latter group will receive more favourable terms of supply than their competitors in the former group. The memorial also refers to the great competitive advantages in relation to other supply works that would be conferred upon private supply works by the possession of State contracts for the delivery of the energy required for the operation of the Berlin railways, and it submits that the State Railway Administration, in the circumstances, should establish Government generating stations for the purpose. It now remains for time to show whether the Prussian Minister for Railways will take any action in regard to the representations made on behalf of the electrical firms of lesser importance than the great concerns. Generally speaking, the State in that country is more or less friendly disposed towards monopolies, in contradistinction to the welfare of the minor branches of any industry, on the ground that the consolidation of interests tends to greater stability in trade and greater uniformity in the degree of employment. The owners of the ordinary iron and steel rolling mills discovered this fact several years ago when they approached the Government with complaints regarding the price-cutting and monopolistic policy of the large steel works, which in the meantime have become still larger. Since then the potash industry has been converted into a legally constituted monopoly; the Westphalian coal trade is also threatened with Government intervention in the event of failure to renew the Ruhr Coal Syndicate, for the reason that the collapse of the combination, it is held, would shake the foundations of the coal and iron and steel industries; and the only hope remaining for the continued independence of the electrical firms of lesser importance in that country would appear to lie in Government action. It is, however, exceedingly doubtful whether anything could be done, even if the Government desired to take any measures other than those already adopted in regard to the prevention of monopolies, in respect to contracts for installations to be connected with electricity supply works. The question of a State monopoly of electrical manufacturing and the supply business, was raised unofficially a few years ago, but it failed to make any progress, and is at present outside the limits of probability or practicability. The only State monopoly sought for in the near future is the control of the petroleum trade—if it can be accomplished—against foreign interests.

BUSINESS NOTES.

Market Quotations.—Correction.—In our "Market Quotations" last week the prices of phosphor bronze were incorrectly given. They are as follow :—

Phosphor bronze, plain castings, 1s. 2d. per lb.
" " rolled bars and rods, 1s. 2d. per lb.
" " rolled strip and sheet. 1s. 2½d. per ton.
White anti-friction metals, £45 to £230 per ton.

Cork Foundation Plates.—The Korfund Co. has recently received a number of orders for insulating machines against the transmission of vibration and noise, with their cork resilient foundation plates. These include Diesel engines of 550, 525, 200 and 120 h.p.; lift motors; a number of gas engines of from 3½ to 26 h.p., and several motor-generators.

Catalogues and Lists.—Messrs. Wallach Bros., Ltd., Royal London House, Finsbury Square, London, E.C.—New list describing and stating prices of the "Pat" patent valve, asbestos packed cock and other steam fittings.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Illustrated pamphlet briefly describing, admirably illustrating, and giving prices and dimensions of, the Nernst projector lamps, models "G" and "H" self-lighting, and model "G A" not self-lighting, which they hold in stock in London.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Advance copy of pamphlet No. 121 (eight pages) giving a complete specification and illustrations of their single and polyphase alternators (pattern HJ).

Messrs. S. Wolf & Co., 115, Southwark Street, London, S.E.—Seventy-two-page catalogue relating to their various portable electric tools. The contents are descriptive with illustrations, prices, code-words and other particulars being tabulated. In the several sections the following are covered:—Electric hand drills and reamers, electromagnetic drilling machine, electric carriage drills, and electrically-driven grinding and polishing machines. Copies of the catalogue will be sent on application.

Messrs. D. H. Bonnella & Son, Ltd., 58 and 60, Mortimer Street, Cavendish Square, London, W.—Four-page illustrated and priced circular (No. 401) dealing with mouthpieces, whistles and brass connections for speaking tubes.

Messrs. W. Geipel & Co., St. Thomas Street, London, S.E.—Pamphlet relating to aluminium electrical conductors.

Messrs. Simplex Conduits, Ltd., London and Birmingham. Mailing card giving prices &c. of Hope's Bi-metal fuse wire of which a sample length for testing is attached to the card.

The Accessories Manufacturing Co., Ltd., 11 Dean Street, Oxford Street, London, W. Large catalogue of electric light fittings, those shown being typical examples of those to be seen at the new showrooms that they have just opened at the above address. The showroom has been opened by arrangement with Messrs. Samuel Heath & Sons, Ltd., for whom they are sole agents for the London, and the Southern, Western and Eastern Counties. The catalogue before us is printed on art paper throughout, and the contents are divided off into sections dealing respectively with electroliers, ceiling fittings, pendants and hall lanterns, adjustable pendants and bed and dining room fittings, brackets, table and piano standards, floor standards, Newel and other standards and billiard fittings. All classes of designs and finishes are represented, and the examples shown include some very fine pieces of work.

Messrs. Veritys, Ltd., 28, King Street, Covent Garden, London, W.C.—Export publication No. 715 (eight pages) giving illustrated particulars and prices of ceiling fans, ironclad switches, house-service fuses, cooking sets, radiators, lantern fittings, and also cut-crystal glass fittings.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham.—Sheet No. 400 describing and giving prices and dimensions of the firm's totally enclosed limit switches for cranes, hoists or lifts.

Messrs. Laurence, Scott & Co., Ltd., Gothic Works, Norwich.—Illustrated leaflet describing their new "Scott" electric motor-car starter and generator.

Messrs. Boving & Co., Ltd., 9½, Union Court, Old Broad Street, London, E.C.—Twelve-page pamphlet containing descriptions, illustrations, and price particulars, of their mechanically-operated turbine and engine, tachometers, tachographs, and speedometers and revolution counters (Dr. Horn's patents).

Messrs. Richard Pape, Ltd., Belvedere Works, Belvedere, Kent.—Pamphlet giving practical hints to users of the "Fors" accumulators.

The Lux Candle Co., Ltd., 36, Whitfield Street, London, W.—Leaflet showing their latest type of candle lamp with Barlock cap, which, when screwed down, keeps the lamp perfectly straight, the rubber washer keeping the candle steady and preventing rattling.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Four-page leaflet giving latest prices of "Gral" wire lamps, "Gral" patent wire Continental lamps, and B.T.-H. carbon lamps; also an abridged list of accessories, including "Gral" arc fittings, Holophane reflectors, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—16-page list (No. FN 1,610) containing illustrations and prices of a variety of fittings for shop and street lighting, railway station, warehouse and other service. The lines shown include lanterns, reflectors and inverted fittings for Osram lamps, from 25 c.p. to 1,000 c.p., wireless china "Striplite" and ordinary metal "Striplite," window bracket and shelf clips, advertising lanterns for shop windows and doorways, and "Highfield" outdoor fittings.

The "Z" Electric Manufacturing Co., Ltd., Orient House, New Broad Street, London, E.C.—Large and very effectively coloured hanging showcard of "Z" lamps, one of these lamps being suspended from an ostrich feather, the legend below reading, "Two of the lightest things known."

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, London, N.E.—New "Wotan" lamp list (No. WL 3), of 16 pages, with the now familiar coloured frontispiece. The list contains particulars and prices of all types of these lamps at present on the market, including 10-c.p. lamps for both high and low-voltage circuits and for low voltages only (20 to 135), a range of 5-c.p. lamps. In the list prices are printed in very bold type. Among the details included are "Goliath" E.S. holders, and matt obscuring lacquer. Some views are given of street, stage, and other lighting. We have also received from the firm a folder containing particulars of the various advertising material (relating to Wotan and tantalum lamps) that they are prepared to supply to their trade customers in connection with their advertising campaign during the present season. A number of small illustrations are included showing the literature that is available and its sizes. There are cut-out and other folders, postcards, also inflated balloons, plaster models, and other advertising display novelties.

Bankruptcy Proceedings.—Joseph Arthur Procter, late electrician, 17, The Boggs, Allerton, Bradford, late 64, Bradford Road, Frizinghall, Bradford, and late 6, Birklands Terrace, Shipley, Yorkshire, and 20, Cecil Terrace, Great Horton, Bradford.—The first meeting of creditors in this matter was held last week at the Official Receiver's Chambers, 12, Duke Street, Bradford, when the statement of affairs showed liabilities amounting to £115, and a deficiency of £98. The failure was attributed to executing contracts under cost, through inexperience. It was decided to leave the matter in the hands of the Official Receiver, who will act as trustee.

Thos. Topping, electrical and mechanical engineer, Southport.—A first and final dividend of 4s. 10d. in the £ is payable on November 19th, at the offices of the Offical Receiver, 11, Dale Street, Liverpool.

Liquidations.—The British Vitrite Works (Swan's Patents), Ltd.—A meeting of creditors is called for November 20th, at 20, Cannon Street, Birmingham.

Fleetwood and District Electric Light and Power Syndicate, Ltd.—Creditors of this company must send particulars of their debts, &c., to the liquidator, Mr. W. Cash, 90, Cannon Street, E.C., by December 20th.

Book Notices.—"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXIX, No. 9. September, 1912. Brussels: E. Bruylant. Price 1.75 fr.

"*Memoirs* of the College of Science and Engineering Kyoto Imperial University." Vol. III, Nos. 9, 10, 11 and 12. March-July, 1912. Kyoto, Japan: The University.

"Boletin de la Sociedad de Fomento Fabril." September 1st, 1912. Santiago, Chile: The Society.

"*Bulletin* of the American Institute of Architects." Vol. XIII, No. 2. July, 1912. Washington: The Institute.

"Magneto and Electric Ignition." By W. Hibbert. Price 2s. net. "The Practical Telephone Handbook." By J. Poole. Price 6s. net. "Wireless Telegraphy and Telephony." By W. J. White. Price 2s. 6d. net. 1912. London: Whittaker & Co.

"A Primer of the Internal Combustion Engine." By H. E. Wimperis. 1912. London: Constable & Co., Ltd. Price 2s. 6d. net.

"*Journal* and List of Members of the Institution of Municipal Engineers." Vol. IV, No. 14. October, 1912. London: The Institution. Price 1s.

"Manual for the Use of Fire Brigades." London: National Fire Brigades' Union. Price 2s. 6d. net.

"Electrical Photometry and Illumination." By Hermann Bohle. 1912. London: Chas. Griffin & Co., Ltd. Price 10s. 6d. net.

"Mésure de l'Equilibre des Circuits Téléphoniques." By M. Béla Gáti. Paris: A. Dumas.

"Where Circulation Means Value."—In the course of an article in the *Newspaper Owner and World* on "Things that Matter in Advertising," Mr. Field Somers says:—

"Advertising is, I suggest, at its best where a spiritedly-conducted and genuine newspaper in which such advertising is placed reaches, with as little overlapping and waste as possible, the public or the interest at which the announcement is specifically directed. An essential household requisite is insufficiently advertised if *any* newspaper that is regarded as the best in its locality—however restricted—is left out of the scheme. An article or service, on the other hand, that only appeals to a comparatively limited class, should obviously be confined to the newspapers or journals appealing to that class, and, for choice, to the best and strongest of them, irrespective of the charge made. By cutting off all fictitious or doubtful values, money is saved to devote to the real and ascertained values, and it is at this point that advertising ceases to be a gamble and becomes a scientific business proposition."

Trade Announcements.—We are informed by the sole British representative of Messrs. K. & Th. Moller G m b.H., of Brackwede, patentees of the Moller air filter, that they have practically completed arrangements for manufacturing in this country.

Mr. S. Utting, of 4, St. Mary Axe, London, E.C., has been appointed sole British representative for the firm of Louis Prat, Paris, the patentee and maker of the Prat induced draught apparatus.

Messrs. Thompson & Co., of 68a, Lincoln's Inn Fields, London, W.C., have been appointed sole British agents for Ateliers Constructions Electriques, Jeumont, who make specialities of bare copper wires, trolley wire and aerial cables.

Messrs. Watlington & Co., Ltd., are carrying a stock of 10,000 Britannia metallic-filament lamps at their new warehouse, Britannia House, 43, Milton Street, London, E.C. At the same new premises they will also carry a stock of transmission line and supply material, and of electric lighting and heating accessories. The firm have issued a small eight-page pamphlet giving particulars and prices of the Britannia lamps of from 5 to 100 Hefner c.p.

For Sale.—The patents, plant, machinery and effects of the British Vitrite Works (Swan's Patent), Ltd., Wolverhampton, are offered for sale as a going concern. The Mersey Railway Co. has for sale a quantity of arc lamps and accessories. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Arabia.—What is described as the first installation of electric lighting in Arabia has lately been completed in the Palace of the Sultan of Oman, in the south-eastern portion of the country.

Australia.—The Provincial Electric Development Co., of Victoria, has decided to install an electric lighting system at Carrum, Aspendale and Chelsea. Current will be obtained from the company's power station to be erected in Dandenong in connection with the lighting of that town. The company has also lighting and power supply projects in hand for the towns of Daylesford, Dunolly and Shepparton.—*Mining and Engineering Review.*

Belfast.—The report of the city electrical engineer on the various sites for the proposed new generating station in connection with the electricity department was submitted to the Electricity Committee last week. In order to compare the advantages of the sites Mr. Bloxam estimated for the construction and operation of a 24,000-h.p. plant in each case, with the cable connections to a ring main encircling the city. Taking an output of 30 million units, 46,875 tons of coal would be required, lighterage amounting to 4d. to 4½d. per ton. In the result the Glenoran site shows capital expenditure amounting to £181,983, plants on the other sites costing from £190,000 to £200,000. In arriving at the cost, cables are reckoned at £14,290 assuming that they would be carried round the Albert Bridge, but this figure would be reduced to £6,574 in the event of a proposed new bridge being built, giving a shorter route. Mr. Bloxam further reports upon the comparison of Diesel engine and steam turbine-driven alternators for a total output of 9,000 KW. in connection with the electricity extensions. He invited the British and Continental Diesel engine manufacturers to quote for Diesel driven alternators of 3,000 KW. output, or, failing this, for smaller size units, and received offers from two Continental firms to build an engine of the size asked for, while British makers would only quote for much smaller units at a very much greater cost per KW. He, therefore, assumed that if Diesel engines were ordered they would be purchased abroad, and would be of the two-cycle six-cylinder type running at 136 R.P.M., and taking the price of these units as the basis of comparison with that of steam turbines purchased from the present contractors, he found that the increase in capital outlay for 9,000 KW. of Diesel plant compared with steam plant, based on the overload rating in each case, including buildings, was £24,560, or an annual charge of £1,535 for interest and sinking fund for 25 years' loan. Regarding the question of fuel, he concludes that if coal is to cost 14s. and oil 70s. a ton, the Diesel plant might fairly be estimated to save ·046d. per unit generated, or £2,875 per annum, on an output of 15 million units. Therefore, deducting the increased capital charges from the diminished fuel cost, £2,875 minus £1,535, an annual saving is shown of £1,340. In addition, there would be a saving in boiler-house wages of possibly £600 per annum, or in all a total saving of £2,000 per annum. This would, however, only accrue after the extensions had increased by 9,000 KW., or say in the year 1920, and assuming the cost of oil did not increase. He is of opinion that in spite of the saving in cost of production which calculation shows, the Committee would be well advised not to embark on a Diesel engine scheme until an engine of the size required has been built and run satisfactorily, and, further, until some evidence is available to show that supplies of oil can be obtained with certainty, and that the price of it is not going to increase owing to the big demand for it that will arise for marine purposes. The Committee adjourned consideration of both reports for a fortnight.

Bournemouth.—The T.C. has invited the Bournemouth and Poole Electricity and Supply Co., Ltd., to tender for the lighting of the Undercliff Drive for five or seven years, with 200-C.P. lamps.

Canterbury.—The T.C. has fixed a charge of 4½d. per unit for current supplied to motors to be used in connection with gas compressors for lighting purposes.

Cheltenham.—On Monday next, at the Town Hall, a "Modern Home Exhibition" will be opened, and will close on the following Saturday, 23rd inst. The electrical section has been organised by the Corporation (Mr. W. J. Bache, borough electrical engineer), and it will contain a representative display of appliances for electric lighting, heating, cooking and power.

Cleckheaton.—At a meeting of the Electricity Committee, a report was read in which it was stated the estimated loss on the quarter's working was £464, and the estimated loss for the half-year £819. On account of this loss, which has been greatly due to the increase price of coal, a Sub-Committee has been appointed to consider a revision of charges.

Consett.—The Urban Council has opened negotiations with the Cleveland and Durham Electric Power Co. for the public lighting of the town in 1913. The company has also been asked to embody in the scheme terms for private lighting.

Continental Notes.—SPAIN.—It is stated that an American named Parrish intends to set up a hydroelectric station on the River Ebro, capable of generating 1,000,000 H.P. Three dams will be constructed, in the neighbourhood of the Cities of Barcelona, Tarragona and Valencia, respectively. The works are being directed by American engineers, and are expected to be completed by 1914.—*Revue Pratique de l'Electricité.*

RUSSIA.—The British Vice-Consul at Hangö reports that there are small waterfalls or rapids in the south of Finland which are suitable for the development of electric energy for tramways, light, and power, &c. The Vice-Consul adds that want of capital has, up to the present, hindered the exploitation of this water power for industrial purposes: he is willing to supply information to British firms who would interest themselves in this matter.

The Moscow municipal authorities propose to construct a new electric power station in that city at a cost of about £316,000. The station is to be equipped with turbine engines using superheated steam.

The Ministry of Trade and Industry has confirmed special regulations for the use of electrical equipments on oilfields.—*Board of Trade Journal.*

The rolling mills of the Société Metallurgique du Midi de la Russie, at Kamenskoie, are now electrically operated. The power station comprises four sets of 2,000-H.P. gas engines and dynamos.

SWEDEN.—A power station of 5,000-H.P. capacity has just been completed by the Sikfors Kraft Aktiebolag at Pitealfau, near Pitea, North Sweden. The water-power of the Sikforsen Falls is utilised, the water being conveyed to the station by two pipes, about 550 ft. in length. At present about 4,000 H.P. is being utilised, the current generated being transmitted to the town of Lulea, 27 miles away, at a pressure of 40,000 volts.

FRANCE.—La Société des Forces Motrices du Rays is the name of a company which has lately been formed in Lyons, with a capital of £10,000, to put down a plant to utilise the Ray Falls at Romeyer (Drome) in the generation of electrical energy for lighting and power purposes.

Chile.—The construction has been authorised of an electric generating station to supply the City of Tocopilla with electric light.

Dover.—The T.C. has unanimously adopted a report by the borough engineer and electrical engineer for the conversion of a number of streets at present lighted by gas, to electric lighting. The scheme provides for replacing 265 gas lamps, costing £973 a year: the electric light would cost £818 for all-night lighting, and £707 for half-night use. The report further details the expected saving by various electric lighting proposals during the year, amounting to £1,108, which, even after meeting the capital cost of carrying out the work, leaves a margin in hand of £160. In 1913-14, including proposed further conversions, a saving of £1,496 will be shown.

The Corporation Electricity Committee, on November 5th, considered a request from the British Electrical and Allied Manufacturers' Association that figures relating to tenders should not be published, on account of the information becoming known to foreign firms. The chairman (Mr. Hobday) expressed the opinion that it was unwise to publish prices, but Ald. Lewis said that the public demanded it, and they could not get away from that. Mr. Beaufoy remarked that those who tendered liked to know the prices, as they were a guide for the future. They simply accepted them in a lump sum, and no details were published. Ald. Lewis said that if people were afraid of foreign competition, they should have Tariff Reform. The Town Clerk explained that only the names and amounts of tenders were reported to open Council. It was eventually decided to defer the matter, in order to see if other manufacturers made a similar request.

Dublin.—A L.G.B. inquiry will be held on November 19th into the application by the T.C. for sanction to loans of £34,000 for electricity purposes. On the 20th inst., a similar inquiry will be held at Pembroke, the Council being desirous of borrowing £9,000 for electric lighting works.

Felixstowe and Walton.—The U.D.C. has accepted the tender of the Suffolk Electricity Supply Co., Ltd., for public lighting, for seven years, within a radius of 150 yards from the back of the Promenade, on terms to be agreed.

The Council has decided to apply to the L.G.B. for a loan of £4,052 for additional plant for the electricity works and extensions for three years.

Harwich.—The T.C. has sealed an agreement to take electricity for its pumping station from the Great Eastern Railway Co. for ten years, at 1½d per unit, and it is estimated that the cost of working the station by electricity will be from £300 to £350 a year, as against over £500 by the present steam power. The capital cost of the scheme is placed at £950.

Hazel Grove and Bramhall.—The U.D.C. has approached the Stockport Corporation with a view to obtaining a supply of electricity, and a canvass of the district is being made for likely consumers. The Council has already decided to obtain a provisional order in the next session of Parliament empowering it to provide electric light for street purposes and for private houses, and applications for additional gas lamps in some of the districts have been deferred pending a report as to the probable date of commencing the supply of electricity.

Hemsworth (Yorkshire).—The Little Houghton P.C. has partially arranged with the Houghton Main Colliery Co. to supply electricity for the lighting of the township.

Heston-Isleworth.—Demonstrations of electric cookery, organised by the Electricity Department, in conjunction with the "'Tricity" cooker manufacturers, and carried out by Mr. F. S. Grogan, have attracted large audiences to the Council House.

Hoddesdon.—The U.D.C. has informed the B. of T. it has no objection to the E.L. Order of 1901, held by the North Metropolitan Electric Supply Co., being revoked. The company itself has applied for the revocation.

Hove.—With regard to the suggested purchase of the undertaking of the E.L. Co. by the T.C., a large meeting of ratepayers held on November 7th decided by a large majority that "the purchase would prove disastrous," and recommended the T.C. not to proceed further with the matter.

India.—Karachi is at last to be illuminated by electric light. We hear that a leading Karachi firm has the matter in hand, and that on the necessary formalities in connection with the licence under the Electricity Act being completed, a company will be established in Karachi for the supply of electrical energy for all forms of lighting, for fans and for all industrial purposes. The prospectus will probably appear about the end of the year, and the new development may be expected to be seen in operation early in 1913.

Kendal.—The T.C. has applied to the B. of T. for permission to use overhead mains in order to supply current to the factory of Mr. Illingworth on Malt Kiln Hill.

Kingstown.—The electric light question was discussed last week by the Council, and a resolution dispensing with notice from the Dublin Southern District Electric Supply Co. of its intention to apply for a prov. order, was unanimously adopted. It was pointed out that Mr. Wm Murphy had agreed to become chairman of the new company, and that the Dublin United Tramways Co. had no power to undertake lighting in the district.

London.—Hackney.—The borough electrical engineer in his report on the working of the electricity undertaking for the year ended March 31st last, states that the year's output amounted to 6,615,526 units, compared with 5,662,795 units for the previous year, or an increase of no less than 16·82 per cent. The total units generated amounted to 7,612,775, of which amount 2,239,920 were sold for private lighting and domestic uses; 3,389,726 for power and factory lighting, and 850,561 for public lighting, while 1,027,219 was used on the works. During the 12 months under consideration, the price obtained per unit for public lighting was 1·36d., this being more than sufficient to pay for the energy supplied. Having regard to the high load-factor of this class of supply, the engineer suggests that the price charged should in future be reduced to 1·2d. per unit, which would also cover the capital charges on the special public lighting cables, and that the carbons, repairs and maintenance, cleaning, lighting and extinguishing, be charged for at prime cost, with 10 per cent. added thereto to cover administration expenses. The financial result of the year's working was a net surplus of £8,950.

Lytham.—The U.D.C. is giving notice of its intention to apply to the B. of T. on or before December 21st next for a provisional order for the supply of electricity within the urban district. In connection with this matter, the Council has approved of the engineer's scheme, and has decided to acquire a plot of land, on lease, for the erection thereon of the proposed electricity works.

Nenagh.—The Urban Council has had under consideration for some time the advisability of installing an electric lighting plant for the town, and will at the next meeting appoint an electrical engineer to carry out the scheme.

Penmaenmawr.—The Urban Council has been notified by the Manchester engineers that, acting on behalf of a syndicate, it was their intention to apply to the B. of T. for an order authorising them to undertake the generation and distribution of electricity for public and private purposes over an area embracing parts of Llanfairfechan and Penmaenmawr, and desiring to ascertain the Council's attitude. The Council is already in possession of an E.L. order, and the letter was referred to the Roads and Improvements Committee.

Rochdale.—The Electricity Committee on Wednesday, last week, referred to a Sub-Committee for consideration and report, a scheme for further additions at the electricity works, involving an expenditure of about £30,000. Negotiations are in progress between the department and certain firms for a large supply of current, and this prospective demand, together with others already agreed upon, renders a further extension necessary. The Committee also approved terms for a supply of current in bulk to the Whitworth U.D.C.

Salford.—The B. of G. has deputed Mr. E. M. Lacey, the engineer engaged in connection with the electric lighting, to interview the Corporation with a view to obtaining the best terms for a supply of current, &c., for the electric lighting of Hope Infirmary. The board has also decided to ask Mr. Lacey to act, after completion of the installation, as consulting engineer, and to make quarterly tests and reports both at the infirmary and nurses' home at a remuneration not exceeding 25 guineas per annum.

Sheffield.—At the meeting of the Council on Saturday last, the Parliamentary Committee recommended the Council to instruct the Town Clerk to proceed with the remaining stages of the Corporation Bill now before the Select Committee of the House of Lords, and to endeavour to get the "electric fittings" clause, as allowed by the House of Commons' Committee, reinserted in the Bill. Ald. Cattell proposed as an amendment that so much as related to the Town Clerk being instructed to endeavour to get the electric fittings clause, as allowed by the House of Commons, reinserted in the Bill, be not confirmed. Dealing with what were supposed to be the special circumstances in the case, he maintained that the factory department had nothing whatever to do with the wiring and fittings department. No one would contend that the cost of motors had anything to do with the cost of the wiring and fittings department. The £2,000 profit they were told about was not a profit on the wiring and fittings department. At least £1,000 of it belonged to the revenue they got from the hire of motors. The officials of the Electric Light Department said on oath that nothing had been charged to the department for rent, interest or depreciation. It was a state of things one would not be surprised at when one considered the number of interests the head of the department had had to take under his wing. They wanted to simplify matters and consolidate their work, and put the department on a business foundation. His opinion was that they would gain by closing the department. Ald. Styring assured the Council that if they left the conduct of the Bill in the hands of the Parliamentary Committee, there would be no fear of losing it. If the wiring and fittings department was worth nothing at all, why did Ald. Cattell move to induce the Corporation to give up what was of no value to others? Very little cost had been incurred by the introduction of the clauses, and he maintained that the wiring and fittings department had cost £28,000. Councillor S. Roberts, jun., said that in all cases where the Corporation had been doing work at less than cost price, they had been making a loss and robbing the traders of their profits. Alderman Styring denied that the Corporation did work at less than cost price. Alderman Bennett said the question had nothing to do with municipalisation. That was settled when they purchased the undertaking years ago. The question before them was simply a business question and nothing else. He agreed with the Chairman of the House of Commons Committee, that under existing circumstances Sheffield ought to have the powers. They had to face things as they were, quite irrespective of what they would do if starting a new undertaking. Councillor Hobson said that no one suggested that the Corporation should go out of electric trading; they must have a wiring department to lay cables through the streets; it was commonly agreed that they should supply motors for hire, and they must wire and fix those motors. The whole question, therefore, resolved itself into whether some small portion of a complete business should be lopped off. He found that in the past the Corporation had carried on the business in the honest belief that they did so as successors in title to an existing business, and introduced no new competition. It did not seem to him precisely right that trade rivals should desire to peremptorily close down a substantial concern and one that was earning substantial departmental profits, without any payment for the goodwill, and without any proposal to take over the stock, but simply to shut the doors of a trade rival and annex the business and its goodwill. He hoped that the traders would seriously consider the situation before they persisted in their claim to annex some portion of the business of the Corporation without compensation by shutting it down on a technicality. On a vote the amendment rejecting this portion of the Parliamentary Committee's minutes was lost by 31 votes to 24.

South Africa.—The electric supply of the Muizenberg (Cape Province) Municipality, and also the recently inaugurated supply from Muizenberg to Wynberg Municipality, was interrupted on October 20th, and it was some time before the cause of the failure could be located. The supply to Wynberg is by three-phase 3,300-volt bare overhead cables, and has been in use only about two weeks. The cables are carried on 30-ft. iron poles from Muizenberg to Wynberg, and it appears that a European boy about 10 years old climbed to the top of one of the poles and touching the wires was instantly killed. The body of the boy lay across the wires for some time, as owing to the lateness of the hour, and the locality, it was difficult to communicate with the Muizenberg power station so as to have the current switched off.

The Cape Town Corporation Electric Lighting Committee has decided to reduce the price of energy for lighting purposes from the present price of 9d. net to a flat rate of 7d. net. This is made possible by the large increase in the demand; in 1908 a little over two million units were sold, and in 1911 this had been increased to 4,161,000 units, and further increased in 1912.

Southampton.—With regard to the Council's action several months ago abolishing slot meters and increasing the price per unit by ¼d. in lieu thereof, the electrical engineer reports that the ¼d. is not sufficient to cover the rental paid, and advises that the price per unit should be increased another ¼d., making ½d. in all, which would be, if anything, still slightly on the low side of the average account. He further suggests an increase of ½d. on the charges of the few prepayment installations connected, to bring the two classes into line. It has been decided to adopt the engineer's suggestions. Application is to be made to the L.G.B. for sanction to borrow £3,000 for general services. A letter has been received from the Itchen U.D.C., stating that it cannot consent to the application of the T.C. to supply electricity to the houses on the Chessel House Estate, also a further letter stating that the District Council has had under consideration a scheme for the establishment of an electricity supply undertaking for Itchen on the basis of taking a supply in bulk from the Corporation, and inquiring whether the Corporation would be prepared to enter into an arrangement for furnishing such a supply, and if so, upon what terms and conditions. The communication has been referred to the electrical engineer for a report.

Swindon.—In order to encourage cooking and heating by electricity, the T.C. has decided to supply energy to consumers of electricity for other purposes, at 1d. per unit, with no meter rental, where the revenue amounts to 25s. per annum. Cooking apparatus is to be let out on the hire or hire-purchase system.

Wednesbury.—The Corporation has received an intimation that the L.G.B. has sanctioned the borrowing of £3,700 for an engine, dynamo and accessories for the electricity works.

Woodbridge.—The U.D.C. has informed the Rural Districts Electric Undertakings, Ltd., that when the present contract with the Gas Co. expires, it will, no doubt, be prepared to consider a tender from the company for public lighting, and that if a reasonable, sufficient and efficient service is maintained by the company, the Council will not apply for a prov. order for 21 years from January 1st, 1913, and will not support any other application for an order during that period.

York.—The T.C. proposes to have the electric light installed in the Municipal Asylum Cottages, and to supply energy to the occupiers at 9d. per week during the six winter months, and 6d. per week during the summer. The first lamps are to be provided free

TRAMWAY and RAILWAY NOTES.

Barnsley.—The Barnsley Electric Traction Co. has decided to introduce a service of motor-'buses to link up some of the populous districts with the tramway system.

Bournemouth.—The general manager of the tramways (Mr. I. Bulfin) has just issued his report for the half-year ended September 30th. The total receipts were £53,749; expenditure, £27,891; gross balance, £25 855. These show an increase on the gross balance for 1912 of £2,548 over the corresponding period of 1911, and £2,631 over the same period of 1910 (the centenary year). In regard to expenses, slight increases are shown in a few cases, viz., in the power station, due to increased units generated and coal strike charges; in the payment of wages, due to the Government insurance; in the permanent way, due to renewals; in the car equipment, due to painting and overhauling. These are amply made up for by the decreases under other heads, as the net result of a decrease of £1,000 in expenses on the six months' running clearly proves. During the six months ending on September 30th, 3,628 more car-miles were run and 200,000 more passengers carried than in the corresponding period of 1911, yet the claims paid for accidents and damage for the six months of 1912 were less than half those for the corresponding period of 1911.

The chairman of the Tramways Committee reported to the T.C. that a director who had power to act for the Electricity Supply Co. had approached him on the question of the price of current outstanding between the Council and his company, and the latter was willing to supply the energy required by the tramways at 1·6d. for the first 250,000 units; 1·5d. for the second 250,000 units; 1·4d. for the third 250,000 units; 1·3d. for the fourth 250,000 units and remainder.

Canada.—The Canadian Express Co., which operates in connection with the Grand Trunk Railway system, is trying an interesting experiment with electrically driven collecting and distributing lorries. Five of these vehicles have been delivered by the makers for use in Montreal and Toronto. The new vehicles have a speed of 10 to 12 miles an hour, and will travel for 45 miles on a single charge. Two of them are built with a carrying capacity of one ton, and the other three can convey loads of two tons each. Electricity was chosen in preference to other forms of motive power on account of the greater simplicity of the mechanism and the ease with which the vehicles can be operated by any intelligent man who has been used to driving horses.

Chesterfield.—The General Purposes Committee has passed a resolution favouring the obtaining of Parliamentary powers for establishing railless trolley vehicle routes as proposed in a joint report by the electrical engineer and borough surveyor. The routes proposed extend to Temple Normanton, three miles; Clay Cross, two routes, each four miles; from Whittington Moor to Unstone, two miles; to Brimington, two miles; and other routes from Whittington Moor and to Bolsover.

Continental Notes.—FRANCE.—The Compagnie des Chemins-de-fer du Midi, like all the rest of the companies which serve mountainous regions (the Paris-Lyons-Méditerranée and the Paris-Orléans), has at last decided to enter on the path of progress. In September last it inaugurated the funicular line of the Superbagnères mountain, above Luchon, and it now announces its intention to undertake a similar work on the slopes of the Pic du Midi de Bigorre. As already notified, the same company has decided to introduce electric driving on the Toulouse-Bayonne main line lying between Montréjeau and Pau and on all its dependent Pyreneean branches, or over 270 km. of lines now in working. With this end in sight, large generating stations are under construction at Soulom, near Pau and at Eget in the Aure valley, 1,000 metres above sea level. The latter will necessitate the construction of an underground canal 15 km. long, to lead the waters from the Oule torrent and from an artificial lake to be created at a height of 1,800 metres, as far as Hourquette d'Arrouyes, where it will fall 750 metres into the Neste d'Aure valley, near the Eget railway line crossing. This head of water is expected to yield 20,000 H.P. A beginning was made with the works in the winter of 1910-11, amid the deep snows of these almost inaccessible regions, 20 km. from the base at Arreau.—*Revue Pratique de l'Electricité.*

The construction of an electric railway between Villefranche and Vernet-les-Baines, in the Pyrenees Orientales, has received the sanction of the Ministre des Travaux Publics.

The T.C. of Villeneuve, in the Department of Seine-et-Oise, have passed a resolution favouring in principle the establishment of a service of electric auto-'buses between Brunoy and Villeneuve.—*Revue Pratique de l'Electricité.*

A scheme for the establishment of a railless system of electrical motor vehicles between Thonon-les-Baines and Morzine, in Upper Savoy, is at present under consideration.

AUSTRIA.—Among the electric railway projects lately announced are a line from Malé to Fucina, 16 6 km. long, estimated to cost 2,414,000 kronen: a light line, for passengers only, from Karlsbad and Fischern to Rohlau, promoted by the Vienna firm, P. Hagyi, Risto & Co., and a line connecting Lana, Burgstall and Oberlana.—*Elek. und Maschinenbau.*

A great extension of the electric tramway network is projected in Prague, the capital of Bohemia. Some five new lines are to be constructed, with a rearrangement of the supply cables. The K.K. Statthalterci has just completed the official investigation of the scheme.—*Elek. und Masch.*

ROUMANIA.—The commission nominated by the T.C. of Bucharest to draft the terms of the auto-'bus concession to be offered for public competition, has issued its recommendations, which now await the approval of the City Council. It recommends a concession for 19 years 11 months, dating from January 1st next, giving a right to serve the whole of the streets of the city, with a reservation of any routes which the concessionaire may neglect for other concessionaires. Any kind of driving power may be chosen, but should electricity be adopted, current must be supplied by the communal electricity works, which is bound to furnish at the same price as that accorded to the Communal Tramway Society. It is stipulated that at the end of the concession, the rolling stock shall become the property of the commune.—*Revue Pratique de l'Electricité.*

SWITZERLAND.—Trials of electric working have been made on the almost completed Lötschberg line, and have given excellent results. Motors of 1,250 H.P. are used, each locomotive being equipped with two, giving a total of 2,500 H.P.—*Revue Pratique de l'Electricité.*

RUSSIA.—In view of the overcrowding of the St. Petersburg tramcars, it is proposed to put a further 75 cars and 42 trailers in circulation, and to enlarge the central power station. The total cost is estimated at about £81,600.

Good progress is being made with the conversion of the horse tramways in the town of Kischinew to electric traction, and it is hoped to re-open the lines to traffic at the beginning of the new year. The company has contracted with the municipal electricity undertaking for the supply of the necessary current.

East Kent.—The East Kent Light Railways Co. is applying to the B. of T. for an order authorising the construction of a light railway from Little Mongeham to Eastry, which is in the new colliery area.

Halifax.—A special meeting of the T.C. was held on Monday, when Mr. C. F. Spencer, chairman of the Tramways Committee, moved a resolution authorising that steps be taken to promote a Bill in the ensuing session of Parliament to enable the Corporation to extend its tramways within and outside the borough and to provide and run motor-'buses outside the borough. In the borough, the Corporation seeks powers for tramways from Spring Hall Lane to Mount Tabor and Wainstalls, from Skircoat Road, to Siddall, and from Siddall to Messrs. Morton's works. Outside the borough, it is proposed to construct and work tramways from Brighouse to Rastrick, from Bailiff Bridge to Brighouse, West Vale to Staniland, Triangle to Ripponden, and another route to Elland; also to construct tramways to run goods traffic to and from the railway goods yard in Church Street and Messrs. Morton's brickworks at Siddall, and Messrs. Oates & Green's works, Ellen Royde. Mr. Spencer said Messrs. Morton's traffic was about 37,000 tons per annum, and that of Messrs. Oates & Green about the same. The Council approved of powers being obtained for the making of these tramways and to construct and work the following tramways in Brighouse: In Huddersfield Road and Bird's Royd Lane, from Huddersfield Road to the L. & Y. Goods Station.

The R.D.C. has approved of the scheme of the Huddersfield Corporation for the proposed tramway to Fixby, and has also consented to the proposed tramway extension from Fixby to Elland.

Keighley.—In connection with the scheme for the introduction of a railless traction service from Ingrow Bridge to the junction of Hebden Road and Leeds Road, Haworth, a distance of about $1\frac{3}{4}$ miles, the Tramways Committee has provisionally accepted the offer of Trackless Trolley, Ltd., London (see "Contracts Closed" column) for the overhead equipment, on condition that the company (1) sends on trial for a period of three months, free of charge, one of its cars, which the Corporation shall be at liberty to use in regular service during that time; (2) supplies one of its own men to drive the car at an inclusive cost not exceeding £3 per week; and (3) gives an undertaking that in the event of its system being considered unsatisfactory by the Corporation, it will, without further charge, alter the overhead equipment and adapt it to such other method of current collection as the Corporation may require.

Little Hulton (near Bolton).—The U.D.C. has appointed a Sub-Committee with power to settle an agreement with the South Lancashire Tramways Co. as to terms under which the company will construct tramways along Manchester Road and Clegg's Lane.

London.—Formal notification has been given by the L.C.C. to the City Corporation that it has decided to seek powers in the next session of Parliament to construct tramways from Southwark Street over the proposed new St. Paul's Bridge, to a point near the most western end of Cheapside.

Morley.—The Corporation has decided to promote in the next Session of Parliament a Bill authorising, among other things, the construction of a railless trolley system from Drighlington, through Gildersome, Morley, West Ardsley, East Ardsley and Stanley to Wakefield.

Newcastle-on-Tyne.—At a special meeting of the T.C. on the 9th inst., Mr. J. H. Rodgers, chairman of the Tramways Committee, moved a motion that the Council apply for a provisional order for an extension of the city tramways; one section from Heaton Road terminus to Stephenson Road, and another section from the centre of the city to the High Level Bridge *viâ* Westgate Road and St. Nicholas Street. The motion was agreed to.

Newcastle.—The Tramways Committee has recommended the City Council to accept a tender for the supply of steel rails of German manufacture, at a cost of £3,660, being £500 less than that of a Leeds firm.

Northampton.—As the result of an appeal the Assessment Committee has reduced the assessment of the Corporation tramways undertaking from £6,105 to £5,100.

Oldham.—It was reported at a meeting of the Tramways Committee last week that there was a profit on the tramways undertaking for the six months ending September 22nd, of £3,060.

Ripley.—The scheme for the construction of tramways from Nottingham to Ripley has been before a special meeting of the U.D.C., when, after full consideration, it was decided to object to the proposals, on the ground that proper allowance for road widening had not been made. It appears to the Council that the roads are to be widened at the expense of the footpaths in certain places; the Council thinks that land should be acquired, and proper widenings made. The objection is to be forwarded to the Board of Trade.

Sheffield.—It is proposed to purchase four motor-omnibuses for the purpose of providing an experimental service in the Meadow Hall district.

Tripoli.—The Acting British Consul-General at Tripoli reports that, according to the local Press, the "Società Romana di Tramways" is on the point of obtaining a concession for the construction and working of electric tramways in that city. The length of the proposed lines will be about 9¼ miles.

Woverhampton.—The annual report of the Tramways Committee to the Council gives the following statement of traffic receipts, &c., for the first six months of this financial year, ended September 30th last, as compared with the same period last year:—1912, 587,947 miles, 5,945,404 passengers, £27,205 receipts, 11·105d. per car-mile; 1911, 580,883 miles, 5,796,366 passengers, £26,732 receipts, 11·045d. per car-mile. From the figures given, it will be noted, states the Committee, that the total revenue for the electric cars during the period referred to shows an increase of £473, or 060d. per car-mile, whilst the number of passengers carried is 149,038 in excess of last year. The result is considered highly satisfactory, having in view the extraordinarily fine summer of last year, together with the heavy traffic on the cars during the Coronation festivities. The receipts on the Wednesfield route show a decrease of £109 for the six months, which is attributable to the motor char-a-banc service on the Cannock Road, many passengers now travelling by these vehicles who had hitherto travelled on the Wednesfield cars.

York.—The B. of T. has granted the T.C. an order for the extension of the electric tramways in Bishopthorpe Road.

TELEGRAPH and TELEPHONE NOTES.

Automobile Wireless Telegraph Plants.—The Star Engineering Co., Ltd., of Wolverhampton, are building a number of 20-H.P. six-cylinder chassis for the Marconi Wireless Telegraph Co., Ltd.; the machines are specially designed to carry a wireless telegraph outfit. An electric generator is carried at about the centre of the chassis, and is driven off the engine of the car through gearing, which can be engaged and disengaged.

Brazil.—The firm of C. Lorenz, of Berlin, have erected a wireless station at Lagoa, near Florianopolis, on the Island of San Catarina, Brazil, for communication with shipping between La Plata and Cape Horn; also for communication with Rio Grande do Sul and Rio Janeiro. The Vielton system is employed.—*Der Tag*, Berlin.

British Telephones.—In the Parliamentary papers Mr. Joynson-Hicks recently asked the Postmaster-General if he would state the number of subscribers' stations, direct exchange lines, and main exchanges taken over from the late National Telephone Co., Ltd., at January 1st, 1912, and the number of subscribers' stations direct exchange lines, and main exchanges existing on the General Post Office telephone system at December 31st, 1911, for London and for the provinces, respectively. Mr. Herbert Samuel, in reply, said the figures asked for were, approximately, as follows:—Post Office.—London: 79,835 exchange stations; 53,208 direct lines; 30 exchanges. Provinces: 39,160 exchange stations; 30,334 direct lines; 1,125 exchanges. National Telephone Co.—London: 131,506 exchange stations; 74,827 direct lines; 62 exchanges. Provinces: 393,934 exchange stations; 297,608 direct lines; 1,545 exchanges.

Iceland.—The Parliament of Iceland has voted 88,000 marks (£4,400) for the establishment of a wireless station on Reykjavik, the capital of the island.

Registration of Telegraph Companies.—Sir Wm. Bull asked the President of the Board of Trade whether he was aware that the Registrar of Joint Stock Companies had recently refused to register the memorandum and articles of companies proposing to carry on the business of telegraphs and telephones unless the memorandum of association contained the words "so far as it lawfully can carry" and that a considerable number of persons had lodged memoranda and articles of association not containing these words, and, owing to the refusal of the Registrar to register the companies, they had been put to expense in altering the provisions of the memorandum of association; whether this action had been taken by the Registrar in pursuance of a request from the Postmaster-General and in order to protect his monopoly and that of companies which had been licensed by him; whether there was anything in breach of the Postmaster-General's monopoly in the mere registration of such a company; whether he was aware that such a company could be properly formed and carry out a large part of the business of a telegraph and telephone company without infringing such monopoly; and whether it was possible for a company to obtain a licence from the Postmaster-General to carry out any part of its work for which a licence was required until it had been registered; and under what authority the Registrar of Joint Stock Companies adopted the course in question.—Mr. Buxton replied that the action of the Registrar of Joint Stock Companies in asking for the insertion of the words in question was originally taken at the suggestion of the Postmaster-General. The matter was receiving further consideration. Later it was announced that the practice in question had been stopped.

The Telephone Transfer.—Former employés of the National Telephone Co., now in the Post Office service, held a mass meeting in Clerkenwell last week to protest against the manner in which the Post Office classification had been applied to them. Other meetings took place simultaneously in various parts of the country. A resolution was passed affirming loyalty to the Postmaster-General, but asking that the promises which he had given in the House of Commons might be carried into effect.

United States.—The Government has voted £220,000 for the erection of a number of wireless stations, mainly to establish communications with ships of the American Navy in distant seas. The chief station at Arlington, near Washington, is to have three towers, one rising to a height of 210 metres, and the other two to 150 metres each. It is also intended to erect stations on the Panama Canal; at Tutuila, one of the Samoa Islands; on the Island of Guana, and on Luzon, in the Philippines.—*Elek. Zeitschr.*

The German wireless station which is in course of construction at Sayville, on Long Island, near New York, about which alarmist rumours have been circulated in American journals, is being built by the Atlantic Communication Co., an American capitalised company, although an offshoot of the Berlin Telefunken Gesellschaft. Its objects are, as its name implies, to exchange communications with ships on the Atlantic passage, and it is in no wise connected with the German Government. Contrary to the statement that it has been surreptitiously erected, the American officials have been duly informed of every stage of its progress from the beginning.—*Elek. Zeitschrift.*

Wireless Telegraph Patents.—We are informed by Messrs. Marconi's Wireless Telegraph Co., Ltd., that Messrs. Siemens Bros., acting in England for the Telefunken Co., have admitted the validity of the Marconi Co.'s patent No. 7,777 of 1900, and arrangements have been come to by which the actions brought by each company are now at an end.

Imperial Wireless System.—On Tuesday last week the Select Committee examined Mr. Llewellyn Preece, who stated that during the last 13 years, as a member of the firm of Preece, Cardew & Snell, he had been largely responsible for the wireless telegraph work in connection with the Crown Colonies, which included the erection of 11 stations. The Marconi Co. was the only one that had had continuous experience in commercial working over 2,000 miles, and seeing that the matter was one of urgency, he considered the Postmaster-General did right in accepting the tender of that company. If he had waited for the Poulsen or the Goldschmidt systems to prove their capabilities, a delay of at least another year would have been incurred. Although the Poulsen system had been in existence for six years, it was only during the last few months that it had become a competitor of the Marconi system. He had checked the price quoted—£60,000 per station—with the cost of plant dealt with by his firm, and considered it a low one, as the actual cost would be £58,700. Seeing that there was no profit on the capital outlay, that State messages were to be free, and that the Postmaster-General could determine the agreement at any time, he considered the royalty of 10 per cent. on gross receipts a reasonable one. The Postmaster-General would have power to fix the rates without reference to the company, and he could substitute other plant at any time; in the latter event only about £10,000 per station would be sacrificed, the rest of the plant being available for other systems. After six stations had been erected, the Government could have additional stations erected by any other company capable of doing the work. The witness had never done any work for the Marconi Co., but he had visited the Clifden station, which worked well and handled a large traffic. The Poulsen people had not proved their claims, or put forward a complete scheme which could be compared with the cost of the Marconi system. He had not placed orders with the Telefunken or other companies, as their tenders had not been satisfactory. He was not a Marconi man. In 1907 the company was in a rotten condition. The company held the master patents for wireless telegraphy, and the probability was that any new invention would infringe those patents. The Lodge patent was more important than the Marconi patent. He had a high opinion of the Poulsen system, but the Marconi Co. stood alone as regarded long-distance working. The former could only work at night between San Francisco and Honolulu. The Marconi Co. stood to lose on the cost of the stations; as they held the master patents.

they were entitled to the 10 per cent. royalty. There was no alternative for the Post Office but to use the Marconi system; the Admiralty experts had had no experience of working over 2,000 miles. He did not think the Poulsen system could be worked without infringing the Muirhead-Lodge patent. He regarded the terms of the agreement, by which no payment would be made until the stations were working satisfactorily, as very stiff.

The witness was further examined at great length regarding the technical details of the various systems. He considered the duplex better than the simplex system for the Imperial scheme. If the Poulsen system later proved to be the better, and the Government resolved to adopt it, but wished to use the Marconi amplifier, he suggested that they should throw out the Marconi system entirely, substitute the Poulsen, and then open negotiations with the Marconi Co. for the use of the amplifier. In that case they would not have to pay the 10 per cent. royalty. He had witnessed a demonstration at the Marconi Co.'s works of transmission at the rate of 50 words a minute from Cheltenham to Poldhu. The company had a great deal of work in hand, apart from this contract. There was no reliable automatic long-distance system at work anywhere. If the Government had waited for the Poulsen Co. to demonstrate their ability to transmit by day over a distance of 2,000 miles, there might have been a delay of 2 or 2½ years before the Imperial system was established.

On Monday the sitting was resumed, and Sir A. F. King, re-called, stated that the Marconi Co. first reduced the period of monopoly to five years, and later dropped it altogether. If they used none of the Marconi patents, the royalty ceased. It was possible that the company might control the situation by purchasing other people's patents. It would be impossible to prevent movement in the shares of any company that got a Post Office contract. He had never put down the great movement in Marconi shares to the Post Office contract; the company had then just acquired the business of the United Wireless Co. in the United States. It was of no consequence to the Government to know whether the company had secret processes or not, so long as they were doing the work. It was not the duty of any Government department to secure an unfair bargain; if a man had a patent he was entitled to be paid a royalty. The Treasury could have made use of the patents and fixed their own price, but at the Post Office they did not negotiate on that basis. Moreover, the Post Office wanted the benefit of the Marconi Co.'s experience, and desired that the company should be responsible for the stations. He did not agree with the chairman of the company when he stated in July that the company had acquired so many patents that the Post Office could not help using some of them. The stipulation in the agreement that any Government department not a party to the agreement should not receive any information as to the working of the system was inserted in order that in the event of the Indian Government or Australian Government not desiring to be parties to the agreement, no secret information connected with the working of the Marconi installations should be communicated to them. The original clause stated that information should not be imparted to other departments, and the Admiralty decided that they could not possibly accept the clause. The Treasury regarded the tender not as a binding contract, but as being "conditional on satisfactory arrangements being made subsequently." The Post Office undertook to obtain the advice of the Marconi Co. before using any new invention, but was not bound to follow that advice. The company would have to refund the £40,000 paid on each station if satisfactory working was not accomplished after six months' working. The company sent messages 3,000 miles mainly overland, between Italy and the East Coast of Africa.

On Wednesday, Mr. Beech Thompson, President of the Federal Wireless Telegraph Co., of U.S.A., gave evidence to the effect that his company, using the Poulsen system, had transmitted messages overland a distance of 1,150 miles in the daytime. Between San Francisco and Honolulu, a distance of 2,400 miles oversea, they regularly transmitted about 3,000 words a day, mainly Press messages, during the night. They had sent messages after 10.30 a.m. (about 8 at Honolulu). They had occasionally picked up messages from greater distances—one from a ship in the Atlantic, 8,000 miles away. The U.S. Government had made his company offers for the patents, but he had not accepted them. He could cover a distance of 2,000 miles. The distance between Ireland and Canada was only about 1,700 miles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. Six electrically-worked luggage lifts for the Aberdeen Joint Station Committee. Engineer, Mr. J. A. Parker, 80, Guild Street, Aberdeen.

Australia. — South Australia. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" November 1st.

December 18th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" November 8th.

December 17th.—Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

Victoria.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" November 1st.

Austria.—Vienna.—December 9th. Tenders are called for, for sundry telegraph materials, milliampere-meters, coloured crayons, &c. Particulars and samples from the K. k. Zentraltelegraphen depôt, Erzherzog Karlstrasse 131, Vienna XXI.

Perjamos, Torontal.—December 31st. Tenders are required for a concession to establish an electric light service. Particulars of the Vorstehung der Grossgemeinde Perjamos.

Birmingham. — November 25th. Electric motors (various), for the City Electric Supply Department. See "Official Notices" November 8th.

Dartford.—November 27th. 500 yd. of concentric lead-covered and armoured cables and accessories, and renewal of lighting battery, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Dover.—November 18th. Two centrifugal pumps, with electric motors, for the Corporation baths. Mr. W. C. Hawke, Borough Engineer, Maison Dieu House, Biggin Street.

France.—Paris.—The State Railway Administration intends to acquire a quantity of high-pressure three-phase electric cable, 15,000 volts, 3 × 100 millimetres section, for the interiors of traction and lighting sub-stations. Particulars from the Bureaux des Services électriques, 1e division, 43 Rue de Rome, Paris.

Tenders are required for the supply of fittings for call and central telephone offices (call plates, bells and receivers, &c.), in 12 lots. Particulars from the Sous-Secrétariat d'Etat des Postes et Télégraphes, Paris.

Greenock.—November 18th. One 3,000-KW. three-phase turbo-alternator, with condensing plant, &c., for the Corporation. See "Official Notices" November 1st.

Hull.—November 20th. Electric lighting, fittings and bells, for the Teachers' Training College, Cottingham Road, for the Education Committee. Particulars (deposit £1 1s.) from the City Treasurer, Guildhall, Hull. Drawings to be seen at the Education Offices, Albion Street.

London.—November 19th. Electric lighting, bells and telephones, at the "Strand" School, Brixton Hill, S.W., and electric lighting at the Southern Outfall Works, Crossness, Abbey Wood. See "Official Notices" November 8th.

Manchester.—November 19th. The Corporation Tramways Committee is inviting tenders for (*a*) tramway rail bonds; (*b*) block tin: (*c*) karri or jarrah wood paving blocks. Specifications, &c., J. M. McElroy, General Manager.

November 19th.—One 650-800 KW. rotary converter and transformer, for the City Electricity Committee. See "Official Notices" November 8th.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture only. Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

January 6th, 1913.—Switchboards, for the Auckland Harbour Board. See "Official Notices" to-day.

Rathmines.—November 25th. Electric wiring of the new Carnegie Library and Technical Institute, for the Rathmines and Rathgar U.D.C. Specification 10s. 6d., can be seen or obtained at the Council's electricity works.

Spain.—November 28th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment of a telephone exchange in the town of La Carolina (province of Jaen), and for the working of the same during a period of 15 years.

November 21st.—The municipal authorities of Roquetas (province of Tarragona) are inviting tenders for the concession for the electric lighting of the town during a period of 15 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Roquetas (Tarragona).

Vich.—The T.C. are ready to receive offers for a concession to light the town by electricity for a period of 10 years, dating from April 16th, 1913. Deposit, 6,000 pesetas. Particulars from the Municipio, Vich.

Jaen.—November 20th. Offers are invited for a concession for 15 years to establish and work a telephone system. Particulars of the Civil Governor.

York.—November 16th. Construction of about 1¼ miles of light railways, for the T.C. Mr. H. Craven, Town Clerk. Returnable deposit of £5.

CLOSED.

Admiralty and Australia.—The Walsall Electrical Co., Ltd., have received an order from the Admiralty for 18 moving coil meters, switchboard type, and one from the Australian Postmaster-General for two moving coil switchboard type instruments, and 11 portable instruments.

Brussels.—The city authorities have entrusted to the firm of J. G. Hiroux & Co., of Brussels, representing the Kabelwerk Duisburg (Germany), the contract for the supply of high-pressure armoured and rubber-insulated cables during the period up to December, 1914, which was the object of the adjudication held on August 9th last.

Felixstowe and Walton.—The U.D.C. has accepted the tender of the D.P. Battery Co., Ltd., for a battery, duplicate booster and arrangements for balancing at £1,117, subject to sanction to a loan being obtained.

Fort William.—For the electric lighting plant, electric bells and the heating installation in connection with the improvements and additions on the Estate of Dalness for Sir Schomberg Macdonnell, the contract has been placed with Messrs. Mackenzie and Moncur, Ltd., of Edinburgh.

Greenock.—Messrs. Kennedy, Stark & Co., Glasgow, have secured the contract for the electric lighting of a new school at Greenock.

Keighley.—The T.C. Tramways Committee has recommended the acceptance of the tender of Trackless Trolley, Ltd., of London, to construct the necessary overhead equipment for the proposed trackless trolley system from Ingrow Bridge to the junction of Hebden Road and Leeds Road, Haworth, a distance of 1 mile and 1,400 yards, for £1,610, subject to certain conditions.

London.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract to supply the whole of the metal-filament lamps to be used on an electric railway in London for the ensuing 12 months.

L.C.C.—The Highways Committee has accepted the tender of Messrs. Rownson, Drew & Clydesdale, Ltd., at £77, for 12 hand scrapers and spare parts required for cleaning tramway conduits. The tender of Alldays & Onions Pneumatic Engineering Co., Ltd., at £135, for a pneumatic power hammer for Poplar permanent way depôt, has also been accepted. Messrs. B. and S. Massey quoted £155.

Mansfield.—The Guardians' Building Committee received the following tenders for the electric lighting installation of the institution :—

J. Woolley		£998
B. Meggitt		980
Mansfield Engineering Co.		955
Furse & Co.		886
Buck (Manchester)		[illegible]
Farr (Nottingham)	(recommended)	725

Tram Rail Contract at Newcastle-on-Tyne.—At a meeting of the City Council on the 9th inst., Mr. Rodgers, chairman of the Tramways Committee, moved that a contract with Messrs. Dick, Kerr & Co., for tram rails be sealed. He said that the matter was not on the agenda, but it was important that the contract should go through. Mr. Stephenson objected, whereupon Mr. Rodgers said if Mr. Stephenson blocked the way he must take the responsibility of the price going up. They wanted 500 tons of rails to complete the work they had to do. The tender of Dick, Kerr & Co. was £3,362 for a kind of rails used by several large municipalities and found satisfactory—Bradford, Leeds, Sheffield, Manchester, Hull, Bristol, &c. It was the lowest tender. The motion having been duly seconded, Mr. Stephenson moved as an amendment that the Council accept the tender of a local firm, Messrs. Walter Scott & Co. The firm, he said, from whom the Tramways Committee proposed to accept the rails, got them from Germany. The difference between their price and the local firm was only £462, or 10 per cent. He believed in the matter of tramway rails they could get better workmanship and better materials at home than if they went abroad. Mr. Woolf seconded and pointed out that English workmen were paid on a better scale than foreign workmen. Mr. Mayne called attention to the fact that Sandberg rails were agreed by experts—such as the city engineer and the city tramways manager—to be better than English standard. The amendment was negatived, and the motion for sealing agreed to.

Paisley.—The T.C. Advisory Committee has had under consideration offers received from the British Electric Transformer Co., Ferranti, Ltd., and Messrs Siemens Bros., Ltd., for the supply of transformers. After consideration had been given to the engineer's report upon the offers, it was agreed to recommend that of the first-named firm for acceptance, provided the temperature rise of their transformer could be brought down to 80°.

Stockport.—The Stores Committee of the Guardians has accepted the tender of the Co-operative Wholesale Society, Manchester, for the supply of 1,000 "Osram" metallic-filament lamps for burning on 240 volts, at the Stepping Hill Hospital.

Sunderland.—The following installation contracts have been secured by Messrs. F. Reid, Ferens & Co. :—Sunderland Picture Empire, also West-End, Murton, Haswell and Southwick Picture Empires ; Queen's Hotel and Arcade, and Easington Private Consumers' Line.

Watford.—The tender of the British Westinghouse Co., Ltd., has been accepted, at £3,004, by the U.D.C., for a steam alternator and regulator ; as has also that of the Electrical Construction Co., at £103, for a switch panel.

West Hartlepool.—Messrs. Venner & Co. have received an order for equipping the West Hartlepool Tramways with Chamberlain & Hookham car meters.

FORTHCOMING EVENTS.

Association of Mining Electrical Engineers (West of Scotland Branch).—[illegible] Meeting at the Royal Technical [illegible]

Association of Engineers-in-Charge.—[illegible] At 3 p.m. [illegible] West End and City [illegible]

[illegible] At 7.30 p.m. [illegible] Wires [illegible] Electrical Faults and How [illegible]

Electro-Harmonic Society.—Monday, November 18th. At the Holborn [illegible]

Institution of Electrical Engineers (Western Section).—Monday, November 18th. [illegible] Address by the [illegible], Mr. W. A. [illegible]

Institution of Electrical Engineers (Manchester Section).—Tuesday, November 19th. At 7.30 p.m. At the University, Manchester. Paper on [illegible] in Three-phase [illegible] by Mr. J. S. Peck.

Illuminating Engineering Society.—Tuesday, November 19th. At 8 p.m. At [illegible] Papers on "A New [illegible]" by Mr. H. [illegible] Harrison, [illegible] and [illegible] Lamps.

Institution of Electrical Engineers (Students' Section).—Wednesday, [illegible] Embankment, W.C. [illegible]

Royal Society of Arts.—Wednesday, November 20th. At 8 p.m. First [illegible] Chairman.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 22nd. At Newcastle-on-Tyne.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, November 18th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 19th.—"B" Company. Recruits' instruction, 7 to 10 p.m. ; company training, 7 to 10 p.m.

Thursday, November 21st.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 22nd.—"D" Company. Recruits' instruction, 7 to 10 p.m. ; company training, 7 to 10 p.m.

Saturday, November 23rd.—A week-end run will take place for "D" Company at East Coalhouse, East Tilbury. Dress: Service dress, puttees, [illegible] and greatcoats will be worn. Parade at Fenchurch Street Station at 3 p.m., the train leaves for Low Street at 3.35 p.m., railway tickets will be issued by the senior N.C.O. at 3 p.m.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

Explosion at an Electricity Works.—It is reported that on November 4th an explosion occurred at the Guernsey Electric Light and Power Co.'s works, situated at the North Side, St. Sampson's. Several employés were near a 250-H.P. Diesel oil engine, when suddenly there was a loud explosion, and the cylinder cover flew upwards. Holes were torn in the roof by the flying masses of metal, which were later found in fragments in the vicinity, parts of the valve gear being 20 yards from the building. The cause of the accident is unknown. The engine was driven by crude oil. It had been installed within the last 18 months.

A Hove Report.—A lengthy report on the Hove Electric Light Co.'s undertaking, by Messrs. Handcock & Dykes, has been received by the General Purposes Committee of the T.C. This details the present position of the undertaking, and suggests, in the event of the Corporation deciding to purchase it, that Diesel engine sets of about 600-KW. capacity should be installed to take the long-hour load, leaving the present condensing engine plant for the peak load. The cost of the alterations and extensions would amount to about £20,000. The report also refers to the possible expansion of the undertaking through the acquisition of street lighting and traction supplies.

The Ferrantians' Dinner.—Mr. A. Bruce Anderson presided over a representative gathering of Ferrantians, past and present, at a dinner at the Waldorf Hotel on Wednesday last. Mr. S. Z. de Ferranti was the guest of the evening, and in response to the toast of his health, he recalled many of the trials and troubles of the pioneer days of electricity generation and supply. Among other things, Mr. Ferranti remarked that the hot bearings which made electrical work a nightmare in the early eighties, were accepted practice in modern turbo-electric plants, the difference being one of forced lubrication. Speaking of electrical marine work, he thought that there might in time be a return to A.C. supply on shipboard. All the early shiplighters were A.C. machines. Mr. H. W. Kolle proposed "The Ferrantians over Seas," and referred to the good work they were doing in many countries abroad. Mr. E. W. Martin, who is in this country from Valparaiso on a short business trip, replied, and hoped that his next visit to the mother country would fit in with a meeting of Ferrantians. Electrical engineers abroad had few opportunities to foregather. Mr. Morton Beales proposed "The Chairman" in a humorous speech, and Mr. Anderson modestly replied.

China and British Engineering.—With reference to the article by Mr. E. T. Williams, of Hong Kong, appearing in our last issue, the author now sends us the following extracts from a leading article which appeared in the *Hong Kong Daily Press* last month: "For a country of China's size a total foreign trade of 849,000,000 taels, or roughly £113,000,000 sterling, is absurdly small. It is but slightly more than the trade of Switzerland. Therefore, it is no exaggeration to say that the possibilities of foreign trade with China are *stupendous*, and we may anticipate from the policies enunciated by the leaders of public opinion that this trade will develop by leaps and bounds, though not, we should add, until China is able to borrow the necessary foreign capital to put her house in order and lay the foundations of solid economic development. During the last decade China's foreign trade has doubled. Mr. Dingle, the author of 'China's Revolution,' predicts that in the next decade, if peace prevails, 'it must be trebled.' This is considered a cautious and conservative estimate. Mr. Dingle also says, 'No right thinking Englishman, no matter how optimistically he may view the general situation of Great Britain's trade in the Chinese Empire, can deny that British trade does not expand proportionately with what is to be done and with what others are doing.'"

In the Canadian Lumber Camps.—In many parts of the Colonies and foreign countries electrical engineers are naturally faced with all sorts of difficulties in carrying out installation work. All sorts of unusual situations have to be met, which demand all the resources and ingenuity of the engineering mind in securing the desired result with unaccustomed materials. In this connection we have been favoured by a correspondent with a photograph illustrating a standard high-tension sub-station switchboard (2,000 volts), as used in Canada. We are assured that this type of board is very often met with in the Lumber Camps there. Perhaps some of our readers in the distant parts of the earth may be able to furnish other and equally interesting photographs of this kind of thing?

H.T. SWITCHBOARD IN CANADIAN LUMBER CAMP.

The Bradford Strike.—At a concert held last Friday, under the auspices of the Bradford Branch of the Electrical Trades Union, Mr. Kinniburgh, the organiser of the Union, in referring to the strike of Bradford electricians, stated that the men had commenced electrical contracting on their own account, and were prepared to accept work for electric installations. He urged other trade unions to give their electrical work to the men on strike and also to support them morally. He announced that no definite settlement had been arrived at, and although one master had granted the advance asked for, the Electrical Contractors' Association had forced him to withdraw his offer.

Miners' Safety Lamps.—In a notice dated October 24th, the Home Secretary has authorised the use underground of apparatus for the relighting electrically of safety lamps, provided that the apparatus complies in all respects with, and is used in accordance with, the regulations in force with respect to the use of electricity underground, that the station where the apparatus is used is not within a distance of 200 yd. of any part of the working face, and that when not in use the apparatus shall be kept securely locked, and no person shall have any key or contrivance for unlocking the apparatus, other than a person appointed in pursuance of the Coal Mines Act. The chief provisions at present in force are as follows:—A safety lamp must not be relighted except at an appointed station, which must not be in a return airway; by a competent person appointed in writing by the manager for the purpose; and after examination by the person appointed. The lamp must also be examined by the appointed person after being relighted, and before being issued. The apparatus must not be used in any part of a mine where inflammable gas, although not normally present, is likely to occur in quantity sufficient to be indicative of danger. The apparatus must be so constructed, installed, protected, worked and maintained as to prevent danger so far as is reasonably practicable, and in particular must be so constructed as to preclude the accumulation of explosive gas within it.

Smoke Nuisance.—Scarborough Electric Supply Co., Ltd., were summoned before the local justices the other day for causing a chimney at their premises to send forth black smoke in such quantities as to be a nuisance. The Bench intimated that they were satisfied the smoke was black smoke within the meaning of the Act, but they thought that, in view of the uncontradicted evidence of the defendants, the company were entitled to the second exception of Sec. 91 of the Act, and they were compelled to dismiss the complaint.

Later on in the sitting a curious situation arose. The Clerk said the Bench would reconsider their decision, it having transpired that a legal difficulty had arisen on a technicality, and that the exception stated did not apply. The solicitor who had acted for the company said he had no further instructions, and added that the company were now entirely unrepresented, also remarking that it was the first time he had known a defendant dismissed, then brought up again and convicted. Ultimately the case was adjourned until to-day (Friday).

Oban Corporation Appeal Dismissed.—According to the *Oban Times*, Sheriff-Principal M'Clure has issued his decision in an appeal by the defenders against a decision of Sheriff Wallace in an action brought by John Campbell, gasfitter and electrician, Stafford Street, Oban, against the Provost, Magistrates and Council of the Burgh of Oban. It will be remembered that the pursuer sought to interdict the defenders from selling or supplying electric light lamps, shades and wire, which the pursuer alleged the defenders had done without having any Parliamentary powers for so doing, and thereby trading to the prejudice, and against the interests, of the pursuer's business.

In granting interim interdict against the Town Council, Sheriff Wallace stated in his note that the question of controversy was one solely of law and of the defenders' powers under the Acts and their Order to engage in the supply of electric fittings, to the detriment of pursuer's business and to his patrimonial loss. No doubt defenders denied that they were engaged in the business or trade of selling or supplying electric fittings. But they admitted that they had been in the habit of supplying, and no doubt intended to continue supplying, their customers or persons who took their supply of electric energy from them with the fittings and adjuncts incidental to the use of that supply, and that, it appeared to him, was sufficient evidence on their part to enable him to decide the real question in controversy between the parties without further delay and expense. He thought, therefore, no good could be served by allowing a proof.

Against this decision the defenders appealed, and the Sheriff-Principal heard the parties' agents debate before him. His Lordship has now dismissed the appeal, adhered to the interlocutor of the Sheriff-Substitute, remitted the cause for further procedure, and found the appellants liable to the respondent in the expenses of the appeal.

Canada.—H.M. Trade Commissioner for Canada reports that a firm at Montreal desires to get into communication with British manufacturers of electric and hydraulic elevators, with a view to securing their representation in Canada. The name and address of the firm may be obtained by British makers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. Any further communications regarding the inquiry should be addressed to H.M. Trade Commissioner, 120, Board of Trade Building, Montreal.—*Board of Trade Journal.*

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTIONS).—The ninth annual dinner of the London Students' Section will take place at the Trocadero Restaurant on Saturday, December 14th, at 7.30 p.m. The President, Mr. W. Duddell, F.R.S., will be present. The secretary of the Institution (Mr. P. F. Rowell) has issued particulars of the arrangements made for the different sections for the coming session. Mr. J. C. Rennie is chairman of the London Section, and the papers that are coming forward for attention are as follows:—

November 20th, opening address by Dr. A. Russell; and at later meetings the papers will be as under:—Discussion on "Passenger Transport in London"; Mr. J. C. Rennie, on "Sterilisation by Electric Light"; Mr. E. T. Driver, "The Conditions Influencing the Design and Minimum Manufacturing Cost of Induction Motors"; Mr. C. H. Goulden, on "Low and Mixed-Pressure Turbine Plant"; Mr. G. W. P. Page, on "Some Problems of Electricity Supply"; Mr. S. W. Mills, on "Electrical Heating and Cooking Apparatus"; Mr. T. J. Hornblower, on "Alternating-Current Railway Signalling."

The Manchester Students' Section, which had its opening address on Tuesday last, has as its chairman the chairman of the Local Section. The arrangements for the coming months are as follows:—Mr. S. N. C. K. Whitehead, on "Individual Electric Driving in a Modern Weaving Shed"; Mr. S. Burns, on "Electric Theatre Installations"; Mr. A. N. Haworth, on "Automatic Circuit-Breakers"; Mr. S. E. W. Taylor, on "Street Photometry"; Mr. A. T. Robertson, on "Winding of Electrical Machinery"; Mr. H. R. Constantine, on "Time Limits"; Mr. W. Parry, on "Practical Testing of Transformers."

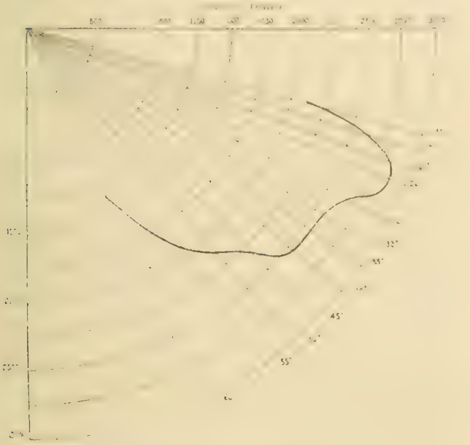
The Glasgow Students' Section held its opening on November 5th with a paper on "The Corporation of Glasgow Electricity Works" by its chairman, Mr. W. W. Lackie. The papers for remaining nights are:—Mr. A. C. Howard, on "Ampere-hour Meters for Direct Current"; a debate; Mr. N. C. Woorfin, on "Electrical Estimates and Opportunities"; Mr. N. McCaskill on "Illumination."

The Newcastle Students' Section, of which Mr. T. C. Christianson is the chairman, met on October 28th, for a paper by that gentle man on "Rotary Converters." Other arrangements for this Section are as below Mr P. Grice on "Heating and Cooling of Electrical Machinery"; Mr. H. D. Phelps on "Notes on Design and the Running of D.C. Sub stations"; Mr. J. C. Hacking on "Phasing Out of A.C. Apparatus"; Mr. J. S. Ellis on "Application of Electricity to the Lighting of Residences, Business Premises and Factories"; Mr. V. O. Haddock on "Notes on a Single-phase Traction System"; Mr. E. Wyatt on "Regulation of Pressure and Continuity of Supply of Electricity under Various Aspects"; Mr. R. C. Philipp on "Notes on the Operation of Three-phase Transformers"; Mr. H. V Henniker on "Cascade Connections."

Royal Society of Arts. The new Session of this Society will be opened on Wednesday evening next, November 20th, by Lord Sanderson, G.C B., K.C.M.G., chairman of the Council, who will deliver an address and distribute the medals awarded last session. Dr. F. Mollwo Perkin will read a paper on "Synthetic Rubber" on December 11th. A course of Cantor Lectures will also be delivered by Mr. C. R. Darling on "Methods of Economising Heat" on Mondays, December 2nd, 9th, and 16th.

Belfast Association of Engineers.—On November 1st a paper was read on "Long-distance Transmission of Power" by Prof. Stanley.

Holborn Street Lighting.—The accompanying illustration shows the distribution of the light given by one of the larger type of tungsten lamps used for lighting the main streets of Holborn, in conjunction with the reflector and lantern designed by Mr. J. S. Highfield (see Elec. Rev., page 644). It will be noticed that the maximum intensity of illumination is produced at a small angle with the horizontal, in accordance with the requirements for uniform illumination, the candle-power at 22° below the horizontal being 2,875, while at 65° it is 1,350. The tungsten lamp has a marked advantage in this respect, as its maximum candle-power is delivered in a horizontal plane, and with the aid of a suitable reflector, the part of the space midway between two lamps can be adequately lighted. Further curves, showing the intensity of illumination at intervals between the lamps, will, no doubt, become available shortly, and will be awaited with interest.



Holborn Street Lighting.

Fatalities.—Dingwall.—The recent accident near Dingwall, which resulted in the death of two persons had a sequel in three actions raised in the Court of Passage at Edinburgh, against the Strathpeffer and Dingwall Electric Co., Ltd., but on Tuesday Lord Dewar was informed that the cases had been settled. The plaintiffs were Donald Ross, foreman ploughman, Fodderty Farm, near Dingwall, who sued for £500 in respect of the death of his 10-year old daughter; Mrs. Ross, his wife, who claimed £1,000 for personal injuries; James Mackenzie Grant, ploughman, Humbuston, near Dingwall, and the other children of Mrs. Jessie Grant, widow, who sued for £750, in respect of the death of their mother. Mr. Ross accepted £100 and costs; Mrs. Ross, £200 and costs; and the Grants, £125 and costs.

Manchester.—An inquest has been held into the cause of death of Wm. Henry Pickwell (24), electrical engineer, who died after receiving an electric shock at the Stuart Street Station of the Manchester Corporation on Nov. 6th. According to the *Manchester Evening News*, it was stated in the course of the evidence that Pickwell, who recently passed the final examination for B.Sc., was engaged in working a switchboard when the accident occurred. He had been instructed to go behind the board to see whether a connection was properly established between some wires. Three of these wires were "live," and witness said it was impossible to make them dead. Pickwell was warned about the wires. He was seen to fall after a flash, and a fellow-workman thought the metal-covered electric lamp which he carried had come into contact with one of the wires. He had thus received a shock at 3,000 volts which would kill him instantly. The Coroner said that it was rather a [illegible] the rubber gloves provided for the purpose of insulation. The witness, Thomas Walker, [illegible] a casual glance behind the switchboard was necessary for the work in hand. He had no need to touch the wires, and the accident seemed to have been due to over-zealousness There was a regulation that panels of the switchboard must be made "dead" when certain work was going on, but he did not think it applied to what they were doing at the time. Mr. Arthur Elwin M'Kenzie, chief assistant engineer to the department, said it was quite possible that Pickwell overbalanced in leaning over to look at the wires. He appeared to have grasped a wire to save himself. A verdict of "Accidental death" was returned.

Dublin.—Last Friday an inquest was held into the death of Robert Shannon, 23, an electrician, who received an electric shock while at work at the Irish Picture Palace Theatre that was in course of erection at Ellis's Quay. Deceased's brother, who gave evidence, said that he and deceased were engaged by Messrs. Curran Bros., of Belfast, in putting electric light into the theatre. Deceased had been only six months at the business. He could not give any explanation of the occurrence. J. Cheevors, who was working on the same landing as Shannon at the time, said that the electric light went out and deceased "went to fix it." He heard him call out and moan and he then fell back. He got up again, and witness asked him what was the matter, but he made no reply. The hospital surgeon said that Shannon was dead on arrival at the hospital. All the organs were healthy, but there was a slight abrasion, which he considered a burn, between the shoulders. Death was due to a very strong shock. Mr. H. Alward, inspector of installations, said that the pressure in the building was 200 volts. He had had 25 years' experience, and he is reported to have said that "he never heard of anyone being killed by a 200-volt current." and that he had received 200-volt shocks himself without injurious effects. "So far as I could see, it would be an impossibility for him to get killed by the current which was on. The majority of people might take a live wire in their hands in Dublin without any injurious effect. I would not hesitate to do so myself." He found that there was no leakage, and could not find anything wrong. The jury found a verdict in accordance with the doctor's evidence.

London.—On Thursday last week the inquest was held on Mr. J. C. Moreton Thompson, aged 52, a solicitor, who died in an electric bath. A Marylebone jury found a verdict of "Death by misadventure," and added a rider that electric baths should be periodically inspected. According to the report in the *Standard*, the widow said that on Sunday her husband was in perfect health. He had taken electric baths at the same place for some time, and had never complained of ill-effects.

Mr. M. D. Dudman, of 8, Cavendish Place, masseur and medical electrician, said that he had no medical degree. He had practised at Cavendish Place for four months. He only treated patients after medical recommendation. He first met the deceased at Harrogate; afterwards Mr. Thompson came to him in London and said that he would like to take the same treatment as he had had at Harrogate, which consisted of electric baths, massage and vibration. He had had nine treatments in London, and an electric bath in every case except one. All patients were treated according to medical instructions. Quite recently Mr. Thompson said he felt better than he ever had done. He put the deceased in a light bath and worked him up to 120°. Mr. Thompson was only 10 minutes in that, and then the witness put him in a water bath for cooling. Through the water he administered an electric current of 400 milliwatts, which was equal to 10 volts, but only about two volts would go through the body. The deceased had only been in the bath six minutes when the telephone-bell rang, and the witness went across the room to answer it. Before he could do so the deceased gave a great shout, and the witness, running back, found him in a sitting position and vomiting. The witness at once tried artificial respiration and sent for a doctor. The water bath was of porcelain, with a teak top. All the electric wires were insulated. There were seven conductors at the side of the bath properly insulated. The deceased could have got no shock through touching the taps of the bath.

The Coroner: Could the deceased get a shock from the water itself?—Yes, if the lamp on the switchboard crossed current and there was a broken filament. In that case the deceased would get the full dose from the main of 240 volts. As a matter of fact, the lamp had been broken. That was the first thing he noticed when the deceased called out. When he went to the telephone the lamp was all right. The deceased could not have touched the lamp The witness's only theory of the cause of the shock was that it was due to a cross current of the guide lamp. He was satisfied that there was no fault with the lamp at all. The effect of a shock of that description would be immediate action upon the heart. As far as the witness could judge, Mr. Thompson was dead when he reached him. He had never seen any bad effects from a bath before. He relied upon the electrical engineers for the condition of the apparatus. He had studied medical electricity for six years. The treatment was given under medical direction. The same standard of switchboard and other apparatus was in use in many places, and no accident had happened. The apparatus had been examined since. The lamp was used to show the quantity of current being made, and to check the quantity. If the lamp suddenly broke the full amount of current would pass uninterruptedly from the main, and would consequently be much larger. They had traced no defect in the bath since the accident. It was impossible from the position in which the deceased was found for him to have touched the switchboard.

Dr. Bernard H. Spilsbury, pathologist at St. Mary's Hospital and to the Home Office, said that the cause of death was nervous shock and heart failure, due to the passing of an electric current. There was no danger in a man without medical qualifications administering the bath if he did so under medical direction.

E. H. Willis, of the Cavendish Electrical Co., said that the switchboard was out of the patient's reach. He could not see how the patient could have received an abnormal shock by the mere breaking of the lamp. This lamp was certainly broken, but whether it had short-circuited was another question. If the lamp was broken and not connecting, there would be no current in the bath, but if it had permanently short-circuited owing to the complete breaking of the filament, the current supplied to the bath would be largely increased. The only defect the witness could find in the bath was the non-protection of the water taps.

The Coroner: What is your opinion of the cause of the shock?—I have experimented with the bath. Supposing the lamp short-circuited—that is to say, the resistance was taken away—240 volts would pass through the bath. I have tried it myself, and found that a strong shock would be received. Another theory is that the filament of the lamp broke and attached again momentarily. Then, momentarily, a very large shock would be received.

Counsel suggested the desirability of having a number of small guide lamps, so that the danger of the whole current passing through would be obviated. The witness assented, and also agreed that some examining body to inspect apparatus would be desirable.

C. H. Smith, instructional engineer to the Marylebone Borough Council electric supply, said that the function of the guide lamp was to break down the voltage from 240 to about 15, or according to the requirements of the bath. The voltage in the bath would be increased by the breaking of the filament of the lamp and consequent short-circuiting. His theory was that a momentary short-circuit in the lamp had been caused. He had known such things to happen before. The high voltage would not be more than instantaneous.

The Midland Electrical Engineers' Ball.—The second Midland Electrical Engineers' annual ball is to be held at the Grand Hotel on Friday, December 20th. Mr. R. A. Chattock is the chairman of the Dance Committee. Mr. G. J. Birk, of 55, Newhall Street, Birmingham, is the hon. secretary and treasurer.

A Contemporary's Majority.—*The South African Mining Journal*, 125, Salisbury House, London, E.C. Special Twenty-first Anniversary Number. 3s. 6d.—We congratulate our contemporary upon its coming of age and the excellent issue with which it celebrates the event. An enormous amount of editorial matter is contributed by various authors relating to South African mining, engineering and other industrial affairs, and we believe that all having trade relations with that part of the world will find it worth while securing a copy of this very exhaustive production. The whole of the work was done locally in Johannesburg, but copies are obtainable in London.

The I.E.E. and "Submen."—The following letter arrived too late for our "Correspondence" columns:—

"I notice a letter from 'Subman' in the current issue of the Electrical Review, complaining bitterly of the attitude taken by the Institution of Electrical Engineers towards submen in general.

"Might I suggest that this is chiefly submen's own fault, and I think that if they were to put their pride in their pocket, and take up positions with some of the leading cinematograph companies, they would gain considerable advantage, not only in the matter of pay, but hours as well.

"One Who has Done so."

L.C.C. Stores Contracts.—Applications are invited from persons and firms wishing to have their names placed on the lists of those from whom the Council invites tenders for the supply of stores and the execution of maintenance contracts. See our advertisement pages to-day.

The Electro-Harmonic Society.—The concert arranged for Monday next will be a Ladies' Night, and, as usual, it will be held at the Holborn Restaurant (King's Hall), commencing at 8 o'clock. The preliminary programme announces the following artistes:—Vocalists: Miss Ada Forrest (soprano), Miss Amy Dewhurst (contralto), Mr. Alfred Heather (tenor), Mr. Peter Dawson (baritone). Pianoforte solo, Miss Marie Novello. Anglo-French comedian, Mr. Alec. Chentrens. Humoresques, Miss Olive Twain. Songs at the piano, Mr. T. C. Sterndale Bennett. Accompanist, Mr. Bernard Flanders, A.R.A.M. Mr. Duddell, the new President of the I.E.E., will occupy the chair.

October Trade Returns.—The official returns issued this week show that during the month of October imports increased by 17 per cent., exports by 10·9 per cent., and re-exports by 15·8 per cent., as compared with the corresponding month of 1911. The exports of electrical goods advanced by £250,563, and machinery increased by £537,435. For the ten months of the year the exports of electrical goods and apparatus (other than machinery and telegraph and telephone wire) have amounted to £3,745,349, an advance of £1,458,481; and those of machinery have been £27,502,255, an increase of £2,057,878.

Appointments Vacant.—Switchboard attendant, for the Corporation Electricity Department, Southend-on-Sea (30s.); second assistant to the Superintendent of Mains, Edinburgh Corporation Electricity Supply (£100). See our advertisement pages in this issue.

The Generators.—A dinner of the Generators will be held on November 22nd, and a concert will follow.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The result of the competitive examination held by the Caxton Publishing Co., Ltd., for business and commercial knowledge has just been published, and we are pleased to note that one of the Wimbledon Borough Council officials, Mr. W. J. Oswald, senior assistant engineer at the Corporation's Electricity Works, has secured fifth place. This is a creditable achievement, considering that there were over 500 competitors from all parts of the United Kingdom. He has been awarded a valuable set of books.

Mr. Percy Hickman, shift engineer at the Dewsbury Corporation Electricity Works, has resigned.

Mr. Charles E. Savage has resigned his appointment as borough electrical engineer to the Corporation of Dudley, in order to join the staff of the Earl of Dudley.

Tramway Officials.—The employés and staff of the Mexborough and Swinton tramways last week presented a silver cigarette case to Mr. C. W. Bentley, the assistant manager, who is leaving Rawmarsh to take up a similar position at Musselburgh, Scotland.

General.—The Council of the City and Guilds of London Institute has conferred the Fellowship of the Institute upon Mr. W. D. B. Duddell, F.R.S. This distinction is extended to those students who have obtained the Associateship of the Institute and spent at least five years in actual practice, and by original and valuable research work or otherwise have contributed to the advancement of the industry in which they are engaged.

York City Council has appointed Mr. T. R. Stancombe, of Dewsbury, as Superintendent of the Installation Department at the Electricity Works, at a commencing salary of £120 a year.

Mr. A. G. Warren, B.Sc., has been appointed a lecturer in the Engineering Faculty of the University of Hong Kong, under Prof. C. A. M. Smith, M.Sc. (late of the East London College). Mr. Warren was a lecturer in the East London College, and has been head of the Engineering Department of the Aston Manor Technical School, Birmingham, for the last 18 months.

According to the *City Press*, Mr. F. G. Whitaker, the Senior Superintendent of the London Postal Service, has just retired after 40 years' service. He joined the staff of the Electric Telegraph Co. in 1866, and four years later, on that undertaking being acquired by the Government, entered the service of the General Post Office.

The marriage took place at Melbourne (Derbyshire) on November 5th of Mr. John Thos. Hewes, of Allestree, chief electrician to Sir H. H. Raphael, M.P., and Miss Alice Heathcote, daughter of Mr. E. Heathcote, of Melbourne.

Mr. Robert Rankin, B.Sc., who, it will be remembered, read a paper on "Automatic Reversible Battery Boosters" before the I.E.E. last session, has joined the staff of the Electrical Power Storage Co., Ltd.

Last Saturday evening at the Connaught Rooms of the Trocadero Restaurant, a complimentary dinner was tendered to Mr. T. Stevens, M.I.C.E., by his past and present colleagues on the staff of the British Thomson-Houston Co., Ltd., upon his severing his connection with the company to enter consulting practice with Messrs. McCarter & Kerr Bock. A large contingent of the Rugby staff was present, as well as the staff from the London office. The chair was occupied by Mr. A. H. Walton, who, in a few well-chosen words, presented Mr. Stevens with an artistic souvenir as an expression of his colleagues' esteem, and voiced their regrets at the loss of his services to the company, wishing him success and prosperity in his new undertaking. All acquainted with Mr. Stevens's sterling ability and his unfailing courtesy feel certain that his success is assured. Following the toasts a much appreciated musical programme was supplied by the following artistes:—Miss Dora Clare, Mr. Murray Ashford, Mr. Norman Payne and Mr. Geo. Blackmore.

Obituary.—Lord Furness.—We deeply regret to record the death, which occurred on Sunday last, at the age of 60 years, of Lord Furness. In September, under medical advice, Lord Furness resigned the chairmanship of Palmer's Shipbuilding Co., and from that time onwards his health became worse. The story of his remarkable rise from humble circumstances (he was the seventh son of one who was at one time a coal-trimmer) to the peerage, and the commercial aptitude or instinct which lifted him stage by stage to affluence and great industrial influence, will doubtless be told in books for the boys for years to come, but the chief points in his career that justify reference to him here are his connection with the well-known firm of Richardsons, Westgarth & Co., Ltd., his experienced advocacy of greater enterprise being shown abroad by the British manufacturer, and his co-partnership scheme introduced in 1898 in the interests of industrial peace and efficiency, which scheme, as our readers know, was, after a short trial, unfortunately rejected by a small majority of the men, owing to Trade Union opposition.

The death is announced from Paris of M. Victor Popp, who for many years has been well known in the electrical world.

NEW COMPANIES REGISTERED.

Leitner (France), Ltd. (125,276).—This company was registered on November 8th, with a capital of £1,000 in £1 shares, to exercise and develop commercially in France certain patented inventions in connection with the Leitner system of automatic electric lighting for trains, tramcars, and other vehicles, and to adopt an agreement with the Leitner Electrical Co., Ltd. The subscribers (with one share each) are:—H. Leitner, 35, St. James' Place, S.W., electrical engineer; F. J. Collis, 7, Princes Street, Westminster, S.W., electrical engineer. Private company. The board is to include two directors, or a director and the secretary of the Leitner Electrical Co., Ltd. The first directors are H. Leitner, F. J. Collis, H. O. Duncan, and H. Munro. Registered office, 7, Princes Street, Westminster.

Blandford Forum and District Electric Supply Co., Ltd. (125,203).—This company was registered on November 6th, with a capital of £7,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. A. Hosker, Kirksleatham, Bournemouth, medical practitioner; E. S. Williams, Dean's Grove, Wimborne. Private company. The number of directors is not to be less than three or more than six; the first are W. H. Baxter, F. C. C. Smith, F. W. Reynolds, A. J. Woodroffe, J. A. Hosker and E. S. Williams. Registered office, Moorgate Court, Moorgate Place, E.C.

Radio Signal Co., Ltd. (125,163).—This company was registered on November 4th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, electrical and mechanical engineers, manufacturers, installers and users of and dealers in electrical appliances, including signals and signal appliances, &c., and to adopt agreements (1) with W. H. Shephard and A. E. McKechnie, and (2) with T. H. B. Palmer and A. A. Sander. The subscribers (with one share each) are:—A. A. Sander, Thorpe Arnold, Warlingham, Surrey, tea broker; F. Evelyn Jones, Whyteleafe Grange, Whyteleafe, Surrey, solicitor. Private company. The number of directors is not to be less than two or more than seven; the first are F. Evelyn Jones, T. H. B. Palmer, A. A. Sander, W. H. Shephard and A. E. McKechnie. Registered office, Norfolk House, 7, Laurence Pountney Hill, E.C.

Hewson Manufacturing Co., Ltd. (125,253).—This company was registered on November 8th, with a capital of £1,000 in £1 shares, to take over the business carried on at 151-7, Wardour Street, W., as "Brown's Patent Syndicate," including the business of manufacturers of electrical and other fittings, illuminating and decorative signs and manufacturers to the electrical and kindred trades, and to adopt an agreement with another electrical company. The subscribers (with one share each) are:—T. Wood, 10, Delamere Terrace, Paddington, W., gentleman; G. F. Tinkle, 26, Yale Court, West Hampstead, N.W., clerk. Private company. The first directors are H. Brown, F. Marpole and A. H. Brackensieck. Remuneration as fixed by the company. Registered by E. H. Riches, 85, Gracechurch Street, E.C.

Budleigh Salterton Electric Light and Power Co., Ltd. (125,155).—This company was registered on November 4th, with a capital of £7,000 in £1 shares, to carry on at Budleigh Salterton and elsewhere in Devon the business of an electric light company in all its branches, and to take over the rights and liabilities of J. A. Purves and W. T. Purves, of Exeter, in a provisional order in respect of the Urban District of Budleigh Salterton. The subscribers are:—H. W. Crews, 4-6, Rolle Street, Exmouth, auctioneer, 25 shares; C. T. K. Roberts, 10, Bedford Circus, Exeter, solicitor, 1 share; J. A. Purves, 11, Bedford Circus, Exeter, engineer, 1 share; J. Hartree, Green Gables, Budleigh Salterton, architect, 25 shares; G. E. Manisty, Naltore Lodge, Budleigh Salterton, architect, 25 shares; J. Row, 243-4, High Street, Exeter, ironmonger, 25 shares; A. A. Somerville, The Cliff, Budleigh Salterton, schoolmaster, 25 shares. Minimum cash subscription, £8,000. The number of directors is not to be less than four or more than nine; the first are H. W. Crews, J. Hartree, G. E. Manisty, J. Row and A. A. Somerville; qualification, £25; remuneration as fixed by the company. Registered office, 10, Bedford Circus, Exeter.

British Accumulator Co., Ltd. (125,172).—This company was registered on November 5th, with a capital of £13,900 in 4,000 "A" ordinary and 8,000 "B" ordinary shares of £1 each, and 38,000 deferred shares of 1s. each, to carry on the business of manufacturers of and dealers in accumulators and other bases for incandescent electric lamps, electric lamp fittings, batteries, dynamos, &c. The subscribers (with one "A" ordinary share each) are:—J. W. B. Peacock, Tanfield Buildings, Bradford, chartered accountant; F. M. Stephenson, 10, Carlton Place, Bradford, solicitor's managing clerk. Private company. The number of directors is not to be less than five or more than seven; the first are S. Willner, C. G. F. Walton, E. A. Gedge, F. W. Turner and G. H. Rayner; secretary, H. Birch; solicitor, H. Hammond, Bradford. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Egham and Staines Electricity Co., Ltd.—A memorandum of satisfaction in full, on October 30th, 1912, of debs. dated December 18th, 1911, and February 28th, 1912, securing £2,850, has been filed.

Brush Electrical Engineering Co., Ltd.—Particulars of £100,000 prior lien participating second deb. stock, created October 2nd, 1912, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £86,620. Property charged: Freehold and leasehold land, plant and machinery at Loughborough, and the company's other assets, present and future, including uncalled capital. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

Electrical and Engineering Supplies Co., Ltd.—Particulars of £600 debentures, created October 3rd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Electrolytic Alkali Co.—The *Financier* states that this company, of Middlewich, intimated to the shareholders on Wednesday that the company was in negotiation for a scheme for the supply of power, which would represent a very large saving to the company. The scheme would probably involve certain rearrangements of the existing conditions; but it was expected that the negotiations would be completed at an early date, and that an announcement would be made at the annual meeting, which was being delayed.

Dorman, Long & Co., Ltd.—The directors have declared a final dividend of 5 per cent., less income-tax making, with the interim dividend, 7½ per cent. for the year.

Provincial Cinematograph Theatres, Ltd.—A second interim dividend of 5 per cent. has been declared, and was payable on November 4th.

CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

THE twenty ninth ordinary general meeting was held on Thursday, November 7th, at Winchester House, E.C., Mr. Henry Wolfenden presiding.

In proposing the adoption of the report (see ELECTRICAL REVIEW, page 753), the CHAIRMAN said there were two salient features about it. One was that the profits had suffered a reduction when compared with the previous year, and, secondly, that the board did not recommend the payment of a dividend, though the profits could be held to justify such a payment if there had not been countervailing reasons. The reduction in the profits amounted to £6,333, and was mainly due to one item of expense being charged against revenue this year for the first time—he alluded to the payment of royalty under a licence which they acquired for the use of certain patents in connection with the manufacture of metal-filament lamps. If they had not had to debit the revenue with that item of expenditure the accounts would have shown profits much more nearly approaching those of last year, though they would still not quite have reached those figures. He was glad to say that the falling off was in no way due to a falling off in the turnover, which was in volume larger than in any previous year since he had been connected with the company. Raw materials had shown a constant tendency to advance in prices, and the various strikes which took place during the year did not make for economy. During the current year and in future they would have to bear the additional expenses of the Insurance Act. As to why they did not recommend a dividend, they could not both have their cake and eat it. Last year he spoke of two lines of extension—one dealing with their selling organisation in countries abroad and the other in extending their manufacturing facilities. The latter they had carried out, partially in the financial year under review and partially since the close of the year, and they were now well equipped with increased plant of the most modern type. They did not contemplate further expenditure of any material amount in this direction at present, though he did not wish to imply that they had arrived at finality. The outlook appeared promising. Their engineering works were full of orders, and were producing more largely than ever before. As to lamps, they were able to produce all types of that article now on the market, and in patterns more numerous and varied than any other individual lamp-making firm. The quality of their productions was unsurpassed. The extension in their foreign sales facilities was essential, and they expected to derive substantial benefit from the expenditure later on. They had taken steps to that end during the year, but much more remained to be done in that direction, and it was in that direction that their efforts must be directed for some time to come. That required money, and to provide it they had had to use their revenue for capital purposes. It was a platitude to say that a business could not stand still—it must either go forward or go back. They elected to go forward, and he believed the shareholders would continue that confidence in the board which they had hitherto shown. Meanwhile, the company was growing in strength, and they hoped as a result of their policy they might be able not only to earn dividends, which they were now doing, but also to resume payment of them as well as provide for the extension of the business. Proceeding to discuss the figures in the balance-sheet, the chairman said that the present position of the Altrincham Electric Supply Co. was a very satisfactory one. Stock and plant which figured at £267,341, was divided as to stock, £186,639, and plant, £80,702. The stock showed an increase of £5,000 over the previous year. That increase and more was caused by the larger stock of raw materials and work in progress. Their lamp stocks were reduced by about £5,000. Plant was up £1,543. A new item in the accounts was expenditure on foreign branches, trade marks and experimental account, £4,450. During the year they had taken steps to establish themselves in two countries abroad. From one of those countries they were regularly receiving orders in consequence, but he regretted to say that so far the results from the other country had not been satisfactory, owing to difficulties in connection with starting the business. As to trade marks, they found that in several countries which they considered important to them, their trade marks were not registered. They had now corrected the omission at a cost of about £500. The expenditure on experimental account spoke for itself, and he could only say that they had obtained valuable results from it. The total expenditure under those three heads was £4,450, and although it had been necessary for the proper carrying on of the business, they could not say that it was represented by tangible assets. On the other hand, it was for the permanent benefit of the company, and they had decided to debit the present year's account with half of the amount, carrying forward the balance to a suspense account. The final result was that they proposed to add £10,000 to the reserve fund, bringing it up to £45,000, and increasing the carry forward by £446.

MR. E. B. ELLICE-CLARK seconded the motion.

MR. PARSONS asked what the London expenses and the directors' fees amounted to. He also inquired whether the additional £5,000 which the company had invested in the Altrincham Co. was compulsory.

MR. RAYMENT complained of the delay in getting out the accounts, and moved as an amendment that instead of carrying £10,000 to the reserve fund, a dividend of 1¼ per cent. should be paid, and the balance remaining carried forward.

MR. KILLINGWORTH HEDGES, as an original shareholder, criticised the management for their want of "push," and said there seemed to be a sort of dry rot going on, as the company did not move with the times. At first they had an excellent business, but when the metal-filament lamp came in they neglected their opportunity, and stuck to the old carbon lamp.

The Chairman, in reply, said that Mr. Rayment's amendment was out of order. Shareholders had power to reduce the dividend, but not to increase it. With regard to the carbon lamp, it was still being made by themselves and others almost to the same extent as it was years ago. and he did not see why they should give up a valuable trade, especially as it in no way detracted from the amount of business they did in metal-filament lamps. If they had been in the possession of funds when metal-filament lamps came out, they would have been able to purchase the patents, but that was not possible, as they had not got the money. If they took stock of the position to-day, and compared it with the position in 1901, when a change in the directorate took place, he had no hesitation in saying that it had immensely improved. As to the directors' fees, they were £3,000, and he, as chairman, received the lion's share, as he devoted practically the whole of his time to the business of the company.

The report was then adopted.

Stock Exchange Notices.—The Committee has (1) appointed special settling days, as under :—

Wednesday, November 27th.—Brisbane Electric Tramways Investment Co., Ltd.—Further issue of 15,000 ordinary shares of £5 each, fully paid, Nos. 75,001 to 90,000.

And ordered the undermentioned securities to be quoted in the Official List :—

Bombay Electric Supply and Tramways Co., Ltd.—60,000 ordinary shares of £10 each, fully paid, Nos. 1 to 14 and 60,001 to 119,986.

Brisbane Electric Tramways Investment Co., Ltd.—Further issue of 15,000 ordinary shares of £5 each, fully paid, Nos. 75,001 to 90,000.

London Electric Supply Corporation, Ltd.—Further issue of £86,667 4 per cent. first mortgage debenture stock.

Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to :—

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 130,000 preference shares of £1 each, fully paid, Nos. 1,708,001 to 1,838,000.

And to allow the following securities to be quoted in the Official List :—

Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000. Renewed special application.

Fraser & Chalmers, Ltd.—The directors report that the accounts for the year ended June 30th show a net profit of £7.378, after payment of debenture interest and after making the usual provision for depreciation, to which must be added £84,132, being the credit balance brought forward, making a total of £91,511 to the credit of profit and loss account. Out of this sum the directors have paid the full preference dividend for the year of £4,725 and an interim ordinary dividend of 3 per cent., absorbing £11,340, leaving a balance of £75,446 to be carried forward. The directors regret the serious decrease in the net profits of the undertaking for the period covered by the accounts, as compared with the year ending June 30th, 1911, which showed a profit of £31,892. According to a financial paper, this difference is due to a decrease in the sales of mining machinery both in South Africa and in England, to severe competition with its inevitable reduction in the selling price of the company's products, and to the necessity of incurring heavy preliminary and other expenditure in the manufacture and introduction of other lines of machinery now called for by users both at home and abroad. To meet this demand and keep the company abreast of the times, the directors have secured valuable patent and manufacturing rights for new types of machinery, and they anticipate that the outlay involved in their introduction will add to the profits of the undertaking in the near future. Owing to the reduced profits, the directors do not recommend the payment of any further dividend for the year.

Castner-Kellner Alkali Co., Ltd. — The directors report that the net profit for the year to September 30th, after allowing for the amount expended in keeping up the works, plant and machinery to the highest state of efficiency, is £177,062, plus £13,222 brought forward, making £190,285. After deducting debenture interest £8,682, and interim dividend of 7½ per cent. paid May 29th, £33,750, there is an available balance of £147,852. The directors recommend the appropriation of this balance as follows : £32,500 to depreciation reserve, increasing it to £322,500 ; £47,500 to the general reserve, increasing it to £177.500 ; £56,250 in payment of a final dividend of 12½ per cent., making (with the interim dividend paid in May) 20 per cent. for the year, leaving £11,602 to be carried forward.

Provincial Tramways Co., Ltd. — The directors' report states (says the *Financier*) that the revenue account for the year to September 30th shows that the net revenue received from the local companies was £36,051 plus £3,354 brought forward. After paying debenture interest, preference dividend, and interim ordinary dividend there remained £18,877. The directors have set aside to credit of reserve and depreciation account £10,000 and written off £500 from the expenses of the issue of debenture stock, leaving a balance of £8,377. The directors recommend that a dividend be paid upon the £1 ordinary shares of 10d. per share, making with 8d. per share paid in June last 1s. 6d. per share, a dividend of 7½ per cent. per annum for the year. The balance dividend upon the ordinary shares will absorb £5,190. and leave £3,187 to be carried forward. The balance standing to the debit of "Expenses of issuing debenture stock" is £2.500, and the directors have written this balance off the reserve and depreciation account, thus extinguishing the debit.

Eastern Telegraph Co., Ltd.

The meeting of the company was held on Wednesday, at Electra House, E.C., Sir J. Wolfe Barry presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 756), said that the gross revenue for the period under review had exceeded that of any previous half-year, while the improvement shown continued to be well maintained. The gross revenue amounted, in round numbers, to £746,700, as against, for the corresponding half-year of 1911, £672,400, or an increase of £74.300. Message receipts showed an increase of £66,500, the increase being spread over practically every branch of the system. It was satisfactory to find that the growth of revenue was due to a general improvement in commercial business, and was not attributable to any of those events of special importance which might, for the time being, affect one particular section of traffic, although, no doubt, the war in Tripoli, while it lasted, to some extent contributed towards the improvement of the revenue. The introduction of deferred messages had also created a new source of revenue while not adversely affecting the ordinary fully-paid traffic ; but, so far, these messages had not materially affected the total revenue. Dividends on shares in other telegraph companies had produced £3,100 more than for the corresponding half-year of 1911, while interest on reserve fund investments and on cash on deposit at the bank, &c., accounted for the remainder of the increased revenue. As regarded the expenditure the total ordinary working expenses amounted, in round numbers, to £306,000, as compared with £291,300 for the corresponding half-year of 1911, or an increase of £14,700. As he pointed out at the last meeting, the growth in volume of traffic necessarily entailed more labour and naturally tended to generally increased expenditure under practically all headings. The expenses in London showed an increase when comparing the two half-years of £1,700, due to some additional staff, but principally to the usual annual promotions. The expenses as stations were £26,700 more than they were in the half-year to June, 1911. Salaries and wages alone were £14,600 more, due to a considerable augmentation in the number of the staff, and to the improved conditions introduced with regard to overtime and Sunday duty. Maintenance of instruments showed an increase of £3,600, caused by the introduction of new apparatus for improving the working of the cables and landlines. Against the increased expenditure the expenses attending maintenance of cables showed a reduction of £14,000 when comparing the two half-years. The board had considered it advisable, in view of the continued depreciation in the market value of the reserve fund investments, to increase the provision on account of investment fluctuations, and had accordingly transferred a further sum of £50,000 from the general reserve fund, for that purpose, the amount set aside on this account now standing at £300,000. As years went on the directors became more impressed with the importance of maintaining a large reserve fund, convinced as they were that the stability of the company was in no small measure due to the consistent carrying out of the policy of maintaining large and available reserve funds. Since 1910 they had expended over £100,000 on various sections, which sum had been charged from time to time against the reserve fund, and they were continuing the work as opportunity offered. They had also charged the cost of the new Gibraltar-Malta-Alexandria cables against this fund, the last instalment of over £220.000 appearing this half-year. The increasing volume of business on the cables, which was proportionately greater than the increase of net revenue, pointed to the necessity of strengthening their cable capacity east of Suez, and the directors had in view the laying of new and important cables from that station eastward, so soon as the necessary landing rights were granted. The Eastern Extension Co. also proposed at the same time to strengthen their means of communication in the Far East. Those new cables would, of course, involve considerable expenditure, which would be met out of the reserve fund and out of the normal increase of revenue. It must be a source of gratification that their reserves enabled them to deal with those matters without any anxiety regarding the usual dividends and bonus paid to the stockholders and without increasing the capital. In view of the foregoing, it was fortunate that they had been able to carry the sum of £230,000 to general reserve fund this half-year. With the view of giving the public a cheap social telegraph service with South Africa, they had introduced week-end letter telegrams between the United Kingdom and the Union of South Africa, and the system came into operation last week. The messages must be written in plain connected English or Dutch language, and the tariff was 15s. for the first 30 words, with an additional 2s. 6d. for every five words or less beyond that number. Messages could be handed in on any day of the week, and would be sent off on Saturday evening. If they were addressed to a town at which the company had a station, the messages would be delivered on Tuesday morning ; if intended for other places they would be posted on, but, if desired by the sender, could be telegraphed to their destination upon payment of the respective local interior telegraph rates for Great Britain or the Union of South Africa.

Sir J. Denison-Pender seconded the motion, and the report was adopted without discussion.

Continental.—Germany.—The Rhenisch Westfalische Electricitätswerke Gesellschaft, of Essen, reports a gross profit of £391,429 for the last financial year, as compared with £384,830 in the preceding 12 months. The net profit amounts to £169,042, which enables the dividend of 8 per cent. to be maintained.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The half-yearly meeting was held on Tuesday at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 756) congratulated the shareholders upon a satisfactory half year. The gross receipts had amounted to £367,000, against £329,000 for the corresponding period of 1911, an increase of £38,000. This satisfactory result was due to a growth of commercial traffic all over the company's system, and it was gratifying to find that this growth had continued since the close of the half-year. The expenses during the same period amounted to £166,000 against £151,000, showing an increase of £15,000, of which nearly £12,000 was accounted for by the heavier cable repairs carried out during the past half-year than in the corresponding period of 1911, and to debiting revenue with the cost of relay and other improved apparatus. The remainder of the increase was due to increased staff, salaries, and other incidental charges. The net profit for the half-year was roundly £182,000, and, after adding £23,000 brought forward, there remained an available balance of £206,000. The usual quarterly interm dividends of 2s. 6d. per share, or at the rate of 5 per cent. per annum, had been paid for the past half-year, and after making the usual provision out of revenue for the maintenance ships, insurance and depreciation funds and adding £75,000 to the general reserve fund, the balance carried forward amounted to £56,000, or, roundly, £5,000 more than for the same period of 1911. In view of the increase in the volume of traffic between Europe and the company's system east of India, and also in their local traffics, due to commercial activity, and the continuous policy of the company, to which he had frequently referred, of lowering their tariffs when they were able to do so without injustice to their shareholders, the directors had in contemplation the strengthening of their cable capacity in the Far East. The Eastern Telegraph Co. had also under consideration important cable improvements west of India. The two proposals would thus form a strengthening of the companies' communication, but, of course, they would be expensive. Owing, however, to the existence of their reserve funds, and the growth of their traffic, they could contemplate the necessary expenditure, which would occupy some two years or more, without any interference with the stability of their ordinary dividend and bonus. As announced in the report, the vacancy in the directorate occasioned by the death of the Marquis of Tweeddale, had been filled by the appointment of Lord Inchcape.

Mr. F. A. Bevan seconded the motion.

Replying to shareholders, the Chairman said the reserve fund investments stood in the books at cost price. The board, with the approval of the shareholders, had arrived at the conclusion that there should be some allowance made for depreciation, and they had put aside a round sum of £150,000 for that purpose. With regard to wireless telegraphy, he saw no reason to alter anything he had said before on the subject, and the experience they had had of its working, and of the considerable strides it was making in different directions, had been that it had done their traffics no harm whatever. How far the increased development of putting up Government stations would be in competition with them it was impossible to say. He did not think they need fear the competition so long as the cables could give a rapid and trustworthy mode of telegraphic communication free from all tampering or tapping. With a certainty of good service he believed the cable companies would always hold their own. As he had said many years ago, if the order of invention had been reversed, and wireless telegraphy had come first and cable telegraphy second, he believed the world would have said—What an enormous improvement the cable method of transmitting telegraphic messages is. As long as they could hold their own as giving the best service to the public, and at a moderate cost, personally he did not think they need fear the competition of wireless telegraphy.

The report was adopted.

Western Telegraph Co., Ltd.

The directors report that for the half-year ended June 30th, 1912, the revenue amounted to £450,815, and the working expenses to £169,770. After providing £16,373 for debenture stock interest, and £8,294 for income-tax, there remains a balance of £256,377; to this is added the sum of £30,312 brought forward from December 31st last, making a total of £286,689. A quarterly interim dividend, amounting to £31,189, has been paid, £445,000 transferred to the general reserve fund, £10,000 to the land and buildings depreciation fund, and £15,000 to the provision on account of investment fluctuations. The directors now recommend the declaration of a final dividend of 3s. per share, making with the interim dividends a total dividend of 6 per cent. for the year, also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £51,982, leaving a balance of £33,517 to be carried forward. The dividend and bonus will be payable on November 14th.

Sir J. Wolfe Barry, K.C.B., presided on Wednesday over the meeting of this company held at Electra House, E.C.

In proposing the adoption of the report (see above), the Chairman said that during the period under review there had been considerable expansion in the volume of trade and commerce in all the countries of South America which were served by the company's system, and they hoped this would be maintained in the future. The company had assisted in the development of these countries by affording a speedy trustworthy means of communication between all parts of that great continent and the other markets of the world. A reduction of 1 fr. per word in their tariff for telegrams was made in May last, and they trusted the telegraphic traffic would increase to such an extent that they would not suffer financially in consequence of this large reduction of nearly 35 per cent. Indeed, the figures to date seemed to warrant this hope, but when development took place so rapidly it was occasionally followed by a period of reaction, and they must not count upon the increases which they had lately had, being maintained without some check. The receipts from messages and other sources of revenue for the half-year showed an increase of nearly £46,000. With regard to the expenses, those in London were more by £362, and at the stations abroad were increased by £8,577. The principal items to which this increase was due were salaries and wages of additional staff required to deal with the increased traffic and the usual annual promotions and increments to the employés of longer service; rent and house allowances were also more at two or three stations. Other accounts which caused extra expenditure were: repairs and additions to buildings and furniture, bankers' commission and legal expenses. On the other hand, there was a decrease in stationery and printing, but this is due to an exceptionally large supply having been sent out last year. The other accounts included in the total of £125,000 showed a net increase of £2,661, which was explained by the further cost of new landlines at Pernambuco and Santos. The several increases to which he had alluded amounted to £11,600. On the other hand, the expenses attending the maintenance of cables were less by £6,639, and there was no item corresponding to that in 1911, when a bonus was granted to the staff.

Sir J. Denison-Pender seconded the motion.

Mr. Humphreys said that reading the report of a cable company's meeting recently, he noticed that they had established wireless telegraphy between two of their smaller stations. It seemed to him that this was a new development, and one likely to be a useful auxiliary to their service. He would like to know whether the board contemplated the adoption of that system under similar circumstances in connection with any other stations.

The Chairman, in reply, said that at the present time the Western Co. had not in contemplation any particular station for wireless telegraphy, but the associated companies—in particular the Eastern Extension and the Eastern—had either instituted already, or were contemplating, exactly what Mr. Humphreys had in his mind—that was having a wireless system with a moderate amount of power in direct communication with their cable stations. That had been found extremely useful in several cases for passing ships. Up to the present time the associated companies had recognised that wireless telegraphy might be a useful feeder to the cables, and that had been borne out by their experience up to the present time.

The report was adopted.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—The accounts for the year ended June 30th show gross receipts amounting to $5,465,300, from which must be deducted operating expenses and taxes $2,642,900, leaving net earnings $2,822,400. Interest on the funded debt has absorbed $1,417,300, the dividend on the 6 per cent. preference stock takes $381,600, while the dividend on the common stock has been raised from 4½ to 5 per cent. There has been set aside for renewals and amortisation, &c., $455,500, leaving a surplus for the year of $204,900.—*Financier.*

Prospectus.—*Ferranti, Ltd.*—The directors have issued to debenture stockholders and shareholders forms of application for an issue of 6 per cent. five-year notes, to the amount of £50,000 in registered notes of £100 each at 95 per cent., which was authorised at the recent meeting.

STOCKS AND SHARES.

Tuesday Evening.

Domestic, as well as foreign, politics have been playing their parts in Stock Exchange markets this week. A difficult account has had to be arranged, the *débâcle* of the end of October being succeeded by further falls in many of the other departments of the House, while various alarms and excursions from the Near East contributed their quota to the causes for unrest. There are indications, however, that the public begin to realise the comparative cheapness of many stocks and shares which cannot be affected, except indirectly, by the Balkans difficulties. People have had to sell investments in order to pay differences; and dealers, while not averse to having stock on their books, naturally wanted to get it as cheaply as possible. The remarkable strength of Consols, however, is a bull point for the House at large; and the mere anticipation of a change of Government at home provided an added cause for subdued cheerfulness.

The feature of the Home markets, so far as Electricity is concerned, is a boomlet in Central London issues. The Ordinary stock put on 5 points on Monday afternoon and 6 more on Tuesday, the Deferred following with a gain of 8. Inquiries in the market as to the cause of this sudden improvement were met with the polite reply that the company was going to be taken over, beyond which the informants would no farther go. "What does it matter," said they, "who is the lucky purchaser? Surely it is sufficient to be told that the line is going to be bought up?"

City and South London rallied to 42½, after having been weak, the price going back to 40½, notwithstanding persistent tips that it was the cheapest to buy in the Home Railway market. The company's 1903 Preference has risen 1, which brings it into line with the 1891 stock. Metropolitans, from 55¼, tumbled to 52½, at which price support was accorded and a smart recovery marked. Districts are unaltered on the week, and no change has taken place in Great Northern and City Preferred. Underground Electrics went back slightly—the 1s. shares to 12s.

News is still awaited as to developments in the case of the Metropolitan Electric Tramways Company, pending which the price of the Ordinary hardened to 1$\frac{5}{16}$, and the Deferred to 6s. 3d., though both Debenture stocks of the company lost a point apiece. London United Tramways Preference are another House tip, and show ⅛ rise, but whether it is right or not to buy them should be, it seems to us, left to the judgment of those with inside knowledge. Some announcement is expected this week. British Electric Traction Preferred went back to 12.

In the Foreign department, the Mexican group shows a fair amount of steadiness, and this notwithstanding the fact that some of the other securities connected with the group to which these Latin-Canadians belong, have been the reverse of good. Mexican Light and Power, and Mexico Trams are unchanged. Monterey Debenture eased off ½, and Shawinigan Water fell 1. On the other hand, Sao Paulo Trams regained 5 points, and Montreals are 4 up. A good deal of business is being done in the rights on Mexico Trams, the price of which at the time of writing is about 1½ premium, bargains being done for cash. This price, it may be mentioned, is quoted for the rights on the old shares. For example: a seller of the new shares which attach to 50 Mexico Tramways would receive £15 if he sold at 1½ premium.

Anglo-Argentine Tramways Preferences are a dull market, and the Firsts can be picked up below 5. There is, however, a better feeling for the Debenture stock, and the latest issue hardened from 2½ discount to 1½ discount, while the 4 per cent. Debenture stock put on ½. British Columbia issues are better, and Electric Supply of Victoria Debentures are 2 points to the good. Calcuttas eased off ⅛, and La Plata Trams are flat as the result of the recent meeting. At that gathering we believe there was sharp criticism; but so far as we have been able to ascertain, those proprietors who were not present at the meeting received no further intimation of this, beyond the statement that there was some discussion. On this point there may be more to say later.

The telegraph market is firmer, and the recent reports by the Eastern undertakings are regarded as extremely satisfactory. Eastern Ordinary is a point to the good, but Eastern Extensions have not recovered the small amount which they lost last week. Globe Preference gave way on a few forced sales, and West India and Panama dwindled to 3$\frac{3}{16}$. In the American section, Anglo-American Deferred rallied to 25¾, but there is not much change otherwise. Amazons at 8 show an improvement. Indo-Europeans again gave way, and Great Northerns lost 10s. National Telephone Deferred hardened on balance, although there are occasional spasms of weakness. Oriental Telephones are $\frac{1}{32}$ lower.

The market in Marconis is moved by the speculative position, and after the shares had been sold down to 5, they picked up to 5⅛. Activity developed in Canadian Marconis, the announcement that the Canadian Government had come to terms with the company helping to stimulate business. After hardening to 22s., the price drooped to 20s. 6d., while Americans and Spanish are almost neglected.

Amongst English Electricity Supply shares, Metropolitans continue to be a weak market, falling another ⅛; while County Preference lost ¼. On the other hand, Hoves have moved up to 7¾, and the demand for them appears to be still unsatisfied. The market as a whole is extremely quiet, and even in City Lights dealings have died away to something like a minimum. At the same time, the holder of any of the London companies' shares may be well advised not to sell just at present.

Manufacturing stocks and shares are somewhat on the dull side. Electric Constructions are certainly harder, and Callenders regained 5s. of the recently-deducted dividend. India-Rubbers, however, fell 10s. to 11. Castner-Kellners are a little lower, despite the repetition of the 20 per cent. dividend, and Brush Second Debenture was marked down another 2 points. The Rubber market failed to benefit from a slight stiffening of the quotation for the raw produce, share prices remaining dull on the whole.

Hurst, Nelson & Co., Ltd.—The annual meeting was held at Glasgow last week. According to the *Financier*, Sir Thomas Mason, who presided, said he was glad to be able to recommend a dividend. Their prospects were entirely different from last year, and but for the miners' strike the conditions would have been even better. They were in the position to be able to pay 12 months' dividend, and a dividend at the rate of 6 per cent. per annum on the preferred share capital from May 15th to November 11th was payable on the latter date, while a dividend of equal amount would be paid on May 15th next. Railways had been giving the company a good share of work. Orders were coming rapidly in from both England and Wales. If prospects continued as they were, the condition of the company would be even better next year.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Nov. 6	2,845	+ 179	23	36,300	+ 319	14·4	..
Ayr	„ 9	292	+ 14	25	9,916	+ 238	[illegible]	..
Birmingham Corp.	„ 2	21,745	+1,909	31	830,674	+101,738	57·17	..
Blackburn	„ 6	2,289	+ 164	32$\frac{1}{7}$	39,060	+ 624	14·62	..
Blackpool Corp. ..	„ 7	1,176	+ 90	..	60,875	+ 5,690	11·87	..
Blackpool-Fleetw'd	„ 9	6 0	+ 54	18	24,536	— 520	8	..
Bournemouth ..	„ 6	3,187	+ 103	31$\frac{3}{7}$	64,469	+ 1,874	21·95	..
Bradford	„ 4	10,518	+ 69	31	174,488	— 691	56	..
Brighton	„ 10	1,719	+ 34	32	35, 37	— 1,035	9·5	..
Bristol	„ 8	13,560	+1,105	..	311,132	+ 25,430	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 1	582	+ 43	44	13,183	+ 3,369	3·65	..
Barnsley	„ 1	385	+ 9	„	7,928	— 288	..	..
Barrow	„ 1	664	+ 64	„	16,8 4	+ 8,181	5·87	..
Devonport ..	„ 1	1,0 0	+ 47	„	23,724	+ 1,649	8·85	..
Gateshead ..	„ 1	2,153	+ 2	„	4 ,964	+ 11	11·25	..
Gravesend ..	„ 1	433	+ 23	„	9,318	— 153	6·5	..
Greenock.. ..	„ 1	1,542	+ 134	„	35,813	+ 3, 88	7·25	..
Kidderminster ..	„ 1	205	+ 11	„	5,830	+ 86	..	..
Merthyr	„ 1	402	+ 6	„	8,874	— 876	2·9	..
Metropolitan ..	„ 1	16,985	— 189	„	387,1 7	— 1,4 9	22	..
Middleton ..	„ 1	21	+ 12	„	14,823	— 337	8·5	..
Mid. Joint Com'tee	„ 1	6, 91	+ 412	„	140,763	+ 7,468	..	..
Oldham—Ashton	„ 1	1,201	+ 55	„	26,968	+ 1, 84	9·18	..
Peterborough ..	„ 1	245	+ 5	„	6, 83	+ 341	5·31	..
Potteries	„ 1	4,815	+ 77	„	84,479	— 1,446	29	..
Rothesay	„ 1	99	+ 18	„	10,353	+ 471	2·75	..
Southport ..	„ 1	514	+ 14	„	13,398	— 252	8·17	..
S. Metropolitan..	„ 1	1,558	+ 13	„	37,544	— 9 6	..	..
Swansea	„ 1	2,280	- 15	„	50,876	+ 190	12·5	..
Tynemouth ..	„ 1	295	— 5	„	11 024	— 941	3·76	..
Weston-s-Mare ..	„ 1	67	— 2	„	6,726	— 1,300	[illegible]	..
‡Worcester ..	„ 1	551	+ 10	„	13,129	— 67	5·75	..
Wrexham ..	„ 1	217	+ 11	„	6, 8	+ 570	..	..
Yorks. Wool. Dist.	„ 1	2,147	+ 17	„	47,7 3	+ 1,140	17	..
Miscellaneous ..	„ 1	417	+ 9	„	10,262	+ 182	..	..
Burnley	„ 9	3,045	+ 345	..	..	..	12·44	·7
Burton-on-Trent ..	„ 10	21	— 10	32	8,793	— 480	6·6	..
Bury	„ 10	2,525	+ 174	32	42,197	— 197	22·5	..
Cardiff	„ 2	4,883	+ 274	31	76,511	— 1,857	17·85	..
Chatham and Dist.	„ 7	1,650	— 14	45	38,723	+ 61	14·9	..
Cork	„ 7	933	+ 20	45	21,756	— 928	9·89	..
Croydon	Oct. 25	3,477	+ 12	30	55,191	+ 929	11·6	..
Darlington	Nov. 2	450	+ 9	31	7,00	+ 71	4·87	..
Darwen	„ 8	660	+ 41	32	9,021	+ 261	4·86	..
Dover	„ 2	425	— 1	31	8,1 1	— 576	4·7	..
Dublin	„ 8	10, 07	+ 67	..	111,519	— 8,542	54·2	..
East Ham	„ 9	2,121	+ 15	32	3 ,503	— 878	7·87	..
Glasgow	„ 9	38,352	+ 273	..	435,823	— 9,905	98	..
Hastings	„ 11	1,572	— 73	..	..	— 2, 23	19·8	..
Hull	„ 9	6 036	+ 20	32	94 866	+ 1,142	18·5	—1
Ilkeston	„ 7	224	— 19	32	3,611	— 718	..	..
Ipswich	„ 2	773	+ 16	31	14,5 6	— 2 9	10·5	..
Kilmarnock.. ..	„ 2	3 5	+ 11	24	4,081	— 180	4·2	..
Lancashire United	„ 6	2,633	+ 51	45	60,775	+ 17	39	..
Leeds	„ 9	15,694	+1,079	32	251,343	+ 8,318	112·	..
Leicester	„ 9	5,144	+ 265	4	114,9 7	+ 3,660	20	..
Leith	„ 9	1,220	+ 56	25$\frac{3}{7}$	17,775	+ 408	3·724	..
Liverpool	„ 2	23,824	+ 801	48$\frac{3}{7}$	526,137	+ 22,277	19	3
‡L.C.C.	Oct. 30	82,980	— 3,890	..	1,48 ,637	— 6 ,354	141·1	—1
London United ..	Nov. 9	11,172	— 169	..	282,797	—13,632	..	..
Lowestoft	„ 9	353	— 11	5	1, 67	— 80	8·5	..
Manchester ..	„ 9	33,682	+2,138	32	540 158	+ 18,351	105	..
Newcastle	„ 9	9,069	+ 503	..	141 305	+ 2,273	81·8	..
†Newport	„ 2	705	+ 24	31	22,029	— 463	7·25	..
Oldham	„ 10	4 038	+ 265	33	68,411	+ 8,732	28	..
Pontypridd	„ 2	830	- 5	31	12,346	— 655	5·5	..
Preston	„ 6	1,573	+ 53	32	26,824	+ 1,190	10	..
Rotherham	„ 6	1,843	+ 854	31$\frac{3}{7}$	24,029	+ 2,256	18	6
Salford	„ 11	9 801	+ 415	32$\frac{1}{7}$	162, 33	+ 3,769	41	..
Sheffield	„ 12	18 941	+ 938	..	220,303	+ 9,004	40	..
Southampton ..	„ 6	2 269	— 24	31	40,5 7	— 128	11	..
Southend-on-Sea ..	„ 6	1,138	+ 119	32	27 472	+ 2,782	7	..
South Shields ..	„ 9	1,224	+ 77	32	20 6 9	+ 215	10·25	..
Tyneside	„ 6	907	+ 49	19	9,439	— 641	11	..
Wallasey	„ 9	2,062	+ 102	31$\frac{6}{7}$	36,504	— 35	8·72	..
†Walthamstow ..	„ 9	665	+ 33	32	23 998	— 1,015		..
West Ham ..	Oct. 31	5 193	— 246	30$\frac{4}{7}$	81 1 0	— 3,23	16·46	1·2
Wolverhampton ..	Nov. 6	2,604	+ 162	32	32,652	+ 734	18·75	..
Cen. London Rly...	„ 9	10 998	+ 367	19	90,805	+ 2,404	6·78	·5
City & S. Lon. Rly.	„ 10	6,155	— 615	19	65 391	— 4,391	7·26	..
Dublin-Lucan Rly.	„ 1	248	+ 5	18	2,813	— 102	7	..
G.N. and City Rly.	„ 9	3,069	— 96	19	26,477	— 202	3·5	..
L'pool Overh'd Rly.	„ 10	3,196	+ 350	..	31,411	+ 2,695	6·6	..
Llandudno-Col. Bay	„ 1	340	+ 47	48½	15,596	+ 735	6·5	..
Lond. Elec. Ry. Co.	„ 9	22,480	—1,580	..	242 940	+ 4,680	21·25	..
Mersey Railway ..	„ 9	4 651	+ 602	19	40 302	+ 4,277	4·5	..
Metropolitan Rly...	„ 3	84 217	— 121	18	302,985	+ 6,009	24·75	..
Met. District Rly...	„ 9	26,788	+ 751	..	234,236	+ 19 050	25	..
Anglo-Argentine ..	„ 4	105,717	+9,927	..	2,245 981	+100,039	..	..
§Auckland	Oct.	19,071	2,586	4	78 029	+13 172	24·1	·8
Bombay (B.E.T.) ..	Oct. 11	6,466	— 60	41	126,128	+ 5,746	..	..
§Brisbane	Sept.	22,700	+1,560	9	181,094	— 3,566	..	..
Brit. Columbia Rly.		..		..	..	..	..	..
Calcutta	Nov. 11	7,162	— 335	..	..	..	..	..
Cape Electric T.Ld.		..	..	.		..	..	..
§Kalgoorlie, W.A...	Sept.	8,251	..	9	28,788	..	20·5	..
§Lisbon		..	..	..		.		..
Madras	Oct. 31	1 607	+ 101	..	33 241	+ 8,601	14·7	2
§Montevideo ..	Oct.	28 488	+8 454	12	346,306	+47,753	..	..
Perth (W.A.) ..	Nov. 8	8,764	+ 511	..	83,993	+ 11,896	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 12th	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9¾— 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾— 9¾	.	4 12 4
Do. Second 6 % Pref.	10	[illegible]	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord.	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½— 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞— 5¼		4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4¼— 4½	..	5 5 3
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	99 —102	..	4 8 3
County of London, Ord.	10	6	4†	11 — 11½	..	5 4 4
Do. 6 % Pref.	10	6	6	11½— 12¼	¼	5 1 1
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101 xd	..	4 8 3
Edmundson's, Ord.	5	Nil		7/16— 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝— 5¼	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4½— 5¼	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½— 8	½	5 12 6

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 12th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½— 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½	..	1⅞— 2¼		3 10 8
Do. 6 % Pref.	5	6	6	4¾— 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	[illegible]	4†	3⅞— 4¼	½	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4½— 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 8
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½— 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4⅜— 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ —101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6	6 — 6½	..	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	9½— 10½	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	86 — 88	..	3 19 7
Smithfield Markets, Ord.	5	2	..	1⅜— 1⅞	..	..
South London, Ord.	4	5	..	3 — 3½	.	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛— 1¼	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	£3	Nil		¼— ½	..	..
Do. 5 % Cum. Pref.	5	2	:	2⅞— 3⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½— 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾— 9¼		5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4¾— 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	1911.	1912.	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛— 5⅜	— ¼	5 6 8
Calcutta, Ord.	5	8½	..	6⅞— 7⅛	— ¼	5 [illegible] 3
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	+ ⅛	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½— 94½	.	5 5 9
Canadian Gen. El. Com.	$100	7	7	116 —120	—2	5 16 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	⅞— 1	..	8 0 0
Do. 5 % Deb.	100	5	5	94 — 97		5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	[illegible]	5	85 — 88	+2	5 13 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16— 1/8	..	Nil
Do. 6 % Pref.	1	6	6	9/16— 11/16	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½— 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 13 8
Mexican Lt. & Power, Common	$100	4	4†	84 — 87	..	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105	..	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1

NAME.	Stock or Share.	1911.	1912.	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83 — 86	— ½	5 16 3
Montreal, Lt., H. and Power	$100	8	9†	234 —239 xd	+ 3	3 15 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	39 — 42 xd	..	..
River Plate, Ord.	Stock	10		240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111 xd	..	5 5 8
Do. 5 % Deb. Stock	Do.	[illegible]	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	6	5	139 —143	—1	3 9 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108		4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	102½—104½	.	4 6 2
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½—101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref.	1	11⅞d.	17⅞d.	15/16— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	[illegible]	103 —105	.	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	1911.	1912.	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4	..	7¾— 8¼	+ ⅛	4 17 0
Do. 5 % Deb. Red.	Stock	[illegible]	5	96½— 98½	+ ½	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	145½—147½	..	5 8 6
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110¼—111¼	— ½	5 6 8
Do. Def.	Do.	30/-	..	25½— 26½	+ ¼	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅝— 7⅞	..	4 8 11
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	..	4 16 8
Cuba Telegraph	10	6	..	9¾— 10¼	— ¼	5 17 1
Do. 10 % Pref.	10	10	10	16¾— 17½	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3¾— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	6¾— 7¼	..	6 18 0
Direct United States Cable	10	5	4	7⅛— 7⅜ xd	..	5 11 2
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 —133	+1	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	76½— 78½	— ½	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98 xd	..	4 1 8
Eastern Extension	10	7	7†	12½— 13⅛	..	5 6 8
Do. 4 % Deb.	Stock	4	4	97 — 99	—2	4 0 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101 xd	..	3 19 3
Globe Telegraph and Trust	10	6	6†	10¾— 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12 — 13	— ½	4 12 4
Great Northern Telegraph	10	18	18	27 — 29	— ½	6 4 2
Indo-European Telegraph	25	13	5†	53 — 58 xd	— ½	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	.	5 — 5½	— 1/16	3 18 2
Do. 7 % Cum. Partic. Pref.	1	17		4¼— 4½	— ⅛	3 15 7

NAME.	Stock or Share.	1911.	1912.	Closing Quotations	Rise + or Fall —	Present Yield p.c.
Monte Video Telephone, Ord.	1	6	6†	15/16— 1 3/16 xd	..	5 13 0
Do. 5 % Pref.	1	5	5	[illegible]— ⅞ xd	..	5 14 8
National Telephone Def.	Stock	6	.	153 —155	+ ½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	98 — 99 xd	+ ¼	4 10 11
Oriental Telep. and Elec.	1	8	6†	1½— 1¾ xd	— 1/32	4 11 5
Do. 6 % Cum. Pref.	1	[illegible]	6	1 1/16— 1 3/16 xd	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10½ — 11½	..	8 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ —101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼— 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅜— 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3 1/16— 3 5/16	— 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10½— 11½	..	5 7 10
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾— 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13¼— 13¾	.	5 1 10
Do. 4 % Deb.	Stock	4	4	96 — 98	½	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 — 101	..	4 9 1

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 12th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 3 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	½	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 93	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	36 — 39	..	..
Do. 5 % Perp. Deb. ..	100	5	5	90 — 94	..	5 11 1
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81 xd	..	6 7 2
Central London Railway, Ord.	100	3	3†	84 — 86	+1½	3 9 9
Do. Pref.	100	4	4	84 — 86	+1	4 13 0
Do. Def.	100	2	..	80 — 82	+½	2 8 9
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1¾	1¼†	42 — 43	..	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	106 —108	..	4 12 7
Do. Do. 1901	100	5	5	106 —108	..	4 12 7
Do. Do. 1903	100	5	5	107 —109	+1	4 11 9
Do. 4 % Deb.	100	4	4	97 —99 xd	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	21/32 — 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5½ — 6	+½	..
Do. 4 % Deb.	100	4	4	70 — 74	..	5 8 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 12th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	54 — 54½	—1	2 19 8
Do. Surplus Lands	100	2⅝	2¼†	63 — 65	..	4 4 7
Do 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	84 — 86	..	4 1 5
Do. 3½ % Con. Pref.	100	3½	3½	83 — 85	—1	4 2 4
Metropolitan District Ord. ..	100	Nil	Nil	39 — 39½	..	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	97 —99 xd	..	4 0 10
Do. 4½ % First Pref.	100	4½	4½	87 — 90	..	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	+1	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1¼ — 1⅜	+⅛	4 7 3
Do. Def.	1	Nil	..	9/32 — 11/32	+1/16	Nil
Do. 5 % Pref.	1	5	5	27/32 — 29/32	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	94 — 96	—1	4 13 9
Do. 5 % Deb.	100	5	5	95 — 98	—1	5 2 0
Potteries, Ord.	1	3½	..	¼ — ⅜	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3¾ — 4	—⅛	Nil
Do. "A"	1/-	..	..	5/16 — ⅜	—1/32	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	87 — 89	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	2⅞ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16 — 5 5/16	1/16	5 3 6
Do. 2nd Pref.	5	5½	5½	4 1/16 — 4 11/16	..	5 17 4
Do. 4 % Deb.	100	4	4	92 — 94	+½	4 5 1
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99 —101	..	4 19 0
Auckland Trams, 5 % Deb. ..	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¼ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16 — 7 5/16 xd	..	5 9 5
Do. 5 % Pref.	5	5	5	4¾ — 5¼ xd	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	144 —149	..	5 7 5
Do. Pref. Ord.	100	6	6	117 —121	+1	4 19 2
Do. 5 % Pref.	100	5	5	106½ —109½	+½	4 11 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	100 —103	—½	4 2 6
Calcutta Trams, Ord.	5	7	5†	5⅞ — 6⅜	—½	5 9 10
Do. 5 % Pref.	5	5	5	4 13/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	11/16 — 13/16	..	..
City Buenos Aires Trams (1904)	5	5	5†	5½ — 5¾	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97 xd	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜ — ⅝	—⅛	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼ xd	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	91 — 94	..	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	111 —115	..	6 1 9
Do. Gen. Con. 5 % Bonds ..	..	5	5	95½— 97½	+½	5 2 7
Do. 6 % Bonds	100	6	6	98 —101	..	5 19 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7 3/16 — 7 9/16	..	6 12 5
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½ — 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	5	5†	145 —155	..	3 4 6
Do. 1st Mort. 5 % Bonds ..	..	5	5	100½—102½	..	4 17 7
Do. 5 % Mort. Bonds ..	100	5	5	96 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	260 —270	+5	3 14 1
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 14 4
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102 xd	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	—½	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	½ — ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/32 — 1 9/32	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	9/16 — 13/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝ — ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	½ — ¾	..	Nil
Do. Deb...	100	4	4	59 — 62	—1	6 9 1
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	.	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	30 — 34	—2	13 4 8
Callender's Cable	5	15	10†	10½ — 11¼ xd	+¼	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	15†	3⅝ — 3¾	—1/16	5 6 8
Do. Deb...	100	4½	4½	105 —108	..	4 3 4

Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	66 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16 — 13/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16	..	6 8 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	¼ — ½	..	Nil
Do. fully paid	5	Nil	..	1½ — 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	73 — 75	.	6 13 4
Electric Construction	2	2½	3¾	13/16 — 1 1/16	+1/16	7 1 4
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12¾	..	6 13 4
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	10 — 11	—½	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13 4
Do. Deb...	100	4	4	97 —100	—½	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	½ — 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

MORE NOTES ON ELECTRIC WELDING.

By V. D. GREEN.

(*Paper read before the* Birmingham and District Electric Club, *November 9th*, 1912.)

In a previous paper which I had the pleasure of reading before the Club in 1909, I dealt (somewhat superficially, I am afraid) with the general principles of electric welding and some of the chief types of apparatus employed. This evening I propose to deal in rather more detail with arc and butt welders, and to touch upon some recent developments.

Before going into the question of electric welding apparatus and machinery, it would seem advisable to consider some of the characteristics of the welds themselves.

A perfect weld may be defined as a union of the two welded parts so perfect that the tensile, compressive, and other properties of the resulting joint are as good as those of the unwelded metal. Perfection, however, is seldom attained in this world, and welds form no exception to the rule. We will, therefore, briefly consider some methods in use, electrical and otherwise, and see how near they come to our ideal. In a paper given before the Institution of Civil Engineers recently, the authors, who certainly had no particular bias in favour of electric or any other method of welding, found that, assuming a standard of strength at the weld of 70 per cent. of that of the unwelded material, electric welding by the Thomson or low-pressure alternating-current system gave much more reliable results than gas or arc welding.

The reason of this is not far to seek. The conditions of welding are, first, that there should be no oxide or foreign matter left in the weld; secondly, that the right temperature and pressure or "working" should be used; and, thirdly, that the heating effect should be stopped at the proper time so as to prevent actually fusing the metal. Now gas welding systems (and for that matter, electric welding by means of an arc) are fusion methods. Take the case of a broken shaft. If it is to be repaired by means of an arc or by gas, the broken ends are first turned down taper at the edges, so that when clamped together in position for welding a deep "V" is left. Into this the operator proceeds to fuse, bit by bit, new metal, until the weld is large enough to stand turning down to the level of the original shaft. Now everything evidently depends upon the operator. If he has the necessary skill, he has united the two parts with a circle of fused metal which is as wide as the "V" slot. But this fused metal has a totally different micro-structure to that of the original pieces, and as the finished shaft cannot well be moved from its aligning cramps until it has cooled, it is practically out of the question to "work" the metal by pressure or "tooling." When the operator has *not* the necessary skill, the result defies description, and will very likely fall to pieces as soon as the least strain is put upon it. As a matter of fact, the only way to get a really strong weld in a shaft by a flame process is to drill and tap both pieces, and let a stud of metal similar to the shaft half into one piece and half into the other, fusing metal all round the screw and the "V" slot so as to prevent it shifting afterwards. I have used this very successfully in welding crankshafts by acetylene.

Contrast this with the same done by means of the low-pressure alternating-current system. Here the heat, upsetting pressure and (in some machines where a swager device is fitted) the "tooling out" of the burr formed by the weld are all under perfect control. The heat, instead of being communicated to the weld from the outside by means of a flame (a method which is wasteful, and takes time), is created in the metal itself by means of the C^2R loss due to its own resistance. The shaft to be welded is clamped in the welding jaws, with a suitable distance piece between, so as to allow for the "shut" of the weld, if it is necessary that the overall dimensions of the finished shaft should be the same as before. The electrical and mechanical adjustments being set, the current is turned on, and in a few seconds the metal, unobscured by any flame, has heated to the plastic stage, "upset" the predetermined amount, and stopped its own current. The resulting weld is not an uncertain fusion, but a true union of the two opposing surfaces. In spite, however, of obvious disadvantages, gas and arc welding are being extensively used for many purposes where great strength is not essential, and where handiness and portability are of more importance than the actual cost per weld or the speed of turning out the work. Moreover, there are many cases where it is only possible to apply one of these systems successfully. The man who tried to patch up a broken casting with a low-pressure welder would see trouble, and it would be equally out of the question to make harness rings on a commercial scale with an arc set. The principal field of the former will always lie in the rapid repetition of standard parts or repairs to finished work where the heating must be strictly localised, while the latter is usually more useful for jobs such as repairing broken castings and work which must be done in position.

In the Benardos arc welding process which is most commonly used, the arc is formed between a carbon rod of specially prepared material which is not readily consumed and the work to be welded. The sizes of the carbons vary considerably, but the samples before you will give you a fair idea of the average dimensions. In order to minimise the risk of carbon being deposited on the work the welding tool should be made the negative pole, where direct current is used, when welding such work as iron or steel castings or any alloys where the presence of carbon is objectionable. When the arc is used only for brazing or soldering, this point is not of so much importance, and as brazing sets are generally handled by men whose knowledge does not extend to an appreciation of the properties of an electric circuit, it is usually preferable to connect the anvil and work to the earthed main of the supply system irrespective of its polarity. The welding tool is always treated with respect, because the flame obviously proceeds from it, but the idea of the anvil being also "alive" is not so evident, and if the operator receives an unpleasant reminder of the fact, his views on the process are apt to be biased. One of the great advantages of arc welding over the Thomson low-pressure or "resistance" method is that practically unlimited heat is available (a matter of great importance where patching defective castings or cutting metal is to be done), without unduly increasing the weight of the apparatus to be handled. In this connection the small welding tool before you will be of interest. Most of the cable work on our demonstrating plant was soldered up with it, and the resulting work was not so much blackened as would have been the case had an ordinary paraffin blow lamp been used, while the insulation of the cable was less affected by the heat. The regulation of the heat was effected by a lamp plug board, and I propose to demonstrate the practical application of it for soldering. The object of the resistance is, of course, to break down the 110 volts pressure of the dynamo to that necessary for the arc, and for steadying and regulating the arc when formed. I trust also to show the use of the arc for cutting metal instead of sawing, where extreme accuracy is not essential. As a matter of fact, however, the current should be about 500 amperes, instead of the 200 I am about to use. In this connection it has always appeared to me that an arc plant would be very useful for cutting off the "risers" or "gates" left on castings, instead of dealing with them in the usual way.

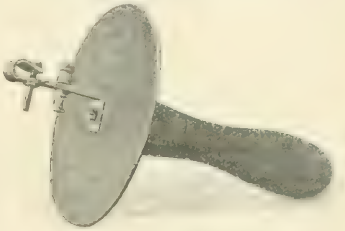


Fig. 1.—Small Arc Brazing Tool.

The principal inherent disadvantages of the arc process are:—

1. The results obtained depend entirely upon the skill of the operator, and so cannot very well be made automatic for repetition work.

2. It is not so safe as the "resistance" method, owing to the comparatively high voltage used, the sparks thrown off when large work is being done, and the chemical effect of the ultra-violet rays on the skin, unless the operator is well protected by asbestos gauntlets, apron, and metal helmet with non-actinic glass eyeholes. It then becomes rather difficult for him to see what he is doing. These remarks apply, of course, chiefly to large work, and for small brazing sets elaborate precautions do not appear necessary, although suitable dark red glasses should always be used. The results of exposure to the ultra-violet rays of the arc are curious. The skin is tanned, and peels off in the same way as when exposed to very bright sunlight. It is, however, more unpleasant than dangerous.

3. The difficulty of keeping the arc reasonably steady becomes more and more serious as the work to be done becomes smaller. The temperature of the arc itself is very high, and cannot be altered to any great extent, so that the only way to decrease the heating effect is to reduce the volume of the flame. Up to a certain point there is not much difficulty in doing this, because it is only necessary to cut in more resistance, and so decrease the current. But in dealing with finer work, such as hard soldering a brooch, the flame has to be narrowed down to the equivalent of a thin blowpipe flame, and as the stability of an arc decreases rapidly as the ratio of length to width increases, a point is soon reached when the electrode has to be held so near the work that it is difficult to see what is happening. It is obvious that this point will be reached sooner with alternating than with continuous current, and it is for this reason that continuous current is nearly always used, though, as you have already seen, the use of alternating current is quite practicable on a larger scale.

The voltage across the arc varies from 50 to about 150 volts, and the current from ·5 ampere to about 500 amperes, according to the particular job in hand. Where arc welding plays an integral part in the manufacturing processes of a works the method of breaking down the mains pressure through a resistance is nearly always too costly, besides making the users an utter nuisance to everyone else on the same supply feeder main, and a specially wound motor-generator or power-driven dynamo having a pronounced falling characteristic is usually installed. I propose, however, to deal with the question of generating and converting plant on another occasion.

In most manufacturing processes where welding is required, modern competition demands great accuracy in the finished article, low running costs and a large output from each operator. This accounts for the steadily increasing use of the low-pressure alternating system first introduced by Elihu Thomson in 1885. As has been previously mentioned, the principle consists of causing very large currents to pass through the abutting ends of the pieces of metal to be welded, thereby causing heat to be generated at the point of junction, which is, of course, the point of highest resistance. At the same time mechanical pressure is applied to force the parts together. As the current heats up the metal at the junction to the welding temperature, the pressure "follows up" the softening surface until a complete weld is effected, and as the heat is developed by the C^2R loss in the metal itself, all parts are equally heated.

Referring to the strength of the welds made by this process, Sir Alexander Kennedy made tests at the request of the Thomson Co., and reported as follows:—"I have tested the bar, both welded and in its natural condition, and the result of both tests is given in the tables. In the case of the wrought-iron bars, the ratio of the welded to the unwelded bar is as follows:—2 in. diameter, 82 per cent.; 1½ in. diameter, 84 per cent.; 1 in. diameter, 87 per cent.; ¾ in. diameter, 98 per cent.; ½ in. diameter, about 95 per cent.; mean ratio, 89 per cent.

"In the case of the ½-in. bar the pieces tested broke very close to the weld. There was not enough bar left to enable me to make separate tests of the bar in its natural condition. The 95 per cent., therefore, is in the nature of an estimate. Of course, in all cases the durability of the metal in the neighbourhood of the weld, as measured by its ultimate extension and reduction of area, is less than elsewhere, as the figures in the report show. The ratio of strength of weld to solid bar in the case of the Bessemer steel specimens is as follows:—1 in. diameter, 92 per cent.; ¾ in. diameter, 97·5 per cent.; ½ in. diameter, 100 per cent.

"In this case, it will be seen that with the ½-in. bar the metal was somewhat hardened by the heat, so that it was actually stronger at the weld than the metal was in its natural condition, as shown by the occurrence of fracture through the solid bar, and not through the weld."

It will be noticed that apparently the strength of the weld decreases with increasing cross-section; but, in my opinion, the results obtained merely show that the machine on which the above samples were welded was too small to deal properly with the large sizes. There is always one particular speed and setting which gives the best result for a given weld, and there is apparently no reason why all the sections tested should not have averaged the same breaking stress.

The following test made upon some No. 7 S.W.G. iron wire rings turned out by one of our semi-automatic welders will also illustrate the reliability of the finished work produced by this process:—(*a*) 1,096 lb. breaking pull, broke at weld; (*b*) 1,249 lb. breaking pull, broke above weld. The solid wire itself, on being tested, broke at 1,325 lb., showing that the metal close to the weld was slightly weaker than the rest of the wire.

The heat is produced where it is wanted, and practically confined there. None is wasted in maintaining an arc. The power therefore is economically employed, and the welding may be continually watched, as it is not covered with flame or obscured in any way. So local, indeed, is the heating that finished work may in many cases be welded without spoiling the polish for more than a quarter of an inch on either side of the weld. This process may be made automatic, and thus uniformity of results may be obtained, an important matter where large quantities are dealt with. Moreover, it is extremely rapid, being practically instantaneous for small sizes, while for larger sizes only a few seconds, depending on the horse-power used, are required. With regard to the horse-power necessary for various kinds of work, the following figures may be of interest:—

ROUND IRON AND STEEL.

Dia.	Area sq. in.	H.P.	Seconds.	B.T.U. per weld.
¼ in.	0·05	2·0	10	0·004
⅜ in.	0·1	4·2	15	0·013
½ in.	0·22	6·5	20	0·027
⅝ in.	0·3	9·0	25	0·046
¾ in.	0·45	13·3	30	0·082

These figures are taken from actual tests, and are not to be regarded as the best which can be got. It should be remembered that although the total energy required to do a given weld remains much the same whether the operation is fast or slow within certain limits of speed, the ratio of power required to time occupied may be considerably varied.

If, however, the rod is bent into a ring, and the ends welded, allowance must be made for the current which will be shunted round the other side of the ring. The amount so shunted depends naturally on the diameter and length of the rod or wire composing the ring. The times given above are rather slower than those obtained in manufacturing work, because it is usually preferable to lose a small percentage of the strength of the weld in order to keep down the labour costs. As long as it is amply strong enough for the purpose for which it is intended, it would be bad policy to treble the production costs for the sake of making the job unnecessarily strong. Of course this speeding-up may easily be carried too far. The commercial limits may be taken as follows:—

1. The power required to hasten the weld rises in a curve which, although comparatively straight at first, bends sharply upwards when the time is very much reduced, and this renders it uneconomical to press the speed of welding too high. The curves shown will illustrate this point forcibly. The running cost is usually so small compared with the labour charges, that it would pay to reduce the times given in the above table down to about one-fifth of the values there given, but beyond that, the capital cost and size of the plant increase beyond a practical limit.

2. The quality of the metal also plays an important part in the speed limit. When you can choose your own speed, it is possible to weld nearly anything in the way of iron and steel that you can get, but where the pace has to be forced it becomes more and more essential that the material should be soft, homogeneous, free from impurities and slag, and consistent in quality. It must be remembered that this paper is not intended to be anything but a practical description of the subject, and while I have personally welded fairly bad stuff successfully at a high speed, it was under laboratory conditions, which would rarely be reproduced in commercial working. Where the weld has been speeded up beyond the limit, and is weak in consequence, it does not always give way at the point of the junction, as shown in the test of the 7 S.W.G. wire already mentioned, but sometimes at a point about midway between the actual weld and the point where the metal was held in the die. This is due to the sudden heating of the weld. No time is given for the heat to spread backwards into the rods, with the result that there is a sudden line of demarcation at either side of the weld, where the micro-structure of the metal changes from the silky fibrous section of the wrought bar to a succession of "slip bands," and thence to a mixed-up fused mass. The joint (one cannot call it a weld) is then no better than an acetylene or arc weld, and will break at the point where the micro-structure changes. It has long been the fashion in papers on the subject of welding to point with pride to the fact that the metal has broken before the weld, but if the break is close up to the weld, the tensile test should be retried, and if the material falls below a reasonable standard of strength and the break occurs in the same place every time, the welding methods should be altered.

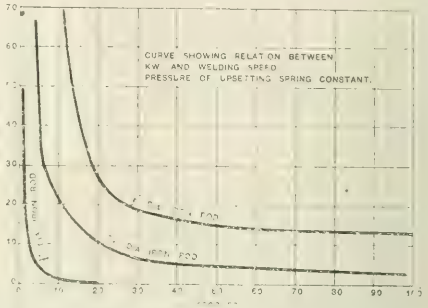


FIG. 2.—RELATION BETWEEN WELDING SPEED AND KILOWATTS (Pressure of upsetting spring constant).

3. The shape of the work has frequently a considerable effect upon the welding speed. Thus, in the manufacture of rings, this limit of welding is usually reached (other things being equal) when the ratio of the diameter of the ring to the diameter of the stock from which it is made becomes less than 5 : 1. This does not mean to say that it is impossible to weld below that size, but merely that there is liable to be trouble when working on a commercial scale unless the operator is very skilful.

4. The fourth point is the welding machine itself. From the foregoing, it is evident that the practical limits of the actual welding time are quickly reached, and any further speeding-up can only be obtained by decreasing the time required to handle, clamp, release, &c., the stock. This means additional cost and complication, and greater chances of mechanical trouble, since the machine must be more or less completely automatic. This, in turn, means that the setting-up of the machine and its adjustments must be done with extreme care, and unless the works are large enough to pay for a thoroughly skilled fitter, familiar with automatic welding machines, to adjust and repair them, a simpler type is preferable, for it must not be forgotten that a very little wear will upset the adjustment, and the machine will turn out scrap quite as fast as good work.

5. The work itself—that is, the accuracy of the processes previous to welding—plays an important part. It has been shown that an accurate machine is necessary for high-speed work, and it follows that it is no use having a machine which will work to $\frac{1}{100}$ in. if the work supplied to it varies ⅛ in. or so. From these considerations it is evident that there comes a point somewhere where the added working and capital costs outweigh the advantage of the gain in speed. This point, however, differs according to the class of work, and depends on an equation which each manufacturer must solve for himself. Personally, I think that the simpler the machine can be kept the better, and my opinion is endorsed by many manufacturers who have had experience of both hand automatic and completely automatic machines.

So far, we have been dealing with tables of round rods and bars, but when the stock is of square or oblong section, the power requisite to weld it rises, on account of the greater radiating surface in proportion to the mass. In the curves just shown it will be noticed that they gradually become horizontal, showing that below a certain KW. input it is impossible to raise the stock to the welding temperature at all, and that the radiation and convection losses balance the heating effect. The difference, however, is not necessarily proportionate to the relative cooling surfaces for equal speeds of welding, and, therefore, we may fairly conclude that in practical working the radiation and convection losses are not, as a rule, serious. To take an instance, a ½-in. inside diameter pipe, having a cross-section of metal equal to that of a ⅝-in. diameter round rod, requires not ·046 unit to weld it but ·061. This is an increase of only about 32 per cent., whereas the relative cooling surfaces are approximately 3 : 2. The mechanical pressure, however, has usually to be much heavier with strip and tube than with ordinary bar, and this makes reliable comparisons difficult to obtain. In order to determine the effect of radiation, conduction and convection on sections of differing shape but equal area, it is necessary to do away with the disturbing element of the mechanical pressure, and I decided therefore that the test must be on fusing a bar, and not welding it. I therefore obtained a piece of $\frac{3}{8}$-in. diameter round iron, having an area of ·1075 sq. in. in cross-section, and a flat strip $\frac{1}{16}$-in. thick, having an equivalent area. I then slacked off the "upsetting" springs of the welder so that there was no mechanical pressure, and heated each sample until it broke. The power in units was ·044 for the bar, and ·1532 for the strip. This is, however, an extreme case.

Let us turn now to the question of the material to be welded. Where iron is dealt with it should be as soft and pure as possible. Iron of this character is to be had, and I know several wire mills which are making a speciality of iron suitable for electric welding. Mostly, however, the samples to be dealt with are a very long way off being pure, and are often "burnt" besides, common Staffordshire iron being probably the greatest offender in this respect. It is by no means impossible to weld it, but the machine has to be set rather more accurately than for the purer iron, and the chance of making scrap under commercial conditions is much greater owing to unlooked-for variations in the quality of the metal.

Mild steel is usually the best possible material for welding which can be readily got anywhere, though the term is rather an elastic one, and I have come across stuff which certainly conformed to specification in so far as a low carbon percentage was concerned, but which contained so many other unscheduled constituents that it was impossible to do anything with it.

I have never done much in the way of experimenting with cast-iron, though I have produced fairly strong welds in this material. Mostly, however, it is cast into shapes which preclude the possibility of getting the parts to be united into the jaws at all, so I never pursued the subject far.

The welding of high carbon steels, copper, nickel, brass, &c., is a fascinating subject. I have already mentioned the conditions necessary for a good weld, and in iron and mild steel all these are fairly easy to fulfil. With high carbon steels one encounters the difficulty that outside a very limited range of setting the carbon tends to be converted into CO and CO_2, and the weld is "burnt."

(*To be continued.*)

BRITISH TRADE IN ROUMANIA.

Roumania is necessarily one of those countries where the buying power both of the public bodies and individuals depends from year to year on the results of the harvests. For this reason, traders must keep a close watch on movements, and regulate their efforts according to conditions which exist at the moment. At the same time there are excellent opportunities in Roumania, particularly for constructive work, but Continental competition is very keen.

In a recent report on the subject of the trade of Roumania, H.M. Consul at Bucharest points out that to gauge thoroughly the Roumanian market for commercial purposes, it is necessary to keep the agricultural prospects in view. Everything depends on the harvest. If two years of plenty follow one another, then business all round increases to an incredible extent, and *vice versâ*. Thus, 1910 was a good year, but for the preceding three years the harvests were poor, and the result is that the bulk of the profits made in 1911 will go to liquidating arrears and debts contracted in the previous years. Should the next year fulfil present expectations, then the following period should be one of great commercial prosperity.

It is to be regretted that more direct business is not done between the United Kingdom and Roumania. It is a fact that the Roumanian market is looked upon with suspicion by British merchants and capitalists, and there can be no doubt that much capital has been lost both by individuals and firms, but this is attributable in a great measure to want of caution in selecting the persons with whom business is to be done. On the other hand, there are representatives of firms who have been dealing with Roumania for a number of years, and who claim to have made practically no debts.

The country is exceptionally fertile. The mineral resources are practically untouched, and the petroleum industry, though it has assumed important proportions, may be said to be still in its infancy.

In view of the above and other advantages, and the desire for development and the activity of the Roumanian people, it seems apparent that British capitalists and manufacturers could find scope for their energies. But it should always be borne in mind that more British capital has been lost in Roumania through worthless agents and bad connections than through any other cause.

Owing to the great facilities afforded by the Orient express, London is within less than three days' journey of Bucharest, and it is to be regretted that more British merchants and prospective investors do not personally visit Roumania and thus study the market and local conditions on the spot.

British merchants find keen competition in this market, though there can be no doubt that if statistics were available discriminating more exactly the origin of goods, it would be found that we command a good share of the trade. British cottons and textiles undoubtedly successfully compete with all others. Our principal competitors are Germany and Austria-Hungary, Italy to a small degree, and of recent years Russia as far as locomotives and cheap machines are concerned.

The principal cause of successful foreign competition may be traceable to the question of transport and freight. German State Railways convey goods at cheap rates to the Austro-Hungarian frontier; thence it is but a short run to the Roumanian frontier over Austro-Hungarian rails, where freights are notably cheap. Goods coming from Austria-Hungary and Germany—our commercial rivals in Roumania—can be ordered and delivered in from 10 to 15 days. British goods take from three to five weeks, and if despatched by sea may take an indefinite period. This could be mitigated if an enterprising line of steamship owners were to run a regular direct service from the United Kingdom to the Danube. At present, freights from the United Kingdom overland and by sea show very little difference. But merchants cannot afford to trust to their orders arriving to date if sent by sea.

The question of credit is one that also affects competition. British merchants frequently exact cash against documents or three months, and exceptionally six months. The foreign firms are more lenient, and give six months, 12 months, and even more. In Roumania credit is essential, and with a competent agent, who thoroughly knows his market and customers, there is no reason why easier terms should not be given. As an example of the extremes to which the question of credit is carried, the Consul quotes the case of a British firm that obtained a small and insignificant order from the Roumanian Government. When it came to the question of terms, the firm insisted on cash against documents, evidently ignoring the fact that the Government disposes of a revenue of some £18,000,000. Naturally, the terms were not agreed to, and the order went elsewhere.

The following electrical goods are imported :—Dynamo-electrical machines, electric motors, rotary converters, dynamo accessories, accumulators with plates for recharging, arc lamps and their mechanism, telegraph and telephone apparatus, bells, batteries for medical and chemical purposes, switches, wire and cables covered with metal, paper, asbestos, gutta-percha, rubber, &c., incandescent lamps, insulators and articles for insulation in earthenware or porcelain. Ventilators are used to some extent in banks, hotels, hospitals and public institutions. Cinematographs are extremely popular in all towns in Roumania. The steady development of home industries in Roumania is favourable to the import trade in electrical goods. The market is the object of keen competition between the United Kingdom, Germany, Austria-Hungary and France. Manufacturers, in order to succeed, should be represented in Roumania; sending catalogues alone is useless. The essential qualities in goods destined for Roumania are cheapness, simplicity and good wearing quality.

Whether British firms avail themselves of the services of commission agents or not it is highly desirable that in opening up business relations in the district they should send out their own agents to establish at least their first connections, and also it is absolutely essential for such men to be capable of transacting their business either in German or in French, failing Roumanian. If the British firm employs a commission agent, it should, in its own interest and before allowing credit to be given, require satisfactory proofs from him that the buyer is solvent and in a good way of business.

THE ABANDONMENT OF A TRAMWAY.

(FROM A LEGAL CONTRIBUTOR.)

It is material for those who have power to run a tramway, but contemplate its abandonment, to remember that abandonment may have a serious effect on what is known as the Parliamentary deposit. In case the abandonment of tramways may take place more frequently in the future, owing to the competition of the motor-'bus, it may be useful to set forth some of the considerations which may affect the Parliamentary deposit, more particularly in view of the case of *in re* West Yorkshire Tramways Bill, 1906, which was decided on October 31st by Mr. Justice Warrington.

Where a tramway is abandoned, the Court, by virtue of the Parliamentary Deposits and Bonds Act, 1892, has power to order that the deposit, or any part thereof, be applied towards compensating any landowners or other persons "whose property has been interfered with or otherwise rendered less valuable by the . . . . abandonment of the undertaking or any portion thereof."

It has been held that the measure of injury due to abandonment is determined by a comparison of the value of the estate immediately before and immediately after the abandonment (*in re* Potteries, Shrewsbury and North Wales Railway Co. (1883), 25 Ch.D. 25), and that account may also be taken of a breach of a collateral obligation if it is such that a breach of it is necessarily involved in the abandonment and indistinguishable from it (*in re* Ruthin Railway Act (1886), 32 Ch.D. 438). That it must be "necessarily involved" was made clear in a case decided in 1911. Where, for instance, the making of a tramway might involve the erection of an embankment which would keep water from the plaintiff's land, the abandonment of the tramway, and the consequent non-erection of the embankment, will not give rise to a claim for compensation. In the case in question a company was authorised by Act of Parliament to construct a tramroad, which would cross land belonging to the respondent, "with all necessary and proper embankments," &c. By Sec. 50 of the Act, it was provided that the deposit made upon the application for the Act in pursuance of the Standing Orders and the Parliamentary Deposits Act, applicable to (*inter alia*) compensation "to landowners or other persons whose property has been interfered with or otherwise rendered less valuable by the commencement, construction, or abandonment of the tramroad" authorised by the Act. The company, in pursuance of an agreement made by them with the respondent before the passing of the Act, subsequently thereto entered into an agreement with him by which the respondent agreed to convey certain lands to the company, and to grant to them by way of easement the right of constructing and maintaining upon certain marsh lands belonging to him "a solid embankment for the purpose of carrying the company's authorised tramroad across the marsh lands," and the company agreed to "construct and thereafter maintain the embankment for the purpose of carrying the tramroad across the marsh lands in the manner aforesaid" as a solid embankment and to form it so as to connect certain existing sea banks, and to be sufficient to prevent the ingress of the tidal waters of a river over land belonging to the respondent. This agreement was followed by a conveyance by which the before-mentioned easement was granted to the company, and which contained a covenant by the company to execute and perform the works specified in the agreement. The proposed tramway was never made, and the company obtained an Act by which it was provided that they should abandon the same, and provision was made for the appointment of a liquidator and the winding up of the company. In proceedings in the Chancery Division in the matter of the application of the deposit fund, the respondent claimed against that fund in respect of diminution of the value of his property by the abandonment of the company's undertaking and the consequent non-construction of the embankment, which would have protected his above-mentioned land from liability to be overflowed by the tidal water, and Warrington, J., being of opinion that the respondent was a landowner whose land had been rendered less valuable by the abandonment of the company's tramroad within the meaning of Sec. 50 of the Act, allowed him to claim against the fund. On appeal by the liquidator of the company, it was held, reversing the decision of the learned judge, that the non-construction of an embankment in accordance with the covenant was not a necessary consequence of the abandonment of the company's undertaking, and, therefore, the respondent was not entitled to compensation out of the deposit fund as claimed by him.

In the case before Mr. Justice Warrington, it appeared that a landowner had entered into an agreement with promoters to sell to them a part of the site of a corner shop. The sale was carried out voluntarily. Under their Act the company were empowered, but were not obliged, to widen the road at the point in question, and the exercise of this power might have resulted in a piece of the applicant's land fronting on the street, which would have increased its value. The claimant alleged that he was entitled to that added value as compensation. Mr. Justice Warrington held that the diminution in value was occasioned not by the abandonment of the tramway, but by the fact that the street was not widened. "Under the Act," he pointed out, "the street need not be widened: even now it might be widened. The applicant was not injured by the abandonment of the tramway, although he might have been through the street not being widened. I am of opinion that the applicant does not come within the class of persons whose property has been interfered with or otherwise rendered less valuable by the abandonment of the tramway."

It is a nice point whether the loss of the advantage of having the tramway running past the door of his house would be such as to entitle a frontager to compensation. It is submitted (in the absence of any definite authority) that it would not. It was, however, held in one of the cases above-mentioned that where the abandonment of a railway involved the non-erection of a station, a landowner was entitled to show that failure to build the station had affected the value of his land.

THE MANCHESTER STEAM USERS' ASSOCIATION.

The annual report of this Association for 1911 is to hand. Owing to the coal strike, it commences with a reference to liquid fuel, and a table is given to show the relative values of coal and crude oil for equal economical results. The figures given range from 35s. per ton of oil to correspond with 26s. for coal, up to 60s. and 45s respectively. Thus, the price of oil must fall considerably before it will pay to burn it for steam raising. The chief advantages of oil are the absence of ashes and clinker, but the report says oil must be burned in brick-lined chambers, which need frequent repair or renewal. But it is now claimed that with even simple pressure burners a large unlined marine furnace will burn oil smokelessly, and the Wallsend Slipway Co. now install oil fuel installations on this system. The efficiency of the internal-combustion engine is approximately double that of the steam engine. A week's oil consumption of 55 hours may be stated at 0·5 lb. per B.H.P.-hour in an internal-combustion engine. For equal economy crude oil at 35s. in a Diesel engine, petrol in a Diesel engine at 44s., coal for producer gas at 11s. 6d., coal for a gas-fired boiler at 8s. 6d., and coal for a steam engine at 10s., are at par, according to this report. Thus, at present prices fuel for the Diesel engine costs twice as much as for a steam engine—ashore, we may conclude, is alone meant. The report suggests the production of cheap gas at a central station, and its piping round to factories. This, by the way, would also solve the factory heating problem, for the exhaust and jacket heat would do this, or there would be the gas itself if more heat were wanted.

This heat problem is the principal trouble in the way of transmitted electricity, and the report says that if one boiler is necessary at a factory it may just as well be big enough to drive the power plant, for one stoker can do the work in most factories. Obviously the Association would advise the generation of electricity at a factory rather than at a central station, and for Lancashire mills which must be heated almost all the year round it is not easy to see the advantage of a central station, which cannot usually even buy fuel at a less cost than the factory, and has the disadvantage of a worse load factor and of a line loss and other charges also. And how much worse would the case be if only the factory owner would use the vast stream of waste heat with which he now heats to 100° F. or more a great pond or a length of canal, when he is burning coal for mill heating that he could so well save.

As the report says, boilers give trouble; not the least is corrosion, and considerable attention is given to this. Internal boiler corrosion is due almost wholly to the oxygen and carbonic acid of the air, which are absorbed by water, and reference is made to the experiments of Heyn and Bauer at some length. The experimenters tested the effect of 40 dissolved salts in reducing or increasing corrosion. These salts included those of calcium, sodium, potassium, ammonium, iron, barium, chromium, magnesium, and boron. The calcium and barium salts did not cause pitting, but sodium salts added to lime salts did. The worst pitting occurred with sodium chloride and sodium carbonate mixed. Some salts attacked central regions, others affected the outer regions of plates. Corrosion from electrolysis is most erratic, it being not uncommon for one boiler in a set to corrode much faster or much more slowly than the remainder.

Except the acetate, all the ammonium salts are corrosive. Steam users afflicted by abnormal and rapid corrosion should analyse the water, for corrosion is a far more complicated affair than has been suspected; it has been thought to be sufficiently guarded against by common soda, whereas this salt mixed with the chloride may be most pernicious. High pressure has very much altered boiler conditions. It will decompose magnesium chloride and produce the acid base HCl. It will causticise sodium carbonate and so cause corrosion of brass mountings. Most of the oxygen in water soon passes into the steam space, but the small amount left behind in the water should be removed by the continuous addition of a deoxydiser with the feed.

Aluminate of barium or $Ba\,O, Al_2\,O_8$ combines with both carbonic and sulphuric acid, and both lime and alumina are deposited. Water thus treated is therefore nearly as pure as distilled water, but is not fit for domestic use, because barium is poisonous. But are not the resulting barium salts insoluble? Not all barium salts are insoluble, if most of them are. If those produced in water softening are not soluble, such a treated water if filtered ought to be good. But barium has so very high an atomic weight that great weights of it must be used to cause lime or magnesia—both bodies of small valency—to deposit. A return to the subject is promised in the near future. The report contains a reference to permutit and the luminator apparatus, if a sheet of corrugated aluminium can be called an apparatus. Its action appears to be without waste of itself to cause lime salts to go down as fine powder instead of as hard scale. Permutit is stated to be too costly to remove lime carbonate, for 70 lb. of common salt are needed for each 100 lb. of lime carbonate precipitated. For sulphate of lime permutit stands a better chance, for to remove 100 lb. of this only 60 lb. of salt is needed [the report says 600 lb., but this appears to be a misprint]. But both permanent and temporary hardness removal seems to be outside the practical power of permutit. Permutit is a double salt with the formula $2\,Si\,O_2, Al_8\,O_2, Na_2\,O, 6H_2\,O$. [Should not the second item be $Al_2\,O_8$?] This is a most interesting and thought-compelling report, and is well worth the reading. On the luminator puzzle a domesticated friend assures the writer that an aluminium kettle will not become encrusted by hard water, but will cause scale-forming matter merely to deposit as loose powder. If this is so, it would appear that the placing of a luminator plate in the magnetic meridian is a mere selling point.

Perhaps we may yet have aluminium boilers?

British Railway Electrification.—In a letter to the *Morning Post*, "Fair Play" calls attention to a rumour to the effect that the engineers of the A.E.G. have made a survey of the London-Brighton railway, while British engineering firms show no sign of activity in connection with the pending contract for the conversion of the railway to electrical working. The writer of the letter protests against the employment of a foreign firm to carry out the work, pointing out that if this is done, the fact that British electricians are not trusted by their own countrymen to undertake British work will be advertised by their competitors all over the world. We may be assured, he says, that material to be used in construction has been bought from British firms, but the assurance is worth little unless we know that those firms have not bought the material from Germany in the first instance; if the A.E.G. secures the contract and gives long credit, with the aid of the banks which finance it, the latter will not allow their money to be spent on goods manufactured out of Germany, and German material will have to be used, even though it may pass through the hands of a British firm. Finally, he alleges that a very grave blow to the British electrical industry is in preparation, and asks whether the British houses and the British public are going to take it lying down.

ELIMINATION OF COLOUR DIFFERENCE IN THE PHOTOMETRY OF INCANDESCENT LAMPS BY MEANS OF MULTI-VOLTAGE STANDARDS.

By DAVIS H. TUCK.

The unit of illumination intensity, mean horizontal candle-power, in the United States and England is based upon the performance of carbon and tungsten-filament incandescent lamps when they are operated at a fixed efficiency, the carbon lamps burning at an efficiency of 4 watts per mean horizontal candle-power, and the tungsten lamps burning at an efficiency of 1·50 watts per mean horizontal candle-power.

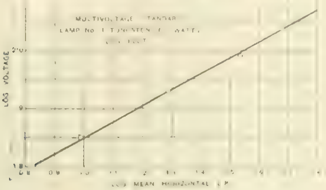


Fig. 1.

When carbon-filament lamps or metal-filament lamps burning at an efficiency other than 4 watts per mean horizontal candle-power, or 1·50 watts per mean horizontal candle-power, are to be compared with primary standard lamps or duplicates of primary standard lamps, the different colour resulting from the different operating efficiency makes the operation of comparison a very difficult one when accurate results are desired and the time to obtain these results is limited.

When different observers make photometric measurements on lamps which operate at an efficiency different from that at which the primary or secondary standard lamps are calibrated, different results are obtained, and different experienced observers will repeat their readings from day to day. With this in view, it will readily be seen that to obtain accurate candle-power values for lamps which burn at a different colour from that of the standards with which they are compared, it is necessary for a large number of experienced observers to make independent measurements from day to day, and the mean of these measurements taken as the true candle-power value of the lamps.

Several combinations have been more or less successfully used to eliminate the difference in colour of the light which falls on either side of the photometer screen, and such combinations are indispensable when a large number of lamps are to be accurately calibrated in a limited time. The flicker photometer is used in some laboratories to eliminate the colour difference between the standard lamp and the test lamp, but the reliability of such data is questionable.

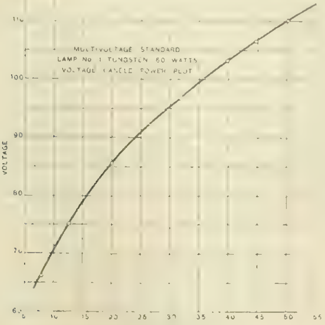


Fig. 2.

Coloured glass is also placed in the path of the light to reduce to the same colour the light which falls on either side of the photometer screen. Several sources of error are likely to occur when coloured glass screens are used. A very large number of coloured glasses would have to be calibrated so as to obtain a colour match with all types of lamps, and such a calibration would involve an enormous amount of labour. The question of permanency of the density of the coloured glass arises, and it is necessary to make check measurements at frequent intervals.

By the adoption of the procedure outlined below, it is possible to make comparisons of lamps operating at different colours once and for all at some convenient time and to make all subsequent comparisons under the favourable conditions of a colour match.

A group of tungsten-filament lamps should be selected which are so constructed that the filaments are strongly anchored, and at the same time the current comes to a steady value in less than 45 seconds. Select four voltages which will operate these lamps at different efficiencies between 4 watts per mean horizontal C.P. and 1·25 watts per mean horizontal C.P.

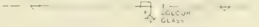
At these voltages let five or more experienced observers make at least nine independent candle-power determinations using carbon or tungsten reference standards.

Arrangement No. 1.

In the table below are given the candle-power and corresponding voltage values of a 60-watt tungsten lamp. The candle-power values given represent the mean of nine measurements for each observer.

	Lamp No. 1, 60 watt tungsten. Volts 107·5. M.H.C.P.	Lamp No. 1, 60 watt tungsten. Volts 98·0. M.H.C.P.	Lamp No. 1, 60 watt tungsten. Volts 85·0. M.H.C.P.	Lamp No. 1, 60 watt tungsten. Volts 71·0. M.H.C.P.
Observer A	46·84	34·23	19·60	9·81
" B	47·10	34·10	19·60	9·85
" C	46·80	34·21	19·72	9·76
" D	46·77	34·08	19·68	9·83
" E	46·80	34·12	19·57	9·79
Mean	46·86	34·15	19·63	9·81

If the logarithms of the voltage values be plotted against the corresponding logarithms of candle-power, the mean values being used, the resulting curve will be a straight line. Such a plot, made from the above data, is shown in fig. 1. If values are read off from the logarithmic plot, and the numbers corresponding to these logarithms are plotted into a direct plot, the candle-power voltage curve shown in fig. 2 may be constructed. It will be noticed that to construct such a curve from direct data would require a prohibitive amount of work.



Arrangement No. 2.

When the candle-power voltage curves have been constructed for a group of multi-voltage standard tungsten lamps, all subsequent comparisons of test lamps may be made against these multi-voltage tungsten standards when these lamps are operated at such a voltage as will produce a colour match with the test lamps. The procedure is the following:—

(*a*) Using the substitution method, adjust the voltage of the comparison lamp to give a colour match with the test lamp when the test lamp is operated at the voltage at which it is to be standardised. If necessary inert a blue glass colour screen between the photometer screen and the comparison lamp. See arrangement No. 1.

(*b*) With the voltage of the comparison lamp at the value as found in operation "*a*" and the colour screen, if used, in place, adjust the voltage of the multi-voltage tungsten standards to give a colour match with the comparison lamp. See arrangement No. 2.

(*c*) Use the multi-voltage tungsten standard lamps at these voltages as standard lamps with which to compare the lamps that are to be tested. See arrangement No. 1.

When the apparatus is designed to move the photometer head and the comparison lamp as a unit, it is advisable to use a carbon comparison lamp, and in such a case it is necessary to use a blue colour screen, as shown in arrangement Nos. 1 and 2, when high efficiency test lamps are to be measured. The glass screen, however, is kept in the same position throughout the entire test so that it is not necessary to calibrate it.

The above method has been found very convenient by the author when groups of lamps of different efficiencies are to be accurately calibrated.

A REMARKABLE COAL-GAS ENGINE.

[COMMUNICATED.]

In these days, when our competitors abroad are devoting so much attention to the internal combustion engine, any outstanding development in this country deserves—and obtains—a most careful attention. In this direction the engine that has been invented by Dr. Archibald Low (D.Sc.) for working on coal, has reached a point of development when it can already claim improved results over existing practice, and the fact that the writer was recently able to study the working of one of these engines, encourages him to think that the particulars then obtained may be instructive to others.

Crudely, the Low engine may be described as running on gas obtained from coal, in a producing plant so compact that the complete plant constitutes nothing more than an elaboration of the cylinder head casting. Obviously, gas production under such conditions necessitates a special system.

Although the idea which this engine embodies has been the subject of seven years' continual study and experiment, inevitably involving trials of various sizes of engines, for the present purposes the writer cannot do better than take for description the machine that he watched at work. This is a large single-cylinder 80-100 H.P. engine of usual horizontal design, merely modified to meet the requirements of the special idea. To this end the 16-in. cylinder head has been replaced by a casting extending somewhat to each side of the cylinder. This casting is made up of various chambers. Looking at it from behind the cylinder, on the extreme left is the hopper chamber, and small coal is here fed by gravity into tubes that run through to the chamber at the other end of the casting. Through these tubes run coarse pitch conveyor worms, ratchet worked from the engine, and these work the coal along the tubes from the hopper chamber.

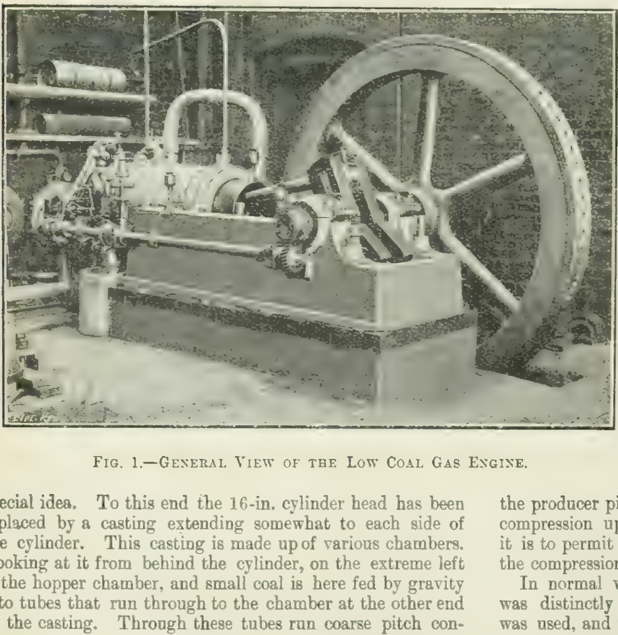
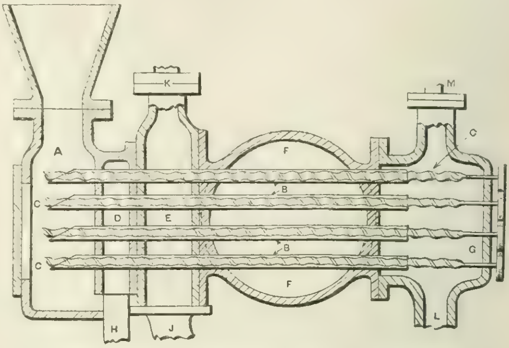


Fig. 1.—General View of the Low Coal Gas Engine.

The engine is started up on ordinary town gas or any other available supply, and after a few minutes' running, these tubes, where they pass through the combustion head and through a chamber heated by the exhaust, become hot enough to raise the coal to incandescence.

The exhaust heated chamber is seen immediately to the left of the cylinder, while on the other side is the shoot chamber, from which the ashes, after being worked to the ends of the tubes, are free to fall into the ash-pit. It will be seen that the ends of the tubes are thus open to the air, which coming up the shoot passes over the incandescent fuel in the tubes and supports combustion.



A, Hopper chamber; B, Gas generating tubes; C, Conveyor worms; D, Chamber where gas is taken off to engine inlet; E, Exhaust heated chamber; F, Cylinder; G, Ash-shoot chamber; H, Pipe to inlet valve; J, Pipe from cylinder exhaust; K, To silencer; L, Ash-shoot; M, Test-cock.

Fig. 2.—Diagrammatic Sketch showing the Principle of the Low Engine (in Section).

In the 100-H.P. engine in question, four 2-in. tubes are used, and where they pass through the small space that exists between the hopper and the exhaust heated chamber, they are drilled with as many ½-in. holes as can be conveniently arranged in staggered formation. It is this small chamber that is connected with the engine inlet pipe, the suction from which draws the air and products of combustion to the engine in the form of air gas and coal gas, and this before reaching the engine is mixed with additional air admitted through an automatic valve placed close to the inlet valve. Earlier trials showed irregular running, owing to the pulsating action from the suction of the engine on a plant of such small volume capacity, and thus we find an india-rubber bag, seen in the photo., fig. 1, interposed between the gas plant and the inlet valve to act as a damper and equalise the flow of gas.

The engine is designed for the rather high compression of 90 lb. per sq. in., and this on purpose to give it a wider range of economical power, for though the compression is rather high for working on air gas and coal gas alone, the engine at 90-lb. compression can quite well work on this mixture for a quarter of an hour or 20 minutes. If extra power is required for short periods on emergency loads, 15-18 per cent. more power can be obtained on this dual mixture than when working on the mixture which is obtained by the introduction of water drips into the producer pipes of the gas plant. On the triple mixture compression up to 130 lb. per sq. in. is quite feasible, and it is to permit of extra power from the dual mixture that the compression ratio is compromised at 90 lb.

In normal working the writer noticed that the engine was distinctly smoother in running than when town gas was used, and this can be accounted for by the molecular construction of the hydrogen in the coal gas and water gas being different, the former having a slower rate of combustion. Thus the pressure is well maintained through the stroke and a good "fat" diagram should be possible. The engine ought to be economical; in fact, judging by what the writer saw in this direction, the inventor will have no difficulty in substantiating his claim of ·5 lb. of coal per B.H.P.-hour—a figure which the writer believes has not hitherto been reached.

Attempts hitherto made to use coal for internal combustion without the addition of elaborate gas making and scrubbing plant, have practically invariably shown a tendency towards tarry deposit in the cylinder, but in the Low engine this trouble does not appear to exist, for the test cock showed that the gas given to the engine was mixed with a thick mustard-coloured smoke, which would not condense except under extreme cold or a combination of considerable cold and high compression, neither of which would be incurred in ordinary working. The piston, too, appeared to be perfectly free from deposit, although somewhat black, but this was due to the burning of the lubricating oil at the high compressions, and the consequent high temperatures of combustion in the cylinder. In fact, to this last may largely be ascribed the remarkable fuel consumption.

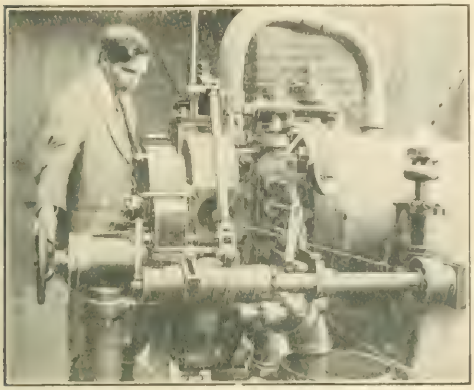


FIG. 3. CYLINDER HEAD ARRANGEMENT OF THE COAL GAS ENGINE. The figure in the photograph shows Dr. Archibald Low. The valve he is operating changes over the gas from town supply to the self-generated supply.

But, apart from the mere economy in fuel consumption, the Low engine promises to have a big future, owing to the simple fact that it utilises the slack and small stuff of our coal supply—the least valuable grades of coal; nor with the larger size of engine need the coal be screened very carefully. The accompanying illustration will give some idea of the size of the coal used in this comparatively large engine. Of course, the size of the fuel depends to some extent on the size of the engine; for cylinders of about 5 in. diameter with corresponding stroke, cubes up to $\frac{1}{4}$ in. would be quite large enough, while for the little 2-H.P. engine with which Dr. Low did much of his experimental work, the coal was scarcely coarser than coarse brown sugar. That the engine is not very exacting about its fuel supply, however, and has a wide range in this direction is evidenced by the fact that it has been shown capable of running on such fuel as sewage.

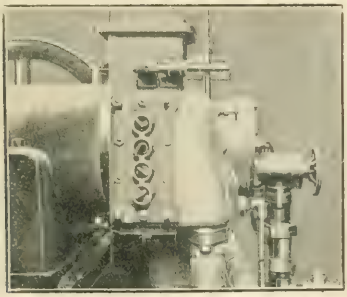


FIG. 4.—COMBUSTION HEAD OF THE LOW ENGINE SEEN FROM THE HOPPER SIDE. The ends of the generating tubes and of the conveyor worms can here be seen.

One other point. In previous attempts to use coal gas in more direct ways than usual, trouble has often been experienced from the production of sulphuric acid. In this case the H_2SO_4 is split up into hydrogen, sulphur, and sulphur dioxide, which causes nothing more than a slight pitting of the easily replaceable generator tubes.

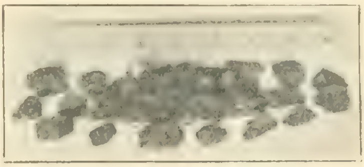


FIG. 5.—GIVING AN IDEA OF THE SIZE AND SORT OF COAL USED ON THE LARGE 100-H.P. LOW ENGINE. The scale shows inches.

The engine has now reached that phase of development when it leaves the experimental, and enters on the commercial stage, and if recent performances afford any criterion, it has a very great future before it, in small and large sizes.

LAYING-OUT ANGLES IN TRANSMISSION LINES.

ONE of the most important preliminary steps in the design of overhead transmission circuits is the determination, surveying and plotting of the route to be followed. The latter must be arranged to take advantage of, or avoid, natural facilities or difficulties, and a certain number of—often very many—deviations have necessarily to be made in the route. It is very important that the angle through which the direction of the line is to be deviated at any point should be rapidly and accurately determined. Methods employing the theodolite and other surveying instruments are well known, but involve costly apparatus and considerable skill and time in their application.

In the course of an interesting discussion which recently ran through several issues of the *Elektrotechnischer Anzeiger*, three very simple methods were described for the determination of line angles. All three methods have been used considerably in practice, and differ little in theory, though one is sometimes more convenient than the others in application. The apparatus required includes only base poles and a 50-ft. measuring tape.

Method 1.—Referring to fig. 1, A B C represents a right-angled triangle with equal sides B A, B C (each = 1·00 to any convenient scale). Suppose the hypothenuse bisected in D and B D joined. The line B D bisects the angle B and is of length = 1 sin 45° = 0·71 (to scale adopted). From B mark out B N, B K, &c., along B D and through N, K draw lines parallel to A C and make B E = B F = 1 = B L = B M, and so on. There is thus obtained a series of isosceles triangles with common apex B.

There exists a definite relationship between the heights and the apex angles of these triangles. As the height varies from 0·71 to 0·00, the apex angle increases from 90° to 180, and every intermediate value of the height corresponds to a definite apex angle, and *vice versâ*.

The chart in fig. 2 consists of a series of such triangles, coapexial at O, and with base apices lying on the circumference of a circle of centre O and radius = 10 (to any convenient scale).

To explain the application of this method, suppose that the angle between A B, B C (fig. 3) has to be determined (in practice the angle between adjacent sections A B, B C of an overhead line lies between 90° and 180°, and fig. 2 has been constructed on the supposition of these limits). Having erected guide posts at A, B, C, supplementary poles D and E are set in the lines B A, B C, and at a distance of 10 m. from B. The distance D E is measured by a tape, the central point M is thus determined and the distance B M is measured. On setting off B M (to scale) along O P on the chart shown in fig. 2, the apex angle of the corresponding equilateral triangle can be at once read by a protractor, (interpolating between two triangles if necessary). The apex angle thus determined is obviously the required angle A B C in fig. 3.

If desired a more or less complete table of corresponding values of perpendicular height and apex angle can be prepared for the series of triangles in fig. 2, as shown alongside the latter.

Method 2.—Whereas method 1 measured the perpendicular distance from the centre B to the chord A C, E F or L M, &c., fig. 1, the present method regards the angle whose value is required as the angle subtended at the centre B of a circle of radius 10 m. by the chord D E (fig. 3). Setting out posts D, E, as before, the distance D E is measured in metres by tape, divided by 10, and thus a figure obtained from which the corresponding central angle α can be determined by reference to a table of angles and chords (such as is to be found in any engineering pocket book). If the angle α is more than, say, 120°, it is better to set the post D at D^1, then determining the angle β, whence the required angle α at once follows. This procedure is desirable on account of the small changes in the length of the chord D E when α approaches 180°, so that a small error in the chord measurement causes a relatively large error in the angle determination.

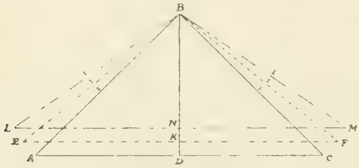


FIG. 1.

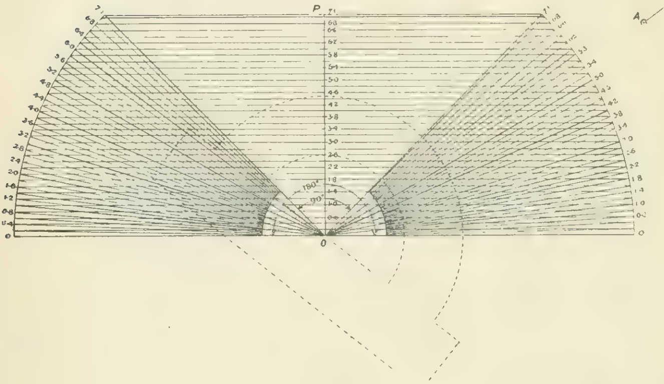


FIG. 2.

As compared with method 1, this method avoids the bisection of D E and the measurement of B M; but, on the other hand, method 1 can be used by reference to a table quite as easily as method 2; and, moreover, the angle α can be determined accurately, however nearly it may equal 180°. Indeed, the accuracy of method 1 rather tends to increase, as the angle α grows larger, for, referring to fig. 4, a given error ($d\,l$) in the height m, subtends a greater chord b when the angle $\alpha/2$ is small, than when this angle is nearly 90°. On the other hand, the error due to ($d\,l$) is never excessive, because the angle α is very rarely, if ever, less than 90° in practice. If, as is probable, the error in m (fig. 4) is a constant percentage, method 1 is yet more accurate in application, since the length ($d\,l$) is less at A (fig. 4) than at B, and hence the angle $d\,\theta^1$ is yet smaller (as compared with $d\,\theta$), than is the case when equal error $d\,l$ occurs in m, m^1.

Method 3.—While depending on the same geometrical foundation as methods 1 and 2, this method evaluates the desired angle by means of a slide rule instead of by reference to tables. It is convenient to determine half the angle $\alpha/2$, or $\beta/2$ (fig. 3), and make the length B D = B E = B D^1 = 5 yards (or metres) in this case. Referring to fig. 3,

$$\sin\frac{\alpha}{2} = \frac{DE/2}{5} = \frac{DE}{10}, \qquad (1)$$

$$\text{or}\ \sin\frac{\beta}{2} = \frac{ED^1/2}{5} = \frac{ED^1}{10}. \qquad (2)$$

Having erected the posts E and D or D^1, and measured the distance D E or E D^1 as before, this length, in yards or metres, is divided by 10, and the result is set on the right-hand half of the upper slider, under the right-hand top unit on an ordinary slide rule. The angle $\alpha/2$ or $\beta/2$ can then be at once read on the back of the slider, and double the angle thus determined is α or β, fig. 3.

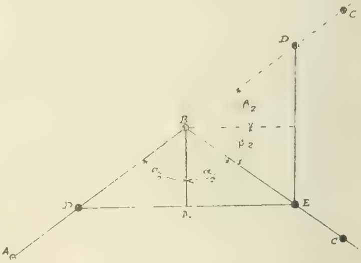


FIG. 3.

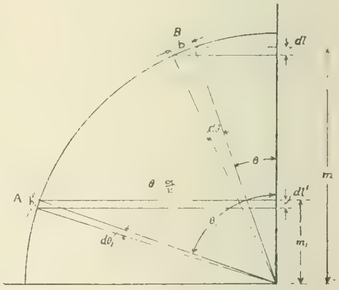


FIG. 4.

As is well known, the slide rule does not give sine values accurately above 60°, hence a good working rule is to use equation (1) if the angle α is less than 90°, and equation (2), corresponding to measurement E D^1, if the angle α is greater than 90°, which it usually is in practice.

TABLE REFERRING TO FIG. 2.—EQUIVALENT VALUES OF m AND ANGLE α.

m.	*Angle* α°.	m.	*Angle* α°.	m.	*Angle* α°.	m.	*Angle* α°.
0·0	180	1·8	159	3·6	137	5·4	114
0·2	178	2·0	157	3·8	135	5·6	111
0·4	175	2·2	155	4·0	132	5·8	109
0·6	173	2·4	152	4·2	130	6·0	105
0·8	171	2·6	150	4·4	128	6·2	103
1·0	168	2·8	147	4·6	125	6·4	100
1·2	165	3·0	145	4·8	122	6·6	96
1·4	163	3·2	143	5·0	119	6·8	93
1·6	161	3·4	140	5·2	116	7·1	90

Prize Distribution.—The annual prize distribution to the successful students of the Northampton Polytechnic Institute, Clerkenwell, E.C., will be held on Friday, December 6th, at 7.30 p.m. The Marquess of Northampton will distribute the prizes and certificates.

PROCEEDINGS OF INSTITUTIONS.

Scientific Shop Management.

On October 23rd, Mr. G. C. Allingham, A.M.I.E.E., read a paper before the Junior Institution of Engineers on the Taylor system of shop management. Discussing present conditions, he pointed out that it was not uncommon for a man to take no less than four times as long over his work as he need do if he did his best. The lack of efficiency was due to the want of means for ascertaining how long it ought to take to do any given piece of work, the tendency of workers to conceal their capabilities, and the inefficient methods of working adopted even by skilled men. Mr. F. W. Taylor and his associates had for 30 years been engaged in a systematic study of manual labour, and had found that, as a rule, work could be done continuously in from one-half to one-quarter the time hitherto expended, and the relationship between employer and employed could be placed on an entirely new basis.

The principle at the root of the system was the analysis of every piece of work into its component parts, and the study of each element, by close observation of first-class workmen. Useless motions were eliminated, others improved; for example, the motions of a bricklayer in laying a brick were reduced from 18 to 5, and in one case from 18 to 2, so that instead of 1,000, he could lay 3,500 bricks per day, with, if anything, less effort than before. Various other instances were cited in the paper, showing, for example, that there was a best size of shovel for handling coal, and another best size for iron ore; even the intervals of rest between carrying heavy loads were subject to correction—with proper intervals of rest and work, nearly four times as much could be done in a day without undue exertion.

In the art of cutting metals, especially, Mr. Taylor's investigations, which comprised some 50,000 experiments at a cost of £30,000 to £40,000, and consumed 400 tons of metal, had led to most valuable results.

The methods adopted were described by the author, who explained also how the rates of payment were fixed so as to enable both workmen and employer to profit by the introduction of the system. For ordinary shop work it was necessary to pay about 30 per cent. above the average current rate of wages; for heavy work, 50 or 60 per cent.; for skilled work, 70 to 80 per cent.; and for work involving both skill and severe exertion, 80 to 100 per cent., above the average. Additional expense was incurred on account of the increased amount of clerical and office work, and more elaborate supervision; but this also was compensated for over and over again by the enormous increase in production, which was not accompanied by a proportionate increase in standing charges. The tendency of the system was to raise the men to a higher class of work than they were on before, and to employ each man on the class of work for which he was best suited. Every man had the chance to do the best he could for himself, and a better chance of getting on than he had previously.

The process of changing to the Taylor system must be gradual; but when once a quarter or a third of the men had been convinced of its advantages by experience, the rest would quickly fall in with it. The system was already in extended use in the United States, where at least 50,000 workmen were employed under it, and in Canada; the output per man had been increased three or fourfold, and the wages by 30 to 100 per cent., but the labour costs were one-half, or less, than they had been even in well-managed works under the old system, with the same plant and equipment. The effect of the system was to raise wages, shorten hours of labour, increase profits, and reduce the selling price, while the workers were benefited not only materially, but also morally. If we were to compete with the United States, we *must* adopt the Taylor system.

Institution of Electrical Engineers (Birmingham Section).

On Wednesday the chairman, Mr. A. M. Taylor, delivered his inaugural address dealing with "Patents and Inventions," on which, he said, the prosperity of the country in general, and of the electrical industry in particular, depended to a greater extent than perhaps was usually supposed. A country which did not provide new developments in industry was apt to stagnate, and would certainly be unable to compete with other countries which were providing these developments.

The question arose whether it was not desirable, in the interests of the country at large, to give still greater stimulus to invention; there was an obvious temptation for large concerns having abundance of capital, and control of certain markets, to seek to use this capital to enhance their profits, and to stifle competition from any new developments.

To take a concrete example: Suppose it had been possible for the manufacturers of reciprocating steam engines to have bought up and stifled all inventions in steam turbines, as rapidly as they appeared; the whole industry of the nation would have suffered, and developments in large power plants would have been retarded to an enormous extent. The destructive tendency of such a course would seem to be self-evident.

One very important reason for the apathy of the capitalist, or the manufacturer, towards the inventor was to be found in the fact that there was a profound distrust in the value of patents, and this was one of the points which it was desired to investigate in the present address.

Another point was the inducement to invention which should be offered by the large firms to their employés, and a third point was the financial assistance which should be offered by independent concerns to the best class of inventors, in the national interest.

Dealing with the first point, it was perhaps not generally known by the inventor that, even when he had survived the scrutiny of the British Patent Office, he had only secured a reasonable chance of his invention not having been anticipated at the Patent Office; he had no assurance that the invention would act in the manner predicted, or that there was real "subject matter" in his invention. The knowledge, in a general way, that there were difficulties of this sort to contend with no doubt had its influence on the capitalist, and even on the manufacturing firms which would otherwise deal with the matter.

A question, then, for careful consideration was whether the inventor got sufficient encouragement from the State to compensate him for these uncertainties, and whether these things were not done better in other countries. In Germany, especially, the investigation of a patent was carried out with a thoroughness that left the inventor, when he emerged successfully through the ordeal, with the confidence that, even if he were attacked in the law courts, his patent would almost certainly not be cancelled either on the ground of lack of "subject matter" or on that of inability to work, if made as described in the specification. Another very good feature about the German patent was that the only fee which the inventor had to pay to obtain this excellent benefit was a matter of some 20 marks, since he did not have to pay the remaining 30 marks unless he was granted the patent, which might be as much as two years later.

The question of the "validity" of a patent, or otherwise, was one of vital importance to the inventor, and the difference between what constituted sufficient to obtain (in England) the grant of a patent and what constituted "subject matter" was little understood by the average engineer.

He would take, for example, the Ilgner patent, which had been granted in this country, and in the pushing of which large sums of money had been incurred, and which, at the instance of a competitor, who had no master patent to offer in its place, was declared to be invalid.

The judgment in this case showed very clearly the erroneousness of the common idea that any combination of known ideas, which effected a new or improved result, was subject matter for a patent. In the present instance the combination of the motor-generator idea (introduced primarily for regulating the speed of the second motor) with the fly-wheel (introduced at the right point of the chain to avoid the excessive demands being transmitted back to the generator) was undoubtedly a combination effecting "a new and improved result," and as such would be accepted by the British Patent Office. But after a company had been formed, and capital spent on developing the scheme, with the supposed certainty of reaping a substantial reward later in royalties, the whole thing was quashed by an action in the law courts.

What, then, could be done for the inventor? Undoubtedly the right way was for the British Patent Office to be invested with powers to enable it to determine authoritatively whether an invention possessed "subject matter" before it issued Letters Patent.

It seemed to him that the British inventor had for too long neglected to avail himself of the means of combination possessed by other individuals, and some powerful organisation was needed in this country to defend his interests, and to state his case in Parliament. Something, in fact, akin to their own Institution was needed.

He might perhaps give a hint to the inventor. If he could not get the British Office routine amended in the desired direction, the German Patent Office was still at his disposal, and the "oracle" could be worked, if done the right way, for a sum not exceeding £3 to £4 if the patentee was his own draughtsman.

Turning to the inducements to invention offered by manufacturers, it was fairly common practice for large manufacturing firms to call upon their employés to sign a document, whereby they agreed to hand over absolutely to the firm all inventions they might make while in their service, and disclaimed any right whatever to participation in the profits. The theory of this arbitrary proceeding was that the employé had got his knowledge through his employer. But, though there were occasional cases where the invention had, so to speak, been pitchforked into the employé's hands in the course of his daily work, there was a large majority of cases where the employé came to the employer with knowledge gained elsewhere, and to the benefit of which the employer was not entitled.

A case happened within his own knowledge, where an exceptionally brilliant engineer was positively dismissed because he refused to hand over to his employers a patent which he had taken out, and the knowledge for which he had certainly obtained before he came to the said employers.

No doubt there were many simple ideas which were the result of a happy inspiration in the course of one's daily work; but the day had gone by when anything of real value could be evolved in electrical engineering without an immense amount of brain work; and, if there were not sufficient stimulus of reward, the busy engineer could hardly be expected to spend his evenings at such problems when he could get along just as well with his employers if he did not do anything outside of his office.

There were certain fairly obvious improvements which might be made in present relations between employer and employé.

It should be absolutely illegal for an employer to compel an employé to hand over to him his invention, on pain either of dismissal, or of prejudice in any way to his advancement if he stayed on with the firm employing him.

The employé should certainly be allowed to apply direct to the Patent Office in the first instance, if he chose to do so. The fact that the patenting fees were, under present arrangements, borne by the employer, counted for very little in the matter. In most cases the inventor would greatly prefer to pay his own.

In all these matters an Institute of Inventors might be of inestimable service to the inventor, if properly arranged to safeguard his interests.

Undoubtedly the engineer with a genuine bent for invention needed every encouragement. By this he did not mean the casual inventor of a new button-hook or boot-jack, but the engineer who, having a good training in fundamental principles, set out with a full knowledge of what had already been accomplished in a particular direction, and had a clear idea of what he wanted to arrive at, and was prepared to make sacrifices in its attainment.

Could not the Institution do something in this sense? All their premiums appeared to be granted on the merits of papers read before the Institution, judged on the basis of their contribution to the general fund of knowledge, or their promotion of a good discussion. But if they had a substantial premium set aside for the inventor who might read a paper descriptive of his work (even if the object of that work were not finally attained), such premium might help him to continue his experiments or developments. And, if contributions towards such a fund were invited on the part of members generally, would there not probably be a large response from members, and thus an additional stimulus given to original work?

The period of six months allowed between the lodging of the provisional and that of the "complete" specification was altogether too short for inventions that involved a great deal of investigation, calculation, experiment and development.

It was very hard on the class of inventors who were the most likely materially to benefit their country that they should be handicapped by having either to drop their original work (and thus lose priority) or to disclose to the public an invention at such a stage that it invited development by others who had not done the really hard work on it. They should be allowed, under increasing penalty, to extend the time to nine months, or even a year.

A suggestion might be made as to whether the British Patent Law should not differentiate between "inventions" in which there was held to be "subject matter" and those in which there was not. There was a large class of very useful inventions in which two or more independent ideas were combined to produce a new and improved result. Surely such an invention deserved better of the public than to be put upon the scrap heap after a lot of time and money had been spent upon it. Take, for instance, the Ilgner case; it was very easy for a judge to be persuaded by expert witnesses that the thing was self-obvious, but the ordinary engineer might be allowed to have his doubts about this.

In any case the fact remained that the crushing of a patent in this way was a distinct discouragement to invention, and that the best class of inventor, viz., the well-informed, plodding engineer, who had a definite purpose and the best equipment for effecting it, was the one most hard hit by it. He would suggest that complete protection be granted to this class of patent, but only, however, for a limited term of years—say 10 years instead of 14 years. Anything which discouraged inventions which would confer a boon upon the country producing them (though they need not be in themselves of striking novelty) was actually a blow aimed at the trade of the country itself, and therefore should be remedied with the least possible delay.

An Improved Joule Radiometer.

On the 8th inst. Mr. F. W. Jordan, A.R.C.S., B.Sc., described before the Physical Society an improved form of his simple Joule apparatus, adapted to show the existence of the Peltier and Thomson effects, which had been designed to eliminate the necessity of elaborate thermal insulation and to give a steady zero and a fairly high sensibility.

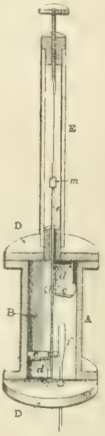
A brass tube A, 4 cm. long, 1·6 cm. diameter and 0·2 cm. thick, was divided longitudinally into two compartments by a copper plate B, 0·6 mm. thick. Two rectangular gaps were cut in diagonally opposite corners of the partition and two sector-shaped disks of copper, *c c*, were soldered to the edges of the gaps to form the horizontal sides of the channels for the current of air between the compartments. The partition B and the disks *c c* were soldered to the inner surface of the brass tube A. Two light mica vanes, *d d*, each 7 mm. × 6·5 mm., and total weight 1·4 mgm., were fixed with a little shellac to a fine glass stem *e*. The distance between the vanes and the other dimensions were arranged so that when suspended the clearance between the edges of the vanes and the sides of the channel was about 1 mm. A small silvered glass mirror *m*, 3·5 × 2·5 × 0·2 mm., was attached to the glass stem *e*, and the whole system was suspended by a quartz fibre 9 cm. long and about 0·004 mm. in diameter. The flanged ends of the brass tube A and the brass cover plates D D were ground plane and screwed together tightly. The glass tube E carrying the torsion head was fitted over a short brass tube fixed centrally to the upper cover plate. The motion of the vanes was limited by stops to about 20°. The air in the interior of the apparatus was thus practically sealed from communication with the atmosphere, and shielded from stray heat by the brass enclosure. The apparatus was fitted inside a concentric brass tube, and the whole was mounted on a levelling stand.

The sensibility of an instrument of this type might be expressed by the deflection in millimetres on a scale at a distance of a metre from the mirror produced by the absorption or evolution of heat at the rate of a microwatt in one of the compartments. This was determined by passing a measured current through a known resistance in one of the compartments.

The ends of a short length of No. 47 eureka wire *f* were soldered to two leads of No. 36 copper wire. The insulated leads were fastened together and to the inside of a narrow glass tube with paraffin wax. The glass tube was passed through a circular aperture in the lower cover plate, and sealed with Chatterton compound; a pair of dummy leads were similarly mounted in the other compartment to compensate any gain or loss of heat along the leads to the resistance loop.

The position of the spot of light on the scale was steady a few minutes after the apparatus had been levelled and adjusted. Bringing the hand quite near to the outer brass tube had no appreciable effect, and the zero remained steady to within a fraction of a millimetre. The motion of the vanes was excessively damped, and the period of swing was much greater than the undamped natural period.

The deflections produced by measured currents through the resistance loop were very nearly proportional to the squares of the currents. In the case of the full scale deflection the spot of light became steady 40 seconds after the current was started through the resistance. On breaking the current the spot of light returned to the original zero in about the same interval of time. This interval of time could be reduced by diminishing the air resistance to the motion of the vanes. The latter could be effected by increasing the clearance around the edges of the vanes. The following figures gave some idea of the sensibility of the instrument.



New Radiometer.

A deflection of 122 mm. on a scale at a distance of a metre from the mirror was produced by a current of 4·75 milliamperes through the resistance of 10·5 ohms. This gave a sensibility of 0·52 mm. per microwatt. The small deflection of about 1 mm. produced by 0·5 milliampere could be repeatedly observed. The range of the instrument could be extended to measure feeble alternating currents of the order of 10^{-4} amperes by using a heater of 1,000 ohms, and the least detectable current in this case would be 5×10^{-5} amperes.

Alternating currents producing more than the full scale deflection could be conveniently and accurately measured by the compensation methods of H. L. Callendar and K. Angström. In Callendar's method the heat from the heater would be absorbed by the current through a thermo-junction in the same compartment. In Angström's method the heat would be balanced by the heat from a similar resistance in the other compartment. A calibration with direct currents would be necessary in every case to measure alternating currents.

The instrument might be adapted to measure the heat given out by small quantities of radium. A calculation showed that 1 mgm. of radium should give a deflection of 50 mm. on the scale.

To measure radiant heat it would be sufficient for most purposes to make a small window of rock salt or fluorite of about 50 sq. mm. in the side of the brass tube A and direct the radiant heat on to a thin metal disk supported centrally by a fibre in one of the compartments. The rate of absorption of heat by the disk could be measured by Callendar's method. The indications of the instrument could thus be made independent of radiant heat from directions other than those limited by a tube directed towards the window and the receiving disk.

Australian Sign.—A novel sign has recently been erected in Kingsway for the Australian Commonwealth. It is illuminated by 156 Osram lamps, which give it a brilliancy enabling the daily messages displayed thereon to be read at a considerable distance. The light is well directed and concentrated by means of hidden reflectors. The electrical work in connection with this sign has been carried out by the Electrical Installations, Ltd., of 27, Martin's Lane, Cannon Street, E.C.

SOME CARLISLE NOTES.

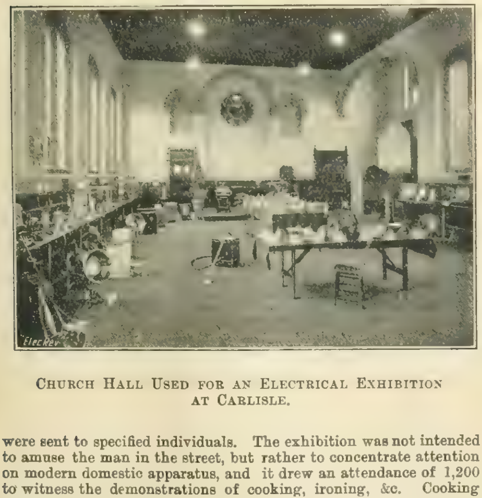
Readers of our pages will be aware that recently a very successful electrical exhibition was held by the Carlisle electricity department, in the main hall of what was a Unitarian Church building, until it was acquired by the Corporation for necessary extensions of the electricity works.

During the past three years the capacity of the works has been trebled, mainly in order to cope with the growing motor load in the city.

This has considerably improved the conditions at the works, and greatly reduced the works costs, making it possible to offer supplies at cheaper rates, and as a result, and with a view to increasing the meagre revenue obtained from mains laid in residential districts, Mr. S. T. Allen, the city electrical engineer, was led to introduce the new "domestic" tariff based on a fixed charge of 12½ per cent. of the annual net rateable value of the house, and ½d. per unit for all energy consumed for lighting, heating, or cooking. The fixed charge is, moreover, payable quarterly, and no meter rents are charged.

Church Buildings Purchased for Extensions by Carlisle Electricity Department.

In order to bring the advantages of this tariff home to existing and potential consumers, and more particularly to emphasise the value of electric cooking, Mr. Allen decided that it was preferable to hold the exhibition previously mentioned, and, further, that the latter would best achieve its purpose, if personal invitations, in the form of cyclostyled letters, accompanied by complimentary tickets were sent to specified individuals. The exhibition was not intended to amuse the man in the street, but rather to concentrate attention on modern domestic apparatus, and it drew an attendance of 1,200 to witness the demonstrations of cooking, ironing, &c. Cooking was carried on nearly all day for about five days, and no attempt was made to ventilate the hall, a feature which was impressed on crowded audiences, and demonstrated the purity of the air under the abnormal conditions prevailing.



Church Hall Used for an Electrical Exhibition at Carlisle.

Invitations were extended to visitors to bring their own joints to be cooked, and they were asked to weigh them both before and after, so that they could prove for themselves the great saving in weight when meat is cooked electrically. A large variety of heating apparatus, irons, kettles, hot-plates, vacuum cleaners and lighting apparatus was on view, and local contractors were invited to make full use of the exhibition and its contents, there being no other showroom in the town. Full advantage was taken of this, and although little was sold directly by the Corporation, which has full powers to sell or hire, a good deal of business was done from outside.

The exhibition was primarily held for the purpose of familiarising consumers with the extended uses of electricity rendered possible by the new domestic tariff, and we gather that the Carlisle Electricity Department is experiencing a busy time as the result.

For one thing, a hire-purchase wiring system between landlord and tenant has been introduced, under which the Corporation obtains tenders for the wiring work only, and the tenant pays for the work in the first instance, but only after agreeing with the landlord that the latter shall deduct from the rent 20 per cent. a year for five years, of the cost of wiring alone.

By this arrangement the landlord pays for the wiring work by instalments and without interest charges, *if* the tenant remains five years; if the latter leaves before that period he sacrifices part of the cost which he originally paid.

The exhibition hall, or part of it, will be permanently used as a showroom by the Electricity Department, which intends to make use of part of the rather secular-looking church building for a battery room, stores and further office accommodation. In conclusion, we are indebted to Mr. S. T. Allen for the interesting notes here printed.

CONSULAR NOTES.

Bosnia.—The British Consul at Sarajevo reports an opening in Bosnia for British-made steam engines, and oil and benzine motors for driving threshing machines and flour mills. H.M. Consul also states that dealers in Sarajevo now apply to his Consulate more frequently than they used to do with the object of getting into direct communication with British firms. The names of such persons are communicated to the Commercial Intelligence Branch of the Board of Trade. Inquiries made of leading merchants seem to show that, on the whole, the demand for British goods is increasing steadily, though the total consumption is still very small—perhaps not over £10,000 worth per year.

The erection of a large new general post office, in which the postal, telegraph and telephone services will be centralised, was begun in 1911, and is to be completed by 1913. The cost is estimated at £47,000. The electric tramway system is to be extended, and a more frequent service introduced. The following works are being contemplated for other towns in Bosnia-Herzegovina:—Banjaluka, electric lighting; Bihac, electric lighting; Bijeljina, electric lighting; Derventa, electric lighting and drainage; Mostar, public baths, £12,500; bridge over the river Narenta, £9,000; electric power station; slaughter-house; Zenica, electric lighting and drainage.

Chile.—The British Consul-General gives the following list of wireless telegraph stations in Chile in a report recently sent home:—

Stations.	Radius. Kiloms.	Remarks.
Arica	600	To be completed next year
Antofagasta .. .	600	,, ,, ,,
Coquimbo	600	,, ,, ,,
Valparaiso	600	Now working
Juan Fernandez ..	600	Projected
Talcahuano	1,200	To be completed end of this year
Mocha	600	,, ,, ,,
Llanquihue	2,000	Projected
Ancud	600	,,
Huafo	600	,,
Cabo Raper ..	600	,,
Evanjelistas	600	,,
Punta Arenas	2,000	,,

Note.—All stations, with the exception of Talcahuano, will be fitted with the Marconi apparatus. Talcahuano will have the Telefunken system. All stations will maintain a permanent service day and night.

Russia.—The British Consul at Moscow reports that owing to the appearance of a new competitor who threatened their monopoly, the Moscow Electric Co. considerably lowered their rates during 1910. The result of this was that many mills and works in Moscow started using electricity for their motive power and lighting. In the Lefort district of Moscow alone out of 48 factories 20 have already adopted electricity, and others are following their example. The works find not only that electricity is cheaper, but also from a hygienic point of view much is gained, and there is less danger to the hands.

Tasmania.—The American Consul at Hobart reports that by the 1st of January of next year, Hobart and small near-by towns will be supplied with cheap electric current for lighting and power purposes derived from the water-power resources, and this ought to stimulate a demand for electrical materials and apparatus, of which American manufacturers might take advantage. The city of Launceston, which now has a limited supply of cheap electric power, will doubtless have larger supplies available in the near future, and it seems only a matter of time when probably most of the towns of Tasmania will be electrically developed. The estimated cost of providing the installation and of erecting some metallurgical works in connection therewith is £250,000. The company expects later on to use the electric power not only for the treatment of complex Australian ores, but also for the manufacture of calcium carbide, calcium cyanamide, &c.

Japan.—The American Consul at Yokohama reports that the Japanese Government has rejected the application of the municipal authorities of Tokio for permission to increase the capacity of the electric light department of the city to approximately one million lights. The Municipality of Tokio is now engaged in the lighting business through the ownership of the electric street-railway lines. The Tokio Asahi states that the reason for rejecting the application is that, when the establishment of the Nippon Electric Light Co., came up for approval last year, the Government, after investigation, ascertained that there was ample room for the operations of three companies—the Tokio Electric Light, the Nippon Electric Light, and the Electric Light Department of the Tokio Railways (now the Electric Bureau of the Tokio municipality)—and granted the Nippon Electric Light Co. the right to furnish electric light to the amount of 11,000 KW. If the Government were now to sanction the new scheme of the Tokio municipality for 17,000 KW. (or actually 20,000 KW.), despite the fact that there has been no particular increase in the demand for electric light in the city, the grant to the Nippon Electric Light Co. would become meaningless.

Venezuela.—The American Consul at La Guaira reports that the telegraphic system of the Government has been extended to Ocumare de la Costa, the point between the La Guaira and Puerto Cabello, toward which the new road from the interior is being constructed. During April the duplex system of telegraphy was established on several of the principal lines of the Government, and this system will be extended to the following places: Maracaibo, Barquisimeto, Trujillo, Merida, Rio Chico and Cumana. The Ministry of Fomento has been authorised to purchase the necessary instruments for the service and to construct direct lines between Trujillo and Valera and between Rio Chico and Cumana.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

FRANCE.—The British Chamber of Commerce in its Monthly Circular calls the attention of British manufacturers and exporters to the fact that French law prohibits the "import, bonding, transit or circulation of all foreign products, natural or manufactured, bearing on themselves or upon their packing cases, bales, envelopes, bands or tickets, &c., any trade or manufacturer's mark, name, sign or indication whatsoever which may cause the belief that such goods are of French make or origin." It is, says the Circular, in the interests of British manufacturers to emphasise in every way the British origin of their goods, and they usually do so, but it occasionally happens that a French customer wishes his name to appear on the goods he orders. Compliance with such a request would involve the seizure of the goods at the port of entry, unless the mark were accompanied by the words "importé d'Angleterre" or "fabriqué en Angleterre," and the same remark applies to any mark or indication whatsoever which is in the slightest degree likely to cause the belief that the goods are French. Even in the case of British firms having branches in France and marking their goods thus—"J. Smith & Son, London and Paris"—such marking would be held to be an infringement of this law unless the mark were accompanied by an indication in French of the real country of origin as above. The Circular draws particular attention to this matter, as the French Customs authorities are said to have made a great number of seizures of goods recently for the above-mentioned reasons, and it further advises British exporters to avoid possible trouble by indicating the British origin of their goods in the most distinct and unmistakable way; and, in the case of firms having a branch in France, to indicate the British origin of their goods, not only upon the goods themselves, but also upon their general office stationery.

TURKEY.—As a result of the war, all goods sent to Turkey from neutral countries must be accompanied by a certificate of origin; if not, such goods will be charged with extra duty of 100 per cent., as well as ordinary duty of 11 per cent. *ad val.*

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,586. "Electric oven." Simplex Conduits, Ltd., and F. G. Taylor. October 28th.

24,592. "Means for and methods of changing the frequency of alternating currents." A. M. Taylor. October 28th.

24,596. "Box or packing for electric light bulbs and the like." H. W. Burbury, E. N. Hillier and W. A. Thompson. October 28th.

24,618. "Power transmission." J. G. P. Thomas and Thomas Transmission, Ltd. October 28th.

24,621. "Electric incandescent lamps." H. Barta. October 28th.

24,626. "Crucibles for electric furnaces." Morgan Crucible Co., Ltd., and C. W. Speirs. October 28th.

24,643. "Electromagnetic separators." Maschinenbau-Anstalt Humbolt. (Convention date, October 27th, 1911, Germany.) October 28th. (Complete.)

24,665. "Devices for automatically adjusting the time of ignition in internal-combustion engines." Firm of R. Bosch. (Convention date, December 6th, 1911. Germany.) October 28th. (Complete.)

24,691. "Driving gear for the armature shafts of magnetic igniting apparatus for internal-combustion engines." S. K. Thoresen and O. R. Olsen. October 28th. (Complete.)

24,713. "Homopolar dynamos." A. Rolfe. October 29th.

24,733. "Electrically controlled locks for securing the doors of railway carriages, taxicabs, or like vehicles when in motion." C. B. Macadam and J. James. October 29th.

24,751. "Electrical transmitting and receiving devices for communication simultaneous and equal movements." J. L. Routin. October 29th.

24,758. "Method for the transmission of photographs and other pictures by means of ordinary telegraph and telephone apparatus." U. Ellero. October 29th. (Complete.)

24,776. "Electrical heating units." E. C. R. Marks. (Landers, Frary and Clark, United States.) (Divided application on 10,029 of 1912, April 27th.) October 29th. (Complete.)

24,810. "Electric heating stoves." S. L. Kilpin. October 29th.

24,875. "Incandescing bodies." C. H. Fischer and R. Zimmermann. (Convention date, December 13th, 1911, Germany.) October 30th. (Complete.)

24,898. "Dynamo-electric machines." A. Rolfe. October 31st.

24,927. "Device for winding and unwinding line wire, chiefly as transmitter of electric current to a varying length." F. J. G. Beyer. October 31st.

24,932. "Switches." J. Liddle. (Gordon Electric and Manufacturing Co., United States.) October 31st. (Complete.)

24,937. "Production of high-frequency currents adapted for use in wireless telegraphy and telephony." W. P. Thompson. (Compagnie Universelle de Telegraphie et de Telephonie sans fil, France.) October 31st. (Complete.)

24,951. "Electric motors used in the propulsion of vehicles." W. H. Allen. October 31st.

24,953. "Fittings for electric lighting purposes." F. A. Wilkinson. October 31st.

24,954. "Electricity meter." L. Schöller. (Convention date, April 30th, 1912, Germany.) October 31st. (Complete.)

24,960. "Apparatus for periodically testing electric currents." C. Smith. October 31st.

24,968. "Arc lamp carbon-holder." A. M. Hooper. October 31st.

24,971. "Electric candle lamps." H. Garde. October 31st.

24 999. "Pole or standard for wireless telegraphy." H. W. Mugleston. October 31st.

25,028. "Mariners' compass." W. D. Whyte. November 1st.

25,052. "Tungsten anti-cathode for Rontgen tubes." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges. Germany). November 1st. (Complete.)

25,090. "Lead alloys." Western Electric Co., Ltd. (Western Electric Co., United States.) November 1st. (Complete.)

25,091. "Azimuth fitting for a mariner's compass." J. G. Cowie. November 1st.

25,096. "Portable self-contained vulcanisers." W. H. Welch and H. Frost and Co., Ltd. November 1st.

25,101. "High-tension electrometers." H. Bauer. November 1st. (Complete.)

25,104. "Electric heating of houses." H. Lofquist. November 1st. (Complete.)

25,139. "Couplings for electrical purposes." V. C. H. Gibson. November 2nd.

25,174. "Telephone exchange systems." F. R. McBerty. (Convention date, November 3rd, 1911, United States.) November 2nd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Manufacture of Insulated Electric Leads or Cables. F. H. Broomfield and E. H. Tawn. 21,334. September 27th.

Portable Electric Signal Lamps. A. J. Stevens and A. J. Lyon. 22,426. October 11th.

Electromagnetic Means for the Transmission of Power. J. G. Balsillie. (Balsillie.) 22,690. October 14th.

Self-Starters for Explosion Engines. N. A. Christensen and A. J. Boult. 22,770. October 16th. (Addition to 15,471 of 1911.)

Field Telephone and Telegraph Set. A. J. Stevens. 23,172. October 20th.

Holders for Telephone Receivers. J. Trenner. 23,314. October 23rd.

Electrical Insulators. J. H. Ellis and British Insulated and Helsby Cables, Ltd. 23,663. October 26th.

Electric Lamps for Motor Vehicles and the like. A. J. Bonnella. 23,713. October 2 th.

Means for Increasing the Power-Factor and Overload Capacity of Alternating-Current Synchronous Machines. G. Kapp. 24,823. November 7th. (Cognate application, 741 of 1912.)

Electric Power Timber Band-Saw Machines. G. Pickles. 25,517. November 16th.

Magnetic Brakes of Tramcars and like Vehicles. G J. Conaty and C. B. Ketley. 26,969. December 2nd. Cognate applications, 743 of 1912 and 3,091 of 1912.)

1912.

Electric Switches. British Thomson-Houston Co. (General Electric Co.) 469. January 5th.

Light Projecting Apparatus and the like. J. T. Roffy. 506. January 6th.

Electrolysis of Metallic Salt Solutions. N. V. Hybinette. 771. January 10th. (January 12th, 1911.)

Combined Electric Wire Connection and Cord Grip. G. St. J. Day. 1,205. January 16th.

Suspenders for Overhead Electric Cables. C. E. Elder. 4,975. February 28th.

Electric Motor Control Systems. Allgemeine Elektricitäts-Ges. 5,803. March 7th. (March 7th, 1911.)

Electrically-Propelled Motor-Cars. Allmanna Svenska Elektriska Akt. Bolaget. 7,992. April 2nd. (April 12th, 1911.)

Electrical Dust Suction Apparatus. Firm of Bunte & Remmler. 10,605. May 4th. (July 3rd, 1911.)

Electric Heating Apparatus. A. F. Berry. 13,861. June 13th. (December 28th, 1911.)

Electric Switches. E. B. Merriam. 14,751. June 24th. (June 23rd, 1911.)

Telegraphic Relays. A. Muirhead and F. L. Muirhead. 17,955. August 2nd.

THE

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THE BROADER VIEW.

THE address with which Mr. Duddell commenced his term of office as President of the Institution of Electrical Engineers last week was marked by two special features : the breadth of view with which he surveyed the field of electrical activity to the very horizon, even invading the borderland which lies between it and the domains of kindred sciences ; and the spirit of suggestion which inspired his comments on the developments which we may hope to see realised sooner or later. In both respects the address resembled in the abstract that memorable one delivered by his predecessor, Dr. Ferranti, two years ago ; but in the concrete form the two were very different, faithfully reflecting the influence of the training and pursuits of their respective authors.

Our German friends divide the electrical industry roughly into two great sections : the "Starkstromtechnik," or strong-current industry, and the "Schwachstromtechnik," or weak-current industry, and of these two arts the immediate past and present Presidents of the Institution respectively are most competent exponents—a fortunate circumstance, for thus the claims of both sections are ensured due recognition. It may be somewhat surprising to the younger members of the Institution, but it is nevertheless a fact, as was once once emphasised by the President, that the "weak-current" section, the department of telegraphs and telephones and the like, to which the Institution owes its origin, is still more important than the supply, traction or manufacturing branch of the electrical industry in this country, whether its claims be based upon the total capital invested or upon the number of persons who depend upon it for their livelihood. Probably in this respect this nation is unique, the bulk of the submarine telegraph work of the world having been carried out by British firms, and still remaining largely in British hands.

Before we consider the technical features of the address, we may direct attention to a remark in the first paragraph, to which perhaps too great significance ought not to be attached, but which, at any rate, serves to indicate the attitude of mind of the new President with regard to the great Institution of which he is the head. He says :— "The Institution is installed in its new home. It has revised its Articles of Association, and it is now prepared, having got these matters out of the way, *to undertake its proper functions with regard to the electrical industry.* There is a wide field of work to be undertaken, on the one hand, in encouraging the publication of scientific technical knowledge, and, on the other, in looking after the interests of the electrical industry." The words which we have italicised are both a confession and a pledge ; a confession that hitherto the "proper functions" of the Institution have not been adequately fulfilled, and a pledge that in the future that reproach shall no longer be justly levelled at it. We do not wish, as we have said, to overload this passing phrase, but the sentence which follows it, outlining the dual functions of the Institution, proves that it was not framed without deliberation. The President, in fact, as he states later in the Address, endorses the views of his predecessor, and we shall look forward to the accomplishment of solid progress in the direction of broadening the scope of the Institution's operations and extending the benefits of membership.

Referring to the very small number of papers dealing with telegraphy that had been read before the Institution—only 12 or 13 during the last 10 years, out of a total of 400—Mr. Duddell expressed some surprise at the disproportion; but when it is remembered that the three subjects of land telegraphy, submarine telegraphy and telephony have almost from the beginning been highly specialised and shut up in watertight compartments, it will be seen that the result can hardly be wondered at. Now that the telegraphs and telephones are wholly in the hands of the Post Office, the division will be even more complete. Moreover, that very active and thriving body, the Institution of Post Office Electrical Engineers, which meets at the Institution building, naturally asserts a prior claim on all papers dealing with these subjects.

Naturally, a considerable portion of the address was devoted to the subject of wireless telegraphy, and the President lucidly outlined the principal problems that are awaiting solution, passing over his own important contributions to the art with the barest mention; indeed, it was left for Sir John Gavey to point out that Mr. Duddell was the first to provide a means of measuring the infinitesimal currents received in the antenna, thus making a great stride towards placing wireless telegraphy on the firm footing of an exact science. Without measurement one works in the dark, and Mr. Duddell himself pointed out, in his reference to the science of sound, that the lack of means to measure the energy of sound waves was one of the causes of its backward condition. From the number of systems of producing radiant energy that are now in the field, and the activity with which research is being prosecuted in various directions, it is safe to predict that a few years will see vast changes brought about in the technics of wireless telegraphy.

An interesting comparison was that which the President instituted between the limits of perception respectively of light, sound and Hertzian waves. It appears that all three are approximately on a par in this respect, the radiation of 200 or 300 watts being in each case just perceptible at a distance of 100 miles. This is a very remarkable fact, though it may, perhaps, have no great significance, and at least it demonstrates the extraordinary sensibility of our senses—and our wireless receivers. The power expended is about equal to the maximum rate at which a man could work for a short period.

The President made a timely reference to the great and increasing importance of the allied subjects of electrochemistry and electrometallurgy, industries which as yet have received but little attention in this country, though they have attained to enormous dimensions abroad. We doubt whether it is fully realised that if a scheme were carried out on a sufficiently large scale, with complete utilisation of by-products, and suitable choice of processes to secure a load factor of 100 per cent., it would be possible to develop these industries in this country using coal as the source of energy, with commercially satisfactory results. Our lack of large water powers is not so great a handicap as superficial consideration would lead one to believe; hydraulic works are costly, and water powers are usually situated far from the raw material as well as from the consumer of the finished products.

Returning to this subject later in the address, Mr. Duddell drew attention to the importance of the nitrate industry in connection with agriculture; already over 100,000 KW. of plant is devoted to this industry in Norway alone, and this figure will be doubled at no distant date. Not only for the purposes of agriculture do we require nitrates, but also for the manufacture of explosives, for the essential constituent of which we are at present wholly dependent upon foreign sources.

In the concluding portion of the Address the President indulged in some interesting speculations regarding the possibilities of future progress in the production of radiation by electrical means. As in wireless telegraphy the problem is to produce long waves of radiant energy, so in illumination the production of excessively short waves, is required; at present the efficiency attained in the latter case is exceedingly low—not above 5 per cent. at best, and under 1 per cent. over the whole range from coal to light. Good work, he said, is being done in the borderland between electricity and radiation, which will bear fruit in the course of time. The converse problem was also interesting—the conversion of the sun's radiant energy into electrical energy. London receives 100,000 KW. per sq. kilometre in the daytime, and if only one-tenth of this could be made available, it would far exceed the present demand for electricity. But we are a long way indeed from achieving success in this direction, and as Mr. Duddell remarked, for the present it is better to develop the water power of Norway than to build radiation traps in the Sahara.

We are pleased to add, in conclusion, that, by a happy coincidence, the Royal Society has just conferred the Hughes Medal upon Mr. Duddell for his investigations into technical electricity.

Legalised Illegalities.

After the lapse of some five years, the full and deadly effect of the Trade Disputes Act has been made manifest by a decision of the House of Lords. Hitherto, many of us have been cherishing the belief that a Trade Union was only "above the law" in the sense that it could not be sued for any wrongful act done in the course or furtherance of a trade dispute. But this is a gross understatement. In future we shall exist—or try to exist—under a state of law which declares that no action founded upon any tortious act alleged to have been committed by or on behalf of a Trade Union shall be entertained by any Court. This state of things was revealed in a judgment of the Upper Chamber on November 18th.

The plaintiffs, who were printers, sued a Trade Union and two of its secretaries, claiming damages for libel and conspiracy. The alleged libel consisted mainly of the contents of a document entitled "The Compositors' Fair List and Guide to the London Printing Offices," sent by the defendants with covering letters to actual or possible customers of the plaintiffs. The plaintiffs, by their statement of claim, alleged that the purpose of the communication was to injure them by representing that they had been guilty of unfair dealing in their business, that they treated their employés harshly, and never employed Trade Union compositors, and that they were not, therefore, fit persons to be entrusted with the execution of orders for printing.

The Trade Union applied that its name be struck out of the writ of summons on the ground that the case as presented by the plaintiffs disclosed, by reason of Sec. 4, Sub.-sec. I, of the Trade Disputes Act, 1906, no reasonable cause of action against the Trade Union. The Court of Appeal held (Lord Justice Farwell dissenting) that the name of the Trade Union must be summarily struck out of the writ of summons, and the House of Lords has affirmed the decision.

It were idle, even if it were respectful, to criticise this decision of the Supreme Tribunal. Their Lordships have laid down the law; and that law can only be altered by Act of Parliament. We wonder whether the public will ever realise the position into which the country has been driven by the machination of those who promoted, and the folly of those who passed, the Trade Disputes Act, which is the *fons et origo* of this new and preposterous doctrine. We do not know anything of the merits of the case in question; the plaintiff, of course, apparently has his remedy against the secretaries. But the serious result is that a Union is under no liability, so far as its funds are concerned, for any tortious act. It can falsely imprison, libel, slander, maliciously prosecute, assault, or act negligently towards any subject of the King without his having any redress by action at law. And we are in the year of grace 1912!

THE COMMERCIAL DEVELOPMENT OF ELECTRICITY SUPPLY.

I.—Organisation.

At first sight it might be supposed that this subject had been worn somewhat threadbare. Many articles from able pens have appeared in the technical Press from time to time, but they have been more or less of a fragmentary nature, and have not dealt with the subject comprehensively.

It is undeniable that abnormal progress has been made generally within the last few years, but those who have been keenly watching the trend of events recently, cannot but admit that the many powerful forces which undoubtedly exist for the betterment of the industry have not been intelligently co-ordinated. It is now high time that the subject was tackled at the root. In some quarters much activity is employed unprofitably, in some a complacent attitude is adopted, while in others apathy is supreme. At the best, spasmodic local effort is the order of the day.

Among the contributory causes to this undesirable state of affairs, municipal control may be said to be the chief. In the introduction of party politics and self-glorification of individual members of the committees, the best interests of electricity undertakings are often entirely submerged, and the financial stability of the departments are undermined by prodigal contributions to the relief of local rates. On the other hand, the meagre capital available, and the frantic efforts to maintain dividends under any consideration, effectually preclude the possibility of independent effort on the part of the majority of companies.

On every side we are confronted with evidence of the disadvantages under which the industry is labouring owing to lack of effective co-operation. It may be pointed out in argument that the Electric Supply Publicity Committee was formed with the object of serving mutual interests, but although it has undeniably aroused some slight preliminary enthusiasm, it has accomplished little beyond the issue of a few circulars and booklets, and promises to settle down as a mutual admiration society.

All credit is due to those members of the executive whose services are given gratuitously to the cause, but, however well intentioned, their efforts are of the spare time variety and amateur in point of expert commercial requirements. That the support accorded to the Committee by the industry is not so cordial as may be desired, is probably due to the fact that the various authorities realise that the activities of the Committee are ineffective. The more influential undertakings have probably members of their own staffs better able to deal with their own particular requirements, and the smaller ones, especially if long distances from the metropolis, may not consider the benefits offered commensurate with the contribution solicited.

It may be safely assumed that the recent developments in the organisation of the gas industry have been seriously followed by all vitally interested in electricity supply. That the potentialities of the competition of electricity are keenly appreciated by gas manufacturers is evinced by the formation of the Commercial Gas Association. The deeply interesting proceedings of the Manchester Congress, one of the outstanding features of which was the masterly presidential address of Mr. Woodall, point unmistakeably to the determination of the industry to further the progress of gas by every possible means. The Association has received the whole-hearted support of gas supply authorities throughout the land, and also of the allied industries, and has engaged a permanent staff of officials specially qualified for the work of the Association, from whom a strenuous forward policy may confidently be expected in the near future. Backed by large financial resources, and under the guidance of an executive composed of the magnates of the gas world, the far-reaching propaganda outlined will tend to retard the tide of electrical prosperity unless immediate steps are taken to counteract it.

The urgency of the necessity for prompt action on the part of the electricity supply industry is most pronounced on account of the important and far-reaching improvements in the manufacture of apparatus, and the consequent extension of the use of current, for heating and cooking, as in this respect the supremacy of gas apparatus is now being seriously assailed. Half-measures will be unavailing, and an Association is needed which will command the confidence and support of all whose interests are allied. As a suggestion, such an association might be named the Electricity Supply Development Association, the executive of which might be comprised of influential members of the electricity supply industry, and possibly representatives of the Manufacturers' and Contractors' Associations. A general manager should control a permanent staff of subordinates, specially selected for the work of various departments.

An Association formed on these or similar lines could carefully foster and encourage the growth and welfare of the industry, and representations from it would be dignified and assured of respectful consideration. The principal sphere of activity would be in the preparation of suitable publicity literature and Press announcements, but among other important matters would be the organisation of exhibitions, the training and employment of canvassers, lecturers and demonstrators, compilation of statistics, and examining and reporting upon apparatus. The Association should thus be in a position to strike a blow quickly and decisively at any point where the interests of electricity supply were assailed, and might adopt a less appropriate motto than the old slogan, "All together, all the time, for everything electrical."

II.—The Commercial Engineer.

At the outset, let it be distinctly understood that this title does not refer to the individual engaged merely in canvassing, and without any special qualifications. There are a number of people at present doing very useful work in this direction, among whom are probably some engineers who, realising the importance of commercial experience, are adopting this opportunity of increasing their qualifications, which in order to meet the approaching demand must be very comprehensive.

In the early days of electricity supply the success of an undertaking was regarded as assured, solely by the engagement of highly trained engineers to run and maintain the generating station and mains network, but although these objects are meritorious and vitally necessary, beyond retaining the good opinion of existing consumers, they have no direct bearing on the acquisition of new business.

Owing to their different methods of operation, electric supply companies were, as a rule, better equipped in regard to commercial organisation than municipal undertakings, their secretarial and accountancy departments being essential to their existence, but even they have failed to move with the times by taking a comprehensive view of the necessity for special activity in development tactics.

In the case of municipal undertakings which are nominally controlled by a misfit imitation of a board of directors, namely, a committee of members of the community periodically elected for their political party faith, the question of administration has been neglected. Chief engineers who have been appointed on the strength of their abilities as engineers, and have gradually assumed the duties of general managers, cannot be expected, without careful consideration, to draw attention to their own lack of commercial experience, and they possibly view with some misgiving the introduction of a new factor in the problem, namely, the commercial engineer, the man who until quite recently was treated with supercilious toleration. In reality, however, they need suffer no more loss of prestige than the general practitioner, or even the expert in one department, who calls in the aid of a specialist to deal with a grave case in which he is insufficiently experienced.

To the credit of some chief engineers, it should be stated that they have courageously admitted their limitations, and have instituted a forward policy by recommending the appointment of commercial managers to organise business-getting departments, and develop the resources of their undertakings, but as a rule commercial methods are regarded by the technical staffs as derogatory. This is less to be expected as, owing to rapid improvements made in machinery by manufacturers, and simplification of systems, the operation of generating stations and mains networks is becoming more automatic, and a glance at the salaries offered in connection with vacant positions in these departments affords evidence that such services are not appreciating in value. The glamour of officialdom may be responsible for the blinding of some of our embryo chief engineers to the fact that, as members of the staff of an electricity supply authority, they are actually engaged in trading, and that expert administration is as commercially necessary to their undertaking as to the establishments of the draper and grocer, to whom current is retailed.

It is a matter of some difficulty to obtain reliable statistics as to the true financial position of many undertakings. Except for one, or perhaps two, underpaid and overworked clerical hacks at the station, the staff for commercial routine is not provided. The keeping of stores accounts, and the allocation of costs, are generally muddled through in a very rough-and-ready fashion. The issue and collection of accounts for current are in most cases not under the control of the borough electrical engineer, but are dealt with at the municipal offices under various individual arrangements.

Thus equipped, the administrative bodies of most undertakings from the outset sat tight, and complacently awaited the promised flood of prosperity, but recently many have begun to realise with some uneasiness that the millennium is receding. Some have boldly ventured the opinion that the time has *now* arrived when a canvass of their territory is advisable, while others have adopted the expedient of employing meter fixers and arc lamp trimmers as canvassers in their spare time, and to assist in these activities half a hundred-weight or so of publicity literature has been purchased, the greater part of which accumulates a deposit of dust in a corner of the office owing to the lack of means to distribute it.

There are, of course, some outstanding examples of undertakings which are run on up-to-date and efficient lines, but it must be regretfully admitted that in a greater or less degree the foregoing indictment includes the majority of the supply authorities in this country. A thorough realisation of the parlous state of the industry must compel serious attention to the acute need for reform. Pedestals must be vacated, and the occupants be prepared to assist in the deliberations which must follow the breakdown of the obsolete methods hitherto employed. Curiously enough, invaluable assistance may be rendered by the man who may not possibly have received any training in central station or mains routine, although such experience forms a useful basis for many other essential qualifications. The commercial engineer is here referred to.

In most successful commercial enterprises engaged in the manufacture of a commodity, the immense value of the distributing organisation of factors, or selling agents, is fully taken advantage of. The manufacturer makes his arrangements with those he considers will dispose of his specialities to consumers to the greatest extent, and devotes his energies to the lowering of the costs of production, and maintaining adequate supplies to his distributors. The selling agents may, or may not, have spent some time in the manufacture of the commodity in question, but, what is to the point, they are in a better position than the manufacturer to dispose of it to the public. Thus there seems to be sound argument for treating the generation and sale of electricity on somewhat similar lines.

There are, no doubt, at the present time a number of commercial engineers (and it is to be sincerely hoped that their ranks will be greatly augmented) whose services could be advantageously employed to infuse new life into the industry as selling agents or business-getters, apart from the reorganisation of existing chaotic commercial conditions, and a consideration of desirable qualifications may be of advantage.

In this connection men of first-class education and address only can hope for success, and after a preliminary training in a central station, which, after all, is not of major importance, they should immediately endeavour to widen their scope by practical experience in many other branches.

A working knowledge of general engineering and drawing office practice is essential, and thorough experience in modern business methods, fluent and tactful correspondence, accountancy and finance are most valuable.

Contrary to general belief, complete knowledge of installation details is not acquired by central station and mains practice, and a few years spent with a good contractor will convince the unbeliever of the truth of this statement. The expert knowledge required to advise upon and fit up modern installations for lighting, heating, cooking and power is considerable, and the commercial engineer must be in a position to decide upon the most effective and economical manner in which these details are to be carried out. The construction and performance of all the latest apparatus must be thoroughly familiar to him, and also the latest applications of the principles of illumination.

The preparation of publicity literature and Press campaigns provide other outlets for his activities, and his judgment here must not be at fault. Electricity supply is in many respects seasonal, and his literary experience must be sound, even if suitably prepared matter and journalistic assistance are available. His discrimination in the value of advertisement will also be called upon.

In the supervision of the wily canvasser his knowledge of this work must be thorough, and here a few remarks may be appropriately made on behalf of that useful individual. The treatment meted out to him on many undertakings is not conducive to the best results. In numerous instances effrontery, and the ability to importune prospective consumers until applications are signed to obtain relief, are the main reasons for engaging the man in this capacity, and when his persuasive powers show signs of waning he is replaced by new blood. This procedure does not make the occupation in the least dignified, neither does it provide the necessary incentive to good work in the interests of the department, and with a better understanding of the broader policy, it is to be hoped that the status of the really efficient canvasser will be considerably raised. Properly organised and carried out canvassing is one of the most effective methods of increasing business, but emulation of the tactics of industrial insurance companies and flash jewellery merchants must be eliminated.

Wild and erratic statements with regard to the uses of gas which cannot be substantiated should be discouraged. Such methods are undignified, and not calculated to assist the cause of electricity. The comparative disadvantages of gas can be discussed in a sound businesslike manner which is worthy of the best traditions of the electricity industry, and at the same time will not give unwarranted offence to men of high commercial ability in the gas world, from whom we of the electricity supply industry have a lot to learn. The acquaintance of the commercial engineer with gas appliances should, therefore, be of more than the nodding variety.

Lest our paragon should appear incomplete, it may be added that tact and the ability to control a varied staff are essential to the success of his efforts.

A number of youths are being regularly turned out as switchboard attendants, or indifferent shift engineers, after serving a perfunctory term of pupilage in central stations, and those possessing the necessary abilities, initiative and capacity for hard work, might alternatively be utilised as raw material for ultimate commercial engineers. They would, at least, escape the monotony of central station routine, and the possibility of following what, owing to lack of scope, promises to become a variety of blind alley occupation.

(To be continued.)

FROGS' MUSCLES AS WIRELESS DETECTORS.

By DR. ALFRED GRADENWITZ.

Dr. Lefeuvre, professor at the Medical High School of Rennes, has devised the following arrangement for recording the contraction of a frog's muscle as produced by the passage of an electrical stimulus through a motive nerve.

The muscle M is solidly fixed in its upper part by means of a pair of tongs, as shown in fig. 1. The end of the sinew is connected by means of a wire to a light lever L pivoted round O. This lever is brought back to its initial position after the contraction is completed, by a weight suspended underneath, and the end of the lever which carries a fine point comes very close to a smoked cylinder performing a uniform rotation. At the very moment the muscle is excited by the intermediary of its nerve N, the contraction curve, enlarged by the lever, is recorded faithfully on the smoked cylinder. While many cold-blooded animals can be used for this experiment, the muscles of frogs' legs are particularly well adapted for the purpose, on account of the regularity of their form, the long duration of their excitability and the special ease with which they can be separated from the body.

So far from severing the muscle completely from the body of the animal, it is, however, preferable to leave it in position, cutting the "Achilles" sinew at the junction, and fixing it to the wire connecting with the lever. In this case the central nervous system of the animal should first be destroyed, lest the experiment be disturbed by motive reflexes. The sciatic nerve is further dissected over a short distance at the level of the thigh, and is lifted by means of the wire hooks which supply the electrical stimulus.

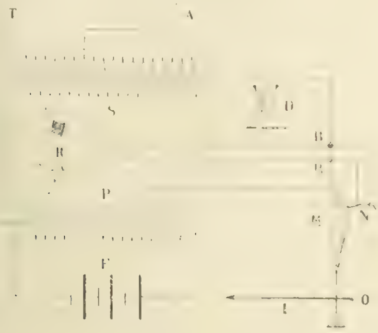


Fig. 1.

The neuro-muscular apparatus is so extremely sensitive to electric stimuli, that it can be used as a sensitive galvanoscope, allowing the very slightest electric variations or waves to be detected. In the arrangement above referred to it further affords the advantage of allowing its indications to be recorded. The following arrangement of connections is employed when using the apparatus for the receiving and recording of wireless signals.

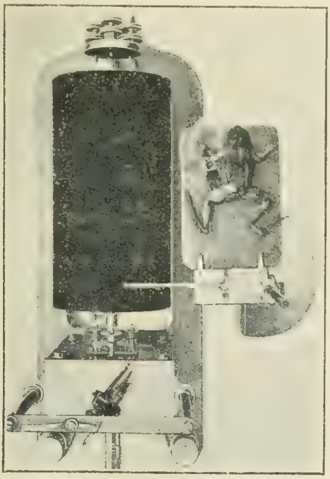


Fig. 2.

As shown in the diagram above, fig. 1, E is a battery of three cells, P a potentiometer allowing the voltage in the receiving circuit to be controlled, S is a tuning coil to which the receiving antenna A is connected, D an electrolytic detector, and R two high-resistance telephone receivers connected up in series.

To the terminals B, B¹ of these telephones are connected in shunt two wires applying the electrical stimulus to the nerve N through the intermediary of small metal hooks. The excitation of the nerve is due to the self-induction currents produced in the coils of the telephones.

The tracings reproduced in fig. 3 were obtained at Rennes by means of the arrangement above described, and are records of the time signals given out daily from the radio-telegraphic station of the Eiffel Tower. The distance between Paris and Rennes is about 300 km. These signals comprise a preliminary signal calling the attention of the observer to a subsequent signal of very short duration, which marks standard time. The time signals are sent out from the clock of the Paris Observatory, which is fitted with a contact actuating the transmission station at the Eiffel Tower. They are sent every morning at 10.45, 10.47 and 10.49 respectively. The preliminary signals are different for each of these markings, and can be expressed in the Morse alphabet. The tracings allow the preliminary as well as the time signals to be distinctly recognised, and when using a very fine style and only slightly smoked paper, they are seen in their upper part to show very fine indentations, the number of which corresponds to the rate of vibration of the transmitting apparatus.

This method of recording time signals is of a remarkable accuracy. The time passing between the moment of excitation of a frog's muscle and the moment of its contraction is, in fact, extremely short. Moreover, this time—the latent period of contraction, as it is called—is a well-known factor, in the present case about one-hundredth of a second, for which due allowance can be made. As regards the delay due to the time taken by the wave in traversing the distance between Paris and Rennes, this is absolutely negligible, the rate of transmission of Hertzian waves being practically the same as the velocity of light, viz., 300,000 km. per second.

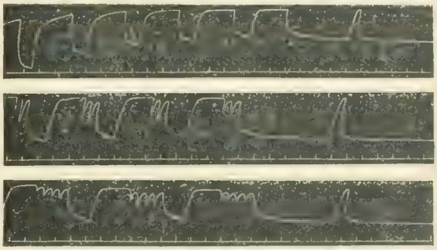


Fig. 3.

While this arrangement is an interesting laboratory apparatus, it is not likely to become a device suited for practical purposes.

A London Exhibition of Mining Machinery.—The mining machinery exhibition to be held at the Royal Agricultural Hall, Islington, N., from May 29th to June 7th, 1913, is the fifth of the series organised by Messrs. Montgomery. We are informed that a strong association of manufacturers representing leading firms in the industry has been formed, and these exhibitions have now become quinquennial, so that after next year there will not be another exhibition until 1918. This arrangement both prevents a tax on the manufacturer through the multiplicity of exhibitions, and enables each to be thoroughly representative. Already three-fourths of the available space has been taken up. and a strong Consultative Committee has been formed to supervise demonstrations of life-saving, &c., apparatus and devices, to organise lectures on subjects of immediate importance to those engaged in mining operations, and to secure the attendance of British, Colonial and foreign representatives of mining institutes, &c. The Committee consists of Mr. W. E. Garforth, LL.D. (President of the Institution of Mining Engineers); Sir Ralph Ashton; Prof. J. S. Haldane, F.R.S.; Sir Henry Hall, I.S.O.; Sir Thomas H. Holland, K.C.I.E., F.R.S.; Mr. A. M. Lamb, M.Inst.M.E.; Mr. H. C. Peake, Past President, Inst.M.E.: and Mr. H. L. Sulman, Past President, I.M.M. Lectures have already been promised by Prof. Haldane. F.R.S., and other well-known authorities. The offices of the exhibition are at 43, Essex Street, London, W.C.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

BY CHAS. J. WEBB, A.I.A.E.

WHILE it has unfortunately to be admitted that in this country at least the onward march of the petrol car would seem to have pushed the electromobile almost completely out of the field—there was not a single electrical motor vehicle on view—the annual Automobile Exhibition held at Olympia, W., last week, under the auspices of the Society of Motor Manufacturers and Traders, afforded striking evidence of the immense business in electrical specialities that the development of the automobile movement has created. A walk round the accessory exhibits in the galleries showed that at practically every other stand some product of electrical works was displayed. The ignition of the explosive charge in the combustion chambers of petrol engines is now almost exclusively effected by means of high-tension magnetos, of which there is a considerable number of makes on the market. By far the most popular is the Bosch, but others appealing for public favour are the Eisemann, Simms, Nilmelior, C.A.V., Ruthardt, Unterberg & Helme (U.H.), Thomson-Bennett & Oleo, all of which contain many points of interest.

It is not only in magnetos, however, that a very large trade is being done; it is the same with sparking-plugs and other ignition accessories, electric lamps, electric horns, &c. The exhibitors in these sections were so numerous and the variety of their productions so large that a mere list of them would more than fill the space available.

The most striking feature of the Exhibition, and the one which calls for principal attention on our part, is the rapid development that has taken place as regards the adoption of electricity as the medium for lighting the lamps in and about motor-cars. Except on small-powered cars the oil lamp has for some years been practically out of the question, and for a time acetylene (itself indirectly an electrical product) held the field. During the past two years or so, however, marked progress has been made in adapting the dynamo to produce a constant current, notwithstanding the varying speed of the petrol motor which drives it, with the result that, where the question of expense is not a serious factor, electricity is rapidly pushing out acetylene, leaving the latter to supply the lighting on the less costly cars. Not only has the new departure been the means of spurring on dynamo designers, but it has brought a revival of business to accumulator makers. With the advent of the magneto as the medium of ignition, the latter experienced a considerable falling off in demand for the 4-volt accumulators which formerly supplied the current for ignition; now, with the adoption of electric lighting, they are enjoying a renewed demand for their productions, for practically all the dynamo lighting sets include a battery of accumulators in the outfit. Among the firms who showed accumulators for this purpose, in addition to the concerns exhibiting complete lighting sets, were Messrs. Van Raden & Co., Ltd., the Klaxon Co., Ltd. (Edison battery), and Messrs. Leo Ripault & Co.

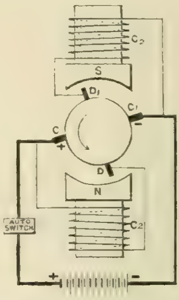
Another new departure which shows signs of considerable development is that of electrical devices for starting the petrol engine of the car from the driver's seat and so obviating the turning of the usual starting handle, examples of these being seen in the White & Crossley cars, the latter being equipped with the Scott-Crossley system, illustrated and described in the last issue of the ELECTRICAL REVIEW. Another system in use on the Lanchester cars provides for the starting of the engine and for the lighting—through a battery—of the different lamps, while a third arrangement is that employed on the Cadillac cars, in which one electrical machine provides not only for starting the engine and lighting the lamps, but also furnishes the necessary spark for the ignition.

Appended are a few particulars of the more important exhibits.

Messrs. C. A. Vandervell & Co. are certainly to be classed as among the pioneers in adapting electric lighting to motor-vehicles, and the fact that there are now over 10,000 of the C.A.V. sets in use speaks volumes for the efficiency and practicability of the system.

It may be briefly mentioned that the dynamo is provided with four poles, two of which are unwound and two wound in the usual way. A special arrangement is made in the commutator whereby certain coils of the armature are continually short-circuited, the effect being that the magnetic flux is so distorted that the unwound poles become magnetised, and the current is produced in the usual way, and drawn off to the battery. As soon as the E.M.F. reaches a certain value, the subsidiary coils begin to act in opposition to the main ones, and as this antagonistic action is increased in exactly the same proportion as the strength of the main fields is increased, a perfect balance is obtained between the two, thus preventing the output exceeding a certain limit. Instead of a minimum-speed electric cut-out to prevent the battery from driving the dynamo as a motor, a free-wheel is arranged on the armature shaft.

One of the best-known dynamos for car lighting purposes is the Leitner, which was exhibited by the Rotax Motor Accessories Co. The feature of this machine lies in the fact that it is self-regulating, no mechanical or electro-mechanical devices being employed. The field magnets are shunt wound, the shunt winding being connected up to a subsidiary brush working on the same commutator as the main brushes, but arranged at right angles thereto (fig. 1). When the speed of revolution is low this brush collects current and increases the excitation of the fields, but as the speed of the armature increases, the magnetic field flux is distorted in the direction of rotation, the consequence being that the voltage of the subsidiary brush is first reduced to zero, and then actually becomes reversed in sign, this negative current weakening the magnetic field to a greater and greater extent according as the tendency for the output to rise becomes greater. The generator is therefore automatic in action at all speeds. A minimum cut-out is provided in the form of a solenoid switch, contained in a separate casing from the switchboard.



C C', Main brushes; D D', Subsidiary brushes.

FIG. 1.—DIAGRAM ILLUSTRATING ACTION OF LEITNER VARIABLE-SPEED DYNAMO.

The P. & R. dynamo, as its name suggests, is made by Messrs. Peto & Radford, Ltd.; it comprises a number of interesting details, notable among which is the provision of a dog-clutch, by means of which the dynamo when not required to charge the battery can be thrown out of gear with its driving medium, thus enabling a considerable economy in wear and tear on the bearings and brushgear. The dynamo, which has a capacity of 120 watts at 15 volts, is of the totally-enclosed shunt-wound type, and is fitted with an electrical minimum-speed cut-out and a mechanical voltage regulator. The latter is extremely ingenious, and comprises a double slipping clutch combined with the driving pulley; a governor ball combined with a double-ended toggle lever, according to the varying speed, releases or engages the clutches, thereby controlling the armature speed.

The governor pulley is entirely enclosed, and runs in oil; it is controlled by one strong compression spring. The gripping surfaces are composed of a material which wears almost indefinitely, and these being opposed to each other, and their surfaces being of the same area, end thrust is equal, and therefore practically eliminated. Messrs. Peto and

Radford also exhibited the "Diva" electric head lamp, in which, by an ingenious arrangement of mirrors, five distinct rays of light are obtained from one lamp.

The dynamo lighting system made by Messrs. Joseph Lucas, Ltd., has been on the market for the past few years, during which period, however, it has undergone various improvements. The machine is of the enclosed shunt-wound type; a mechanical device consisting of a slipping clutch is provided to ensure a constant output, notwithstanding the varying speed of the petrol-motor, by which it is actuated. The belt pulley through which the armature is driven, is furnished with a small friction clutch in which the frictional surfaces are engaged and disengaged by an automatic centrifugal governor, the whole being self-contained in a dust and oil-proof casing. The result is that, however fast the pulley be revolving, the armature shaft to which it is indirectly coupled cannot exceed a certain predetermined speed. When the armature attains its maximum speed, the friction clutch is automatically disengaged by the governor, and the driving effort momentarily ceases. Directly, however, the speed drops, the clutch again takes up the drive. A minimum speed cut-out is provided on the switchboard, the shunt winding being also broken when the accumulators are not being charged, so that the armature then runs quite free. Two sizes of the machine are made, 100 and 200 watts capacity respectively.

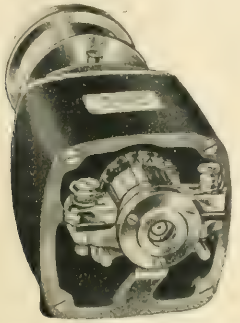


Fig. 2.—The Lucas Dynamo, End Cover Removed, Showing Commutator and Brush Gear.

Messrs. Brown Bros., Ltd., exhibited the Brolt dynamo, the feature of which is the addition to the two main poles which are excited by a shunt-wound winding connected to the brushes of two auxiliary poles at right angles thereto (fig. 3); the latter are unwound but are excited by the cross-magnetisation caused by the working current in the armature. Two brushes are placed in the neutral position relative to the main poles, they being made wide enough to short-circuit several armature coils during the period of commutation. The action of the machine is as follows :—

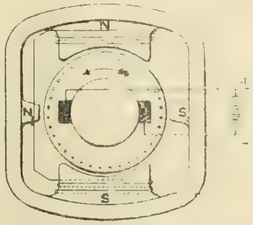


Fig. 3.—Diagrammatic Section of Brolt Dynamo.

When the armature is revolved a voltage is induced between the brushes exactly as in any ordinary dynamo, and the machine commences to charge the battery as soon as the necessary speed is reached. The load current in the armature exercises a cross-magnetising tendency which creates a magnetic flux in the auxiliary unwound poles provided to receive it. The armature coils short-circuited by the brushes cut this cross flux, and in consequence have a short-circuit current induced in them which is proportionate to the cross flux and to the speed of rotation. Any increase of speed is immediately accompanied by a proportionate increase in the short-circuit current, which demagnetises the main field, and keeps the output constant. Again, if the output current should tend to increase, an increased cross-magnetisation results, which, in turn, increases the short-circuit current, therefore preventing any increase in voltage. The automatic regulation of output is therefore obtained by purely electrical means, there being no moving parts whatever except the armature.

A minimum cut-out switch working on the solenoid principle is mounted on the switchboard to prevent the battery discharging through the dynamo when the latter is running at a low speed. A feature of the Brolt dynamo, which is made in three sizes—6 amperes at 6 volts, 6 amperes at 12 volts, and 12 amperes at 12 volts—is the rapid rise of the output curve, the maximum current being reached at twice the cutting-in speed.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The I.E.E. Examinations.

With reference to your remarks in the current issue referring to the examination for admission to the Institution of Electrical Engineers :—

I do not know who has been selected to settle this very important question, but as it is the most important of all the alterations, and on its satisfactory settlement the future welfare of the Institution largely depends, perhaps some outside expression of opinion may not be out of place.

As the graduate class is recruited largely from men actually engaged in studying to enter our industry, it seems quite unnecessary to impose any examination on this class. In any event, there should not be any examination for students who have already been articled to an engineering works or an engineer, or who have entered for a regular course of training at one of the recognised training institutions. This exemption might even be extended to anyone engaged in an electrical business during the day and attending any regular night classes.

Most of these classes have entrance examinations, and it will be a great pity if the Institution decides to hold such an examination itself. Omitting this first examination has one very important advantage—that the examination for the Associate Member class could then include a sufficient range of subjects to show that the applicant had a thoroughly good all-round general knowledge. The questions on these general subjects could be set on a very different level to that of a student's examination, and would be a considerable factor in raising the status of the members of the whole industry. The examinations on electrical subjects should be set to show that in this branch of physics and engineering the applicant was worth his London University degree.

Your suggestion for a *viva voce* examination would be excellent if it could be arranged without undue hardships on distant applicants, and if the right men to examine could be found at the various centres.

Percy Good.

London, S.E., *November 15th*, 1912.

The Institution of Electrical Engineers.

With reference to the letters in recent issues of the Review on the subject of the I.E.E. and "the 17s. a week man," it is certainly time some decided action was taken by those members of the profession for whom the I.E.E. has done, and is doing, nothing to improve their position, either financially or otherwise. While I do not for a moment wish to decry the good work it has done in the past in furthering the interests of the industry, it must be admitted that to the class of whom your correspondents speak, the Institution, as a body, has been of little or no use. What is the reason for this? A number of reasons might be suggested, but the principal reason is the fact that the Institution contains too many members of the type of which "Subman" speaks, those to whom the financial advancement of the rank and file is undesirable for various reasons. Another cause is the presence of men in the Institution who are not, and have never been, connected with public supply work. Of course there are other causes, but to put the matter in a nutshell, the Institution by reason of its constitution, administration, and regulations, is of no use to the rising or younger members of the profession. As "Subman" states, one has only to glance over the advertisement columns of any of the technical journals to see the appalling condition of things, shift engineers, mains assistants, sub-station attendants and such, of whom the highest qualifications are asked, are offered the princely salary of £1 or 30s. per week, generally a seven-day week, and if one of these unfortunates has the impertinence to ask any more, he is promptly informed that his place could be filled immediately by a cheaper man. So much for the position of matters at present; now for the cause and remedy. Regarding the cause, several could be put forward, but I think there are two evils which are largely responsible. First, the premium pupil evil; and, secondly, the improver evil. As long as those responsible for running public supply concerns can obtain intelligent, well-educated youths (some of them University trained), anxious to get into the supply end of the business for a few shillings a week, and so long as this is permissible, so long will matters go on as they are. The question arises, how can this be prevented? I would suggest as follows:—First, by the establishment of a system of examination and registration by the Board of Trade, the same as in the case of marine engineers; this would effectively deal with the case of improvers, and such doing shift engineer's duties for a paltry remuneration, as it would be illegal for anyone who had not a certificate to be in charge of plant which was generating public supply, and, of course, the certificates would only be granted to fully qualified men. For sub-station men a similar scheme of registration and licensing could be arranged. This would be the legal part of the reform, now for the employés' part. The first thing to be done is the formation of a business-like organisation with a decided policy as suggested by "Subman." Some years ago we heard a lot about a proposed "assistant engineers' association," but apparently the idea fell through; but the time has now arrived for definite and decided action, and as one who has been connected with the supply section of the profession for some years, and has seen the condition of matters at their worst, I would venture to suggest the following:—That an association be formed to be known as "the International Electrical Association," membership to consist of shiftmen, junior assistants, and those younger members of the profession who are outside the ranks of the I.E.E. The objects of this organisation would be:—(1) The collection and publication of information regarding situations; (2) the formation of a standard wage scale, and the necessary steps for securing the same; (3) to seek for the Parliamentary regulation of supply staffs as regards the granting of licences and certificates; these would be the three principal objects. No doubt many readers will remark, "a tall order"; but as Mr. Abraham stated in his letter, what the British Medical Association and the Incorporated Law Society have done for the medical and legal professions, a properly-organised and enthusiastic Association can do for the electrical profession. Rome was not built in a day, but by steady, determined effort the rank and file can change for good the present state of affairs. Of course, the Association would not seek to act in an antagonistic or hindering manner towards any of the Institutes, and, as the suggested title implies, membership would be open to engineers in any part of the world. I must apologise for encroaching so far on your valuable space, but the best of the technical journals, the Review included, have supported us in the past, and it is to them we now look for further support and guidance. I leave it to an abler pen than mine to elaborate other details, but will conclude by saying that I shall be pleased to assist in any possible way, and hope that these remarks may stir up others to take decided action.

Zantha.

Contracts in India.

In your issue of October 11th, page 566, Vol. LXXI, No. 1,820, I have read with amusement a letter signed by Mr. J. Elliott, of Messrs. Greaves, Cotton & Co., of Bombay. I do not think there is much to be gained by my discussing closely the various statements made by this gentleman, but in order that you may see the position for yourself, I send you the original order for the illumination of Bombay, received by me from the electrical engineer to the Government, which you will see is dated May 16th, 1911, while Mr. Elliott, by his own statements, shows that he only submitted a tender on June 1st.

As the order had already been given to me in the middle of May, and it had been arranged with the electrical engineer that I should sail to London on June 3rd, in order to inspect the illumination work done there during the Coronation, and to purchase supplies for similar work to be carried out here during the Royal visit to Bombay, I have no hesitation in saying that the request that Messrs. Greaves, Cotton & Co. should submit a tender was only made to safeguard the electrical engineer to the Government of Bombay, and as unpleasant questions might have been asked by other firms as to why he placed the order with me without tenders being invited. I may also add that tenders were invited on June 1st with my knowledge and acquiescence.

To support what I have already stated about the Electrical Department, P.W.D., Bombay, I send you herewith a cutting from the October issue of *Indian Industries and Power*.

I quite understand Mr. Elliott's action, as his firm receive a great deal of work from Government without tenders being invited, and great dissatisfaction at present prevails owing to the electrical engineer placing most of his contracts with this firm. You can now see the reason why Mr. Elliott holds a brief for the electrical engineer.

I would ask you to be good enough to return the original order which I now send you, under registered cover, and if you wish any further details I shall be glad to place all my papers at your disposal, showing how I obtained the Government contract before tenders were invited from others.

I do not think that such a state of affairs would be tolerated for one moment in England, and it certainly cannot last much longer here; unless the Government remodel their electrical department there is sure to be a great scandal.

N. M. Marshall.

Bombay, *November 1st*, 1912.

P.S.—I have never traded under the name of N. M. Marshall, but always under the name of Marshall & Co., and perhaps in view of Mr. Elliott's remarks, it may interest you to receive a copy of a testimonial I have received from the Hon. Mr. Herbert G. Greaves, the head of his firm, and a list of work carried out by my firm.

[All the documents above-mentioned were duly received, and are in accordance with our correspondent's statements.—Eds. E.R.]

Fuse Formulæ.

Referring to my previous letters on this matter, I wish to point out that in the case of short circuits the interior of the fuse wire is undoubtedly at a much higher temperature than the exterior, and consequently the bursting effect frequently noticed is easily accounted for.

I do not see how a theory which puts the resistance per unit length equal to $\rho_0/\pi a^2$ (it really does not matter whether it is ρ_0 or ρ_θ) can possibly represent the facts. As is well known, fuses behave more like unstable liquid jets, in some cases forming larger and larger globules of molten metal till disruption occurs. In other cases there is the temperature gradient, which is great.

I do not see why Mr. Chapman should refer to my suggestion as "wild assertion." My views are backed up not only by my own experiments, but also by those of other people.

For instance, Preece found that for certain wires $c \propto d$, and for others $c \propto d^{\frac{3}{2}}$. Again, Ayrton and Kilgour "observed experimentally" that the current varied as the three-halves power for thick, and the first power of diameter for thin wires. Both these sets of experiments refer to raising a wire, or to be more accurate, the surface of a wire, to a definite temperature. I have already referred to some results by other experimenters.

Mr. Chapman refers to the high-thermal conductivity of copper, although I am not aware of any results for that substance at a temperature above melting point. He wishes me to believe that the interior of a fusing wire is at the same temperature as its exterior, and I cannot, since it is contrary to all experience.

I do not feel called upon to accept a theory as true which is demonstrably false, even though it be backed up by experiments correct to six significant figures (which it is not).

I referred in my first letter to certain formulæ in order to show that convection of heat, or conduction of heat, will not explain the difference alone, and suggest alteration of the path of the current.

In hydromechanics, as is well known, certain laws break down when the velocity of flow reaches a certain critical value for, say, water in pipes.

Regarding specific resistance (I prefer the old name) in text-books, we are informed that as the temperature rises we find that $\rho_\theta = \rho_0 (1 + \alpha\theta + \beta\theta^2)$. Consequently, to obtain the resistance of a wire at any temperature, all we have to do is to insert the value for that temperature, and go merrily ahead. This may satisfy some people, and, I suppose, even degrees are granted to painstaking individuals who spend much time in accurately determining these constants, and reading papers on them. Yet such procedure, I humbly submit, is only a bungling process at the best, and I doubt whether the ingenious people who perpetrated the original monstrosity of calculating resistance in this way, ever intended it to be applied to molten fuse wires.

Regarding temperature gradients, anyone who has experimented with fuses will have noticed on many occasions that even when the current is slowly increased, molten globules are often shot out of the wire on fusing, and do not solidify for a considerable time; therefore, I am forced to conclude, both by experiment and by mathematical investigation, that the interior is much hotter than the exterior of a wire in that condition.

The theory put forward by Dr. Russell seems to be utterly impossible for many reasons other than those dealt with in my letters, although exceedingly interesting to me.

Meanwhile, all I wish to point out is that all the so-called theories of fuses are in a bad way, and are useless, and there is no numerical index covering all cases for wires, and that commonsense explains much.

Neither do I write this to influence people to throw their wooden gods overboard if they derive any satisfaction from keeping them; nor do I address those people (some of whom I have encountered) whose aperture for the admission of new ideas is boarded up and "No admission" written large on it.

I hope Mr. Chapman will not take this as referring to him in any way; I may say I have read his letters with much pleasure, and we seem only to differ in degree.

W. H. F. Murdoch.

Mill Hill, *November* 16*th*, 1912.

Electrical Sweating.

I notice in your last issue an advertisement by a London municipal authority, offering the stupendous salary of £65 per annum for the services of an assistant charge engineer.

The gentleman appointed must have had a good mechanical and electrical training, also experience! (save the mark) of a modern A.C. station. I note the authority in question are too ashamed to disclose their identity, unless, perhaps, they are afraid they will be inundated with prospective candidates.

I wonder how the chief engineer to this "authority" expects the fortunate (?) candidate to live, and uphold *his* authority, when most probably the labourers under him are in receipt of more remuneration than himself. It would be interesting to know the salaries of the rest of the unfortunate staff, and whether this system of sweating is carried throughout the department.

Most engineers with the training desired above, have had to serve several years' apprenticeship, and to pay large fees for their training, with the ultimate outlook as black as depicted in this scandalous advertisement. If this sort of thing is allowed to continue, what will the electrical profession degenerate into? One can only marvel that the advertisers did not add, "Gentlemen with private income preferred."

The unfortunate charge engineers at this station have my entire sympathy, as theirs must indeed be a dog's life under such disgraceful conditions. It is now quite time the suggested "Electrical Charge Engineers' Association" came into existence, and I should be one of the foremost applicants for membership.

Disgusted.

Speed of Signalling through Submarine Cables.

The remarks of Prof. C. L. T. Griffith, in your issue of November 15th, in regard to calculations relating to the constants of submarine cables, will be endorsed by all who have experienced the advantages possessed by a slide rule for this class of work. Several years ago the merits of the straight form of slide rule—which gives all values of pairs of D and *d* simultaneously, for a single setting on the logarithmic scale, in the manner now described by Mr. Griffith—appealed to me as being an excellent basis for a direct-reading instrument for cable calculations. There were practical difficulties, however, and I ultimately decided in favour of the equi-angular logarithmic spiral, as applied in acoustics. (See Donkin's "Acoustics." Second Edition, pages 26-27.) A few remarks concerning the reasons for this selection may be helpful to those who may desire to design such instruments.

It should be premised that the object is to design a *direct-reading* instrument to indicate log D/*d*, capacity, dielectric resistance, and, if possible, the weights of conductor and dielectric respectively, as well as the conductor resistance, and in special cases, perhaps, the inductance, per unit length. If only log D/*d* were required, the straight slide rule would be admirable for the purpose. Unfortunately, the range of cable calculations is represented by only about one-fifth of the length of the rule, and the space available for extra figures to denote capacity and dielectric resistance is thus forbiddingly small. It is still more difficult to find space upon such a rule for weights and other details. Similarly, if only log D/*d* is required, or if all the pairs of values of D and *d* corresponding to a given value of log D/*d* are to be determined, the Fuller cylindrical slide rule leaves nothing to be desired. The pointers can be set to fixed positions, corresponding to a given pair of values of D and *d*, the cylinder can then be moved so as to indicate all other pairs representing that ratio of diameters, and log D/*d* can be read off easily to four figures. This, however, is only one step towards making a direct-reading instrument for cable calculations, and again the difficulty is to find space for the figures required to denote the weights and electrical values.

The advantage of the equi-angular logarithmic spiral is that it can be drawn or engraved upon a plane card, with plenty of room for the figures necessary to make the instrument direct-reading. Its basis is a circle divided equally into 360°; and the additional scales needed to indicate capacity, dielectric resistance, and log D/*d*, are concentric circles similarly divided, which can easily be increased in number. Moreover, the radial scales are divided into equal parts, and they may conveniently carry the figures indicating weights or conductor resistances. It avoids, in fact, the difficulty of the division of scales into logarithmic parts, by transferring the logarithmic operations to the spiral. The defect of it is, or was, that the D and *d* readings on the radial scales near the pole of the spiral are rendered inaccurate by the rapid change of curvature approaching that point. This defect is completely overcome by drawing a second spiral exactly like the first, but moved further round the circle in the manner described in the paper to which Mr. Griffith refers, and in the *Proceedings* of the Physical Society, Vol. XXIV, Part II, 1912.

The conclusion seems to be that either the straight, cylindrical, or equi-angular logarithmic spiral form is available for cable calculations. Preference is to be given to the straight form when all the pairs of D and d are to be selected for a given value of log D/d, without reference to electrical values. The Fuller slide-rule is to be recommended for working out particular cases, and for extending the calculations. For a direct-reading instrument, the equi-angular logarithmic spiral, provided with a secondary spiral, is probably the best. This equi-angular logarithmic spiral must not be confused with the ordinary spiral "slide-rule." It must necessarily be a specialised instrument, marked to suit the particular materials or problems with which an individual user may happen to be concerned. The primary and secondary spirals, of which the co-ordinates are given in my paper (*l.c.*), however, will be found to apply to all cases, and in general only the figures on the circular and radial scales will require alteration with change of conditions. Will you allow me to add that the instrument is not patented, and that I have no financial interest in it or in any form of slide-rule?

Rollo Appleyard.

November 15th, 1912.

Patents and Inventions.

I have read with interest your report of the address of the Chairman of the Birmingham Section of the Institution of Electrical Engineers.

Mr. A. M. Taylor makes the rather startling proposal that it should be absolutely illegal for an employer to compel an "employé to hand over to him his invention." Surely so far-reaching a suggestion should hardly have been advanced by an ex-officio member of the Council of the Institution without some limitation.

If the author of the address will kindly define his terms "employé" and "invention," I will, with your permission, endeavour to point out the objections of one employer, at least, to such legislation.

Something Wrong.

Generating Plant for Village Lighting.

I have read with interest the letters in your "Correspondence" columns respecting the electric lighting of small towns, say, of 6,000 to 10,000 inhabitants. I should be pleased to hear if a scheme, as follows, has been tried.

The difficulty appears to be to get a steady load over the biggest part of the day to keep the engines and staff profitably employed. Why not, in the case of a lighting company, take up a side line requiring power and work it themselves? Say a brickyard or corn mill. It should not be difficult, by advertising or otherwise, to build up a profitable business on these lines, which would do a lot towards paying a dividend.

M. A. P.

Stands for Cooking on Inverted Electric Irons.—The Marion Light and Heating Co., Marion, Ind., recently distributed among its customers who have electric irons little stands for holding the irons in an inverted position for cooking, heating water, &c. The holders were simply and substantially constructed of $\frac{3}{8}$-in. by $\frac{1}{16}$-in. iron, securely riveted and painted with aluminium bronze. In lots of 100 they cost 15 cents each, but they were given away by the central station to any customer owning an iron who called and asked for a holder. The holders fit any kind of electric iron and adapt the upturned heating surface for warming water, cooking eggs, boiling coffee, warming baby's milk, &c. With no other device than the electric iron in the house, a fair breakfast can be prepared in a few minutes. The holder is also useful for other household operations, such as steaming velvet, &c. Mr. S. H. Smith, local manager, checked the consumptions of several customers who employed these holders to amplify the uses of their electric irons, and found that those compared had each increased consumption by about 15 cents' worth, so that the little stands paid for themselves the first month.—*Electrical World.*

THE OFFICIAL BALANCE A TALE OF A TEST.

By A.M.I.E.E.

"The official balancing of the electrical circuits on H.M. Ship —— will commence on the -th inst. Please attend."

So runs the usual notice received by contractors for electrical machinery and apparatus to H.M. Navy.

The operation with the above high-sounding title is merely the testing, for continuity, conductivity, and insulation resistance, of everything electrical on board the ship, and is so named from the use which is made of the "bridge" method for conductivity tests; hence the term "balancing the bridge" has given the test the name of "The Official Balance." As this test is most dreaded by all taking part in it, the following account of an insulation test, which, for sheer strenuousness, eclipsed anything in the writer's experience, may be of interest to readers.

The bare recital of the fact that after being fitted and tried on board, and before final acceptance by the authorities, all electrical apparatus must pass a certain test to prove the quality and condition of the insulation, conveys very little to electrical men who have not had the actual experience. For instance, a motor left standing for a week on the open deck in the rain, or in a compartment awash with water for eight months, or to have a motor used as a platform by a driller, who manages by some feat of juggling known only to his species to mess up the interior with soap suds, or to have the compartment in which a motor is fitted entirely filled with water in order to test watertight doors, are all mere incidents exciting no comment, being just part of the game.

On receipt of the customary notice the writer repaired to the Royal Dockyard at ————, arriving on a Monday. Amongst other things the writer was responsible for two motors of 140 and 30 H.P. respectively, and the first deadlock occurred right away. The orders were that all drying-out and testing was to be completed within the week, as the ship was going to sea on the following Monday; while from another department came a special order to the writer that nothing must be taken apart, as the motors were required for use on the Thursday. The second order thus rendered the fulfilment of the first quite out of the question. The motors, while quite workable, were in a very damp condition owing to the compartment in which they were fitted having been awash with water for six or eight months. However, something had to be done, so we commenced on the large motor with the usual recognised methods of drying a motor without dismantling it.

The writer's staff consisted of a chargeman erector, two erectors and a labourer—all non-electric men. The first thing was to get a squad of labourers to clear out the water, no easy task, and dockyard "maties" are not given to hustling.

For the remainder of that week every effort was made to heat up the motor. We ran it, "stalling" it at intervals with the brake in order to get a good volume of current through it. We packed 50-C.P. lamps inside the motor and controller, and left the shunt circuit "on" at nights. On Thursday we had a full-load run for a few hours, but all to no purpose; that motor absolutely refused to warm up. We continued the treatment until Saturday, and we were then informed that Monday's trip was postponed until later in the week, so we immediately commenced with stronger measures.

A quantity of prepared charcoal, guaranteed free from fumes, and several perforated metal bowls were procured. We then opened out the machine, which had a diagonally split hinged frame, and lifted out the armature—an operation easily accomplished in the shops, with cranes, &c., in about 30 minutes, but which took exactly 15 hours between decks on board ship. Only those who have had similar experience can understand. The armature weighed over a ton, and was bulky in proportion. There was barely room, between the highest point of the motor frame when open, and the beams overhead, for the armature and chain blocks. The motor lay with the spindle fore and aft of the ship, and the only available deck space on which to land the armature was on the starboard side of the motor; but this space was taken up by the top half of the now open motor frame, the hinge being at the lower end of the diagonal joint. On the port side of the motor a vertical shaft blocked the way, so we planned to lift the armature clear of the frame, block it up with timber, move the chain blocks to port, take a fresh lift and swing the armature as far to port as the vertical shaft would allow, close the motor, block up the armature again, move the chain blocks to starboard, lift the armature again and swing it over the top of the motor and land it on the deck. All this was accomplished, after indescribable trouble, up to the point of trying to get the armature back over the top of the motor. This we found to be impossible. The highest part of the frame when closed was just a trifle higher than the highest point when open, and this trifle made all the difference; we could not get another quarter inch of lift, so there the armature had to remain. We blocked the armature up with timber, allowing it to rest upon its spindle, but allowing the slings to remain for safety. We then started the charcoal fires; two of these were put under the armature, one upon an iron plate, which was placed upon the bottom pole-piece inside the motor, and two under the main controller. The motor, armature and controller were then covered over with pieces of sail cloth, sacking, or anything procurable, to keep in the heat, and one of our number remaining to watch, we left the ship about 4 a.m. on Sunday.

The charcoal fire treatment was continued on Monday with good results, all the parts warming up nicely, but a new difficulty presented itself. The fumes off the charcoal were so deadly that to remain in the compartment for long was impossible, and yet the fires could not be left, as varnish might run and drop into the fire causing a flare up at any moment. We therefore started the ventilating fan, but the weather being wet at the time this resulted in damp air being pumped into the compartment, undoing all the good the charcoal fires had done—the insulation resistance appreciably dropping in a very short time—so we had to stop the fan and put up with the deadly fumes. The effect of charcoal fumes is curious, causing frightful pains in the head, and when human endurance can stand no more, and the sufferer climbs out into the fresh air, he loses all power in his limbs, sometimes collapsing upon the deck; the fresh air having that effect. All suffered terribly, two of our number being laid off, but as the treatment was having the desired effect, and either coal or coke fires were quite out of the question, we persevered in spite of all drawbacks.

Towards the end of the week all the parts of the motor seemed perfectly dry, testing out well and quite up to standard. The main controller was not so good, but we decided that we could continue the treatment upon this while putting the motor together for the official test, which we now proceeded to do, as official tests are only made upon complete machines, not upon disconnected parts.

When we got the motor together again, we found, to our unspeakable disgust, that everything was as damp as when we commenced, so that any official test was out of the question. This was a facer. We found that the apparent dryness had been surface dryness only; the moisture in the armature core and F.M. coils still remained, the heat having dried the outer tape, &c., only, and the damp sweated out again in a few hours' time. This brought us back to the starting point again, so, in desperation, we tried all we knew to heat up the machine. The brushes were "shorted," and double full-load current passed through the series coils, this being varied by "shorting" the series, disconnecting the shunt and passing double current through the armature. This was kept up until the heat from the resistance grids blistered the paint off the controller case, but with little effect upon the motor. At this juncture we had a complaint from the "juice" department that we were appropriating the entire output of one generator, at the same time notifying us that the date of ship's leaving dock having been still further postponed, the boiler fires would be drawn that evening, and for the future, current—from the shore—would only be available for lighting purposes. Here was another facer. However, more time being now given us we started in and stripped the motor bare to the casting. How this was done and all put together again with no assistance from the ship's company, in a place below the water line, as dark as a coal mine, often the sole light being that from a tallow dip, with insufficient head room and floor space, absolutely beggars description. The whole frightful experience lingers in the writer's mind as a hideous nightmare.

The plan was to take ashore everything portable and bake it in the dockyard drying oven. We soon found that the armature, which had a very long spindle, was too long to pass up the ladder way and turn out through the opening or doorway, at the top, so it had perforce to be dealt with on the spot.

We procured an empty packing case just long enough to take the body of the armature, the spindle sticking out through slots at each end. This case could just be squeezed through the doorway and down into the compartment without an inch of room to spare.

To provide room for the armature case, we had, after opening the machine, to disconnect the hinge and remove the movable half of the frame to another part of the compartment. The armature was then lifted into the case, six or eight 50-C.P. lamps were laid upon iron plates along the bottom corners of the case, the brush gear, brush leads, terminal bars, &c., were packed away in odd corners, the lamps connected up to the nearest fuse box, and the cover put on. The six magnet coils were then removed—a man could just stagger under one—and taken ashore, then some distance upon a handcart to the drying stove in which they were left for some days.

We now turned our attention to the main controller, putting charcoal braziers inside, round about, and underneath. Water was again collecting in the compartment, which was now appreciably warm, and the resulting steam was condensing upon the walls of the compartment, which, having cold water at the other side, made an efficient surface condenser, the water running down in tiny rivulets. A gang of cleaners was again set to work, and the cause of the trouble, a centrifugal pump in the corner, having been discovered and the leakage stopped, we finally got rid of the water.

After continuing the baking treatment for about five days we decided to put the motor together again. The field coils had to be brought a distance of about a third of a mile in an open handcart in a drizzling rain, covered with damp sacking. Fortunately we got them down into the now slightly warm compartment before they were cold, consequently they did not sweat. Every single detail—brush holders, brush leads, terminal bars, field coils, cable connections, &c., was separately tested, both before and after fitting into place, and again after connecting up, as the connecting up of any faulty part, however small, would spoil the whole test. How anxiously we watched for the swing of the Megger needle, as each added part was tested. Would it swing to "infinity" or "zero"?

We worked all night hoping to be ready for the official test by the following forenoon, which was Saturday, but as time went on, it became certain that we should not be ready before the testing officer knocked off at noon for the rest of the day. Here was another fix. If the test was left over until Monday, it was highly probable the insulation resistance would be down to zero by that time, unless the motor was nursed day and night until then. However, the testing officer kindly offered to come on board in the afternoon in order to save the situation. We finished at 1 p.m., the motor complete testing out to 10 megohms to earth. An hour later the insulation resistance had dropped 1 megohm. At 3 p.m. when the official test was made, it had further dropped to 8 megohms. The official minimum being two, it was accepted as very satisfactory. The controller being still below the minimum, acceptance was deferred pending further treatment.

The writer was now thoroughly knocked up, added to which a definite date had been fixed for the ship's departure, so that it was necessary to send to headquarters for further assistance.

The remainder of the work, the stripping of the main controller and smaller motor, and baking of the parts, was work of no special difficulty as compared with the other, and calls for no particular comment.

The most exasperating part of the affair was when the writer, arriving home, luckily alive, was declared by other members of the staff—who know not the delights of insulation tests—to be a lucky beggar to get six weeks' holiday. The writer was 18 months in completely recovering from the said holiday (?).

THE MELBOURNE RAILWAYS ELECTRIFICATION REPORT.

In the report prepared by Mr. Charles Merz in 1908 upon the electrification of the Melbourne Suburban Railways, the whole question of the substitution of electric traction for steam railways was very fully gone into.

At that time, however, the Commissioners did not feel convinced that electrification was justifiable, or that the estimate of traffic increase would be realised. These have, however, already been far exceeded. In 1908 there were about 70,000,000 suburban passengers per annum, the figure for this year will exceed 90,000,000, and in 1917, after electrification, it is estimated that there will be 150,000,000 passenger journeys per annum on the suburban lines. Hence the present proposals deal with this number of passengers, but all parts of the electrification scheme are arranged to be capable of extension from time to time as the traffic subsequently increases.

In order to handle this traffic, it is proposed that the traffic in the mornings and in the evenings, should be provided for by increasing the length of the trains, though it is not proposed to have any longer trains than six coaches to commence with. The scheduled speed, including stops, is 21 miles per hour.

With a view to enabling the Government to decide finally which system is more suitable for the Victorian Railways, complete alternative schemes were prepared by Messrs. Merz and McLellan, and public tenders were invited by the Agent-General in Europe upon them. Offers were received from all the leading manufacturers of the world who prepared detailed proposals accompanied by stringent guarantees.

One particular object kept in view in preparing the specifications and in the scrutiny to which they were subject by Mr. Stone, the Government electrician, who has been collaborating with Mr. Merz in London, was that the resulting comparison should be perfectly fair to the rival systems and the different makers. The fact that no criticisms were put forward by the exponents of either system would indicate that they were fair to all parties.

The present report is divided into three parts, the first part dealing with the choice of system for the suburban lines; the second part dealing with this choice as affected by the country lines, and the third part dealing with the cost of converting suburban lines on the system recommended, and the financial results to be expected from electric working. The suburban lines comprise some 150 route miles, including the lines to Sandringham, Frankston, Dandenong, Ringwood, Eltham, Reservoir, Fawkner, Broadmeadows, St. Albans, and Williamstown. The cost of converting these lines on the direct-current and single-phase schemes amount to £2,349,437 and £3,057,024 respectively, on the basis of the best tenders for each scheme. These figures exclude only those items of capital expenditure which would be unaffected by he choice of systems, as, for instance, the steam-raising plant, the building of the power-house and the repair shops. Hence it will be seen that the single-phase system is more costly than the system recommended, by £707,587. In the same way, a comparison between the working costs of the two systems shows the single-phase system to be more costly by £70,567. More important still, the direct-current system will show increasing advantage over the single-phase system as the traffic increases year by year. Hence, it is obvious that the Government has little choice, and it is certainly satisfactory that the tenders should have such a decisive result.

Although, however, the direct-current system is the more suitable for suburban lines, some doubt existed as to which system would prove the better when electric traction came to be extended to country lines. Comparisons for typical country lines were, therefore, made, and the case of the Melbourne, Woodend and Bendigo line is analysed by Mr. Merz in his report.

The initial cost of converting this line on the single-phase system is more by about £13,000 than on the direct-current system and the annual working cost is also more (some £1,600). These differences are small, but tend to increase as traffic grows. From this it is obvious that the direct-current scheme, which shows such large advantages over single-phase for the suburban system, proves quite as suitable for country lines, such as the Bendigo line, 100 miles in length.

The system to be adopted having thus been definitely settled by the results of the tenders, the report deals with the actual cost of converting the suburban lines and the financial results of so doing. The average speed of the trains is to be increased by nearly a third, and the frequency of the trains by a very large amount. It is estimated by the Commissioners that in 1915 the cost of operating the suburban system by steam will be £360,431 per annum, while electric working will cost £235,416, making a saving of some £125,000 a year in working expenses alone, apart altogether from any increase of revenue. There will, of course, be a very large increase in traffic as the result of electrification, but as it is impossible to tell exactly what this will be, depending as it does so much upon the general prosperity of the city and the State, the profits which will accrue from the electrification with different increases of traffic are given. Mr. Merz estimates that the increases will not be less than 25 per cent., and may very possibly be more; even with this figure the suburban railways will show an immediate profit (after paying interest and sinking fund on all outlays) of £287,674 per annum, in addition to all the other advantages of electrification. The Report has been considered in detail by the Victorian Commissioners, and presented to the Government.

Power will be supplied from Yarraville, in the form of three-phase alternating current at 25 cycles per second, the pressure being 20,000 volts, and will be transmitted partly by underground cables, partly by overhead wires to 12 sub-stations at various points on the system where it will be transformed down, and converted to direct current at 1,500 volts. Overhead wires are to be used throughout the system for the supply of current to the trains. These will consist of units, each consisting of one motor coach and one trailer coach, the length of train varying from two to six coaches. The complete scheme includes the provision of 500 motor coaches, each carrying a four-motor equipment, and 450 trailer coaches.

The single-phase scheme which was compared with the direct-current scheme just described and proved more costly, included the generation of three-phase current at 25 cycles and 20,000 volts, and its distribution to various points on the system at which the current would be supplied to the trolley wires as three separate single-phase currents, the pressure between the trolley wires and the running rails forming the return circuit being 11,000 volts. The make-up of the trains and their schedule speed and carrying capacity would be the same as in the other scheme.

The capital expenditure is estimated as follows:—By 1913, £500,000; by 1914, £1,200,000; by 1915, £1,700,000; by 1916, £2,200,000; by 1917, £2,450,000; by 1918, £2,600,000; by 1919, £2,676,360.

We may add that our readers were informed in our issues of October 11th (page 575), and November 8th (page 744), that the direct-current system at 1,500 volts would almost certainly be adopted.

LEGAL.

Charge against an Electrician.

In the Southern Police Court, Dublin, last week, Wm. Willoughby' an electrician, was charged on remand with having fraudulently converted to his own use electrical fittings, &c., to the value of £5, or thereabouts, entrusted to his charge at Kingsbridge Station by his employer, Mr. J. C. Meldon, contractor, South Anne Street. The prisoner was further charged with having obtained, between January 1st and July 18th, the sum of £33 from Mr. Meldon by means of forging the names of men alleged to have been employed on jobs to time sheets.

For the defence, it was asserted that it was a custom for the defendant to take jobs and do them in his spare time, and that the goods he took were debited him by Mr. Meldon.

Edward Meath, cashier in the employment of Mr. Meldon, stated that the time sheets, from which he had made out the men's wages, were given to him by Willoughby. Willoughby handed him sheets which were in respect of the two men—Brennan and O'Toole—who were supposed to be employed on the Kingsbridge Station job. From these sheets the witness made out the men's wages, which amounted to £15 10s. in respect of Brennan, and £8 4s. in respect of O'Toole. He gave the money to Willoughby to be paid to the men. On July 16th Willoughby brought him two sheets, one for Brennan and the other for O'Toole, and at the same time told him that he was going to pay off both men. The witness asked Willoughby for the men's insurance cards, and said he would not pay anyone unless they had insurance cards. The prisoner said that he had not the cards, but would tell the men to get temporary cards, and to come to the office for payment. Up to the present neither of the men had come to claim his wages.

A number of other witnesses having given evidence to the effect that there were no men named Brennan and O'Toole employed on the Kingsbridge job, the prisoner was returned for trial to the City Sessions, on bail.

Gott v. Veritys, Ltd.

(*Continued from page* 785.)

On the 13th inst., Mr. Vachell, for the defendants, contended that, upon the face of the agreement, there was no obligation undertaken by the defendants to manufacture and sell. The whole of their rights to the sole privilege of manufacturing and selling depended upon their giving active operation to the patents. It was for them to say whether they would manufacture and sell, and by the action of the agreement if at any time they did not do so the plaintiff's rights revived. He pointed out that these were joint patents in which every penny of expenditure had come out of the company's pockets. The misfortunes of Mr. Gott had been those of many other patentees. Other people had brought competitive articles in the market at such a cheap price that Mr. Gott's articles—excellent in their principles, no doubt—had ceased to be of practical use by reason of their expense The conduct of the defendants had been this: in trying to keep their position in the market and compete successfully with others, they had put plaintiff's inventions on one side, and had ideas and specifications for other appliances which they found they could produce at a cheaper rate.

Giving evidence, the chairman of the company, Mr. G. H. Verity, said that, in his conversations with Mr. Gott, cheapness of construction of articles was very much in the forefront. He found that, so far as the starters designed by Mr. Gott were concerned, the firm's prices were too high. With regard to controllers made specially for an Admiralty contract, it was found, after the drawing got to the practical stage in the workshop, that the cost was very much higher than originally contemplated. There was never any desire, in substituting another article, to do Mr. Gott an injury. The Admiralty bought very keenly.

Mr. Vachell: Just of late.

Witness: No, they always have done so.

On Monday, in the High Courts, Mr. Edward Pollock delivered judgment. He said the plaintiff's case was that it had been agreed that the defendants should manufacture and sell certain patented articles, of which Mr. Gott was the inventor, and pay him the royalties. The claim had set forth that it was a further term of the contract, that, in the event of Veritys desiring to discontinue the manufacture and sale of the articles, they should give plaintiff three months' notice to that effect. It was alleged that the defendants did not give the desired notice, but had allowed the patents to remain as live patents on the market. The articles in question were starters and controllers. The defendants had paid into Court the whole of the amount of the royalties due to Mr. Gott under the contract with him. They had in addition paid £5 into Court. In his opinion that amount was quite sufficient to cover any damage sustained by Gott, and there must be judgment for the defendants in consequence. Defendants would have to pay the costs up to the date of payment into Court, the plaintiff to pay the costs after the payment in, except as to the issue regarding proof of liability on the contract apart from issues raised by amendment.

Gery v. Day Motor Co.

(*Continued from page 784.*)

Further cross-examined, plaintiff said he did not demand that the engineer should light the house direct from the dynamo, despite the fact that the number of lights would greatly vary. He expected to have his house efficiently lighted, whether the lights were coupled direct with the dynamo or through the cells. In other words, he wanted a plant according to the specification.

Mr. Bertram Augustus Evans, chief electrician to the firm of Messrs. Furneaux & Thomas, electrical engineers, of Swansea, gave evidence with regard to tests he had made of the plant in question; he described them as unsatisfactory.

Cross-examined, Witness admitted that in one of his reports he described the voltage as steady on that particular occasion. It was true that if the voltage were steady the engine speed must be also steady. He was very surprised when he examined the plant to find that no means had been supplied for running the lights direct off the dynamo.

Mr. Colefax, K.C. (for defendants): The practice of running the lights direct off the dynamo is resorted to mostly in cases of factory and shop installations, where you have a fairly steady load?—Yes.

Do you know of any case of coupling the lights direct with the dynamo in plants for private house lighting?—Oh, yes.

In such cases, is not the dynamo generally a compound-wound machine?—Witness replied that in some cases it might be so. He would not necessarily advise a compound-wound machine for private house lighting; on the contrary, he might install a shunt-wound machine with commutating poles.

Re-examined, witness said the dynamo in question was designed to run direct, but there was no switch arrangement to allow it to do so. When he tried to charge the batteries, he found it was impossible, and he had to shut down after attempting it for five minutes, because the fluctuation in the readings was so great it was impossible to tell what current was going into the cells.

Mr. Arthur Roscoe Furneaux, senior partner in the above-named firm, also gave expert evidence. His firm, he said, had had a fairly large experience of private house lighting installations. In January of this year he was called in by plaintiff to test the plant in question He ran the engine on a light load with paraffin, and found a speed variation of from 550 to 900 revolutions in two minutes. He then proceeded to apply the specification test. He connected the dynamo up to a water resistance and created a load of 55 volts, 28 amperes; with these readings (he used his own instruments), the engine speed fluctuated between 930 and 950 revolutions. He then reduced the load to approximately 22 amperes, and the speed of the engine immediately rose to 1,050 revolutions. Even using dead-beat instruments, he found very great difficulty in taking a perfectly accurate reading owing to the fluctuations. He also tried running the lights direct, but without switching in or out any of the lights the lamps "jumped." It would be impossible to sit in a room and read by them. He then connected up the cells and tried to charge them for 20 minutes, using the meters provided on the switchboard, but he found the needles varied so much that it would be impossible to form any idea of the amount of current going into the batteries. In his opinion the plant was not an efficient one for the purpose for which it was required.

Further examined, Witness said he knew it was the practice with certain leading firms of dynamo makers to supply shunt-wound dynamos with commutating poles for the purpose of running direct on to the lights. This machine was of that type, and therefore he was justified in assuming that this machine ought also to run direct. The difficulty with this plant was the inefficiency of the engine governor.

Cross-examined by Mr. Walker (with Mr. Colefax, K.C.), Witness said that Messrs. Siemens Bros. had orders to supply him with a shunt-wound machine fitted with commutating poles for running direct on the lights, and they guaranteed its satisfactory working. The Westinghouse Co. also made a similar machine. He did not think the 6 per cent. variation specified was excessive.

When the dynamo is being used with a low voltage, the magnetic field is greatly weakened?—Yes.

And in your test you worked on a low voltage?

Witness admitted that that was so.

Mr. Walker then opened the case for the defence, and said defendants never agreed to supply a dynamo which would run direct on the lights, and their evidence would show that the machine in question was not designed to do so. The reason why plaintiff tried to run it in that fashion was because the batteries had been smashed up, owing to the negligence of plaintiff's people. They had coupled them up in such a way as to short-circuit them and render them utterly useless. When the plant was delivered, it was in a thoroughly sound condition, and no complaint was made with respect to it until it had been in the hands of plaintiff's people for some little while.

Mr. Joseph Day, managing director of the defendant company, then gave evidence, and said he was the inventor of the two-stroke system of engine, such as was supplied in this instance. There were many more engines sold throughout the world working on that principle than on the four-stroke principle. This particular class of engine was frequently supplied for electric lighting work in cases where the load was constant. Continuing, witness described the interview with Mr. Brown at the premises of the Electrical Federation, which ultimately led to the order being given. It was always intended that the plant should be run with the batteries. Not a word was ever said about lighting direct with the plant. He did not mind which plaintiff had, in fact, he would just as soon have fitted him out with a direct-running plant.

George Venn, mechanic in defendants' employ, gave evidence to the effect that when the plant was first installed he went down and ran the engine for some 48 hours, charging the cells. It ran very well, and Mr. Gery expressed his satisfaction. He handed it over to the plaintiff. Later, in consequence of complaints, he went down to see the plant and found that the engine was not in the condition in which he left it. Parts had been altered; for instance, the commutator had been put into a lathe and filed down.

Mr. Francis Hird, departmental manager to Messrs. Siemens Bros., stated that he had examined the dynamo in question, and in his opinion it was not a suitable machine for direct lighting purposes. It was possible to use a shunt-wound dynamo with commutating poles for direct lighting purposes, but he was not aware that it was the practice of his firm to make such machines, especially for direct lighting. It was news to him that Mr. Furneaux had ordered such a machine from his company for that purpose. The machine supplied to plaintiff was obviously to be used for charging batteries. If the engine when it was first installed satisfactorily charged the batteries for 40 hours, there was no reason why it should not continue to do so.

Mr. Albert Edgar Fleming, in defendants' employ and the engineer in charge of the plant in question, described the charging test, &c., when the plant was installed, and said plaintiff then expressed himself as very well satisfied.

Mr. Edward Cutting, of the firm of Messrs. Cutting Bros., dynamo and motor engineers, of Stamford, Lincs., gave evidence, and stated that his firm supplied the generator in question. It was a shunt-wound machine, and was not the type of machine to be used for direct lighting. It was a commutating-pole dynamo, designed to prevent sparking when giving an increased amperage output working on a weakened field. The dynamo supplied was perfectly efficient for battery-charging purposes, and was a standard type manufactured by his firm.

Mr. Frank Broadbent, consulting engineer, also gave expert evidence in regard to the plant. He said that by the specification, to his mind, it was clearly intended that a plant for lighting off the batteries and not for direct lighting should be supplied. The dynamo was not constructed for direct lighting.

This concluded the evidence, and counsel then addressed the Referee upon the whole case.

Judgment was reserved.

The Telephone Arbitration.

(*Continued from page 784.*)

Dealing with contractors' charges, including the charge made by sub-contractors, Sir J. Simon contended that here again the figures of the company were wrong. He claimed that the Post Office figures for labour were confirmed by a great body of practical testimony from contractors and others. In regard to the percentage to be allowed for contractors' supervision, the question arose as to whether there ought to be anything allowed for storage. The provision made by the Post Office for contractors' profit was ample, because it was not usual to allow contractors' profit upon materials supplied when the contractor was himself supplying the materials. He submitted that the evidence given on behalf of the Post Office as to that was overwhelming, and it had not been challenged on the other side. It did not matter whether they were dealing with overhead wires or underground cables, the question of supervision of labour was not affected in any way by the purpose for which the work was intended. Supervision was not a function of time, although it might be regarded as a function of labour and materials. Whatever they regarded it as, so long as the work was carried out under normal conditions, time did not affect the question of materials and labour. They had the experience of judges of all sorts that 21 per cent. was a right percentage for this head. It was not a question of the ratio of salary to time. If they did the thing 12 times as fast, they paid out the wages 12 times as fast, but still they paid out the same amount.

Sir J. Woodhouse said that if the work were done in a shorter time, it did not follow that the wages would be the same, because it might involve night work, which was more expensive.

Sir J. Simon agreed that under those circumstances the wages account might be higher, and as a consequence, the percentage of the cost of supervision to the cost of labour would be lower. His contention was, however, that 21 per cent. for supervision was a proper figure for a normal rate of construction.

The Solicitor-General having concluded his arguments so far as the contractors' evidence and the re-instating cost were concerned, said he would next have to deal with the employers' burdens, the checks, and the depreciation. The question then arose as to the probable duration of the proceedings, and Sir John said he thought he would be able to finish the depreciation case in a day, and if the Court adjourned until Monday, he hoped to be able to conclude his speech on Tuesday.

Mr. Danckwerts, K.C., said that if the question of land and buildings were gone into, it would take about 80 days more.

The Solicitor-General: I am glad to say that that part of the case is in the hands of the Attorney-General.

Mr. Danckwerts asked as to the remaining branches of the case, said that he was unable to make a definite statement as owing to thunderclouds in the air he had been unable to confer with the Attorney-General.

Mr. Justice Lawrence said that when the Court had made up its mind on the first part of the case they hoped it would not be necessary to contest some of the other matters which might be very burdensome to both parties.

On Monday, when the Court resumed after the adjournment on the previous Wednesday, Sir J. Simon continued to sum up the case for the Postmaster-General on the question of the cost of construction of the company's plant. Dealing with the question of the amount which should be added to the contractors' total charges for employers' burden, in order to arrive at the total of construction, the Solicitor-General said the Postmaster-General had produced a great body of evidence in order to show that 5 per cent. was a proper allowance to make to cover the burdens falling upon the employers' shoulders. Under this heading the company charged 10·835 per cent. He submitted that it was impossible to contend that the Postmaster-General's figure of 5 per cent. was "grossly insufficient," inasmuch as it was based on sound judgment and experience. On a 5 per cent. computation the total sum for this item amounted to no less than £578,000. Proceeding, Sir John next dealt with the question of the increased cost consequent upon the work of obtaining wayleaves, and the expediency of taking this item into account in the contractors' totals.

Sir Jas. Woodhouse remarked that, the company having no statutory rights, had to arrange for wayleaves, which might have involved an enormous amount of difficulty and correspondence. It was impossible to treat telephone construction too much like tramway construction, because, in the latter case, the works were concentrated, and they were bound to take into account the cost, &c., of obtaining wayleaves.

Sir J. Simon said he agreed there were special difficulties in that respect, but he submitted that the work of obtaining wayleaves was not part of the contractors' business. It was the employers' business, and, therefore, should figure as a special item of cost.

(*To be continued.*)

Bradford Strike Prosecution.—"Persistent Following."

A case of considerable interest to employers and employés in the electrical engineering trade came before the Bradford Stipendiary Magistrate (Mr. H. W. W. Wilberforce), at the Bradford City Police Court on Thursday last, when Lional Barker, of 34, Napier Street, Bradford, and Atkinson Pinder, of 29, Springfield Street, Bradford, were summoned at the instance of Arthur Arrowsmith, of 6, Cross Street, Leeds, "in that they, with a view to compelling the complainant to abstain from doing an act which he had a legal right to do, to wit, working as an electrician's labourer at the New Picture House, Thornton Road, Bradford, did unlawfully and wrongfully and without legal authority persistently follow him." The complainant was represented by Mr. Alex. Neill, whilst Mr. W. Trenholme appeared for the defendants, who both pleaded not guilty. The prosecution was taken under the Conspiracy and Protection of Property Act, 1875.

Mr. Neill said that he ought to mention that a strike of electricians had been proceeding in Bradford from October 12th right up to the present time. The complainant was employed on work at the New Picture House, Thornton Road, and on the evening of October 25th the two defendants were waiting outside the Picture House, evidently with a view to speaking to complainant, and endeavouring, by peaceful persuasion, to get him to come out on strike. When complainant left his work that day he was met by a hostile crowd numbering some 50 or 60 persons who followed him to the car, booing and calling out "Blacklegs!" to him and his companion. The police were amongst the crowd in good numbers, and two constables escorted complainant and his friend to the car. When the car was reached, a section of the crowd endeavoured to board the car with the complainant. Amongst those who succeeded in their object were the two defendants, and during the journey they tried to persuade him that he had no right to work, and he (Mr. Neill) suggested that they also terrified the complainant. Bills were distributed amongst the people on the car, which showed clearly what the object of the defendants and their fellows was. The contents of the bills were: "Bradford Electricians' Dispute. Fellow Workers,—A few men, known as blacklegs, are assisting the employers to try and defeat the legitimate demand of the men for better conditions. We therefore ask you to assist us in clearing this dangerous element from our path. Our fight is yours. To-morrow it might be your turn. Workers of the world, unite." He (Mr. Neill) said that the intention of the two defendants was, that by persistently following, they expected to be able to compel the complainant to leave his work.

The complainant corroborated Mr. Neill's statements, and said that the defendant Pinder said to him that he was no man, and a blackleg. He (complainant) asked how he could be a blackleg when he was not an electrical engineer, but only a labourer, and he was then charged with doing electrical work.

Cross-examined by Mr. Trenholme, complainant stated that there was no actual demonstration against him, and that he was not afraid of the strikers individually. He thought there would have been some trouble if the police officers had not been present. He would not get any higher wages if the electricians succeeded in getting what they demanded. He had been followed by other strikers since October 25th, who gave him to understand that they intended getting him out, and would give him a good hiding when they got the chance.

P.C. Shaw and P.C. McClinton said they accompanied the complainant from his work to the car, and travelled with him to the terminus. They gave evidence as to the methods used by the strikers who were in the car to try to get the complainant out on strike, and stated that the strikers were getting so excited that they had to warn them to be careful what they said. The arguments were used in a menacing sort of way, and could not be described as quite peaceful.

Inspector Challoner corroborated the statements of the constables.

Mr. Trenholme said that under Sec. 2 of the Trades Disputes Act the defendants were quite entitled to do what they had done.

The Stipendiary Magistrate asked what necessity there was for such a number of strikers to board the car if it was only for peaceful argument with the complainant.

Mr. Trenholme said there was no evidence that the defendants had spoken to the complainant at all. Also, there was no evidence whatever that any attempt had been made by the defendants to compel the complainant to abstain from work.

The Stipendiary Magistrate: It is ridiculous to suggest that there is no tittle of evidence of compelling action.

The Defendants gave evidence to the effect that only peaceful persuasion was used by the strikers during their conversation with the complainant, and they parted quite good friends.

Frederick William Horsfall stated that he was with the complainant when he was followed, and he had decided to relinquish his work the following day.

The Stipendiary Magistrate asked if the Trades Union would undertake not to follow, in the manner in which they had been doing in this case, during the continuance of the strike.

Mr. Trenholme, after consultation with the Union, said that they would be prepared to give such an undertaking as was desired by the Stipendiary Magistrate if there would be no conviction.

The Stipendiary Magistrate said he could not enter into any bargain of that sort. He was anxious that the dispute should be conducted in a proper manner. He suggested that the Trades Union should undertake "That no persons in the employment to which this dispute relates shall be followed, except by members of the Strike Committee authorised to discuss the matter." This would extend to any person deputed by the Strike Committee to discuss the subject.

Mr. Trenholme said that his clients would agree to the undertaking as suggested by the Stipendiary Magistrate, and the case was thereupon adjourned for a fortnight.

BUSINESS NOTES.

The Price of Aluminium.—It is reported from Berlin that a meeting of the International Aluminium Syndicate was to have been held on November 14th to discuss the situation of the market and make an advance in prices. The price until recently has been M. 80 (£4) per cwt, but the metal has not really been obtainable at this quotation for some time past, charges of £4 5s., and even up to £4 10s., having to be paid for small parcels. The active demand is attributed to the increasing use of aluminium for domestic utensils and for military purposes by army authorities, who are adopting the metal to a growing extent for field flasks and articles of war. Since these lines were written, it has transpired that no decision was reached at the conference which was held in Paris. The minimum consequently remains at £4 per cwt., but will be increased when the price actually obtained exceeds the minimum by 15 per cent.

Canadian Duty on German Wire Lamps.—It is reported from Berlin that the Government of Canada has introduced special duties on certain goods of German origin as from November 1st, these including Wolfram lamps. The imports of these lamps from Germany have hitherto been treated, it is said, "fairly uniformly with French and Dutch products," but British lamps enjoy a preference of 5 per cent. Now Canada has imposed a special duty on German lamps, and it is thought possible that the business of some makers will thereby be disturbed. It is understood, however, that this does not affect the German Incandescent Gas (Auer) Light Co., as the company avails itself of the English Welsbach Co. for exports to Canada.

Constantinople Troubles.—It is stated that considerable losses have probably been incurred by the Ganz Electricity Works Co. and the Hungarian General Credit Bank or its associated electrical trust in connection with the various lighting and traffic enterprises in Constantinople, in consequence of the reported destruction of many cables in the Turkish capital. The representative of the Ganz Co. in Constantinople has reached Buda-Pesth to give particulars of the situation.

For Sale.—MESSRS. P. HUDDLESTON & CO. will, on November 26th, sell by auction, at 56, Redcliff Street, Bristol, a large quantity of electrical apparatus, &c. See our advertisement pages to-day.

Consular Notes.—Norway.—The British Consul at Christiania, in a recent report, states that the total imports of machinery into Norway in 1911 were valued at £1,149,350. The following are the details of the principal machinery imports by countries of purchase :—

Motors, steam, water, gas or petroleum.—From Germany, £36,000 ; Sweden, £53,000 ; United Kingdom, £3,000 ; U.S.A., £18,000 ; Denmark, £30,000.

Other machinery (except agricultural).—From Germany, £385,000 ; Sweden, £44,000 ; United Kingdom, £108,000 ; U.S.A., £54,000 ; Denmark, £25,000.

Parts of machinery.—From Germany, £219,000 ; Sweden, £53,000 ; United Kingdom, £26,000 ; U.S.A., £6,000 ; Denmark, £12,000.

Compared with the corresponding returns for 1910, the above figures represent a loss to British trade of about £1,000 under the heading of motors. British motors unfortunately seem to find little demand in Norway as compared with those of Sweden, Germany, Denmark and the United States. A reference to statistics of past years points to the fact that it is chiefly Sweden and Denmark who have wrested from us the market, which eight years ago was worth some £20,000 to British exporters. General machinery and parts of machinery from the United Kingdom showed a satisfactory advance in 1911. The reason for the loss of trade in motors is probably to be ascribed largely to the cheapness and suitability of the Scandinavian motor, especially as auxiliary motors for the fishing vessels and pleasure motor-boats. Some British firms have tried to get their marine motors introduced, but it is believed that their efforts have not met with any measure of success, and there would seem to be but little opening at present for British steam, gas, electric or petroleum motors.

Later in his report, the Consul states that one or two British firms have acted on the suggestions made in last year's report as to the possibilities of trade by post with Norway. There is another point which has occurred to him which might conduce to the general advantage of British traders and to the help which the Consulate can give to inquirers. British firms are constantly applying to the Board of Trade Commercial Intelligence Branch or to the Consulate for the names of suitable agents to represent them ; but it hardly ever happens that a British firm afterwards notifies to the Consul the name of the agent actually selected, and the Consulate is thus left uninformed as to the names of a large proportion of the local agents of the British firms he is there to assist. In such circumstances it is obvious that there can be little co-operation between agent and Consulate in the interests of British trade ; in cases of commercial failures, happily rare of late years, the Consul does not know the names of the probable British creditors whom he can warn in time to safeguard their interests, and it may happen that fresh applicants may be supplied with the names of local agents who already represent competing British firms. The Consul would, therefore, gladly welcome any notification of the names of local representatives of British firms, and would be pleased if British commercial travellers going to Christiania would call at the Consulate during their stay.

Canary Islands.—The American Consul reports that the local telephone company, which is Swedish, is considering the installation of a new and modern system. The present line runs from Teneriffe to Laguna and Tacaronte, with about 300 subscribers on the books in Teneriffe and 100 in Laguna. The tram company was recently affiliated under the name of the Compania Electrica Industrial de Teneriffe with the electric light company, which a short time ago extended its service to Laguna, and now supplies the light for both cities from a greatly enlarged and modern plant completed in 1911. Electricity is used almost exclusively for lighting, except by the poorer people, though the wealthier people living in the country have their own acetylene gas plants.

The past year saw an improvement in the service of the German-South American Cable Co., partly perhaps because of the completion of the new wireless company. The various cables from the Canary Islands have been laid since 1884. In that year the Spanish National Submarine Cable Telegraph Co. obtained a 10-year concession from the Spanish Government to lay the first island cables between Cadiz and Teneriffe (860 miles), Teneriffe and Las Palmas (57 miles), Teneriffe and La Palma (69 miles) and Las Palmas and Arecife Lanzarote (124 miles). Upon the expiration of this concession the Spanish Government took the lines over, and has since worked them through a Government staff. In 1908, new cables between all these points were laid to replace the old lines. In 1885 an English company laid a cable from Teneriffe to St. Louis, Senegal (896 miles), under a 15-year concession from the Spanish and French Governments in agreement. Upon the expiration of this concession the company dissolved, after previously handing over the cables to the French Government, which subsequently transferred its holdings to the South American Cable Co., Ltd., to be used as an extension to its regular system from Pernambuco to Dakar. The St. Louis station thereupon was closed and the terminus of the old Teneriffe line moved to Dakar. Messages for Europe and North America by this cable now go *via* the Dakar-Brest cable. In 1909 the German-South American Telegraph Co. laid a cable under a 50-year contract with the Spanish Government, assisted by liberal German Governmental support, between Teneriffe and Emden, and in 1910 another cable between Teneriffe and Monrovia, Liberia. The latter has since been extended from Monrovia to Pernambuco. The rates per word to Europe or North America by the German-South American Co. and by the Government cable are practically the same.

The Marconi Wireless Co. has completed and put into operation its installation, after a considerable delay in fulfilling the stipulations of the Spanish Government. While this company will compete with the cable company, there is no anticipation of war between them. Where similar service can be performed by each the rates are similar. The four towers are each 185 ft. high.

China.—The American Consul at Tientsin reports that the telephone mileage in Tientsin on December 31st, 1911, was 2,122, and number of stations 1,831—increases of 40 miles and 33 stations in 12 months. The figures for Tientsin will be practically stationary for the present year, owing to the fact that the switchboard is filled, and there can be no increase in number of stations until the entire telephone system of the city is rebuilt. It was intended to undertake this work as soon as possible this year, but even though the new material were ordered immediately the new system could not be in operation until some time in 1913. In Peking on December 31st, 1911, there were 2,136 telephone subscribers, an increase of 505 in 12 months, while 1,434 miles of bare wire and 5,056 miles of cable core were in use. The unsettled condition of business at present and the lack of capital alone prevent a very great increase in the use of the telephone. The Chinese in Tientsin and Peking thoroughly understand the advantage of telephonic communication, and it is only a question of time, plus normal business conditions, to witness an extraordinary development. The trouble in this country is the lack of long-distance lines, the longest at present being about 120 miles.

Catalogues Wanted for Malay.—MR. C. HARCOURT STEVENS, chief engineer, Sempam electric power station, Tras, Pahang, Federated Malay States, asks us to state that he will be pleased to receive price lists, pamphlets, &c., from manufacturers of general station appliances, lighting accessories, and complete petrol-electric sets (small).

Winter Resort.—We have received a copy of the official illustrated booklet issued by the Falmouth Corporation, bringing before the public the suitability of the climate and resources of that resort for winter visitors.

Catalogues and Lists.—MESSRS. ELLIOTT BROS., Century Works, Lewisham, London, S.E.—Three new lists as follows :—No. 51 (20 pages) concerning D.C. switchboard instruments, moving coil and soft iron types ; No. 56 (16 pages) relating to various patterns of portable instruments for C.C. and A.C. ; and No. 57 (16 pages) devoted to testing sets. All of the lists contain specification information, with illustrations and tabulated particulars and prices.

MESSRS. BERRY, SKINNER & CO., 78, Upper Thames Street, London, E.C.—Leaflet respecting the "Pygmy" electric heater.

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—Illustrated and priced leaflets ; No. 37, "Eclipse" intense flame arc lamps ; No. 37A, semi-enclosed arc lamps for D.C. ; one relating to the double-carbon flame lamp for D.C. or A.C. ; also the first part of a Christmas list of electrical novelties.

MR. G. WILKINSON, Beech Mount, Harrogate.—Pamphlet containing brief particulars of the "Losles" system of steam pipe drainage and a selection of testimonials from electricity works engineers who have had experience therewith.

MR. O. N. BECK, 11, Queen Victoria Street, London, E.C.—Priced leaflet relating to rope and chain steel protectors for hoisting and transporting work.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—A 52-page booklet entitled "The Book of the Excello," being a semi-technical treatise on the "Excello" flame arc lamp, in which a good number of night photographs are included showing the lamps in actual use. Contractors can have copies on application.

THE TURBO-ELECTRICAL CO., 25, Victoria Street, London, S.W.—Sixteen-page illustrated pamphlet describing high lift centrifugal pumps, and showing some examples of their applications in mine drainage, shaft-sinking, public water supply, boiler-feeding, and other service.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—A very fine instrument catalogue (No. 508) of about 250 pages. The book is, we believe, the most complete and comprehensive catalogue of measuring instruments that we have seen, and must have involved a large amount of labour and expense in its production. Attention may be directed to a few special lines, namely, moving coil and dynamometer type instruments for laboratory purposes, combination sets of instruments, a special astatic wattmeter which has great sensitiveness at very low power factors, a line of electrostatic voltmeters for pressures up to 150,000 volts, the Siemens-Blondel oscillograph, and to a wide range of rheostats, but there are doubtless numerous other manufactures in the work which would also interest our readers. There are in all some 15 sections, but the book requires to be seen for its completeness to be fully appreciated.

Messrs. Eureka Pump Co., 53, Bothwell Street, Glasgow.—Catalogue No. 214 (60 pages), containing full descriptive particulars and excellent half-tone views and line diagrams of their various designs of Eureka steam pumps and power pumps. Some useful information and tables of interest in such a connection, and the Eureka Telegraphic Code, occupy the last 16 pages. We understand that the works of the company have been running night and day for the past 18 months, and extensions are in hand to enable them to cope with orders. The London office is at 25, Victoria Street, S.W., under the management of Mr. Philip S. Doherty, late of the Worthington Pump Co. The company also has offices at Newcastle, Cardiff and Manchester, and agents in many foreign countries.

Messrs. Clarke, Chapman & Co., Ltd., Victoria Works, Gateshead-on-Tyne.—A number of catalogues containing full and illustrated information relating to their manufactures, including Woodeson's water-tube boilers and direct-acting steam pumps.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet giving particulars and prices of a heat indicator in the form of a paint, which they are now introducing under the name of "Detectheat." This well-known method of detecting hot bearings is very effectual; a sample, consisting of a piece of metal painted with the detector can be had on application.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—New priced leaflet relating to "Guttaflex" patent rubber-cord armoured flexibles, of which large stocks are carried.

The Cambridge Scientific Instrument Co., Ltd., Cambridge.—An excellent pocket-size catalogue (No. 102) of about 120 pages, wherein their wide range of electrical instruments are particularised with neat illustrations, and very clearly indicated prices. The contents include galvanometers, oscillographs, electroscopes, and electrometers, resistances, bridges, potentiometers, and so on. Several pages contain a complete list of code-words, and net weights in tabulated form.

Trade Announcements.—Messrs. Watlington and Co., Ltd., are carrying a stock of 100,000, not 10,000, Britannia lamps, as we understood last week. Their number in Milton Street is 48, not 43.

The Acton Lamp Co., Ltd., have just removed their head office and sales department to the works at Agnes Road, Acton, W., with a view to centralising their business. All communications should be sent to that address.

Messrs. Imeson, Finch & Co. (1912), Ltd., of Bridge Works, Stockton-on-Tees, have just recently purchased from the liquidator of Messrs. Traction Supplies, Ltd., of Sunderland, the full patent rights and stock for "Whites" two-way reversible and renewable finger. The firm are now fully equipped for the manufacture of these goods, and indeed for any tramway material.

New premises at 6a, Parade, Canterbury, have been opened by Mr. L. A. Wells, electrical engineer.

Messrs. Hutton Bros., electrical engineers, of Swindon, have removed their business from Commercial Road to the Quantock Works, Devizes Road.

Messrs. Pontelec Welding Patents, Ltd., have removed to larger premises at 46, Constitution Hill, Birmingham. Their new telephone number is "Central 4413."

Bankruptcy Proceedings.—Joseph Arthur Procter, Bradford, warehouseman, late electrician.—This debtor attended at the County Court, Manor Row, Bradford, on November 13th, for his public examination on accounts showing a deficiency of £113. It transpired that the debtor started business, without experience, in 1909 at Frizinghall, with a capital of just over £9. He attributed his failure to under-estimating and want of practical knowledge. The case was declared closed.

Harry Thorpe and H. J. Salter (trading in co-partnership as Thorpe & Salter, electrical engineers, High Holborn, W.C., and Holloway). Also Harry Thorpe (separate estate).—In both cases, a first and final dividend of 20s. in the £ and 4 per cent. interest is payable after November 23rd at Carey Street, W.C. This was a 1905 failure. (See Electrical Review, August 4th, 1905, p. 177). Congratulations!

Fred. Shaw, electrical contractor, Hull.—A supplemental dividend of 4s. 6¼d. in the £ is payable November 26th, at York City Bank Chambers, Lowgate, Hull.

Alfred Sitch, metal-worker and electrical engineer, Brecknock Road, London.—An order was made on October 22nd, suspending discharge for two years.

Book Notices.—*The Teaching of Electric Light Switching.* London: A. P. Lundberg & Sons.—This booklet is addressed to teachers in technical colleges, &c., and is intended to draw their attention to the importance of a competent knowledge of the "Art of Switching." To this end, various methods of teaching the art are mentioned, and particulars are given of the demonstration boards and other aids to lecturers obtainable from the publishers.

"*Annuaire* du Bureau des Longitudes." 1913. Paris: Gauthier-Villars. Price 1 fr. 50.

"Handbuch der Elektrizität und des Magnetismus." By Prof. Dr. L. Graetz. Leipzig: Johann A. Barth. Price M. 13.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 2. November, 1912. New York: The Institute. Price $1.

"An Outline of the Metallurgy of Iron and Steel." By A. H. Sexton and J. S. G. Primrose. Manchester: Scientific Publishing Co. Price 12s. 6d. net.

"*Proceedings* of the Rugby Engineering Society." Vol. IX, 1911-12. Rugby: The Society. Price 10s. 6d. net.

"*Calendar* of the University College, University of London." 1912-13. London: Taylor & Francis.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Part 1, 1912-13. Glasgow: The Institution.

"Practical Measurements in Radioactivity." By W. Makower and H. Geiger. 1912. London: Longmans, Green & Co. Price 5s. net.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 7. October, 1912. New York: The Society. Price 75 cents.

"Design of Electrical Machinery." Vol. III. Alternators, Synchronous Motors, Rotary Converters. By Wm. T. Reyson. 1912. London: Chapman and Hall, Ltd. Price 6s. 6d. net.

"Light: Its Use and Misuse." New York: Illuminating Engineering Society.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXIX, No. 4. October, 1912. Philadelphia: The Club.

"*Journal* of the American Society of Mechanical Engineers." November, 1912. New York: The Society. Price 35 cents.

"*Transactions* of the University of Toronto Engineering Society." Vol. VI, No. 6. October, 1912. Toronto: The University.

Electrical Trades Union.—We are asked to state that owing to the requirements of the Insurance Act and the growth of membership, the general office of the Electrical Trades Union will be removed to more commodious premises at 137, Great Clowes Street, Broughton, Manchester, where all communications should be addressed on and after December 1st.

Liquidations.—Bryant Trading Syndicate, Ltd.—A petition for winding up, presented by Mr. A. Rosenthal, Finchley Road, London, a creditor, is to be heard on November 26th.

British Hosiery and Electrolytic Bleaching Co., Ltd.—This company is winding up voluntarily, with Mr. De Westley Layton, 167, Fenchurch Street, E.C., as liquidator. Creditors must forward particulars of debts, &c., by December 31st.

LIGHTING and POWER NOTES.

Accrington.—Speaking at the starting of Messrs. Boardman & Baron's new cotton mill at Clayton-le-Moors, Mr. Boardman said it was only by the merest chance that the new mill was not equipped with electrical instead of steam driving. The Accrington Corporation was asked what it could do for the firm, but it was not at that time in a position to supply all the current that would have been needed—hence the adoption of the older method. Had the Corporation been only a little more advanced with its electricity extensions, then it was possible the new Royal Mills, with its 1,008 looms, would have been the first in that district to be completed without chimneys.

Argentina.—The San Cristobal (Santa Fé) municipality has granted a concession for an electric light station to J. A. Aguirre. The concession and contract are for 25 years.

The Victoria municipality (Entre Rios) has been calling for tenders for public lighting by means of 136 arc lamps, for a period of ten years.—*Review of the River Plate.*

Atherton (Lancs.).—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £1,300 to meet further outlay in providing transformers, switchgear and pillar-boxes.

Australia.—The Petersburg Corporation (S.A.) is taking the initial steps in connection with the installation of a municipal electric supply. The scheme is estimated to cost £6,000. The Railways Department has agreed to take 50,000 units per annum, at 4½d. per unit, required for the local workshops equipment.

A poll of the ratepayers of Albury (N.S.W.) has been taken with respect to the proposal that the local Council should be authorised to borrow £105,000 for the purpose of installing an electric light and power plant, and resulted in favour of the scheme.

The North Sydney Council held a special meeting to consider the report of Mr. G. A. Julius, consulting engineer, who was commissioned to inquire into the various offers to provide electric lighting in the municipality. In his report, Mr. Julius favoured the proposal from the Sydney City Council, but recommended the offer of the Northern Suburbs Electric Light and Power Corporation, because it included the destruction of garbage, which he had been given to understand was essential. The discussion, which was a long one, showed a feeling that the expert had been hampered in his report, and eventually it was decided that Mr. Julius be asked to report fully on the various schemes submitted, independent of any instructions he may have received, and, if necessary, to confer with the Works Department in regard to the proposals from that department.—*Australian Mining Standard.*

Billericay.—The R.D.C. has appointed a committee to consider the advisability of having the new hospital lighted by electricity instead of by petrol-gas.

Birmingham.—An excellently-produced and well-illustrated 26-page booklet, entitled "Electricity in the Modern Home," has been issued by the electric supply department. The pamphlet explains in simple language the applications of electricity in the different sections of the home, the various apparatus in use being illustrated by well-drawn pen-and-ink sketches with suitable legends. The concluding pages refer briefly to electric cooking and general domestic work, and end with a few paragraphs dealing with the terms of electricity supply. This production should appeal strongly to the better-class residents of the city.

Cambridge.—The Cambridge Electric Supply Co. has been approached by some residents of Godmanchester, Hunts. (about 14 miles distant), as to the possibility of a supply of electricity for that district, and the adjoining town of Huntingdon has been asked to participate in a scheme. Discussed at the Huntingdon T.C. meeting, it was decided that the Council could not take any part in the scheme, but it would offer no opposition to a company furnishing a supply. The population of Huntingdon is between 4,000 and 5,000, and of Godmanchester about 2,000.

Cheltenham.—During the present week a "Modern Home Exhibition," which gives every promise of success, has been held at the Town Hall. Primarily, the idea is to illustrate the domestic and other uses of electricity, the price of which has recently undergone considerable reduction. The central feature of the Exhibition is a fully-furnished miniature villa, which is used to demonstrate electrical applications in the home, and in addition some 40 well-known electrical firms are exhibiting lighting, heating and cooking appliances. In the restaurant a well-known local firm of caterers is using a complete equipment of electrical cooking apparatus, and elsewhere the general traders of the town have a number of exhibits on view. The "Modern Home Electrical Bulletin," printed in the Exhibition, tells one all there is to know about the Exhibition, and sufficient to interest us in the possibilities of the apparatus displayed there. In organising the Exhibition, the Electricity Committee joined forces with Mr. Cecil Gill Smith, who has had previous exhibition experience, and Mr. W. J. Bache, the borough electrical engineer, and Mr. Smith, whose joint endeavours have resulted so successfully, are to be congratulated on their work.

Continental Notes.—GERMANY.—The German city of Stuttgart, which has hitherto been without the modern illuminant, now proposes to make up the deficiency by taking a supply of current from the projected Murg Valley station, to which it stands nearer than Mannheim, the original objective of that plant.

The Murg Valley hydroelectric scheme, which is the most important, as it is the first effort on a large scale to utilise the water powers of the kingdom of Baden, has now been laid before the Landtag by the Government in the form of a draft Bill. The scheme, as previously stated, is estimated to cost some 30,000.000 marks, and will, when fully accomplished, supply power to the extent of 100,000 H.P. The high-pressure current will be distributed by long-distance mains from the station at Forbach to Mannheim, and will be used not only for lighting purposes, but for driving the machinery in the Mannheim railway workshops and at the harbour. The existing steam central stations at Karlsruhe and Mannheim will be incorporated. All political parties are unanimous as to its benefits, so that the realisation of the scheme is assured.

The Government of Baden, with the approval of the Landtag, have organised a department for water powers and electricity. The department will be entrusted with the development of water sources and the drafting of communal and other schemes for the utilisation of public and private water reserves. It will also advise public bodies in their negotiations with private supply companies, supervise current supply contracts, enact regulations against accidents, &c.—*Elektrotechnik u. Masch.*

NORWAY.—The *Industrie Electrique* learns that an important waterfall situated near one of the Norwegian fiords is in the market. It has a flow of 5 cb. metres per second from a height of 865 metres, and will develop 40,000 KW. The station, which may be built on the seashore, at the foot of the mountain down which the water will be conducted, will be well placed for the electric treatment of iron ore, the fiord being accessible to shipping at all seasons.

AUSTRIA.—A Vienna electrical engineering concern is interested in a project to put down a plant to utilise the water of the River Drau at Faal, near Marburg, in the generation of electrical energy for lighting and power purposes. It is stated that no less than 24,000 H.P. will be available.

SPAIN.—A concession has lately been granted to put down a plant to utilise the water-power of the River Noguera Rubagorzano at Traga de Nogueras (Province of Lerida) in the generation of electrical energy for lighting and power purposes in the district.

ITALY.—La Societa Electricita Riviera di Ponente (Negri), of Milan, is increasing its capital from £480,000 to £800.000, with the object of putting down a plant to utilise the water-power of the River Roja in the generation of electrical energy, and for the supply of the same to several sections of the State Railway system which are about to be electrified.

FRANCE.—The capacity of the power station of the Société de l'Energie Electrique du Nord de la France, of Roubaix, is to be increased to 40,000 H.P. by the addition of a new 10,000-KW. steam turbine and dynamo.

Crowborough.—The local gas company is applying for a prov. order for electric light in the parishes of Crowborough, Maryfield, Buxted and Hartfield, and those parts of the parishes of Rotherfield, Withyham, Frant and Speldhurst which are not within a four miles' radius of Tunbridge Wells.

Cwmamman.—The U.D.C. has decided to apply for a prov. order for electric light, and to engage Mr. Higgs, of Swansea, as electrical engineer at £5 per cent. on the outlay. As the result of a canvass, 389 probable private consumers have been secured.

Darton (Barnsley).—At the last meeting of the District Council the matter of the lighting of the township came up for discussion. It was stated that the General Purposes Committee had had a consultation with representatives of an electrical company and a gas company, the former undertaking to supply 154 lamps with electricity to burn 2,000 hours per annum, at a cost of 24s. per lamp per annum, or including maintenance charges, but not broken globes, 13s. to 15s. extra per lamp per annum; the estimated capital cost with overhead wires and a lamp on every other standard was £9 15s. 6d. per lamp for wooden poles, and £13 15s. 6d. per lamp for steel poles. The gas company was prepared to undertake to supply gas lighting, including all maintenance, for an inclusive sum of 35s. per lamp per annum. The matter has been referred from the Council to the Committee, and now resolves itself into a fight between the supporters of electricity and those who support the use of gas.

Darwen.—The new plant being put down at the electricity supply works, under the extension scheme prepared by Mr. C. Garnett, the Council's electrical engineer, includes one 1,250 KW. Dick, Kerr high-pressure turbine, coupled direct to a 3,000-volt three-phase alternator. Also a 300-KW. rotary converter by the British Westinghouse Co. A Rees Roturbo rotary jet condenser of latest type, giving a vacuum of 27¾ in. is to be installed, and a remote-control switchboard by Messrs. Ferranti.

Doncaster.—The T.C. is applying to the B. of T. for an order extending the area of supply under the E L orders of 1898 and 1912 so as to include the Urban Districts of Bentley-with-Arksey and Balby-with-Hexthorpe.

Douglas (Isle of Man).—The Special Electrical Undertaking Committee of the T.C. has recommended the establishment of a public electrical undertaking for the borough on the lines suggested in the report of Messrs. Handcock & Dykes, and that as current must be provided for the Villa Marina for the ensuing season, steps be taken with a view to carrying out a section of the scheme, so as to obtain the necessary supply of current.

Dromore (Co. Down).—A special meeting of Council was held on the 13th inst., for further consideration of the electric lighting scheme. It was explained that the special business was to consider a resolution that the Council should apply for a provisional order. The present system of public lighting was costing the Council £150 a year, representing £3,000 capital. The engineers (Messrs. Millar, Wilson & Pegg) had prepared two schemes, estimated to cost £3,200 and £3,600, and by adopting either the Council might count on a profit of, roughly, £300 a year, after payment of working expenses. On a vote, the resolution was adopted.

Ealing.—The B.C. has instructed the electrical engineer to obtain tenders for the immediate laying down of three new feeder mains, two to the Broadway and one along Mattock Lane, at an estimated cost of £4,000, this amount having already been sanctioned by the L.G.B. in a loan for mains and services; and also to prepare a specification, to be submitted to tender, showing the requirements with regard to the installation of a new switchboard at the works.

The desirability of the Council undertaking the outside lighting of small shops by means of incandescent lamps, at an inclusive price per annum, to include provision of lamps, fitting up, maintenance and supply of current, was fully reported upon by the electrical engineer last week, and a resolution was adopted agreeing to undertake such work at the following scale of charges:—200 C.P., £3 16s. 6d. per annum; 300 C.P., £5 15s., and 600-C.P., £9 13s.

The Chamber of Commerce has resolved to call a special meeting of Ealing electrical contractors to discuss the merits of what is known as the "Ealing clause" in reference to municipal trading, and also the proposal of the Borough Council to establish a showroom at the Town Hall for electrical apparatus. Mr. J. D. Knight, borough electrical engineer, while denying the fact that the Electricity Committee was competing unfairly with Ealing contractors, agreed that it would be very satisfactory to call a meeting and hear differences of opinion that might have arisen as to the "Ealing clause."

Earlestown.—The U.D.C. has decided not to proceed any further at present with the application to the B. of T. for a provisional order for electric light.

Elland.—The D.C. has decided to apply for sanction to borrow £1,000 for the purpose of the electricity undertaking.

Epsom.—With a view to adopting electrical pumping at the waterworks, the U.D.C. has decided to obtain an estimate of the cost of cable, motor, &c.

Felixstowe.—With reference to our note last week, we understand that the Electricity Co. has lost the public lighting, the decision of the Council being to give all the lighting it can to the local gas company at a somewhat higher price than the electric light tender for a period of seven years. The Electricity Co. is, however, to carry out the lighting of roads within 150 yards of the Promenade, which is, of course, now electrically lighted, this arrangement being part of an agreement with the Council dating from 1903.

Grange (Lancs.).—The U.D.C. has informed Mr. Thomas Wilkinson that it will be prepared to grant him facilities for supplying electricity in the district, subject to the arrangement of terms for the sale of the undertaking at the end of a term of years.

Gravesend.—A L.G.B. inquiry was held on November 12th by Mr. T. C. Ekin into the application of the T.C. for a loan of £10,000 for E.L. purposes, viz.:—Mains extensions, £8,000; house services, £1,200; coal store, £500; automatic stoker, £260; incidental expenditure, £40. A councillor opposed on the ground that too much capital had been expended on extensions to Northfleet.

Grimsby.—The Public Lighting Committee of the T.C. on Monday decided to recommend the installation of additional plant at the electricity works, at an estimated cost of £8,000.

Harold Wood.—The Electrical and Engineering Supplies Co, Ltd., has applied to the Romford R.D.C. for permission to erect electric lamps in the streets at Harold Wood, but the Council has replied that it has no power to grant the application.

Haywards Heath.—The U.D.C., on Monday, decided not to proceed with an application for a prov. order for electric light. This decision has been arrived at after consideration of expert advice.

Herne Bay.—The Gas Co. is applying to Parliament by Bill for powers to take over and work the electric light prov. order obtained by the U.D.C.

Hove.—The General Purposes (Lighting) Sub-Committee of the T.C. recently received a report prepared by Messrs. Handcock & Dykes, on the undertaking of the Hove Electric Lighting Co., Ltd., in regard to which the Council, on November 14th, decided by 17 votes to 16, to give notice of its intention to exercise its powers of purchase. The Hove authorities are at liberty, at the expiration of 21 years, to purchase the undertaking, buildings, works, machinery and plant of the company, either by:—(1) Paying the company the amount of the legitimate capital expenditure of the company, with such sum added as shall, with the profits previously made, and available for distribution as dividends, make up a total cumulative dividend of 7 per cent. per annum on the capital actually received by the company from the shareholders: or (2) on paying for the undertaking by valuation as a going concern, and not subject to the restrictions set forth in the second section of the Electric Lighting Act of 1888, the amount of such capital expenditure, or of such valuation, as the case may be, to be settled, in case of dispute, by arbitration. The original plant consisted of Lancashire boilers supplying steam to high speed engines direct coupled to Crompton dynamos together with a storage battery, the system of supplying being low-pressure direct-current on the three-wire system, the pressure supplied to the houses being 110 volts, or 220 volts between the outers of the mains. This plant has been considerably added to, and during the past year an exhaust steam turbine generator has been added at the Holland Road station. The capital expended on machinery and tools is £53,761, and on electrical instruments (which means practically switchboards and accessories) £2,914. The Holland Road plant, although in good order and capable of good work for several years yet, is antiquated; the Leighton Road station is much more conveniently arranged, and it was evidently intended by the company that it would gradually take the place of the Holland Road station. The maximum load on the combined stations at present is about 1,000 KW., the day-load in the summer falling as low as 70 KW., although it is probable that both figures will shortly be increased. The average cost of coal per unit sold throughout last year was 0·81d. This is a very high figure compared with stations worked with Diesel engines, and having a much smaller output. If the 1,139,328 units sold last year by the Hove Co. had only cost the same price per unit for fuel as at stations using crude oil engines, the total fuel costs, instead of being £3,865, would have been £1,380—a saving of £2,485 per annum. Dealing with new plant, should the Corporation decide to purchase the undertaking, Messrs. Handcock & Dykes recommend putting down Diesel oil-engine driven generators to take the long-hour load, keeping the present steam plant for the peak load, which only lasts quite a short time. They would propose to put in Diesel-driven sets to a total of about 600 KW., which, with the present steam sets, would give a total plant capacity installed of some 2,700 KW., and would meet all probable requirements for some time hence. This new plant should be installed at Leighton Road. The 600-KW. Diesel engines, together with the 490 KW. of condensing engines will take the main load. the Holland Road station being used as a battery sub-station, and to help during the winter peak. It would eventually be shut down as the original plant wears out, the exhaust turbine being then, or at an earlier date, transferred to Leighton Road. To carry out these alterations and additions would cost about £20,000. Assuming that the undertaking were purchased on the basis of "capital legitimately expended," the cost, according to last year's capital account, would be £174,998. In conclusion, and in dealing with the future, Messrs. Handcock & Dykes state that they understand that there are some 1,800 gas lamps in the borough. Should the Council decide to convert these to electricity, and spend the same annual amount for electrical energy that is now paid for gas, it should be possible, with the generating plant that will then be at their disposal, to give a somewhat improved public illumination, and, as a result of the increased output from the electric light works, to make a further reduction to the private consumers of 0·25d. per unit or more. Further than this, there is the question of electric traction within the borough. If this matures it would certainly be more advantageous financially both to private consumers and to the traction undertaking to supply energy for this from their own station than to keep the two separate, more especially as a multiplicity of generating stations in one compact area is not advisable. Electric cooking and heating would also provide a new source of revenue.

Ilford.—The U.D.C. has refused its consent to an application by the County of London Electric Supply Co., Ltd., for a prov. order to enable it to supply current in bulk in the district, and will oppose the application.

India.—Messrs. Crompton & Co. have entered into a contract with the Nagpur Electric Light and Power Co., for a complete plant to generate and supply electricity in Nagpur. Steam is to be generated by three Babcock water-tube boilers having a capacity of 5,000 lb. of steam an hour. The generating plant will consist of three Crompton direct-current dynamos, coupled direct to Belliss engines, two of 100-KW. output each, and one of 50 KW.—*Indian Textile Journal.*

A scheme is on foot for establishing a hydro-electric power station between Candy and Colombo, for the purpose of generating electric power in bulk for both industrial and traction purposes. Mr. H. R. Speyer, consulting electrical engineer, has been retained for formulating a scheme.—*Indian Engineering.*

Isle of Thanet.—The Westgate-on-Sea and Birchington Gas Co. is applying for powers to supply electricity in the parishes of Westgate, Birchington, Acol and St. Nicholas-at-Wade, all of which are in the area of the Isle of Thanet R.D.C.

Leeds.—The revenue returns for the half-year ending September 30th show that 9,628,779 units were sold as against 6,573,365 in the corresponding period of 1911, the revenue in the two cases being £46,047 and £39,097. Deducting working expenses ·48d. per unit as against ·52d., and the proportion of capital and interest charges in each case, there remains a deficit of £6,189 for the summer six months of 1912 as compared with a deficit of £7,200 for the corresponding period of 1911—the deficit during this period being, of course, more than covered by the larger returns of the winter months. The private lighting sales are now increasing normally, and the revenue shows an improvement of 7·3 per cent.; for power 6,213,824 units were sold at an average of ·188d. per unit, the motors supplied aggregating over 20,000 H.P. The motor units have increased from 306 to 325 per connected H.P. in the last half-year. A new item in the sales is 1,605,176 units to the tramways department, at the low figure of ·30d. per unit.

The Parliamentary Committee of the City Council has decided to recommend the Council at its next meeting to leave out of the Parliamentary Bill application for powers to acquire a new site for a new electricity generating station. The Committee also recommends that the clause seeking powers to run a railless trolley system of cars to Crossgates should also be omitted, and, therefore, the route will finish at Halton.

Liverpool.—In view of the importance of the electrical work and the small amount of time which could be devoted to it at the fortnightly meetings of the Committee, Councillor Gates suggested at the meeting of the Electricity Committee on Friday that a Sub-committee be formed to meet fortnightly alternately with the general body. They were, he said, faced with considerable developments electrically in the near future. Liverpool afforded great opportunity for the supply of electrical energy for power and lighting on a larger scale. It was decided to defer the matter for a week, to give time for consideration.

London.—Stoke Newington.—As from March 31st last the charge in respect of steam supplied by the refuse destructor for the generation of electricity is to be at the maximum rate of £1 per 1,000 units for all low-tension units delivered at Edward's Lane station—the minimum charge is £10 per quarter for water consumed—and the payment of the balance between such minimum and maximum rate to be subject to deduction of the extra cost of the bulk supply, consequent upon failure of the steam supply from any cause, each quarter to be calculated separately.

Newport (Mon.).—A L.G.B. inquiry was held on November 14th by Mr. T. C. Ekin into the application of the T.C. for a loan of £3,220 for electricity purposes. There was no opposition.

New Zealand.—The Whangarei B.C. has at last received the report of Mr. E. Parry, chief electrical engineer of the Dominion Public Works Department, on the proposal to generate electrical power by utilising the Wairua Falls. Mr. Parry is of the opinion that the Wairua Falls are capable of developing up to 1,500 H.P. without any outlay for storage of the waters, the only work necessary being to divert the river into a race. Mr. Parry has calculated that the construction of a race pipe-line, generating station, the transmission of the power to Whangarei, and its distribution for industrial purposes in the neighbourhood, would involve an outlay of £82,000. An annual revenue of £10,540 would, he considered, be required to defray expenses. Further, Mr. Parry estimates that a charge of £7 per annum would be the minimum rate at which power could be supplied in the bulk to power users. Consequent upon this information, the Whangarei B.C. intends to go into the matter again.—*Australian Mining Standard.*

Northwich.—The Weaverham Electricity Supply Co., Ltd., of Northwich, is giving formal notice of its intention to apply to the B. of T. on or before December 21st next under the Electric Lighting Acts, 1882 to 1909, for a prov. order authorising it to supply electricity for all public and private purposes in the parishes of Weaverham-cum-Milton, Acton, Cuddington and part of Oakmere, all in the Northwich rural district.

Peterborough.—At a recent meeting of the T.C., the electrical engineer submitted comparative data in respect of a turbo-generator and a Diesel generator for proposed extensions. He recommended the former, and was instructed to submit particulars as to the extension with that plant.

Port Glasgow.—Terms between the Greenock and Port Glasgow Corporations for a supply of electricity for all purposes to Port Glasgow have been signed. Greenock Corporation will give an immediate supply to large power users in Port Glasgow.

Shipston-on-Stour.—The B. of G. has referred to the House Committee the question of having the electric light installed at the Workhouse. Messrs. Brown & Parsons, of Leamington, who are carrying out a scheme in the town, have offered to lay the main to the gates of the institution free of charge.

South Africa.—An Oudtshoorn syndicate has acquired some 100,000 acres of land adjoining the Orange River, and, it is stated intends to utilise the falls of the river in hydro-electric development, with a view to electric pumping for irrigation, and for driving flour mills. According to a local paper, the Durban T.C. has been subjected to considerable criticism, because after initiating low tariffs for electric cooking purposes, and inducing consumers to adopt the new charges, it has now been found that the Council has no powers to secure a supply of cheap electrical ranges to be let out on the hire-purchase system, as was intended. Consumers will, therefore, have to secure their apparatus from electrical storemen, in regard to whom it is alleged that prices are kept unduly high. It has been arranged, however, for the Corporation to finance consumers, the hire-purchase system being continued, and apparatus will be supplied by contractors, who will give a two-year guarantee.

Sunderland.—At the recent L.G.B. inquiry in connection with the Council's application for the sanction of the Board to the borrowing of £37,207 for the purposes of the electrical undertaking, the Inspector suggested that the Council carefully consider a scheme by which the balance of the outstanding loans on the disused steam generating plant should be paid off at an earlier date than is provided for in the original sanctions. The Committee has given this matter very careful consideration, and recommends that the Board be requested to give its approval to the sale of the disused plant upon the following terms :—The proceeds of the sale, together with the interest thereon, to be paid into a separate "superseded plant account," until such time as the balance of the outstanding loans have been met. After reserving 20 per cent. to form a reserve or contingency fund, the net profits of the undertaking to be allocated to the credit of the "superseded plant account." This arrangement to be for three years, and to come up for reconsideration at the end of that period. The report of the Committee was adopted.

Taunton.—The T.C. has decided to purchase about 20 sets of electric cookers and apparatus for hiring out at rentals based on 10 per cent. per annum on the net cost.

The question of opening electricity showrooms and offices in the town has been deferred for a year.

Truro.—Sitting in committee on November 12th, the T.C. decided to apply for its own prov. order for electric supply.

As has been stated in the Electrical Review, orders are being applied for by the Gas Co. and others.

Wakefield.—It has been decided to utilise the tramway poles on Doncaster Road and Barnsley Road (by agreement) for carrying cables in connection with the supply of electricity to Belle View and Sandal.

Willesden.—A request for a supply of electrical energy for 250 H.P. was recently received by the Council in a portion of the district where no distributing cables were laid capable of dealing with such a demand. Estimates were prepared and submitted to the Electricity Committee, who decided to recommend to the Council the extension of H.T. mains and the erection of a temporary substation to deal with about four times the amount of the demand received. The Council met, confirmed the Committee's recommendation, and the plant was ordered within 10 days of the request being made. Something over 3 miles of H.T. cable was laid, and a 300-KW. rotary converter delivered 8 weeks later. This plant has now been put into operation, and is intended to supply energy for the new factories which are being built in the Park Royal district, where a number of valuable sites are still available. We congratulate the Council and its engineer, Mr. A. W. Blake, on this smart performance

Worcester.—After holding two special meetings to consider the proposals of the city engineer in regard to the electricity undertaking. The Electricity Committee has decided that application be made to the L.G.B. for sanction to borrow £7,400 for extending the boiler house at Hylton Road Station and providing a steam turbine and alternator. The total amount required is £7,650, which is made up as follows : Extension of boiler house, £1,200 ; extension of bunkers and coal-handling plant, £500 ; mechanical stoker for Powick boiler, £200 ; steam piping, valves, &c., £150 ; induced draught plant, £250 ; steam turbine-driven 1,000-KW. two-phase alternator, condenser, and necessary foundations, £5,100 ; new fittings for Powick boiler, with removal and re-erection, to be paid for out of revenue, £250.

Last May, the Council agreed to take over from Messrs. Heenan and Froude, 15 motors for £200. The Committee has now sanctioned an arrangement whereby 10 of these, of 195 H.P., are to be exchanged for 10 new motors of 240 H.P. from the Electric Construction Co., the Council paying the company £200.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Lomas Municipality has given its sanction to the concession for the construction of an electric tramway in Lomas, the concession being for 20 years.—*Review of the River Plate.*

Australia.—According to *The Standard*, Mr. Merz has been asked by the Western Australian Government to give his views on the development of the Perth tramway system. After an examination of the question, Mr. Merz has advised that certain extensions to the tramways should be made, and that a power station to supply energy for both tramways and railways should be established.

Birmingham.—The City Council has decided that application be made to the Light Railway Commissioners for an order under the Light Railways Act. 1896, authorising the construction and working by the Corporation of a light railway, joining up the Halesowen light railway, with the line from Balden Road to Bearwood, sanctioned by the order of the Corporation obtained this year.

Brighton.—It is proposed, on the recommendation of the Tramways Committee, to make provision in the Corporation Parliamentary Bill for power to equip railless traction routes from St. George's Road, *via* Montague Place, to Kemp Town Goods Station entrance.

Clydebank.—After negotiations lasting several years, the plans for tramway bridges over the Forth and Clyde Canal at Dalmuir and Kilbowie have been passed by the Dean of Guild Court. Of the expense to be incurred, Glasgow Corporation pays £11,000.

Continental Note.—Germany.—A scheme is at present under consideration for the construction of an electric railway between Griersdorf, Arnsdorf and Steinseiffen, Silesia.

East Kent.—The B. of T. has confirmed the order made by the Light Railway Commissioners authorising the construction of light railways from Wingham to Stodmarsh, and from Great Mongeham to Ripple in the new colliery area.

Folkestone—Sandgate.—The National Electric Construction Co. has approached the Folkestone T.C. and the Sandgate U.D.C. on the question of the construction of tramways or a railless traction system. Both Councils have decided not to consider any scheme by which overhead wires would be used.

Halifax.—The Tramways Committee has decided to introduce a motor-'bus service between Mytholmroyd and Cragg Vale within five weeks of the date of the Royal Assent to the Bill, which it is promoting in the next session of Parliament. From Councillor C. W. Greenwood the Committee has received an offer of a personal guarantee of £100 through the Mytholmroyd D.C. Should there be a loss the service will be continued until the £100 is exhausted.

Huddersfield.—The Corporation has approved of the tramway extension scheme from Elland to West Vale. A subcommittee has been authorised to confer with the Elland D.C. in regard thereto, and application is to be made for the necessary Parliamentary powers. It has also been decided that in the proposed Bill, powers be inserted for the running of railless trolley vehicles from the present terminus at Outlane to the borough boundary.

Ilford.—A report upon the desirability of applying for powers to extend the electric tramways through the Cranbrook and Grange Estates is to be prepared by the tramways manager.

Keighley.—The T.C. has discussed the recommendation of the Tramways Committee to accept the offer of the Trackless Trolley Co., London, to construct overhead equipment for the proposed railless traction system from Ingrow Bridge to Haworth, at a cost of £1,610. A resolution of acceptance was carried.

Leith.—The Provisional Order for the new Lothians (electric) Railway is now prepared. It is on a more ambitious scale than the previous one, which was dismissed earlier in the year. A syndicate of coalmasters and others are promoting this new railway, with the main object of getting direct and quick service from the collieries in Mid and East Lothian to the docks at

Leith. A departure has been made in the drafting of this Provisional Order now in hand by meeting objections that the new line would be practically a private line. It will in addition to working the coal traffic also take passengers and goods. The principal line will be from the fishing village of Cockenzie to Leith Docks; and there are mapped out six branches or short communication lines to collieries off the main route. The plans, therefore, are on a larger scale than the previous proposals debated before a Committee of the Lords in the spring of this year, when the preamble of the Bill was found not proved. Electric power is to work all the traffic, and this will necessarily be on an important scale. This new Lothians Railway will compete with the North British Railway.

Lepton (near Huddersfield).—The U.D.C. has appointed a deputation to interview the Huddersfield Tramways Committee, to ascertain whether the Committee would be prepared to extend its tramways to Grange Moor.

Liverpool.—The new type of double-deck electric tramcar, designed for the use of the Corporation service by Mr. C. W. Mallins, general manager of the tramways department (already described in the ELECTRICAL REVIEW), was inspected on the route on Friday last by the Tramway Committee, and is understood to have given general satisfaction. The feature of this car is that a separate entrance and exit are provided, with two staircases running in opposite directions for ingress to and egress from the upper deck. A barrier rail divides the incoming and outgoing passengers, and also forms a recess for the conductor to stand in, with suitable checking apparatus for the collection of fares.

London.—According to the daily papers, the Metropolitan District Railway is to undertake alterations and improvements at Earl's Court Station, in connection with which the Ealing electrical services will be operated in future without obstructing those to Wimbledon. The estimated cost of the work is £70,000.

London Railway Amalgamation.—It is officially announced that the Central London and City and South London tube railways will in future form part of the Underground Electric Railways system, and that arrangements have been concluded between the Metropolitan Electric Tramways, Ltd., the Tramways (M.E.T.) Omnibus Co., and the London United Tramways, Ltd., for the consolidation of the interests of the shareholders in these companies by the formation of a new company, and also by the London General Omnibus Co. for the control of the 'buses of the Metropolitan Co. By this scheme the underground obtains control of the only two unabsorbed electric tube lines in London, but parts with the management of the London United Tramways, which, under the proposed amalgamation with the Metropolitan Tramways, will be under the management of Mr. James Devonshire.

In the circular issued to the City and South London shareholders, it is pointed out that that line is suffering severely from competition, and that the board has agreed to promote a Bill in the next session of Parliament for the widening of the tunnels and the provision of the necessary capital for the work, and for new rolling stock and electrical equipment. It is stated that the new concern will control capital of over £23,000,000.

Some of the clauses of the Metropolitan Railway Bill are of interest, having regard to its acquisition of the Great Northern and City tube. It is proposed to make a connection between the latter and the Metropolitan Co.'s Liverpool Street station, and an extension to Princes Street, where the Waterloo and City tube would be joined, the South-Western Co. being associated with the Metropolitan in the scheme.

Morocco.—Application has been made for a concession to construct and work an electric tramway in the town of Melilla.

Nottingham.—The Corporation is promoting in Parliament this month a Bill authorising an extension of its running powers outside the city boundaries. Under the scheme provision is made for the introduction of an electric 'bus service for West Bridgford, and, in view of the Royal Show in 1915 at Woolaton Park, the laying of a tramway in Derby Road as far as Woolaton Park Gates.

Stirling.—The directors of the Stirling and Bridge of Allan Tramways, one of the few systems still relying on horses, are at present considering the adoption of a system of mechanical traction. According to Mr. Brand (Glasgow), the chairman, they have not arrived at any absolutely definite result, and are still negotiating with companies and makers of mechanical traction machines which they think will suit them better than new tramcars. Last year's traffic receipts were £4,542.

Tasmania.—The Bill which was to have enabled the Hobart City Council to take over the tramway service of the Hobart Tramway Co. was rejected in the Legislative Assembly by 15 votes to 13, there being a strong feeling that the Government and not the City Council should own the tramways.—*Australian Mining Standard.*

TELEGRAPH and TELEPHONE NOTES.

An All-British Atlantic Cable.—On Friday last Mr. Charles Bright, F.R.S.E., gave evidence before the Royal Commission on the resources of the Empire as to the necessity of a State-owned Atlantic cable, connecting the United Kingdom with Canada, and so with the Pacific cable to Australia and New Zealand. He also advocated the provision of cable communication with the Cape landing only on British territory, pointing out in each case the strategic importance of national control in time of war. Wireless telegraphy should, in his opinion, be used as an auxiliary means of communication between the different parts of the Empire. As was well known, the use of cipher codes for the purpose of ensuring secrecy was quite ineffective.

Australia.—The wireless telegraph stations at Fremantle and Port Adelaide were opened for public service on September 30th.

France.—A small wireless installation suitable for an aeroplane, and actually used with success during recent French army manœuvres, seems worthy of serious attention. It is made on the Rouzet system, by the Soc. Industrielle de T.S.F. et Elec and using high-frequency current produced on a new principle, gives superior results, being exceedingly regular in working, with reduction of weight and bulk. A biplane fitted with this equipment can maintain communication with a station on the ground while circulating around it aloft to distances embraced by a radius of 100 kilometres. It draws only 250 watts from the motor driving the biplane, and weighs no more than 30 kg.—*L'Industrie Electrique.*

German Islands.—A wireless scheme to link up the islands of the Bismarck Archipelago with Sydney has been arranged, and the first instalment of the plant has reached Rabaul, in New Britain. The station will be on the Telefunken system, and will be of high power, capable of calling up the Pennant Hills station near Sydney, or Yap, in the Caroline Islands.

Germany.—The German cruiser *Göben*, at Constantinople, is said to be in wireless communication not only with wireless stations in Germany, such as Norddeich, on the coast of East Friesland, but also with the flagship *Deutschland*, in home waters.

Imperial Wireless System.—As briefly mentioned in our last issue, on Wednesday last week the evidence of Mr. Beech Thomson, president of the Federal Wireless Telegraph Co., of America, was taken by the Select Committee on the Marconi Agreement. He said they were transmitting on the Poulsen system 2,000—2,500 words daily from San Francisco to Honolulu, with 24 KW. They began this service on October 20th this year. In the daytime they could work over 1,400 miles. His company had developed several valuable patents since it commenced operations, and very important improvements had been made in the last six months. If the negotiations in progress with the English company were concluded, it would have the right to use the patents worked by his company in America. He had refused to make any contract with the United States Government until the system was perfected. The continuous wave that his company was using was more reliable than the spark system. He admitted that the United States Government had made no contract with the company, and that its future relations with that Government depended entirely on whether the Government was satisfied with the working of the instruments when they were installed. After 8.30 a.m., the signals from Honolulu grew faint. He had not been in America since October 20th, when the regular service was first established. His system was not the same as that which was offered to the British Government by the Poulsen representatives. The Marconi Co. had brought two lawsuits against his company, which were still pending.

On Thursday Mr. Thomson was further examined, and said he was certain be could give a reliable 24-hour service over 2,000 miles. He would be prepared to erect 6 stations round the world, 2,000 miles apart, within 8 months, all in working order. He stated that American wireless experts held that if the art had not been controlled by Marconi greater progress would have been made; that the spark system on which Marconi was working could never be developed for high-class work, and that the damped-wave theory contained unlimited possibilities. The group of men with whom he was associated represented a capital of at least 100 million dollars. They would have been glad to tender for the chain of Imperial stations at £60,000 per station on the basis of "no play no pay," giving a 24-hour service. The capital of his company was five million pounds. He refused to produce a balance-sheet and to answer questions about his company's capital.

On Monday Sir D. de V. Graaff, Minister of Posts and Telegraphs of the South African Union, gave evidence on behalf of his Government, which, he said, was in complete accord with the Imperial Government on the subject, and cordially approved of the arrangements that had been made. His Government attached great importance to the fact that the Marconi Co. alone was carrying on a continuous long-distance service, and would not take part in any scheme which involved experiments and delay. The experts in South Africa stated that the Marconi system was the only one that could cover the distances. After hearing Mr. Thomson's evidence, he certainly would not support the giving of the contract to his company under the present conditions. It was the strategical aspect of the scheme that interested his Government. He hoped there would be a double wireless connection with South Africa—on the west coast as well as the east. Asked whether it would be reasonable for the Government to suggest that the Marconi Co. would not be allowed to use their patents unless they agreed to terms dictated by the Government, the witness said certainly not. After having heard Mr. Thomson's evidence, he was more than ever disposed to give the contract to the Marconi Co.; Mr. Thomson's system was still "in the air."

Sir Alex. King was recalled, and said that the probable revenue per station was estimated to be over £31,000, making for the six stations about £200,000 a year, on the assumption that there was sufficient work to occupy the stations 24 hours a day at the specified rate. He vehemently protested against the manner in which he was questioned by one member of the Committee as though he were a prisoner—and repeated that to say to the company "if you do not accept our terms we will not give you any licence" would have been dishonest.

Japan.—An official of the Japanese Department of Communications has been appointed to visit Great Britain, to investigate works connected with electricity and Post-Office work.

Norway.—The Government has approved of the agreement between the Norwegian Telegraph Bureau and the Marconi Co. for the establishment of a long-distance wireless station.

South America.—Wireless communication between Lima, on the west coast, and Para, on the east coast, has been successfully established across South America by the Berlin Telefunken Co. The whole distance is 2,113 miles across virgin forest, the Andes, nearly 20,000 ft. in height, intervening. Telegrams handed in at Lima are sent by wireless direct to Manaos, a distance of 1,367 miles, and thence again by radio-telegraphy to Para, a distance of 745 miles.—*Australian Mining Standard.*

United States.—The wireless station erected by the United States Navy Department at Fort Meyer, Arlington, Va., which, when completed, will represent an investment of over £200,000, was tested on the night of October 28th, when messages were sent to the Key West and Colon stations. It is expected that the station will possess a sending radius of 3,000 miles under ordinary weather conditions. Its most striking feature is the three steel towers, connected at their tops by a series of 23 wires, from which the messages will be radiated and received. The towers are arranged 400 ft. apart at the corners of a triangle around a central receiving and sending station. The westernmost of these towers is 600 ft. high and 150 ft. square at the base, while the other two towers are 450 ft. high and 120 ft. square at the base. The wireless equipment in the station, although built especially for the navy, is not entirely new, having been in use at the Fessenden station at Brant Rock, Mass., in 1910, where it was subjected to exhaustive tests for a period of over eight months. The equipment comprises a 100-kw. motor-generator set, energy for driving which is purchased from the Potomac Electric Power Co., of Washington. At the end of the motor-generator shaft is a synchronous rotating spark-gap.—*Electrical World.*

Wireless in War.—It is stated that the Turkish wireless station near Smyrna was destroyed by the Italian cruiser *Pisa* on April 20th, and spectators declare that about 200 shots were fired for that purpose. As a consequence, no radiographic station on the coast is in the hands of Turkey in the present war, though the Turkish warships are partly equipped with old types of Marconi apparatus. Shortly before the outbreak of the present war, the Ottoman Government obtained two modern portable stations on the Telefunken system, and these were at once dispatched to the scene of operations. On the other hand, the Balkan States have provided themselves with a sufficient number of portable stations on the Telefunken, Marconi, and Poulsen systems, together with plant made by the Société Française Radioelectrique, of Paris. The stations at Athens and Varna, which are equipped with the new type of Marconi apparatus, are able to communicate with one another, and their range extends over the whole of the scene of war. It is said that these two land stations are of special importance for the co-operation of the land and naval forces, as 13 Greek warships are fitted with apparatus of the latest type, and wireless stations are also installed on most of the Greek and Bulgarian merchant steamers. The range of the ship stations is such that the vessels are able to get into communication with the land stations at Athens and Varna at any time.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. Six electrically-worked luggage lifts for the Aberdeen Joint Station Committee. Engineer, Mr. J. A. Parker, 80, Guild Street, Aberdeen.

Austria.—Drohobycz.—November 30th. Tenders are required for the supply for the year 1913 of the following materials: 500 metal-filament lamps, 350 carbon lamps, 3,500 arc lamp carbons, 200 kg. of plain copper wire, 500 m. of insulated copper wire, 200 m. of lustre wire, 100 porcelain insulators, 10 electric hand-lamps, and 100 safety switches. Further particulars of the Direktion der K.k. Mineralöl Fabrik, Drohobycz, Austria.

Ayr.—The T.C. invites tenders for the supply of about 220 tons of steel grooved tramway rails and fishplates. Mr. J. Young, Town Buildings, Ayr.

Australia. — South Australia. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" November 1st.

December 18th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" November 8th.

December 17th.—Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

Victoria.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

January 24th, 1913. Two 1,000-kw. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" to-day.

New South Wales.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" November 1st.

Tenders were recently invited by the Sydney Municipal Council for the installation of a storage battery in the neighbourhood of King and Macquarie Streets. The invitation has temporarily been withdrawn, but tenders will be again called for in the near future.—*Tenders, M. and E. Review.*

Balderton, Notts. — December 14th. The Parish Council invites tenders for an electrical installation for street lighting, consisting of the necessary lamp standards, posts, overhead conductors, incandescent fittings, insulators, brackets, &c. Particulars from the Clerk, Balderton Parish Council, 7, Osborn Terrace, Balderton, where a complete plan, showing the proposed positions of all lights and course of cable, can be seen by appointment.

Belgium.—November 26th. La Société de l'Exposition de Gand, 1913 (Rue des Moineaux), Ghent, is inviting tenders for the installation, maintenance and working during the period of the Exhibition, of the pumps, electric motors and piping required in connection with the cascade in the Court of Honour.

Birmingham. — November 25th. Electric motors (various), for the City Electric Supply Department. See "Official Notices" November 8th.

Brussels.—Offers required for the supply of telegraph cables and fittings. The special terms are contained in form No. 1,189, to be had on application. Deposit 1,300 fr. Musée Commerciale, Brussels.

Dartford.—November 27th. 500 yd. of concentric lead-covered and armoured cables and accessories, and renewal of lighting battery, for the U.D.C. Electricity Department. See "Official Notices" November 15th.

Eastbourne.—December 16th. 99 long-burning flame arc lamps for street lighting, and purchase of 99 open-type double-carbon lamps to be displaced, for the Corporation. See "Official Notices" to-day.

Edinburgh.—November 23rd. Electric lighting installation at the Store Cattle Byres, Cattle Market, Georgie. Specifications, &c., at Engineer's Office, Dewar Place, Edinburgh (deposit £1 1s.).

Gravesend.—December 2nd. High-tension cables, for the Corporation. See "Official Notices" to-day.

Halifax.—December 3rd. Two water-tube boilers, with superheaters and mechanical stokers, for the Corporation Tramways and Electricity Committee. See "Official Notices" to-day.

Hungary.—December 31st. The municipal authorities of Perjamo (Torontal Komitat) are inviting tenders for the establishment of a central station for the supply of electrical energy for public and private lighting and power purposes in the town.

Leeds.—December 2nd. Electrical equipment required for combined centrifugal sewage pumps. Mr. G. A. Hart, Sewerage Engineer, 26, Great George Street, Leeds. (Deposit £10, returnable).

London.—Hackney.—December 12th. Open type and flame arc lamp carbons, for the B.C. See "Official Notices" to-day.

New Zealand.—December 16th. Two 150-b.h.p. Diesel engines, two 100-kw. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture only.

Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

January 6th, 1913.—Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Portugal.—By a decree of the Minister of Public Works, a Commission has been appointed for the building of a new head post, telephone and telegraph office in Lisbon. The staff of inspectors for the electrical industry will also be lodged in the same building. Should the scheme be realised, there will be a large demand for electric apparatus. Firms seeking to secure orders should apply to the General Administration of Posts and Telegraphs, Lisbon. —*Electrotechnische Nachrichten.*

Rathmines.—November 25th. Electric wiring of the new Carnegie Library and Technical Institute, for the Rathmines and Rathgar U.D.C. Specification 10s. 6d., can be seen or obtained at the Council's electricity works.

Rimini (Italy).—November 26th. Offers required for the supply to the workshops at Rimini of an electric truck.

Spain.—November 30th. Tenders are being invited by the municipal authorities of Calanas for the establishment of a central electric lighting station in the town.

November 30th.—The municipal authorities of Finisterre (province of Coruna) are inviting tenders for the concession for the electric lighting of the town during a period of four years.

Trimdon Grange (Co. Durham).—December 7th. Electric fittings for a year, for the Trimdon Grange Colliery. The Storekeeper.

Vienna.—December 9th. Tenders are required for the supply and erection of an electrically-worked locomotive turntable in the Mährisch-Ostrau-Oderfurt railway station. Particulars of the K.k. Nordbahndirection, Vienna.

Wigan.—November 25th. Uniform clothing for the Corporation tramway employés. Mr. F. Buckley, tramways traffic manager.

CLOSED.

Atherton (Lancs.).—The U.D.C. has accepted the tender of the British Westinghouse Co., Manchester, for a 250-K.V.A. transformer.

Australia.—The following contracts have been placed, according to the *Australian Mining Standard*:—

MELBOURNE.—P.M.G.'s department:

Rubber-insulated copper conductors.—Australian Metal Co., Ltd., £3,615.
Copper wire, braided.—B.I. and Helsby Cables, Ltd., £530.
Rubber-insulated copper wire.—W. T. Henley's Telegraph Works Co., £6,263.
Instruments (measuring).—Western Electric Co., Ltd., £127.
10,000 stoneware insulators.—Commonwealth Art Pottery Co., £104.
Material for wireless telegraph stations.—Inglis, Smith & Co., £108.

BRISBANE.—P.M.G.'s department:

170 miles wire.—Brabant, £585 and £1,445.
374 yd. cable.—B.I. and Helsby Cables, Ltd., £301.
990 yd. cable.—W. T. Henley's Co., £256.
100 iron poles.—Stewarts & Lloyds (Australia), £437.

HOBART.—P.M.G.'s department:

Common-battery switchboards.—Bartram & Son Pty., Ltd., £318.

SYDNEY.—P.M.G.'s department:

Switchboard for Peterham Exchange.—Western Electric Co. (Australia), Ltd., £4,646.

ADELAIDE.—P.M.G.'s department:—

Telephone switchboards.—J. Bartram & Son and Western Electric Co.
10 miles wire.—Theodore Zwicker & Co., £203.
10 miles copper wire.—Noyes Bros., £174.
50 miles tinned copper wire.—W. T. Henley's Co., £545.
200 common-battery telephones.—Western Electric Co., £372.

Brighton.—The T.C. Electricity Committee recommends the extension of the agreement with Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of Wotan lamps for side-street lighting.

Dewsbury.—The Dewsbury and District Infirmary Board has accepted the tender of Messrs. Wadsworth & Co., at £280, for a new electric lift.

Doncaster.—The Electricity and Tramways Committee has accepted the following tenders:—

Albion Motor Co.—Motor chassis, £559. } For motor tower wagon.
Rawlinson's Motors.—Tower and lorry body, £96. }
Hadfield's Steel Foundry Co.—Specials in connection with Bentley tramway extension, £254.

Glasgow.—The T.C. has accepted the following tenders for tramways department requirements:—

Commutators.—British Westinghouse Co., Ltd.
Special work.—Hadfield's Steel Foundry Co., Ltd.
M.F. lamps.—Wm. C. Yuille & Co., Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric crane.—J. Carrick & Sons, Ltd.
Telephones.—Spagnoletti, Ltd., West London Scientific Apparatus Co.
Electrical transporter.—John M. Henderson & Co.

INDIA OFFICE, STORE DEPARTMENT.

Cables.—Siemens Bros. & Co., W. T. Henley's Telegraph Works Co.
Generating set.—Lancashire Dynamo & Motor Co.
Insulators.—Marconi's Wireless Telegraph Co.
Mouthpieces, &c.—Peel-Conner Telephone Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Telephone cable.—British Insulated & Helsby Cables, Ltd., W. T. Henley's Telegraph Works Co.
Submarine cable.—Telegraph Construction & Maintenance Co.
Tubular poles, &c.—Siemens Bros. & Co.
Pole parts.—Francis Morton & Co.

OFFICE OF WORKS.

Lifts and cranes for new Stationery Office for Office of Works stores.—Aldous and Campbell, Ltd.

G.P.O.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., British L.M. Ericsson Manufacturing Co., International Electric Co., London Electric Wire Co. and Smiths, Ltd., Peel-Conner Telephone Works, Ltd., Siemens Bros. & Co., Western Electric Co.
Wood arms.—Millar's Timber & Trading Co.
Electric light cable.—J. Frankenburg & Sons, Ltd.
Telephonic cable.—British Insulated & Helsby Cables, Ltd., Callender's Cable & Construction Co., W. T. Henley's Telegraph Works Co., Johnson & Phillips, Ltd., Siemens Bros. & Co., Western Electric Co.
Stoneware ducts.—Albion Clay Co.
Electric light fittings.—General Electric Co.
Telegraphic ironwork.—Bullers, Ltd.
Telegraphic wire.—India-Rubber, Gutta-Percha & Telegraph Works Co., London Electric Wire Co. and Smiths, Ltd.
Wireless station, Valentia Island, Ireland.—Patrick Murphy.
Equipment of Edinburgh Central Telephone Exchange.—Western Electric Co.

Keighley.—The T.C. has accepted the tender of the Trackless Trolley Co., Ltd., for the overhead equipment for trolley vehicles from Ingrow Bridge to Haworth (1 mile 1,400 yd.), at £1,610, on condition that a car shall be sent on trial for three months, and that if the system is considered to be unsatisfactory, the company will, free of charge, alter the equipment and adapt it to such other method of current collection as the T.C. may require.

London.—L.C.C.—Consequent upon the Council's reference back of the Highways Committee's recommendation to accept a tender by Messrs. J. Batt & Co., for foreign-made driving-wheel tires and pony-wheel tires (as already reported), the Committee now recommends tenders for acceptance as follows:—

Cammell, Laird & Co.—5,000 driving wheel tires, at £1 4s. each.
Henry Bessemer & Co.—5,000 pony wheel tires, at £1 1s. each.

Nuneaton.—The T.C. has accepted the tender of Callender's Cable & Construction Co. for cable for extensions, at £97.

Ramsbottom.—The U.D.C. has accepted the tender of Messrs. Stewarts & Lloyds for poles and fittings required for the overhead equipment in connection with the tramways.

Salford.—Messrs. Quilliam Bros. have received an order from the Corporation tramways for four Collins' patent automatic point turners with patent mercury stuffing box.

Sunderland.—The T.C. last week accepted the following tenders:—

General Electric Co.—27 flame arc lamps.
E. Cleaton, Rees & Co.—Oil.
W. G. Farrow & Co.—Tubing and bends.
India-Rubber & Gutta-Percha Co.—Cable.
British Insulated & Helsby Cables.—E.H.T. cable.
Albion Clay Co.—Two-way conduit.
British Westinghouse Electric & Manufacturing Co.—Wattmeters.

Watford.—The B.G. has accepted the tender of Messrs. Rogers & Gowlett, Ltd., of Watford, for electric wiring, &c., at the workhouse.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 22nd. At Newcastle. Conversazione.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, November 25th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Heating and Cooling of Electrical Machinery," by Mr. P. Grice.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, November 26th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Individual Electric Driving in a Modern Weaving Shed," by Mr. S. N. C. K. Whitehead.

Faraday Society.—Tuesday, November 26th. At 8 p.m. At the I.E.E., Embankment, W.C. Papers on "The Billiter Alkali-Chlorine Cells," by Mr. A. J. Allmand; and "Note on the Electrolysis of Nitric Acid Solutions of Copper," by Mr. J. H. Stansbie.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, November 27th. At 7.30 p.m. At the University, Birmingham. Paper on "Earthed *v.* Unearthed Neutrals on Three-Phase A.C. Systems," by Mr. J. S. Peck.

Institution of Electrical Engineers (London).—Thursday, November 28th. At 8 p.m. Paper on "Earthed *v.* Unearthed Neutrals on Three-Phase A.C. Systems," by Mr. J. S. Peck.

Association of Engineers-in-Charge.—Saturday, November 30th. Social. Dance.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION)

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, November 25th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 26th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, November 28th.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 29th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, November 30th.—"D" Company. Run with portable searchlight set, at 3 p.m., for work on Wimbledon Common. "A" Company.—Run at Fort Coalhouse. Parade at Fenchurch Street Station at 3 p.m. Dress: Service dress, puttees and greatcoat.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

The Electrical Engineers' Ball. 1913.—The tenth annual Electrical Engineers' Ball will be held at the Hotel Cecil on Friday, January 31st. The Banqueting Room and the Supper Rooms have been redecorated since last year, and the dancing floor has been relaid. Mr H. Glemster's Band has again been engaged for the occasion. The following gentlemen have consented to serve on the Committee:—

Alabaster, H.
Anderson, A. Bruce
Bailey, F.
Baldwin, O. H.
Belfield, R.
Berry, H. H.
Blunt, W. W.
Bowden, J. H.
Brousson, R. P.
Browett, T.
Brown, C. S. Vesey
Byng, Leonard
Callender, Jas.
Cramb, A. C.
Davenport, F. R.
Dobson, Sydney
Dunlop, D. N.
Elder, T. C.
Ferranti, S. Z. de
Fox, E. J.
Garcke, E.
Gatehouse, T. E.
Geipel, K.
Geipel, W.
Gray, Jas.
Gray, R. Kaye
Grote, E. R.
Hadley, A. E.
Hawes, F. B. O.
Hammond, R.
Hill, Charles
Highfield, J. S.
Hirst, H.
Holden, Col. H. Capel
Hooper, John P.
Huddleston, J. Snow
Kingsbury, J. E.
Leaf, H. M.
Leigh, F. A. C.
Madgen, W. L.
Matthews, W. Lee
Mordey, W. M.
McMahon, P. V.
Murray, Lee
Nalder, F. H.
Nash, E. A.
O'Meara, Major
Partridge, G. W.
Pearson, Hugh A.
Railing, M. J.
Roberts, Martin F.
Rosenthal, J. H.
Rutherford, W.
Rowell, P. F.
Sharp, Sydney
Shepherd, J.
Siemens, Alex.
Sillar, A. M.
Scholey, H.
Sparks, C. P.
Steinitz, J. J.
Sutton, G.
Taylor, J.
Wallis-Jones, R. J.
Wordingham, C. H.

Executive Committee: Baldwin, O. H.; Fox, E. J.; Madgen, W. L.; McMahon, P. V.; Shepherd, J.; Wallis-Jones, R. J.; Wordingham, C. H.

Hon. Secretaries.—Alabaster, H.; Sillar, A. M.

Hon. Treasurer: Kingsbury, J. E.

Inquiries.—A correspondent asks where "Saterite" insulating material can be obtained. Makers of the "Defiance Resistance" and "Marmorite" are asked for.

Manchester Electro-Harmonic Society.—We have received from the musical director a programme of the second concert of this newly-formed Society, to be held on Friday, November 29th. From a musical point of view it is splendid, and brings back to our minds the old days of the London Electro-Harmonic Society, when Haydn, Mozart and Mendelssohn quartets and trios, Bach's double concerto for two violins, Maurer's concertante for four violins, &c., were welcomed and thoroughly enjoyed. Part singing, too, was then made a feature, and what can give greater pleasure to a cultured musician who can follow something more than mere melody, the soul of music though it be, unless it is Chamber music? But, alas! *Tempora mutantur, et nos mutamur in illis.* The taste of late years, amongst the younger people, at all events, is all for the variety and lightness of the halls, a new turn every five or ten minutes, and in a programme of but 11 items, to perform two complete instrumental trios, would be enough to clear the King's Hall, although in the early days members, who are no longer to be seen at these concerts, were keen supporters of the classical side of the Divine Art. We can only express the hope that Mr. Smith will be able to retain the high standard he has set; we must "wait and see." It may be added that the Manchester Society will be specially pleased to welcome any London friends.

"Northampton" Past Day Students' Association.—The winter programme of this Association opened with a very successful whist drive at the Furnival Hall, Holborn, last Friday evening. The N Ions (for such is their name) duly arrived in couples, but electrolysis soon started, and dissociation followed in the usual way. The next meeting is the annual reunion of country members on Saturday evening, December 28th, at the Northampton Institute.

Glasgow Electricians' Strike.—On Saturday at noon 500 electrical workmen in the employment of various Clydeside shipbuilding firms struck work. The present maximum rate is 8½d. per hour, and the men demanded an increase to 9d. Three firms, Messrs. Brown & Co., Clydebank, W. Beardmore & Co., Dalmains, and the Fairfield Co., Govan, all of whom have pressing Admiralty contracts on hand, agreed to concede the advance, but the other firms refused. A strike as stated was declared, and the majority of the electricians have come out; there were no indications of a settlement at the time of going to press.

Rheims Congress of Electroculture.—The first International Congress of Electroculture and applications of electricity to agriculture and agricultural industries, was held at Rheims, from October 24th to 26th, under the presidency of M. Lonay. M. Berthault represented the Minister of Agriculture, and M. Gautier the Academie des Sciences. Delegates from Russia, Hungary, Belgium and Luxemburg were also present.

Several papers were read on electroculture, the first being an historical review by Lieut. Basty, who has tested a number of methods, including those of Paulin and Schtchawinsky, in his gardens at Angers, and who has invented a *petit paratonnerre* and *dynamocapteur*—the first being on the point-collector principle, and the latter employing a zinc-copper couple connected by a wire. According to M. Basty, the growth and maturity of plants are hastened, and a finer crop is secured, by the application of the above methods; germination is accelerated by the passage of a very weak current. On the other hand, M. Kövessi has found the passage of D.C. through soil in which grain is sown, to retard and impair germination—particularly in the neighbourhood of the electrodes. M. Pilsoudsky reported very favourable results from the use of iron-zinc couples on a very large scale in the south of Russia.

M. Blondin described the manufacture of nitrogenous manures from atmospheric nitrogen:—(1) By the formation of cyanamide from calcium carbide; (2) by the formation of an aluminium nitrate which is converted to ammoniate, and then to ammonium sulphate; (3) by the use of a high-tension spark discharge. The latter process is operated on a huge scale in Norwegian works, and M. Blondin communicated numerous details of working.

M. Fillet dealt with electric ploughing as practised in various parts (chiefly colonial). A temporary or trailing supply cable is employed, and the plough is hauled to and fro between trucks (one of which may simply act as an anchor), at opposite sides of the field. Electric motors are now quite suitable for this duty, and require little upkeep. Under certain conditions, it is advantageous to erect private generating stations.

M. Leclerc communicated his experience with electrically-driven root and chaff cutters, &c.—machines which require low power, and work only 200-250 hours per annum. Threshers require up to 10 H.P. It may be assumed that a farm consumes about 10 KW.-hours per acre per annum for lighting and the operation of "indoor" machinery. The advantages in favour of large distribution networks from large central stations were explained.

M. Escard discussed the application of electricity to the sterilising of food stuffs (butter, flour, &c.) and water, and to the bleaching of flour and the dissipation of fogs.—*Génie Civil.*

Fatalities.—Leeds.—Mr. J. C. Malcolm, the Leeds City Coroner, on Monday held an inquest on the body of Edwin Howgate (17), of Maud Street, who was found unconscious in a burning cellar in the Fox and Grapes Yard, Kirkgate, on Friday afternoon. He was taken to the infirmary, and died before admission.

Benjamin Howgate, smallware dealer, Kirkgate, the tenant of the cellar, stated that fumes and smoke were issuing from the cellar when he was called to it. He found no sign of a blaze, however, but he noticed the electric motor buzzing. He inquired for his nephew, the deceased, who understood the working of the motors, but no one knew where he was. Witness went to find him, and on returning met his brother, who told him the lad was in the cellar dead. Two men brought him up in an unconscious condition. Witness also said that the cellar had been flooded a few days ago owing to the stoppage of a sewage pipe. The medical evidence showed that the condition of the body was quite consistent with its having received an electric shock.

Mr. Albert Jones, electrical engineer, said the coils of the motor were completely burnt out, and had no doubt been blazing. As a result of the flooding the coils had been soaked through. They became connected electrically with the motor frame, and immediately the current was put on the motor it would either blow the fuse or burn up the coils. The latter evidently occurred, and the machinery had been made so that anyone touching it would receive a severe shock.

The jury returned a verdict of "Accidental Death."

South Staffs.—The County Coroner held an inquest at Bilston on Monday relative to the death of Frederick Rigby (18), which had occurred at the Spring Vale Works of Alfred Hickman, Ltd. The evidence of an electric crane driver named Frank Schofield went to show that the deceased youth had been working an electric controller for some months past, and he was regarded as a capable operator. On the night of the 15th inst. Schofield went to ask Rigby a question, and found him leaning on the controller. He did not speak, and Witness switched off the current, whereupon Rigby fell to the ground. He was picked up, but death took place within a few minutes. There was a burn on the youth's left forearm, and witness came to the conclusion that he must have sustained it on the guard or on the contact. Replying to Mr. Haslam, who represented the firm, witness said there was a wooden platform from which the controllers should be worked. The iron plate on which Rigby was standing was on the other side of the controller and Rigby should not have been on it. Dr. John Wells, who had made a post-mortem examination, said he could not attribute death to anything, but having heard the evidence as to the burn on the forearm, he considered the youth was killed by an electric current having passed through him.—William Wetherall, electrical engineer at the works, said the wood platform was the proper place from which to work the controller. The latter was tested immediately after the accident had been reported, and it was found to be all right. The jury found that Rigby was killed by an electric shock, the result of an accident, and suggested that there should be more protection for the men. Mr. Haslam said the firm were willing to carry out any suggestion approved by the factory inspector.

A 2,000-B.H.P. Single-Cylinder Diesel Engine.—From time to time we are permitted to penetrate a little into the semi-secrecy with which Continental Diesel engine builders surround their development of the large Diesel engine. Our contemporary, *The Motor Ship*, in its last issue, published a view of a complete 2,000-B.H.P. single-cylinder Diesel engine in Messrs. Krupp's works, which is the first photograph that we recollect having seen of a complete engine of this type. We gather that as much as 2,500 B.H.P. has been developed in its single cylinder, which is of the two-cycle double-acting type. Views have, of course, appeared of large Diesel engine cylinders, but the cylinder alone does not constitute an engine.

Concert.—The Lamp and Wiring Supplies Department of the British Thomson-Houston Co., Ltd., held a smoking concert at The Cannon, Walbrook, E.C., on Tuesday evening last, Mr. J. N. Stephens presiding.

Appointment Vacant. – Assistant to mains superintendent, for the Greenock Corporation Electricity Department (50s.). See our advertisement pages in this issue.

The Light Railways Bill.—In the House of Commons on 18th inst., this Bill, as amended in Standing Committee, was considered, and Mr. Robertson moved to omit Clause 2 giving power to the Light Railways Commissioners to authorise railless trolley systems. The result would have been, says the report in the *Times*, to leave matters connected with railless trolley systems in exactly the position which they had previously occupied. "It seemed desirable that questions of responsibility for road maintenance should be dealt with in a general and systematic manner." The voting for the clause was 134, and against 315—majority against 181. An amendment to Clause 6, moved by Mr. Robertson, was described by him as "practically a drafting amendment, designed to meet the fear expressed in Committee, that the local authorities would be under no check," and it was carried by a majority of 177.

Prize Distribution.—The distribution of prizes and certificates at the Borough Polytechnic Institute takes place on Monday, December 2nd, at 8 o'clock p.m. Sir Albert Spicer, M.P., will make the presentations.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—At the opening meeting of the session on Thursday last week, Dr. Ferranti presented the premiums awarded for papers read during the past session, and announced that Prof. S. P. Thompson had presented a medallion of William Gilbert to the Institution. He then read the list of names of the members of the Industrial Committee, which are as follows:—Mr. Duddell, F.R.S. (President I.E.E.); Mr. H. Hirst (Chairman of the Committee); Messrs. A. B. Anderson, G. Balfour, G. H. Bowden, D. N. Dunlop, S. Z. de Ferranti, E. Garcke, F. Gill, Godfrey Isaacs, H. C. Levis, C. H. Merz, R. K. Morcom, W. M. Morrison, S. Morse, A. H. Preece, H. Faraday Proctor, W. Rutherford, A. H. Seabrook, A. Siemens, Dane Sinclair, C. P. Sparks, A. H. Stanley, A. de Turckheim, F. J. Walker, and H. E. Wimperis.

Dr. Ferranti then vacated the chair, and Mr. Duddell, the new president, read his inaugural address. In moving a vote of thanks, Mr. W. M. Mordey spoke of the excellent work that had been accomplished by the president, not only in electrotechnics but also in the service of the Institution, and Sir John Gavey, who seconded the motion, described how Mr. Duddell, on receiving from him the suggestion that some means of measuring the excessively weak currents received in wireless telegraphy was urgently necessary, in the course of a few weeks succeeded in devising a satisfactory instrument, and thus overcame one of their greatest difficulties.

PHYSICAL SOCIETY.—At the meeting held on November 8th, a paper "On a Method of Measuring the Thomson Effect" was read by Mr. H. R. Nettleton. In this paper an investigation is made of the distribution of temperature along a conductor conveying an electric current and at the same time moving uniformly through two fixed temperature sources. The effect of the Thomson heat on the distribution is seen to be exactly similar to the effect of a small impressed velocity. This result is applied to mercury to measure the Thomson effect.

A paper on "An Improved Joule Radiometer and its Applications" was read by Mr. F. W. Jordan. An abstract of this was given in our last issue.

A paper on the "Thermomagnetic Study of Steel" was read by Dr. S. W. J. Smith. Thermomagnetic measurements make it increasingly evident that the magnetic properties of steels are frequently those of mixtures of magnetic substances, each possessing characteristic properties, which contribute in a comparatively definite way to the properties of the material as a whole. In the case of a simple ferromagnetic substance, magnetising fields can generally be found in which the permeability variation with temperature is comparatively small except in the neighbourhood of the critical temperature. In such fields there is a very clearly marked peak in the permeability temperature curve for the substance. The explanation of this peak which the molecular theory affords is well known, and suggests that the phenomenon should be found common to all ferromagnetic substances. The immediate object of the paper is to show that it is exhibited by the carbide of iron (cementite) which exists in annealed carbon steels.

ILLUMINATING ENGINEERING SOCIETY.—At the meeting on Tuesday last, the hon. secretary, Mr. Leon Gaster, reported on progress made during the past few months. Reference was made to the importance now attached by the Home Office to the subject of the lighting of factories, to the work done at the International Congress held in Milan last May in connection with the prevention of industrial accidents, and to the lighting of mines and miners' safety lamps. Papers were also read on "Ancient Forms of Lamps" (Mr. J. W. Johnston), "A New Illumination Photometer" (Mr. Haydn T. Harrison), "Some Simple Colour Boxes" (Mr. W. C. Clinton), "Photography in Illuminating Engineering" (Messrs. J. S. Dow and V. H. Mackinney), and "Miners' Lamps."

ROYAL SCOTTISH SOCIETY OF ARTS.—"Electric Projectors and Some of their Uses" was the subject of a paper read by the vice-president, Mr. Alex. Ogilvie, B.Sc., at the annual general meeting. Mr. Basil A. Pilkington, for his paper on "Some Recent Improvements in Electric Single Wiring, with Special Reference to the Author's Terroid System," was awarded a Makdougall-Brisbane prize, value £5.

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).—A meeting of the Section was held on Tuesday, when Mr. J. S. Peck read a paper on "Earthed *v.* Unearthed Neutrals on A.C. Systems." A discussion followed, and was replied to by the author.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH SECTION).—On the 12th inst. the opening meeting of the session was held, and the chairman, Mr. W. McWhirter, gave his inaugural address.

LIVERPOOL UNIVERSITY ENGINEERING SOCIETY.—On Tuesday last week Mr J. S. Peck, consulting electrical engineer to the Westinghouse Co, Ltd., of Manchester, read a paper on the design of high-voltage long-distance transmission plant.

JUNIOR INSTITUTION OF ENGINEERS.—At a recent meeting a paper was read by Mr. A. H. Tyler on "The Application of CO_2 to Refrigeration." It was pointed out that CO_2 had much to recommend it as a refrigerating medium, as it was inexpensive, generally obtainable and safe to handle, being inodorous and harmless.

ELECTRICAL ASSOCIATION OF NEW SOUTH WALES.—According to the *Australian Mining Standard*, the annual meeting of the Association was held at Sydney last month. At the conclusion of the ordinary business a paper was read by Mr. Burgess (newly-elected president) on "Some Notes on Electric Heating and Cooking."

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—A meeting of the West of Scotland Branch was held on Saturday last at Glasgow, when an interesting paper was read by Mr. A. Campbell King, colliery manager, Wallhouse, Linlithgowshire, on "The Electrification of a Small Group of Collieries." The author held that if current had to be distributed over fairly long distances, it ought to be at a pressure of 3,000 volts or thereabouts, alternating two or three-phase, and he would use this in the mine at a voltage of 450 or 500, either alternating or direct current. It was to be regretted that a fair proportion of electrical accidents happened with coal-cutters. He thought that compressed air was the ideal motive power for coal-cutting machines; but in order to obviate the loss in transmission of power, he would use a motor-driven compressor situated at a convenient distance from the face and thence lead air pipes to the gate ends. This system would allow coal-cutting to be carried on under conditions where electrical coal-cutters could not safely be operated owing to gas. A coal-cutter was not an ideal subject for electrification, because the conditions under which the motor had to work were anything but satisfactory, owing to vibration and dust. Next to compressed air, however, he held that the D.C. was better than the A.C. machine. In the earlier days of the electrification of collieries he had seen very shoddy electrical plant and fittings supplied. An attendant would keep a motor or generator in better condition if it came to a colliery decently finished and substantially made.

Discussion was thereafter resumed on the paper read by Mr. A. B. Muirhead, Lenzie, at the last meeting, on "Notes on Electricity, Rule No. 7." It was announced that a smoking concert under the auspices of the branch would be held in Glasgow on Saturday, December 14th.

INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN SECTION).—The inaugural meeting of the Western Section was held at the Engineers' Institute, Cardiff, on Monday, when Mr. W. A. Chamen delivered his inaugural address, of which we give an abstract on another page.

A dinner subsequently took place at the Park Hotel, and was well attended, the chairman being supported by the Lord Mayor of Cardiff, Mr. A. P. Trotter, of the Board of Trade, Mr. W. N. Lewis, chairman of the Cardiff Chamber of Commerce, Mr. W. Judd, Mr. W. McWhirter, chairman of the Scottish Section, Mr. Faraday Proctor, Mr. Arthur Ellis, and many other well-known gentlemen.

The loyal toasts having been duly honoured, Mr. W. D. Wight, in a happy speech, proposed "The Institution of Electrical Engineers and the Western Section." Mr. W. Judd responding, congratulated the Western Section upon its inauguration. He said it was thought in London that the Institution was in a flourishing condition. The hard work of the past few years was now likely to bear fruit. The result of a great deal of consideration was to give the Institution a handsome and commodious habitation, with the object that it should not only add to the dignity of the Institution, but should also be a centre for electrical work. Steps would be taken very soon to form a lending library in connection with the Institution, so that members from the provinces might see valuable works of reference. It would, he believed, be without doubt the finest electrical library in the world, and would be a very valuable asset. All the misunderstandings between the central body and the local sections were now cleared away, and a feeling of friendship and solidarity had been established. The new president was imbued with progressive views, and there were other schemes before the Council, and a good deal of work was being done.

Mr. W. A. Chamen, who also responded, said it was the desire of the Council to make the Institution really a useful power throughout the land. There was a fear, a little time back, that small societies would be formed in the provinces, and particularly in South Wales, and the only result of that would be the formation of another unit, which would take away some of the power and force which might be available to the great parent Institution for carrying through its measures, and there was undoubtedly a very effective power behind a large body of people who were united. London understood the feeling in the provinces to the full, and wished to encourage them in every possible way; and down in Wales they desired the assistance of all electrical engineers who had not yet become members. There was between 260,000 and 300,000 H.P. of motors working in the Western district, but in spite of that only about 213 members of all grades had joined, and a very small amount of reflection would show that there was something wrong in that, for there must be a great number of people who were eligible, and who ought to join. Arrangements had been made for holding meetings if necessary in the remote corners of South Wales, as well as at Cardiff and Bristol, in order to get the electrical profession generally interested in the work of the Institution.

Mr. W. McWhirter then proposed the toast of "The City of Cardiff," to which the Lord Mayor suitably responded.

Mr. W. North Lewis, in proposing the health of the Chairman, said that South Wales and the West of England were looking forward to great electrical developments in the near future.

Mr. Chamen briefly returned thanks.

During the evening a capital musical programme was gone through, the artistes being Miss Mabel Mander, Mr. Granville Tate and Mr. Sam Taylor. Madame Mander Fox, R.A.M., was the accompanist.

Institution of Electrical Engineers (Yorkshire Local Section).—The second general meeting of the session will be held at the Leeds University, on Wednesday, December 4th, at 7.15 p.m., when a lecture will be delivered by Prof. J. Goodman on "Roller and Ball Bearings." A plain tea will be provided at the University, between the hours of 6 p.m. and 7.15 p.m., at the rate of 6d. per head, for the convenience of members who desire to fraternise.

Lecture.—Mr. O. Cooke, of West Moors, on Monday last week, entertained a large audience, assembled under the auspices of the Wesley Guild, Wimborne, with a lecture on electricity.

Holborn Public Lighting.—Referring to the article in connection with the Holborn public lighting, which appeared in our issue of the 15th inst., Mr. J. S. Highfield writes to point out that the reflectors used in the lanterns were not of his design, as there stated. The lanterns were designed by him, but the form of reflector employed is that designed by Mr. Haydn Harrison, and used by him in several of his lanterns, and Mr. Highfield wishes to take the earliest opportunity of pointing out that to Mr. Haydn Harrison is due this ingenious form of reflector.

The Cliff Lift at Scarborough.—At the annual meeting of the Scarborough Central Tramways Co. on Wednesday—the company controls a lift from the top of the cliff to the bottom—the chairman remarked that the cost of electric power had been very satisfactory. The power was converted from steam to electricity about two years ago. The chairman added that they used to pay for coke, when running the old engines, as much as £44, but last year the cost was only £20 for electricity and coke. The number of passengers booked for entertainment places was 40,678, against 23,546 the preceding year. The total number of passengers carried was 204,082, and the number of trips 32,211. The chairman added that theirs used to be a 6 per cent. dividend-paying concern, but the street tramways had hit them hard. They were now again on the up-grade, and the dividend had risen from 2s. to, this year, 3s. 6d. per share (£5).

Staff Dance.—In connection with the Newcastle-upon-Tyne Electric Supply Co., Ltd., a Staff Dance was held at the Heaton Assembly Rooms, Heaton Road, on Friday evening, November 15th. Mr. and Mrs. R. P. Sloan received the guests at 7.45 p.m., and dancing continued from 8.15 p.m. to 1 a.m. There was a total attendance of about 240, which included a large number of staff members from the various departments, and also several former members of the company's staff. The organisation was in the hands of a representative committee. The rooms were tastefully decorated; music was by Mr. R. Jackson and orchestra, and the catering by Mr. T. Hall. Special travelling accommodation was provided at the termination of the dance, to convey people to the coast, Benton and the neighbouring districts.

Pulling the Trolley Cord.—Albert Ashwin was summoned at West Ham for interfering with the trolley cord of a tramcar. He is reported as saying that he unwittingly "touched the wrong string." He was fined £2 and £1 1s. costs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric traction and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. L. H. Cumberland, assistant charge engineer at Hampstead, has resigned, in order to take up an appointment as charge engineer at Dewsbury Corporation Electricity Works.

The Watford U.D.C. has appointed Mr. T. Hollins junior shift engineer, as assistant mains superintendent, vice Mr. R. S. Savory resigned.

Mr. A. Mercer, outside superintendent at the Gravesend Corporation Electricity Works, has resigned.

At Nelson Town Council, last week, the resignation of Mr. Rennie H. West, the chief clerk in the electricity department (who is leaving for Manchester), was accepted; Mr. Ralph Wilmore was promoted to the position of chief clerk.

The Tunbridge Wells T.C. has granted an additional remuneration of £30 to Mr. J. Bemrose, chief assistant electrical engineer, in respect of the satisfactory services rendered by him whilst in charge of the undertaking from August 20th to October 14th.

Mr. C. H. Tritton, of Gillingham, has been appointed to the post of shift engineer at Watford electricity works.

Tramway Officials.—Mr. W. Binns, engineer and manager of the Corporation tramways at Reading, has accepted an important appointment at Para, Brazil. Mr. Binns went to Reading from Newcastle-on-Tyne in 1903. The T.C. on November 14th decided to grant 100 guineas to Mr. Binns as remuneration for extra and special services rendered in connection with the tramway undertaking.

Consequent upon the resignation of Mr. Binns, the T.C. has appointed Mr. G. F. Craven, chief assistant engineer, as general manager and engineer of the tramways, at a salary of £400 a year; Mr. Jas. McLennan Calder, tramways works assistant, as chief assistant engineer, at £180 a year, rising by £10 per annum to £200; and Mr. Francis Harry Glover, engineering assistant at the depôt, as works assistant at £150 a year, rising by £10 per annum to £180.

After holding the position of engineer and manager at the Devonport and District Tramways for about four years, Mr. C. W. Durnford has left that borough to take up the appointment of manager of Sheerness and District Electric Light, Power and Traction Co., and has been succeeded at Devonport by Mr. George Cardwell, formerly general manager of the Hartlepool Electric Tramways Co. Before leaving for Sheerness, Mr. Durnford received a parting gift from the employés in the shape of a rose bowl.

General.—Following upon the recent municipal elections in Glasgow, changes have taken place in the convenerships of the Tramways and Electricity Committees. The new conveners and sub-conveners are:—Tramways: Bailie Robt. Kirkland, convener; Bailie James Alston, sub-convener. Electricity: Bailie Wm. B. Smith, convener; Councillor W. H. Hanway, sub-convener.

The directors of the Chelsea Electricity Supply Co., Ltd., have appointed Mr. W. R. Davies to be chairman of the company, and Mr. Stanley Beeton to fill the vacancy on the board caused by the death of Sir Irving Courtenay.

At the fortnightly meeting of the Nenagh Urban Council, last week, Mr. Louis Lawless was appointed electrical engineer for the purpose of supervising the erection of an electric plant for Nenagh. There were three applicants for the position.

Mr. Howard, borough electrical engineer at Taunton, has been appointed Lecturer in Electrical Engineering at the Borough Technical Institute.

After 42 years' service in the Postal Telegraph Department of the Post Office, Mr. H. R. Kempe, the Electrician to the Department, retires at the termination of the present year.

The Council of the Chartered Institute of Secretaries has elected Mr. F. J. Walker (St. James' and Pall Mall Electric Light Co., Ltd.), treasurer; and Mr. A. F. Harrison (City of London Electric Lighting Co., Ltd.), a member of the Council.

Mr. Harold D. Symons has resigned his position with the British Westinghouse and Manufacturing Co., Ltd., in order to take up the management of the European business of the Sterling Varnish Co. Mr. Symons's appointment dates from the 1st inst.

Mr. Councillor F. Denning, J.P., and Mr. Councillor J. O. Pelton, J.P., have been elected chairman and vice-chairman respectively of the Croydon Corporation Tramways Committee.

We are informed that Mr. James Walker is about to join the staff of Messrs. Böving & Co., Ltd., water power engineers, and will also join the board of directors. After a lengthy experience with the contracting firm of Messrs. S. Pearson and Son, of Westminster, he was engaged by Messrs. J. G. White and Co., Ltd., with whom he has been for the last nine years, acting as construction superintendent on large works abroad, and latterly as engineer-in-charge of construction in the head office in London. With his wide experience in hydro-electric undertakings and civil engineering work in general, he will be a great acquisition to the firm. Mr. Reginald K. Morcom has also consented to act on the board of Messrs. Böving & Co.

Mr. Alfred H. Gibbings, of Buenos Ayres, is now in this country on a short business visit.

Councillor James Heald has been re-elected chairman of the Lancaster Electricity Committee of the T.C.

CITY NOTES.

Allgemeine Elektrizitäts Gesellschaft.

The report of the directors for the year ended with June 30th. 1912, recommends, as was mentioned in this journal on November 1st, the payment of a dividend of 14 per cent., being the same rate as in the preceding year. During the year the turnover and orders on hand largely exceeded expectations, and the extension of the company's organisation to almost all parts of the world suggested that a year of general industrial development both at home and abroad would afford increased possibilities of work. In addition, the supply of current from large central stations to large districts was rapidly progressing and placed exceptional demands on the capacity of the workshops. In order to meet these requirements, considerable extensions of the works became necessary, and these had been partly carried out and were partly proposed. Large funds were needed for the acquisition of sites and the erection of buildings thereon, the extension and perfection of works equipment, the financial participation in undertakings in accordance with the economic problems. and the share taken in the capital increase of the Zurich Bank for Electrical Enterprises. It was proposed to widen the financial basis of the undertaking in order to maintain the "liquidity" desirable for the working programme. According to the announcement made in the report for the previous year, 4½ per cent. bonds for £1,500,000 had been issued and the incidental costs of £53,000 had already been written off in the accounts for 1911-12. It was now intended to make an emission of new shares to the nominal amount of £1,250,000, the major portion of which would be offered to existing shareholders by the company's banking group in the proportion of one new share for seven present shares. The accounts show the following figures, those for 1910-11 being added for the purpose of comparison :—

	1911-12.	1910-11.
Ordinary share capital	£6,500.000	£6,500,000
Loan capital	3,987,000	2,517.000
Gross profits	1.405,000	1,257,000
General expenses	43,000	38,000
Taxes	85,000	101.000
Depreciation	35,000	32,000
Net profits...	1.187,000	1.085.000
Reserve fund	150,000	118,000
Bonuses	45,000	42,500
Pension fund	45,000	42,500
Dividend	910,000	805.000
,, per cent.	14	14
Carried forward	36,000	32,000

It should be explained that the rate of 14 per cent. applies to the whole of the ordinary share capital, whereas in 1910-11 new capital of £1,500.000 only participated to the extent of 7 per cent. The gross profits are stated to have been solely derived from manufacturing, whilst those realised from financial transactions are. as usual, not disclosed. As new machinery, tools and patterns have been completely written off as in former years, it is naturally assumed that a portion of the financial profits has been devoted to this purpose, and to any further depreciation that may be necessary other than the sum of £35.000 set forth in the table; and the remainder of the profits from this source has been allocated to the undisclosed reserve fund. It is noteworthy in this connection that apart from the comparatively small holding of Government and municipal loans, a yield of 10·8 per cent. was obtained on the book value of the securities in portfolio. The open or disclosed reserve fund, with the present addition of £150.000, becomes increased to £3,250,000, or one-half of the ordinary share capital.

The report proceeds to state that the deliveries effected by the machinery works, comprised 118.205 machines, and transformers of a total of 2,529,000 H.P., as compared with 92,186 of 2,385,869 H.P. in 1910-11. These figures do not include the turnover at the company's work in Vienna, Riga and Milan, which raises the grand total to 133,499 machines and transformers of 3,620,000 H.P., as against 92,470 of 2,830,000 H.P. in 1910-11. A new development at the Berlin works related to the electrical equipment of submarine boats with a special type of motor and switching apparatus. The prices realised by the turbine works showed a slight improvement, and the steam turbines delivered numbered 312 of 735,648 H.P., as contrasted with 284 of 441,467 H.P. in the previous year. A new speciality was the introduction of boiler feed pumps driven by turbines, and a large number was already in operation. The degree of activity in the arc lamp factory was about the same as in 1910-11, whilst a further favourable development took place in the meter department, notwithstanding declining prices.

The Oberspree cable works were so well occupied that by the adoption of double and triple shifts it was possible to execute the increased orders. The company's consumption of copper advanced from 27,034 tons in 1910-11 to 31,326 tons last year. Concerning metal-filament lamps, the report mentions that the turnover expanded by 80 per cent., and the production had to be permanently extended. On the other hand, the sale of carbon lamps declined under the operation of these circumstances. The comprehensive extensions made by iron and steel producers afforded abundant employment to the company's department for large machines, and the demand for these units continues at the present time. The rolling mill motors delivered and under construction comprised 385 of a total of 680,000 H.P., whilst an increased business was transacted in mining plant. After referring to central stations and tramway work, the report states that two turbo-dynamos, each of 10,000 KW., are about to be started by the Victoria Falls and Transvaal Power Co. and two further units of 12,000 KW. are expected to be brought into operation by the end of this year. The total capacity of the plant supplied by the company to the Victoria Falls Co. will then have reached 230,000 H.P. It is added that the total number of employés is 70,162, as compared with 60,818 a year ago, and 6,551 and 5,454 in the two years respectively are engaged at the works in Vienna, Riga and Milan.

Provincial Tramways Co., Ltd.

Mr. Andrew Beattie presided on Friday last over the ordinary general meeting of this company held at the offices, Moorgate Station Chambers, E.C. In moving the adoption of the report (see Electrical Review, page 800) he said that at the last annual meeting he had the pleasure of presenting an excellent report which was attributed to the very fine summer. The net receipts on that occasion amounted to £36,434, as compared with £33,454 in 1910, an increase of £3,000. It was then stated that the directors were afraid that it would be difficult to keep up to that high water mark. However, the net profits for the year under review were £30,061, which was only a small decrease of £393. That was more than accounted for by the increases in the price of coal, wages, and the company's contribution under the National Insurance Act. Their increased expenditure was considerably more than the decrease in the net profits. It would, therefore, be seen that this year was even better than last year, which was the second best in the history of the company. The directors further desired to point out that the summer of 1911 was a most exceptional one, whereas this year was positively wet, and altogether most unfavourable for tramway traffic. He need scarcely point out that such adverse conditions affected tramway enterprises at seaside towns more than those at inland centres. He asked the shareholders to congratulate themselves on the year's earnings. The directors were more than pleased at the satisfactory results. It showed that a progressive tramways company was directed by men of experience. The dividend of 7½ per cent. was the same as last year. During the past year the directors had given special attention to the question of motor-omnibuses. There were several points in favour of omnibuses as compared with tramways. The cost of running was cheap; there was no track to lay down, and, consequently, a saving in capital expenditure; no wayleaves to pay to local authorities; no payment demanded by local authorities in regard to widenings or improvements of streets; no local authorities calling attention to the state of the track or roadway, and the 'buses could take up passengers close to the footway. It would be seen that the advantages were great, and it would be found the disadvantages were few now that the motor-'buses had reached a point near perfection. In view of these facts, the directors had instituted a service of omnibuses, and with advantage to the company. They did not fear competition from the outside. They were quite alive to all that was going on, and they proposed increasing the number of motor-omnibuses. The fact of having these motor-'bus services would enable the company at any time, if they thought local authorities were unreasonable in their demands for wayleaves or taxation, to be more independent than hitherto. The best relations existed between the company and the different local authorities. They carried out their agreements in the spirit and the letter, and they believed their policy was recognised and reciprocated. The directors had also had under consideration the question of taking upon themselves third-party risks. The premium paid to the insurance company was a little over £1,000, and the actual amount they had been called upon to pay for accidents was £280. That had been about the average for the past four years. It would, therefore, be seen that had the company taken the risks themselves there would have been a considerable saving. It had been thought that if the company could form a reserve of £6,000 at the rate of £1,000 a year they might take the third-party risks. The directors took different views upon the subject. It had to be remembered that should there be a serious accident it would mean a big draw on the company's resources. In the event of no such accident the shareholders would, of course, realise the benefit of saving the premiums which would otherwise go to the insurance company. At present matters were in *status quo*. Turning to the balance-sheet, the chairman pointed out that it did not disclose any details; such information, however, could be obtained by any shareholder. It was to the dividends that the shareholders really looked, and he hoped that the present state of things would continue. He had no reason to suppose that there would be any change. The company was never in a more healthy condition, and he was not without hope that it might be more prosperous than in the past.

Mr. S. Hern seconded the motion, and remarked that they felt it was in the interests of the shareholders that they should take steps to take advantage of the motor-omnibus traffic. The directors felt they must not be behind the times.

The report was adopted.

The following resolution was also carried: "That the company be authorised to run motor-omnibuses or cars, motor char-a-bancs, or other mechanically-propelled vehicles either in connection with the tramways or otherwise."

Richard Hornsby & Sons, Ltd.—The directors announce a dividend on the ordinary and new shares of 6¼ per cent., less income-tax, for the year ended September 30th, placing £10,000 to reserve account, and carrying forward £3,877.

Amazon Telegraph Co., Ltd.

MR. GEO. KEITH (chairman) presided on Monday at the offices 42 Old Broad Street, E.C. over the eighteenth ordinary general meeting of the above company.

In moving the adoption of the report (see ELEC. REV., page 756), the CHAIRMAN said their business in the Amazon had been quiet and not so active as it was during the previous year, when owing to the exceptionally high price of rubber, and the political troubles in Manaos, there was remarkable increase in the traffic passing over the cables. The rubber statistics showed that the crop last year was the largest ever gathered, but prices were low and steady, which caused a decrease in the number of telegrams required for market quotations. Fluctuations of exchange also always brought in a large number of telegrams but that also was reduced by the steadiness of the exchange during the year. All this had had a corresponding effect on the year's business. The traffic receipts showed a decrease of about 15 per cent. as compared with those of the preceding year, but were 25 per cent. more than the year before that. Interest on the year's cash balances also brought in £669 more, and the total revenue, including the subsidy, came out at £104,444, or £14,080 less than last year. The expenses at stations showed an increase of £1,290, mainly due to the placing underground of the landlines at Para and Manaos. Establishment expenses had been increased by the additional expense of the new steamer *Ramos*, which went out to the Amazon last June. Surveys and trench cable for the renewal and extension of the Lago Grande cable between Santarem and Parintins had also increased the miscellaneous expenses. On the other hand, the cost of cable used during the year showed a large decrease, and the total expenses attending maintenance and cable showed a decrease of £1,353. The aggregate of the other items of expenditure also showed a decrease, whilst the usual depreciation hitherto written off the *Viking* was omitted and included in the special reserve now established for the renewal and maintenance of cable steamers. Altogether the working expenses amounted to £51,199, or £3,746 less than last year. As regarded the other charges against the year's revenue £15,000 had been paid in debenture interest, but no charge had yet been made for the half-yearly redemption, which commenced this year, and would form a charge on the revenue of the current year. £15,000 was added to the general reserve fund for the maintenance of the cables, and £12,000 was applied to the special reserve for the maintenance of the cable-ships. After meeting these charges and the working expenses the directors were able to recommend the payment of a dividend of 4½ per cent. for the year, leaving £5,664 to be carried forward. Their cables were working well and gave the Government and the public a rapid service. They were still difficult and costly to maintain in the main river of the Amazon, especially when the river was full, but even in that respect the position was gradually being improved. Every opportunity was taken to remove the cable to any side water which could be found suitable for the purpose. Their new small steamer *Ramos* greatly facilitated this work, and removed the delays and difficulties which had hitherto been experienced in effecting shallow water repairs. The *Ramos* was also capable of taking the place of the larger steamer *Viking* if repairs in the main river had to be attended to when that steamer was not available for the work. All this should ensure, as far as possible, the efficient maintenance of the cables, and the perfect working of the business. This year business in the Amazon continued good, and the traffic receipts up to date compared favourably with those of last year. On the 1st inst. their local rates were considerably reduced, but they hoped to recoup this by a satisfactory increase from that traffic during the coming rubber season. He might also mention that the automatic reduction now made in the rates reduced some of the lower ones more than should be, and he hoped the Government would grant a reconsideration of this and of other unnecessary restrictions which acted unfairly on the successful working of the service.

MR. E. B. ELLICE CLARK seconded the motion, and the report was adopted without discussion.

United River Plate Telephone Co., Ltd.

SIR FREDERICK GREEN, J.P., presided on Tuesday over an extraordinary general meeting of the shareholders of this company, held at Winchester House, E.C. In proposing a resolution increasing the number of the directors to six, and the appointment of Mr. George Franklin to a seat on the board, the chairman said the vacancy had been brought about by the lamented death of the late chairman, Sir Irving Courtenay. Sir Irving was one of the original directors when it was a small affair and not very prosperous. For 21 years he had been chairman, and during his tenure of office the company had gone on by leaps and bounds, and he had not the slightest hesitation in saying that it was largely owing to the late chairman's ability and zeal that the company had been brought to its present flourishing position. That had been recognised on the other side of the world as well, for they had received a letter from Dr. Drago, the chairman of the Local Committee in Buenos Ayres, stating how greatly they appreciated Sir Irving's visits to them. He never spared himself in his work for the company, and he absolutely refused to obey the doctor's orders and take things more quietly. All his colleagues on the board greatly regretted his death, and how great his loss was, was quickly found out when they tried to fill his place. He (the chairman) had no doubt that on the board they had sufficient ability to fill the position of chairman, but for one reason or another they had not found it possible among themselves to elect a gentleman who would, in their opinion satisfactorily fulfil the requirements and do the work which Sir Irving Courtenay had been doing so successfully for the last 21 years. They, therefore, had to look abroad, and he thought they were to be congratulated that they had found Mr. George Franklin, a gentleman whose name stood in the front rank in the telephonic world, able and willing to come on the board. As they knew, Mr. Franklin was the chairman of the National Telephone Co., which had lately been bought by the Post Office, and it was under those circumstances that Mr. Franklin was free to come to them with the view of acting as chairman. He could assure the shareholders that there was plenty of work to do, and although he had no figures, he could tell them that good progress was being made, and they wanted a man of the energy and ability of Mr. Franklin to carry on the work. They found that the authorities in the River Plate were getting more and more exacting, but notwithstanding that, when they met next year he believed they would find the figures satisfactory. There was one pleasing incident connected with Mr. Franklin's proposed election, and that was that their colleague Sir John Gavey, who was an old friend of Mr. Franklin's and who had been employed by the Post Office to fight their battles against the National Telephone Co., had been very much struck by the ability with which Mr. Franklin was fighting the case for the company. They were the two champions, one on either side, and the fight had been so protracted and so keen that they had both learned to appreciate one another. The reason they proposed to increase the number of directors was that they felt that whenever a casual vacancy occurred on the board they ought to take the opportunity of appointing Mr. David Smith, their secretary, to the vacancy. During the last few months the late chairman had been visibly ailing, and Mr. Smith had been the life and soul of the London office. They thought it was right that they should show some appreciation of his hard work, and they had therefore elected Mr. Smith as a director. By doing that they lost the opportunity of appointing Mr. Franklin to this casual vacancy, but they did it deliberately, because they wished to increase the number of directors beyond what they had been working with lately, and to do that it was necessary to get the permission of the shareholders.

SIR JOHN GAVEY seconded the resolution, and it was carried unanimously.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Wednesday, November 27th.—Sun Power Co. Eastern Hemisphere, Ltd.—150,000 vendor ordinary shares of £1 each fully paid, Nos. 8 to 150,007.

Thursday, December 5th.—Anglo-Argentine Tramways Co., Ltd.—Scrip fully and partly paid for a further issue of £1,500,000 5 per cent. debenture stock.

And ordered the undermentioned to be quoted in the Official List:

Anglo-Argentine Tramways Co., Ltd.—Scrip partly paid for a further issue of £1,500,000 5 per cent. debenture stock.

Newcastle and District Electric Lighting Co., Ltd.—£146,040 6 per cent. second mortgage debentures, Nos. 1 to 620A, 622 to 778A, and 780 to 1,429A of £100, and 1 to 167B of £20 each (registered).

Uxbridge and District Electric Supply Co., Ltd.—£77,000 [illegible] per cent. debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Canadian Western Natural Gas, Light, Heat and Power Co., Ltd.—Further issue of £113,013 5 per cent. first mortgage debenture stock.

Portland Railway, Light and Power Co.—$16,000,000 5 per cent. first and refunding mortgage 30 year sinking fund gold bonds series "A", Nos. M 1 to 15,400 of $1,000, D 1 to 800 of $500, and A to J 1 to 200 of $100 each.

Sao Paulo Tramway, Light and Power Co., Ltd.—Further issue of £221,917 5 per cent. perpetual consolidated debenture stock.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS round the Stock Exchange are in a more cheerful frame of mind. Their nerves are becoming case-hardened to scares and alarms. For example: last Monday afternoon a report that Bulgaria and Servia were assuming a belligerent attitude towards Austria failed to exercise anything but the most transitory influence over markets. The Home Railway department, in particular, has been strong, the buying being based upon hopes of benefits to accrue to the railways upon the passing of the Single Clause Bill by the Government, allowing the companies to raise their charges.

By the way, Mr. Keir Hardie's protest against this action is surely one of the quaintest that could be imagined. He maintained that revision of the rates was unnecessary, in view of the fact that "Home Railway stocks had already increased in value since the labour disputes." The views of proprietors of these securities upon Mr. Keir Hardie's suggestion have been a good deal more forcible than printable—at all events, so far as the Stock Exchange is concerned.

Speculation in Central London stocks remains one of the features of the Home Railway market. The Ordinary and Preferred are now on the same lines of quotation, and the Deferred stock shows a rise of 3, so that the improvements during the past fortnight are 12, 2, and 11 respectively. At the last rate of dividend on the Deferred stock, the yield at the present price looks a little odd, and one dealer in the market humorously complained that the return on the money was very little more than that afforded by East London Ordinary or Little Chathams.

City and South London Ordinary has been moving sharply, but after a good rise during the week the price remains unchanged on balance. All four of the company's 5 per cent. Preference stocks are now quoted 107—109. Great Northern and City Preferred rose ⅛ in sympathy with the sharp improvement in Metropolitan Consolidated stock. The latter advanced at one time to 56¼, but from this there was a reaction of nearly 2 points, leaving them only a little better on the week. Districts show a good gain, although the price is well below the best point reached. The Prior Lien stock has moved up to par as its top figure. A good feature has been a jump of 12s. 6d. in Underground Electric Railways Ordinary shares, the buying of which has been very persistent, and. in conjunction, the shilling shares rose to 14s. The 6 per cent. Income bonds, too, are better. We add to our list of prices the company's 6 per cent. First Cumulative Income Debenture stock, which now stands at 113 middle.

In the Traction list. the feature is a further rise of 12s. 6d. in London United Preference shares, while the Company's 4 per cent. Debenture stock is a point higher, these movements being due to the reasons already detailed here. Metropolitan Electric Tramways Ordinary have been a strong market, while the Deferred remain about 6s. The Preference crept up to 18s. 9d., and in the circumstances it is rather surprising that the 4½ per cent. Debenture stock should be slightly easier.

As regards English Electricity Supply shares, rumour runs riot as to what is going to happen to the principal undertakings comprised in this section. Almost every day there comes an addition to the set of reports already current, some of which are obviously very exaggerated; they have the effect, however, of keeping the market strong. The fall in County Preference last week has been wiped out, and the company's Ordinary shares rose ⅛. Kensingtons are ⅛ higher; while Chelsea's City Preference and St. James's Ordinary are all 5s. to the good. The firmness extends to the provincial list, where Oxfords are in demand. It is a little singular that Metropolitans should hang fire; the price has not yet recovered from its decline of last week. Prior charge stocks in this department are good, too; and. on the whole, are more easily sold than bought.

The reassurances of Sir John Wolfe Barry to holders of shares in cable companies, to the effect that the latter are not likely to be damaged, in his opinion, by the competition of wireless telegraphy have had a favourable influence upon the market, and there is more disposition on the part of brokers to direct their clients' attention to the good yields derivable from investment in such securities. We think it may be taken for granted that the wireless scares are practically over. There have been several during the past decade—each, however, less potent than its predecessor; and it seems fair to accept the weighty authority of Sir John Wolfe Barry on such a subject. That there should be room for both classes of enterprise has long been the opinion of the Stock Exchange market; but, naturally enough. many timid holders of cable shares have been frightened into realising as the Marconi system swept forward with giant strides.

Eastern Extensions are better on the week, and there are small rises in Anglo-American Preferred, Globe Preference, and American Telephone and Telegraph Capital stock. Various *ex*-dividend markings last pay-day were responsible for putting down a few prices to the extent of the distribution. West India and Panamas, however, recovered considerably more than the deduction, and show a rise of 3s. 9d. on the week, speculation having revived in them to some extent. Western Telegraphs are dull, and Chili Telephones eased off, while National Telephone Deferred has come in for a little selling. Business sprang up again in Marconis, the price rising rapidly on the announcement that the Company had concluded negotiations with the Norwegian Telegraph Department for the erection of a high-power station in Norway; this, of course, gave rise to whispers of another subsidiary to be formed. Canadian, American, and Spanish Marconis improved in consequence of the better tone in the price of the parent shares, business in which has been more animated than it has been for some time past.

Latin-Canadian issues tend to improve, though the movements are not very material one way or the other, being mostly confined to ½ to 1. It is thought that the situation in Mexico is distinctly clearer, and for this reason several of the issues connected with that country are a little better. Cape Electric Trams eased off 1/16. The Anglo-Argentine group keeps steady. Northern Light, Power and Coal Bonds are flat, being down to 36, a drop of 4½ points; this is a somewhat nominal movement, business in the Bonds nowadays being more or less a matter of negotiation.

The Manufacturing group is almost unchanged, the principal alteration being a fall of £1 in India-Rubber shares, which has reduced the quotation to 9½. Telegraph Constructions rose 10s. to 35½, and Castner-Kellner are better upon further consideration of the report, upon which we commented last week. Edison & Swan "A" shares slipped back to 5s. middle. No improvement has occurred in the Brush division. Rubber shares went ahead rather smartly at the beginning of the week, on the anticipation of good prices being realised at the auction sales in Mincing Lane. But the market keeps tender, and it must be said that there is not much increase in public business up to the present.

Perth Tramways Co., Ltd.—At a special meeting held on Monday, the resolutions passed at the previous meeting regarding the sale of the undertaking were confirmed.

Continental.—France.—The report of the Société Industrielle des Telephones, of Paris, for the last financial year shows a net profit of £64,194, as compared with only £61,254 in the preceding 12 months.

Italy.—La Società Elettricita de la Sicile Orientale, of Milan, is increasing its capital from £400,000 to £460,000.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, November 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£26	..
a Lead, Nitrate	„	£30	10s. inc.
a „ White Sugar	„	£25 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4⅛d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	72/6	2/6 inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	8⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£90	£5 inc.
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅝d.	..
c „ Tube (brazed)	„	11¼d.	..
c „ „ (solid drawn)	„	9¾d.	..
c „ Wire, basis	„	9⅛d.	..
c Copper Tubes (brazed)	„	1/0⅞d.	½d. inc.
c „ „ (solid drawn)	„	11¾d.	¼d. inc.
g „ Bars (best selected)	per ton	£93	£1 inc.
g „ Sheet	„	£93	£1 inc.
g „ Rod	„	£93	£1 inc.
d „ (Electrolytic) Bars	„	£82	..
d „ „ Sheets	„	£99	..
d „ „ Rods	„	£87	..
d „ „ H.C. Wire	per lb.	10 3/16d.	..
f Ebonite Rod	„	5/3	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	..	..
h India-rubber, Para fine	„	4/6	2½d. inc.
j Iron Pig (Cleveland warrants)	per ton	68/-	1/3 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£18 15	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 12 6	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
p Phosphor Bronze, plain castings	„	1/2	..
p „ „ rolled bars & rods	„	1/2	..
p „ „ rolled strip & sheet	„	1/2½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11½d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£229 to £230	dec.
n „ Wire, Nos. 1 to 16	per lb.	2/8	..
p White Anti-friction Metals	per ton	£45 to £230	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£31 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Copper.—After the drop in price during October, principally due to general depression over the impending war, copper is again stronger, and bids fair to remain so. The European visible supplies, including Holland and Germany, stand, for mid-month, at 43,552 tons, as against 46,341 tons for the end of October (figures from Messrs. H. R. Merton & Co.'s circular). The drop includes transfer or consumption of 949 tons from English stocks, and 54 tons from French. The quantities afloat from Chile and Australia are also at a lower figure than on October 31st. Supplies from North America, for the fortnight, are above the average; from Spain and Portugal well over it, against which, of course, must be set the fact that last month's supplies from these two countries were very small. Chilian shipments are rather low, and Australian just within the average. Total deliveries, at 23,805 tons, are brisk, and, if doubled for the month, will indicate an active market. American stocks, taken from the American Copper Producers' Association, were higher for the end of October than for the end of September by 6,106 tons. The total visible supply at the end of October was 80,602 tons, the highest since April of this year.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 19th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9½—10½	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾—9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord.	5	10	9	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½— 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞— 5⅜	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜— 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	94 — 96		4 8 4
Chelsea, Ord.	5	5	4†	4½— 5	+ ¼	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	+ ½	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	100 —108	+ 1	4 7 5
County of London, Ord.	10	6	4†	11⅛ — 11⅝	+ ⅛	5 3 8
Do. 6 % Pref.	10	6	6	11¾ — 12¼	+ ¼	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 8 4
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 8 8
Edmundson's, Ord.	5	Nil		7/16— 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3— 3½	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½— 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞— 8⅛	+ ⅛	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	.	1⅞— 2⅛	.	3 10 8
Do. 6 % Pref.	5	6	6	4¾— 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅞ — 4⅛	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4¾	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 — 100	+ ½	4 10 0
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅝— 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ 101	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6⅛ — 6⅝	+ ⅛	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9¾— 10¼	+ ¼	4 15 3
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88		3 19 7
Smithfield Markets, Ord.	5	2	..	1⅛— 1⅞	..	..
South London, Ord.	4	5	..	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1¼— 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	£3	Nil		¼— ½	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅝— 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½— 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾— 9¼		5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4¾ — 5¼	..	4 5 3

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛— 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅞— 7⅛ xd	..	5 19 1
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16		4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½— 94½	..	5 5 9
Canadian Gen. El. Com.	$100	7	7	117 —121	+ 1	5 15 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	¾— 1	..	8 0 0
Do. 5 % Deb.	100	5	5	94 — 97		5 8 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95 — 97	+ 2	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	85 — 88	..	5 13 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16— 3/16	..	Nil
Do. 6 % Pref.	1	6	6	11/16— 13/16	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½— 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 13 8
Mexican Lt. & Power, Common	$100	4	4†	85 — 89	+ 1½	4 11 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105	..	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	84 — 87	+ 1	5 15 0
Montreal, Lt., H. and Power	$100	8	9†	234 —239	..	3 15 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5†	84 — 88	— ½	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	140 —141	+ 1	3 9 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	.	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100½—102½ xd	.	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½—101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref.	1	11⅞d.	17⅞d.	15/16— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½—105½	+ ½	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7¾— 8¼	.	4 17 0
Do. 5 % Deb. Red.	Stock	5	5	96½— 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	146 —148	+ ½	5 8 1
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 8 9
Anglo-American Telegraph	Stock	3	3	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110¼—111¼	+ ¼	5 7 8
Do. Def.	Do.	30/-	..	25⅛ — 25⅝	..	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½— 7¾	— ⅛	5 3 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	81 — 83	..	4 16 8
Cuba Telegraph	10	6	6†	9 — 10 xd	...	6 0 0
Do. 10 % Pref.	10	10	10	16 — 17 xd	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½— 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	6¾— 7¼	..	6 18 0
Direct United States Cable	10	5	4	7⅛— 7⅝	..	6 11 2
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 —133	..	5 5 3
Do. 3½ % Pref. Stock	Do.	3½	3½	76½— 78½	..	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	12¾— 13¼	+ ⅛	5 5 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	10¾— 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12⅝ — 13⅛	+ ⅛	4 11 4
Great Northern Telegraph	10	18	18	27 — 29	..	6 4 2
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 5/16— 5 7/16	+ 5/16	3 13 6
Do. 7 % Cum. Partic. Pref.	1	17	.	4⅜ — 4⅝	+ ⅜	3 9 8
Monte Video Telephone, Ord.	1	[illegible]	6†	15/16— 1 1/16	..	5 13 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 8
National Telephone Def.	Stock	6	..	151½—153½	—1½	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 99	..	4 10 11
Oriental Telep. and Elec.	1	[illegible]	6†	1⅜— 1⅝	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1 1/16— 1 3/16	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10⅞— 11⅜	..	8 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼— 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅜— 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3 3/16— 3 5/16 xd	+ 3/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½ xd	— 1/16	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9½— 10 xd	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13⅛— 13⅝	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 —101	..	4 9 1

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 19th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16— 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16— 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	86 — 89	..	..
Do. 5 % Perp. Deb. ..	100	5	5	90 — 94	..	5 11 1
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8†	85 — 87	+1	3 9 0
Do. Pref.	100	4	4	85 — 87	+1	4 12 0
Do. Def.	100	2	..	83 — 85	+3	2 7 1
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1⅝	1¼†	42 — 43	..	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	107 —109	+1	4 11 9
Do. Do. 1901	100	5	5	107 —109	+1	4 12 7
Do. Do. 1903	100	5	5	107 —109	..	4 11 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅜— 2⅝	+ ⅛	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32— 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	+1	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5⅞— 6⅜	+ ⅜	..
Do. 4 % Deb.	100	4	4	71 — 75	+1	5 6 8
Metropolitan Railway Consol. ..	100	1⅞	1½†	54¼— 54¾	+ ½	2 19 4
Do. Surplus Lands	100	2⅞	2⅝†	62 — 64	—1	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	+1	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	+1	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	39¾— 40¼	+ ¾	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	98 —100	+1	4 0 0
Do. 4½ % First Pref.	100	4½	4½	88 — 90	+1	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1 3/32— 1 13/32	+ 1/32	4 5 4
Do. Def.	1	Nil	..	9/32— 11/32	..	Nil
Do. 5 % Pref.	1	5	5	13/16— 15/16	+ 1/32	5 6 8
Do. 4½ % Deb.	100	4½	4½	93 — 95	—1	4 14 9
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Potteries, Ord.	1	3½	..	¼— ⅜	..	..
Do. 5 % Pref.	1	5	5	17/32— 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88 xd	..	5 2 3
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	4⅜— 4⅝	+ ⅜	Nil
Do. "A"	1/-	..	..	21/32— 23/32	+ 3/32	..
Do. 6% First Cum. Inc. Deb.	100	..	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	90 — 92	+1	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼— ¾	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	+ ⅛	4 5 9
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1911.	1912.	Closing Quotations Nov. 19th.	Rise + or Fall	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 15/16— 5 1/16	..	5 8 6
Do. 2nd Pref.	5	5½	5½	4 11/16— 4 15/16	..	5 17 4
Do. 4 % Deb.	100	4	4	93 — 95	+1	4 4 3
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99½—101½	+ ½	4 18 6
Auckland Trams, 5 % Deb. ..	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½— 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16— 7 5/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4⅞— 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	144 —149	..	5 7 5
Do. Pref. Ord.	100	6	6	117 —121	..	4 19 2
Do. 5 % Pref.	100	5	5	107 —110	+ ½	4 11 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	100 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	5⅞— 6⅜	..	5 9 10
Do. 5 % Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 8
Cape Electric Trams	1	2½	..	⅝— ¾	1/16	..
City Buenos Aires Trams (1904)	5	5	5†	5 3/16— 5 11/16 xd	— 1/16	4 8 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜— ⅝	..	..
Do. Pref.	1	6	..	31/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 8 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	—1	5 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	112 —117	+1½	5 19 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	95 — 97	— ½	5 3 1
Do. 6 % Bonds	100	6	6	99½—102½	+1½	5 17 1
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7 5/16— 7 11/16	+ ⅛	6 9 10
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	96½— 98½ xd	..	5 1 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛— 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½— 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	5	5†	..	..	..
Do. 1st Mort. 5 % Bonds ..	..	5	5	101½—103½	+1	4 16 7
Do. 5 % Mort. Bonds ..	100	5	5	96½— 98½	+ ½	5 1 6
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	..	..	..
Do. 5 % 1st Deb.	$500	5	5	102½—104½	+ ½	4 15 8
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	1912.	Closing Quotations Nov. 19th.	Rise + or Fall	Present Yield p.c.
Aron, Ord.	1	6	..	½— ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/16— 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	3/16— 5/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝— ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½— 8	..	6 5 0
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	3	Nil	Nil	½— ¾	..	Nil
Do. Deb...	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10½— 11½	..	6 13 4
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	15†	3 11/16— 3 15/16	+ 1/16	5 5 0
Do. Deb...	100	4½	4½	105 —108	..	4 3 4
Crompton & Co.	3	Nil	..	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16— 13/16	..	..
Do. Pref.	1	6	6	13/16— 15/16	..	6 8 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	⅛— ⅜	— ⅛	Nil
Do. fully paid	5	Nil	..	1½— 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	13/16— 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12¾	..	6 13 4
Do. Pref.	5	4½	4½	4 13/16— 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	9 — 10	—1	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	84½— 86½	+ ½	5 14 9
Do. Deb...	100	4	4	97 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

MORE NOTES ON ELECTRIC WELDING.

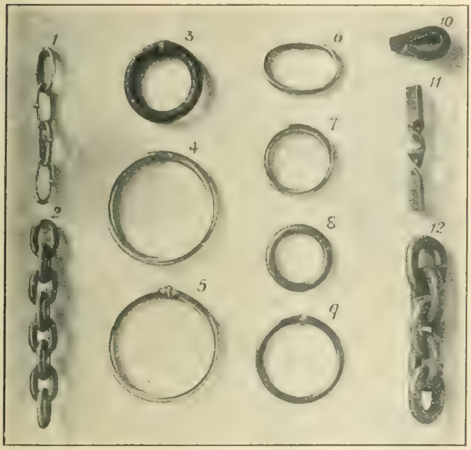
By V. D. GREEN.

(*Continued from page 807.*)

As the percentage of carbon increases, the difficulties of making a successful weld increase also, and the settings have to be more and more accurate. But the sample before you will show that even a fairly large amount of carbon does not altogether preclude welding. This piece was originally of a ½-in. square section and was welded for a client of ours as a demonstration. It contains about 5 per cent. or more of carbon and will harden in air to such an extent that we found it very difficult to file or saw unless cooled down very slowly. After welding, we sent it to our customer who reheated and forged it into a strip $\frac{3}{16}$ in by $\frac{3}{8}$ in. wide, and then bent it over with a hammer while cooling. He admitted that his own smiths could never weld the material at all.

I have also here a sample of common iron and mild steel welded to tool steel. The application of this to the manufacture of tools and cutlery is evident.

With copper, one encounters the difficulty that it must be raised to a much higher temperature than iron before it will weld, and that it then oxidises very readily. Unfortunately, too, its melting point is nearly the same as that of iron, so that its liquefying and welding temperatures are very close together. Very accurate setting of the machine, therefore, becomes imperative. Brass and nickel have all the difficulties of copper plus several special troubles of their own. The worst is the tendency of the zinc to volatilise before the copper constituent has come up to the welding heat. The chief trouble incidental to the welding of silver, lead, aluminium and other metals of the same group is their affinity for oxygen, especially when heated, and this necessitates the temperature being kept as low as is consistent with obtaining a good weld. It is curious, by the way, that silver, which can readily be welded by a jeweller's blow-pipe, is very difficult indeed to weld electrically. This is quite a reversal of what one usually finds.



1, Bridoon chain (links unswaged); 2, chain links welded and swaged; 3, mild steel harness ring welded; 4, nickel "rustless" harness ring welded and swaged and finished; 5, nickel "rustless" harness ring welded and swaged; 6, nickel harness ring flattened to show strength of weld; 7, mild steel harness ring nickelled and finished; 8, mild steel harness ring ready for welding; 9, harness ring welded and swaged (mild steel); 10, weld in air-hardening steel, forged and bent hot; 11, flat strip, mild steel, welded and twisted while hot; 12, chain links linked up ready for welding.

Fig. 3.—Group of Electrically-welded Articles.

We must now leave the subject of the welds and welding conditions, and go on to the question of the welding machines themselves. As has been already mentioned, the "resistance" system of welding involves the use of very heavy currents at an exceedingly low electrical pressure, and the plant must, therefore, be designed to produce these economically. It is largely for this reason that alternating currents are employed, so that the power may be generated at a comparatively high pressure where convenient, and fed into a transformer which will change the energy supplied to it into the low pressure form suitable for welding. It is true that during the early stages of electric welding the original Thomson Co. took out a patent for a special low voltage dynamo in which the welding current was generated without using a transformer at all, but as it necessitated mounting the welder immediately over the alternator, and led to all sorts of expense and trouble on account of the low voltage and consequent cost and complication of the armature and field windings, it was soon abandoned. In fact, I doubt whether it was ever seriously intended to be anything but a "blocking patent."

The original apparatus described by Prof. Thomson in his specification was curious, and in view of what is now known about transformer design not specially efficient. The core was a circular iron ring presumably laminated. Outside this was the secondary coil consisting of a single turn of cast copper hinged in the middle and terminating in two split sockets which could be tightened by means of screws on the work. A powerful spiral spring tended to pull the two halves of the coil together for the purpose of upsetting the weld, and an adjustable stop pin on one of the jaws limited the amount of "shove." Crude though this apparatus was, however, astonishing results were obtained compared with the older fire-welding method, and it was not long before improvements were made enabling the Thomson process to leave the "scientific toy stage and to take its part as a factor to be seriously reckoned with in the industrial world.

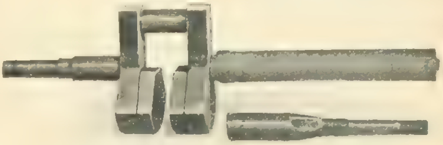


Fig. 4.—Broken Crankshaft Repaired with Electric Butt Welder.

It was soon obvious that some method of regulating the secondary voltage was urgently necessary. The pressure, which was quite insufficient for a 1-in. square bar, was enough to blow a ¼-in. rod to pieces before the current could be cut off. Where, as was generally the case at first, each welder had its own dynamo, field regulation on the generator gave all the variation which was required, especially as very exact results were not regarded as essential at this stage of the evolution of the process. But when several welders were installed in a single works, it was necessary to have a separate control for each welder. Probably the first method adopted was placing a resistance in series with the primary winding of the transformer. I have on occasions used this myself as an emergency method, but, beyond the advantage that it does not pull the alternator voltage about quite so much as a choking coil, it has very little to recommend it. From this to a choking coil was an obvious step. This method was more economical than a resistance, and even now is unrivalled for certain work. Another method is to have tappings in the primary windings, and this has also advantages (principally where the heat is to be concentrated as much as possible).

The original method of applying the upsetting force was also open to grave objections. To begin with, a hinged joint through which, say, 10,000 amperes have to pass is not a particularly satisfactory affair. Moreover, the electrical pressure is so low that more than 50 per cent. might quite conceivably be wasted through imperfect contact, due to pitting caused by the enormous currents used crossing from one half of the hinge to the other. Also it was felt that the horseshoe design of secondary was not very convenient for handling, because on account of the exposed primary coils the apparatus had either to be suspended from a chain or propped up on the floor. The horseshoe form, therefore, is now almost exclusively confined to tram rail welders which are slung from a crane. Under these modifying influences the secondary coil was inverted and cast solid in one piece, and was fixed to the underside of an iron table suitably insulated, the primary and core being arranged underneath and the whole cased in for protection. The ends of the secondary were milled out "V" shaped and carefully scraped flat. On these a pair of massive copper slabs were mounted, carrying renewable dies and having hand wheels for screwing down the work between clamps. Although the sliding surfaces were still retained, this method minimised the risk of bad contact by greatly increasing the area of the joint through which the current had to pass. Even this, however, had its disadvantages. I remember on one occasion when assembling a welder of the earlier type I found it impossible to make it work at all on account of the sliding surfaces having got oily. The method which we invariably adopt except in very small sizes is to connect the jaws directly to a flexible secondary built up of thin laminations, and this overcomes the trouble altogether, for there are no sliding surfaces to carry current at all.

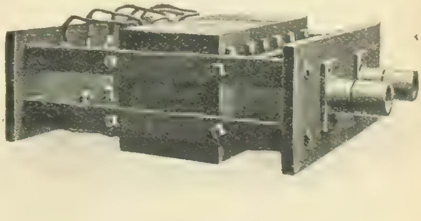


Fig. 5.—Chain Welding Transformer

As the method of applying the pressure to produce the "upset" through a spring direct made it difficult readily and quickly to open the jaws to the necessary amount, a lever, or toggle and lever, was next added.

The original type of limiting stop for controlling the amount of "upset" proved very unsatisfactory for the higher welding speeds which increasing competition rendered necessary. It certainly prevented the "upset" from being carried too far, but there was the danger that unless the welding current was stopped simultaneously, the weld would burn through owing to want of mechanical pressure. What was wanted was a device which would cut off the current automatically at the right time, and probably no other part of a welder has received so much attention as this one. The most obvious thing was a switch in the primary circuit which, when forced by the hand into the "on" position, engaged with a catch, which kept it closed.

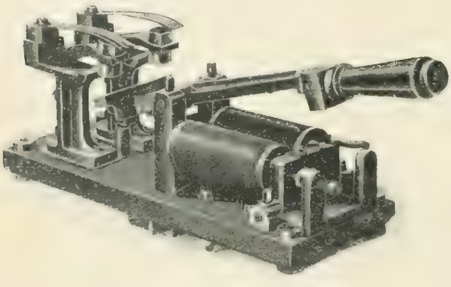
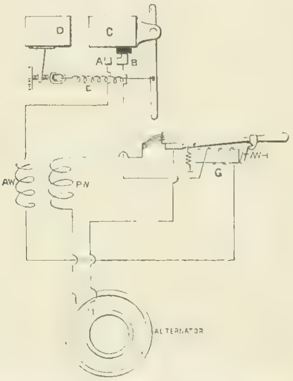


Fig. 6.—Thomson Welding Switch.

A pin on the movable welder jaw was so placed that when the predetermined "upset" had taken place, it tripped the catch off a knife edge and allowed the switch to open under the influence of a strong spring. This was an enormous improvement, and enabled the speed of working and the accuracy obtained to be much increased. Unfortunately, it was a most inconvenient thing to have a high pressure switch close to the welding heads and to remove it out of the way and yet link it up accurately to the welder jaw increased the expense and complication to an undesirable extent, as, of course, every additional link or member increased the backlash and consequent inaccuracy of the control.



A, B, Contacts; C, D, Jaws of welder; E, Upsetting spring; G, Control switch; A W, P W, Auxiliary and primary windings of transformer.

Fig. 7.—Diagram of Connections of Thomson Switch.

The next stage of evolution was an electrically-operated trip-gear, such as the one you see before you (fig. 6). A special winding is arranged on the transformer which is allowed to send current through the magnet coils of the switch when the circuit is completed by means of a pair of insulated contacts, one on the frame of the machine, and one on the movable jaw (fig. 7). When the handle is depressed and the current turned on, the armature of the magnet falls forward and a knife edge engages with a catch on the handle lever. When the proper upset has taken place the contacts on the jaw and frame come together and allow current to flow from the auxiliary coil on the transformer through the magnet, which attracts the armature backwards and releases the switch. This enables the switch to be put anywhere on the machine that happens to be convenient, and so far it has the advantage of a purely mechanical switch. But there is one great drawback common to both. No matter how hard the steel of the knife edge and catch may be, there is bound to be some wear, and when it is considered that a welder may make 4,000 or 5,000 welds a day, it will not surprise anyone to learn that the wear will very soon be bad enough to upset the accuracy of the cut-off—long before the working parts have arrived at the "scrapping" point. The fact that the device is electrically operated does not help matters in this respect; in fact, it makes them rather worse, because in addition to the errors due to mechanical wear, there is an uncertain lag caused by the time required first to saturate the armature and then to pull it up against the magnet face. What is wanted is something which shall have a very small wear, and which will keep its adjustment unaltered up to the end of its useful life. In order to attain as near as I could to this ideal I designed and patented a switch which, after careful testing, my firm, Messrs. Pontelec Welding Patents, Ltd., have adopted for use on their high-speed machines. It was evident from the start that all trip gear must go, and the working of the switch must be electrical throughout. The switch (figs. 8 and 9) is of the radial type, because every time contact is made or broken there is a rubbing action on the contact stud which tends to keep it clean. Dirt is the first stage towards pitting, and the rapid destruction of the stud. This stud is readily renewable. In the type before you there are two levers. The first, or contact lever, carries a pair of liberally rated brushes, one brass and the other carbon, each having a separate spring feed to allow for wear. A strong spring tending to pull the lever off the contact is attached at its outer end to a stout iron pillar on the slate base. The second lever carries the handle, and has mounted upon it a powerful electromagnet having faced iron cheeks which, on one side, are adapted to bed on to a loose armature on the contact lever, and, on the other, make magnetic circuit through an angle-iron stop piece, which limits the travel in the "make" direction. This lever has also a spring tending to pull it in the same direction as the contact lever, but it is only strong enough to ensure its coming away from the iron stop-piece with certainty. A pair of quadrants feed the magnet circuit through a pair of spring plunger contacts, and a flat compound buffer spring is provided on the slate base to take up the recoil of the two levers. On the fixed portion of the welder jaw are two small contacts, which are normally kept pressed together by a weak spring. One contact is attached to a sliding bar, which carries a projection on the other end. An adjusting screw on the moving part of the welder jaw presses against this projection when the correct upset has taken place, and continuing

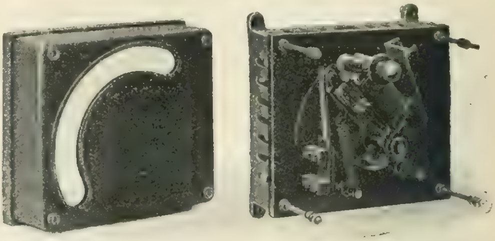
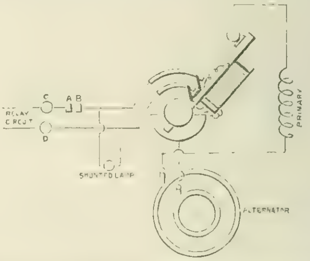
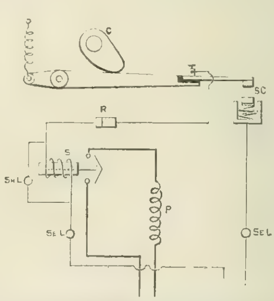


Fig. 8.—Green's Patent Automatic Switch.



A, B, Contacts on jaws of welder; C, D, Lamps in series with magnet coil.

Fig. 9.—Diagram of Connections of Green Switch.



C, Closing cam; S C, Spring contacts; R, Relay breaking contacts on jaws; S, Solenoid switch; P, Primary of welder; Sh L, Shunted lamp; Se L, Series lamps.

Fig. 10.—Diagram of Connections for Automatic Welder.

its travel carries the bar with it, thus separating the contacts. The electrical connections are as follows The main primary circuit of the welder passes from the A.C. mains to the main contact of the automatic switch, through the primary windings of the transformer, to the mains again. The relay circuit, which may either be taken from the same source as the main primary circuit, or, where an alternator, motor-generator or rotary converter is used, from the D.C. supply mains or from the exciter, passes through a carbon-filament lamp to the magnet coil of the switch, from thence to the relay contacts on the jaws, through another carbon-filament lamp, back to the supply. Across the magnet coil a tantalum lamp is shunted. The action of the switch is as follows: When the welder jaws are pressed back to their proper position and the weld inserted, the contacts on the movable jaw are closed by the spring, the switch magnet is energised and the signal lamps light, showing that all is ready for turning on the current. One lamp is by the side of the operator and one is usually arranged to act as a tell-tale in the foreman's office, thus enabling the speed of working to be checked without the foreman having to leave his desk. If preferred a counting device registering the number of welds made could be substituted. The handle lever of the switch is then pushed "on," and by means of the electromagnet it pulls the contact lever over with it, both levers being thus held against the angle-iron stop-piece by the attraction of the other face of the magnet. As the metal in the jaws becomes plastic the upsetting spring forces the jaws together, and the pin on the movable jaw engages with the projection on the contact bar, thus separating the contacts and de-energising the switch magnet, when both levers are pulled to the "off" position by their springs. It is evident that the amount of accuracy obtained depends upon the length of the spark formed between the jaw contacts when drawn slowly apart by the upsetting metal and by the length of time taken for the switch magnet to de-energise—that is, on the amount of self-induction in the circuit. The series lamps in the relay circuit reduce the proportion of inductance to resistance, and the lamp shunted across the magnet windings takes up the inductive discharge from the coil and ensures instantaneous release. The net result is that the spark at the jaw contacts even on 440 volts is almost unnoticeable. Moreover, this control system has the advantage of being foolproof. There are two ways in which a careless operator can spoil a weld. He may fail to press the jaws back to the stop-pin which limits the backward travel. In this case the upsetting spring would force the jaw to the forward end of its slide, and if the current were applied to the stock, the jaw already being at the limit of its upsetting travel would not "follow up" the softening metal. The weld would then burn through. But it will be seen that if the jaw is at the wrong end of its travel, the relay circuit is necessarily broken, and it is therefore impossible to pick up the contact lever of the switch and so make circuit through the transformer. The other alternative is that the operator may fail to let go the switch handle before the upset has reached the pre-determined point, especially if the speed of welding is high. In this case if left to itself the weld would upset right to the end of the jaw travel and then burn through. But as soon as the relay circuit is interrupted the magnet is de-energised and the contact lever is released independently of whether the handle is held or not.

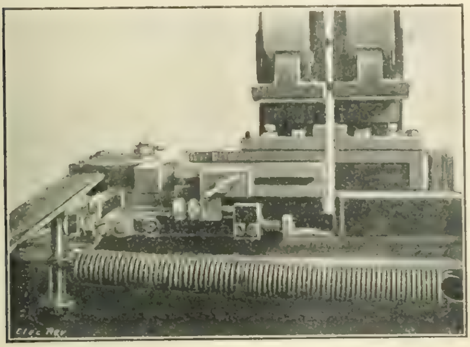


Fig. 11.—Original Type of Butt Welder Jaws, showing Relay Contact Gear of Patent Switch.

"The proof of the pudding is in the eating—or in the digesting," and I was assured by a firm for whom we had installed a plant a little while back that during the first week of running it they had made no scrap, though their operator was not an experienced hand; in fact, I doubt whether he had ever made the acquaintance of an electric welder before. All that happened was that the machine declined to go on until the cycle of operations was correctly carried out. The errors described above do not seem very likely to occur, but in practice, with unskilled operators and high working speeds, they do happen fairly frequently.

Of course, difficulties cropped up in connection with the first one or two switches, but, curiously enough, they did not occur over the electrical action, but over the mechanical details. It is difficult to realise the terrific strains which are put upon the switch of a welding machine, both by normal working and by the careless methods of the user. One would not readily imagine that an operator would slam the switch on violently enough to break the slate base and the cast-iron lever, or that he—or, as is usually the case, she—could break a $\frac{1}{2}$-in. stop-pin through, but I have known both these things happen. These troubles may doubtless be attributed to the "fatigue" of the material due to the incessant jarring. However, we have not heard of anything lately beyond fair wear and tear, and it is pretty certain that we should have done if there had been trouble.

(To be concluded.)

Erratum.—In fig. 2, p. 806, the middle curve relates to [illegible] in., not $1\frac{1}{2}$-in. rod.

PROCEEDINGS OF INSTITUTIONS.

The Institution of Electrical Engineers.

(Abstract of Inaugural Address delivered in London, November 14th, 1912.)

By William Duddell, F.R.S., President.

The Institution is installed in its new home; it has revised its articles of association, and it is now prepared, having got these matters out of the way, to undertake its proper functions with regard to the electrical industry. There is a wide field of work to be undertaken, on the one hand, in encouraging the publication of scientific technical knowledge: and, on the other, in looking after the interests of the electrical industry.

Eight years ago, when it became evident that the finances of the Institution would shortly allow us to have a building of our own in which a proper library could be fitted up, the Institution started to bring the library up to date, a work which is now nearing completion. The combination of the older works which were collected by the late Sir Francis Ronalds, and modern works which the Institution has obtained either by gift or purchase, forms a library which outrivals any other library of electrical literature, certainly in this country, and possibly in the world. The classified section of modern technical books is very complete. I hope that at a not distant date we may acquire a sufficient duplication of modern works to enable the Institution to lend them to those members who cannot conveniently visit the library.

Another subject which I wish to invite the members to support is the Institution Museum. One of the great difficulties in making a museum is that when things are in common use everyone thinks that they are of no importance to a museum, and directly they go out of common use and begin to become historically interesting, one finds that all the examples have been destroyed and that they are no longer obtainable. I should like, therefore, to personally appeal to the members of the Institution to present to the museum examples of present-day apparatus as they become obsolete, so that they may be preserved for future generations rather than that they should be melted down as scrap.

With regard to the progress of the Institution, latterly so much has been said and written, and my predecessor in office has so fully explained to you our aims, that I think I cannot do better than endorse his views without adding anything.

I want to take this opportunity of voicing a warning against this Institution becoming narrow in its ideas, and limiting itself too much to one branch of the electrical industry. The Institution of Electrical Engineers should, according to my view, embrace in its discussions and papers all matters dealing with electricity. I think I have noticed a tendency of late years to limit more and more the papers read before the Institution to one class of subject. The tendency is to bring before the Institution papers mainly dealing with generation, distribution, and the cost of electrical energy, and in many cases only dealing with these as large general questions.

Of the 6,600 members the proportion must be very small who have the actual scheming or designing of large things. The great bulk of the profession must naturally be occupied in working in their own groove in life. These members have very little chance at the present time of discussing their own special subjects. Details—small things—are very often of the greatest importance. In many cases the success of a big scheme or a big plant mainly depends upon the attention that has been bestowed on its detail. I trust that during the coming session members will bring forward for discussion many subjects which might be looked upon under the old ideas as not being of sufficient importance to discuss at a general meeting of the Institution, but which can be discussed with advantage at the informal meetings which it is proposed to hold.

The tendency to restrict the subjects brought before the Institution is not good for the profession nor for the Institution. To attain that much desired and talked-of progress in the application of electricity, and with it the advancement of the industry, it is necessary for all engineers to take as wide a view as possible of everything that concerns their profession.

We hear little, if anything, about what is occurring on what I may term the borderland between electricity and the other sciences. In this borderland or fringe a large number of scientific workers are quietly at work, and what is to-day a laboratory experiment may to-morrow form the basis of a large industry.

Probably from the point of view of the amount of money invested and number of men employed, the original work of this Institution occupies the first rank. I refer to telegraph engineering. It is curious, considering the importance of the subject, how few papers dealing with telegraphy have been read before us. We have had during the last 10 years, only 12 papers dealing with this subject, in a total of 400 papers and addresses published in the *Journal*. I do not think that this can be said to be due to the fact that there is nothing new to describe. A great deal of work has been going on in telegraphy and telephony, and a steady and real progress has been made.

It is difficult to obtain figures of the amount of money invested in the telegraphs and telephones of this country, but if we take the original sum of money paid by the State when it purchased the telegraphs, and the amount of money spent on its extension, together with the money spent by the Post Office and the National Telephone Co. for the telephones, the sum is probably well over £100,000,000, and the number of employés probably exceeds 100,000.

Electric signalling on railways may be looked upon as a form of telegraphy in which most striking advances have been made in the last few years.

I cannot leave the subject of telegraphy without mentioning the progress that is being made in the art of wireless telegraphy. Since Signor Marconi read his paper on wireless telegraphy before this Institution in 1899 we have had a number of papers dealing with different parts of the apparatus, but we have not had a general review of the subject. The principles are well known.

There seems no doubt that long waves are more suitable for long-distance transmission, but the question is far from settled as to what is the best wave-length for long-distance work, or even whether there is such a thing as a best wave-length for any given distance.

What is a suitable wave-length; or, in other words, what is a suitable frequency to use in the antenna? This most fundamental question is, I believe, as yet unanswered.

The engineering problems which confront us at the transmitting end are the design and support of the aerial conductor, the machinery to produce in it high-frequency currents of one definite frequency and of considerable power, and the mechanism for cutting up the high-frequency currents to form the dots and dashes of the Morse code. The changes that have taken place in the design of the aerial have been mainly in two directions, the one to make it more suitable for the longer wave-lengths now in use, and the other to give the aerial such a shape that the radiation may be much stronger in one direction than in any other. The first desideratum is obtained by extending the height of the aerial and by increasing the capacity of the condenser formed by the upper part and the earth. Of the directive aerials the Marconi type, consisting of a comparatively short vertical part and a much longer horizontal part, is the only one that has come into use for long distances. As an example, the aerials proposed for the Imperial wireless scheme are to be 300 feet high and apparently some two or three thousand feet long, supported by ten steel masts. The design of an inexpensive form of mast to carry the aerial is a difficult engineering problem.

The type of generating plant depends upon the system employed, and here it is necessary to distinguish between the two forms which the high-frequency currents in the aerial may take.

In the first form the amplitude of the high-frequency current in the aerial starts from zero, rises rapidly to a maximum value, and then dies away again. In the second form the current is of constant amplitude exactly similar to that produced by an alternator. Considering the first and older form the oscillations are produced by the sudden discharge of a condenser through a small self-induction. If the condenser be charged by means of an alternator, in general one discharge will be obtained across the spark-gap with the corresponding train of oscillation during each half-period, thus the number of trains of oscillation per second is equal to twice the alternator frequency. This number can be varied by suitable adjustment.

If we have a given amount of energy to transform per second, the higher the spark frequency the less the energy to be dealt with at each spark. Further, for a given size of condenser, the less the energy the less the voltage to which it will have to be charged. Hence, there are certain advantages in the high spark frequency and a further advantage will appear when we consider the receiver.

The spark frequency has gradually increased from 10 to 20 per second with the induction coil, to 100-200 per second, corresponding to commercial alternating supply currents, and up to 1,000-1,200 obtained from special designs of alternators.

A method much in use for obtaining a high spark frequency from an ordinary, say 50-frequency supply, is to employ a rotating spark-gap or discharger. The apparatus consists essentially of a number of revolving electrodes, which in turn come between the fixed electrodes of the spark-gap and cause discharges to take place, shortening the sparking distance. The number and speed of the revolving electrodes is so chosen as to give the required spark frequency. If such a discharger is used in connection with a continuous current, as is done at Clifden, one discharge is obtained each time the electrode or stud passes between the fixed electrodes of the gap.

One great advantage of the revolving type of discharger over the older fixed gap is that the windage on the electrodes keeps them cool and blows away the conducting gases formed at each discharge, so that the gap rapidly passes from the conducting into the insulating condition. This is a matter of great importance, for if the gap did not rapidly recover its insulating properties an arc would be formed which would prevent the condenser being fully charged again. A number of methods of cooling the electrodes and gases of the spark-gap have been devised. One, which is being largely used by the Telefunken Co., consists of making the spark-gap of a number of flat metal disks, separated by extremely small air-spaces of the order of a tenth of a millimetre, so that the cooling action of the disks on the gases between them is very great. This cooling action causes a rapid extinction of the discharge called "quenching." Quenching is of great value in reducing the reaction between the oscillations in the aerial and those in the condenser circuit, thus enabling tighter coupling to be used and a pure radiation to be obtained. This system, due to Prof. Wien, is spoken of as the Wien or Shock excitation system.

A number of ingenious methods have been proposed in which advantage is taken of the fact that a condenser takes a certain time to charge through a resistance to a given voltage.

If a high-voltage continuous-current supply is available, and a condenser be connected to it through a resistance, the condenser will charge to any voltage less than the supply voltage in a definite time depending on the value of the resistance. If the condenser be also connected through a self-induction to a discharger in the ordinary way, then discharges can be obtained at regular intervals, depending upon the time the condenser takes to charge. It is quite easy to vary this time over a very wide range, say, from one discharge per second to 100,000 per second, provided the spark-gap becomes insulating sufficiently quickly after each discharge. Mr. Galletti has coupled together a number of circuits on the above principle to enable large powers to be dealt with, and he informs me that he is now erecting near Lyons, in France, a transmitting station on a large scale. The results of the tests of this station will be extremely interesting.

Turning next to the continuous oscillations, the arc method has been longest in the field. The principle is well known to you, as it was described before this Institution in 1900. It consists in shunting an unstable arc with a self-induction in series with a condenser when, if the conditions are suitably adjusted, high-frequency oscillations take place in the condenser circuit of practically constant amplitude. Since then Poulsen and his colleagues have founded a practical system on this principle, and considerable progress has been made, although the system has not come into commercial use in this country. The engineering difficulties of the system appear to consist in maintaining the arcs, by means of which large powers are being transformed, so perfectly regulated that the output of high-frequency current is constant both in strength and in wave-length.

High speeds, over 100 words per minute, have been attained in tests of this system between Copenhagen and Cullercoats in England. I am informed that a number of commercial stations have been recently opened on the west coast of the United States, and that good communication is now being obtained by night between San Francisco and Honolulu, a distance of 2,360 miles, with only 25 KW. The stations have masts rather over 400 ft. high, and they are now being equipped with arcs to transform much larger powers.

(*To be concluded.*)

The Turbo-Converter: a High-speed D.C. Generating Unit.

(*Discussion on paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, by* F. CREEDY, *November 5th*, 1912. *See* ELECTRICAL REVIEW, *p.* 765.)

PROF. MILES WALKER said it was his experience that commutators could run at something like 10,000 or 11,000 ft. per minute without any difficulty whatever. The difficulties which had arisen in turbo-generators were due not to the high speed of the commutators but to the fact that sufficient provision had not been made for expansion and contraction. If a commutator was running perfectly true (and the radial-face commutator could be made to run true for years), in the mere fact that it was running at 3,000 R.P.M. or the commutator at 10,000 ft. per minute, there was absolutely nothing against it at all. There were in this country machines delivering thousands of amperes which ran at speeds of 2,000 to 3,000 R.P.M. from year to year. He could show the author a brush that had run for 18,000 hours, practically three years, and the brush had only worn ½ in. It, therefore, gave a false impression to say that high-speed commutators could not be built. In a certain works in Sheffield there was a very cautious engineer who decided to put in a machine with carbon brushes, running at 2,000 R.P.M. After he had had that 500-KW. machine he went in for a 1,000-KW. unit, and that machine was running continuously pouring out 4,000 amperes at 2,000 R.P.M. The Cunard Co. decided to use a radial type commutator continuous-current turbo machine on their ships; what they wanted was something that did not require much attention. There were machines in Manchester built by Siemens which were running in a thoroughly satisfactory way. One member of Mr. Creedy's machine was nearly twice as large as the one at Sheffield. The copper losses were only ·3 in a continuous-current machine, whereas Mr. Creedy's were ·75. The machine could not be built any smaller than the rotary converter.

MR. J. S. PECK said he could hardly understand how any mechanical man could accept a design such as that shown for a commercial machine. First there was a converter with both parts rotating. Then the machine was coupled through a jockey shaft and through fast and loose pulleys to another machine, and the whole combination as given looked to be perfectly hopeless as a commercial and practical machine. The D.C. turbo-generator was, in his mind, no ideal, in spite of what Prof. Walker had said. The tendency on the part of the turbine manufacturers was always to speed the machine higher and higher, so that he believed the final solution of the problem of driving large D.C. generator at very high speeds would be either through a gear reduction or through some other reduction, such as a rotary converter and an A.C. generator. Mr Creedy had shown a speed reduction of two to one, if he used some other speed to get a higher speed on the turbine and a lower speed on the generator. or both the advantage claimed of the capacity of two to one no longer held.

Mr. W. Cramp said Mr. Ferranti told him, at least 15 years ago, that one of the first generators he built had a rotating armature and field, and he still believed in that principle, if it were not for the difficulties to be overcome in the matter of bearings. It might be possible, in his opinion, that the overhung bearing would be adopted. Overhung bearings had been used successfully, and one German company put on the market some 10 years ago a line of motors consisting of ring armatures in which both the inside and the outside of the ring armatures were made use of. There was a line of motors on the market, made in Canada, and used in small cars, in which the armature drove one wheel of the car and the rotating field drove the other wheel. The motors had been used for many years, and were successful. It gave a very small motor with comparatively few turns in the armature at a comparatively high speed.

Mr. G. W. Worrall thought the difficulty with a D.C. turbo-generator was not entirely in the commutator, but, to a very great extent, between the commutator and the armature. He had come across two serious breakdowns; the first was due to broken commutator sections, a trouble which manufacturers now claimed to have overcome (and in turbines that had come under his notice of the newer type he had not had the same trouble); the second was the formation of a layer of dust between the connections between the commutator and the armature. It was almost impossible to get the dirt out because the little bits that got in hardened, owing to the terrific speed, and formed a solid mass. When the armature itself broke down it was an expensive thing to repair, and so one was rather inclined to consider slower speeds. In spite of the many difficulties in Mr. Creedy's invention, it should be very seriously considered, in view of the fact that the D.C. part could be run at a lower speed, and could easily be cleaned.

Photo by *E. Donald Fraser, Cardiff.*

W. A. Chamen.

Chairman of the Western Local Section of the I.E.E.

Mr. A. E. McKenzie said that the high-speed turbine driving through single-reduction gear a continuous - current generator would be preferable to the arrangement shown in the paper. He knew of a turbine which had been running for over 12 months almost continuously at 7,500 R.P.M., driving a pump through a single-reduction gear, ratio 10 to 1; it might be a continuous-current generator for all the turbine knew about it, and if it was the aim of most turbine builders to get a high speed, then surely a speed of 7,500 R.P.M. was sufficient. This pump, after working continuously for over 12 months, showed no sign of wear at all; it was exactly the same as when put in. A firm of engineers had put forward a proposal for a 3,000-H.P. turbine which would run at 3,500 R.P.M. and would drive a 1,800-KW. D.C. generator through a single-reduction gear at 1,000 R.P.M. He had no doubt it would be made a perfectly satisfactory job. Regarding the machine the author had put forward, those who had been unfortunate enough to deal with large units which had been subjected to very heavy short-circuits would not look with very great favour upon the mechanical design of the stator.

Mr. J. Purrett said he would like to know how the cost of this machine would compare with existing arrangements for producing similar results. It appeared to him that in a machine such as the one described, reliability was being considerably sacrificed.

The **Author**, in reply, said he did not dispute that the high-speed commutator was possible. The turbine taken by Prof. Walker rotated at 3,000 R.P.M.; the one described in the paper only ran at 1,800. If Prof. Walker's machine was designed for the latter speed, it would be nearly the same size as the one shown. The question was whether this machine was cheaper than a mechanical gear with a full-size generator. If it was not, then, of course. the gearing had it.

Institution of Electrical Engineers (Western Local Section).

On Monday last, **Mr. W. A. Chamen** read his inaugural address as chairman of the Section, at Cardiff. He said that, at a rough estimate, the total horse-power of motors and lighting and heating devices installed in the area served by the Western Section could not be less than 260,000 H.P. The membership of the Institution within the area was small, the total being 212, of whom 117 were Associate Members. There must be many electrical engineers and other persons who were eligible for admission, within the Western district. The new "Graduate" class should attract large numbers, and every endeavour was being made to remove the objection that those living in the district could obtain no benefit by joining the Institution.

After enumerating the various purposes to which electricity was applied in the West, Mr. Chamen considered the possibilities of development in other directions. The adoption of railless traction would be welcomed by users of the roads, but in order that it might be carried on satisfactorily, the roads would have to be kept in better condition. The storage battery might yet be found a very useful friend in districts where electricity supply was continuously available, and the modern improvements in battery vehicles appeared to open up possibilities well worth the serious consideration of those who were contemplating the introduction of railless traction. Motor-'buses, carrying 36 people, and capable of running 45 to 50 miles without recharging, with replaceable accumulators weighing about 1 ton, had been produced, and the cost of maintenance of the accumulators seemed to have been reduced to quite a moderate figure. The simplicity of the whole equipment, and the perfect control of the vehicle made this method of traction a most fascinating one. Pointing out the various advantages of electric traction on railways, Mr. Chamen outlined the three chief methods of carrying it out, remarking that each had its advantages under certain circumstances. The use of electricity for stimulating the growth of crops and plants was briefly discussed, and the chairman expressed the opinion that as electricity supply became more generally available, considerable developments might be made in this direction. The importance of the subject was emphasised, in view of the inadequate production of food stuffs in this country.

Turning to the question of the supply of electricity, Mr. Chamen pointed out that where this was available small plants could be economically operated by electricity, such as an automatic sewage pumping installation near Cardiff, small water supplies, &c. He expressed surprise at the difficulties which were placed in the way of electricity supply companies by persons who might be expected, in their own interests, to assist the companies in every way, and he advocated the creation of statutory powers to confer upon the latter the right to go across any property within reason, paying compensation for any genuine injury suffered by the landlord thereby, as in Italy and Switzerland.

Local authorities raised unnecessary difficulties, and in many instances had prevented the introduction of electricity supply within their districts without sound reason. It was to be deplored that there was such a want of trust in the good faith of the directors of companies; the conditions laid down by Parliament and the Board of Trade provided ample safeguards for the public. The local authorities had an absolute veto against the erection of overhead electric lines, without appeal to the Board of Trade; this was apparently an oversight, and should be remedied. In several cases, however, the local authorities had co-operated with the power supply companies on reasonable terms.

In one instance a U.D.C. was putting down a refuse destructor with electric generating plant, and would supply energy to the mains of the power company at an agreed price; on the other hand, the U.D.C. had agreed to take bulk supplies of electrical energy at various parts of the district, through which the transmission mains already ran, and would itself distribute the electricity. The arrangement provided a market for the Council's waste energy at all times of the day or night, while affording a supply of energy when required at a moderate price, and saved the cost of transmission. In another instance a U.D.C. had agreed to the company obtaining a prov. order for the supply of the district, and had arranged for the electric lighting of the roads and streets. It was to be hoped that these beginnings of better understandings between companies and Councils would spread as time went on.

Several large colliery companies in the district of the South Wales Electrical Power Co., where the mains of the latter were not yet extended, had put in their own plant, but had chosen the same periodicity as that of the Power Co., with a view to linking up for mutual advantage in the future. Thus the surplus power available at one colliery could be utilised at another, and so on. Points such as these showed that there was much work for the Institution to take in hand, which was purely commercial and untechnical, but was nevertheless of the very highest importance to the development of the uses of electricity.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Temperature Control.

In connection with some remarks made by us on page 687 respecting the prospects of automatic temperature control in conjunction with electric heating, we have received from the Geissinger Regulator Agency, of 7, Redcross Street, Liverpool, some particulars of the Geissinger system of temperature control of electric heaters which has been applied in connection with the temperature regulation of the magazines on the latest U.S. battleships, on the trains of the New York Central Railway's electrified system, and on the Cunard, White Star, Hamburg-American, North German Lloyd, Elder Dempster, and other steamers for cabin heating, &c. The system has been working for four years on the German ships without giving any trouble.

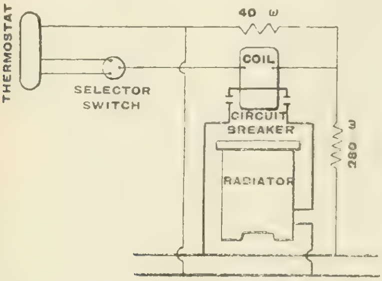


Fig. 1.—Diagram showing Connections of Thermostat, Automatic Switch and Heater, Geissinger System.

The simplest arrangement such as would be suitable for controlling one radiator on a 100-volt circuit is shown diagrammatically in fig. 1, and consists of a thermostat with a two-way selector switch (carrying about 12 volts and $\frac{1}{10}$ amp.) and a circuit breaker, the magnet or relay coil of which is energised by the closing of the thermostat contacts, and which in turn closes the radiator or main heating circuit.

Each thermostat case contains two thermostats, each set for a prearranged temperature, and either of which can be switched in or both switched out by the two-way selector switch.

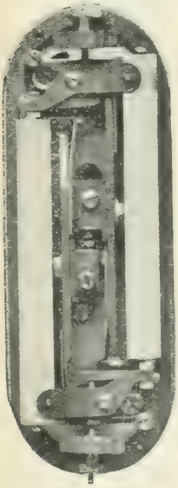


Fig. 2.—Interior of Geissinger Thermostat.

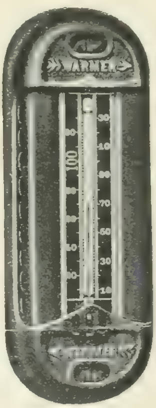


Fig. 3.—Exterior of Thermostat.

The thermostat proper is a patented device operating by means of the expansion of a channel-shaped bar, between the ends of which a bowed spring steel blade is held; the latter carries a platinum contact at its centre, which, as the supporting bar contracts, closes a circuit through a similar fixed contact. An electromagnet in the thermostat circuit allows a time lag in the operation of the contacts, which are fully adjustable as to position. The pressure between the contacts is mechanical and fixed, and not dependent upon any difference in temperature from the standard at which the device is supposed to act.

The thermostat could not carry the main current for even the smallest heater, owing to the limited expansion and contraction of its parts and very small break at the contacts, and only a very small current of low voltage can pass if arcing is to be entirely eliminated. To meet this condition in the case of a 100-volt D.C circuit, a 40-ohm resistance is shunted round each thermostat and relay coil, the latter having about 120 ohms resistance, and eight separate thermostats, each with a 40-ohm shunt (for controlling eight heaters) would be permanently connected in series across the mains. In the case of the single radiator shown in fig. 1, an additional line resistance of 280 ohms is inserted to take the place of the seven displaced resistances, and for higher or lower line voltages the resistance would be varied accordingly.

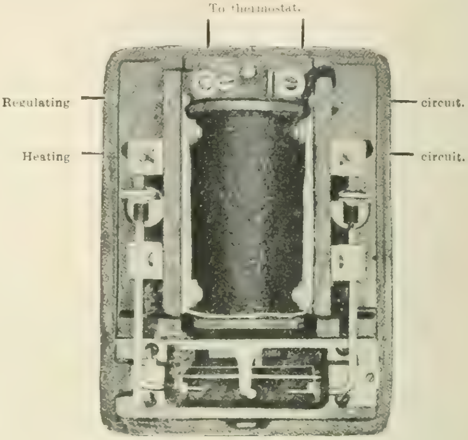


Fig. 4.—Automatic Circuit-Breaker.

Where a series of rooms, such as is referred to above, are equipped on this system, only the thermostats and heaters are placed in the rooms, the eight automatic switches being arranged in a cabinet which is installed in a corridor or passage, and also contains a master switch, by means of which the regulating circuit (carrying $\frac{1}{8}$ ampere) can be opened and all the heaters in connection cut off.

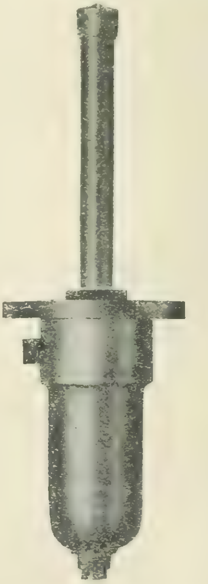


Fig. 5.—Special Vibration-proof, Tank Type, Sealed Geissinger Thermostat.

The pre-arranged temperatures for the duplicate thermostat are usually 65° and 70°, and are adjustable by means of a key.

Obviously the thermostat must be placed so as to give a true indication of the general temperature in the room, away from sources of heat, outside walls and draughts. It is claimed that the positive nature of the contacts and freedom from the effects of vibration have eliminated all the sources of trouble which exist in the old type of compound bar thermostat.

The system has been applied to the control of electrical, steam and hot-water heating, and not only is greater comfort obtained through the elimination of overheating, but a considerable saving in energy results in the case of electrical heating.

In the case of the New York Central Railroad, on which this system of temperature control with electrical heating has been in use, 186 equipments being employed, it is estimated that ·84 unit per car-mile without, and ·59 unit with the Geissinger regulator, were consumed on the average for heating, and the saving was figured at £1,250 for the season.

A special form of tank type thermostat, vibration proof, is supplied for the temperature control of tanks, chambers, ovens, &c., in which case the part of the thermostat which is sensible to temperature changes consists of a hermetically sealed 1 in. metal tube projecting about 9 in. into the tank or chamber.

Thermostats of this type to control temperatures up to 1,000° F. are manufactured. The control is arranged to opèrate motors, valves, dampers, &c., connected with the sources or distribution of heat and cold, and so designed that in the event of failure of the current, the consequent error in temperature will be on the safe side.

It has been applied in the case of powder magazines, refrigerators, hot-water and liquor tanks, gas-heated ovens and chambers, sterilisers, &c.

Ventilated Bracket Insulators.

A type of insulator which has recently been considerably used in high-tension work consists in a "rotation body" of smooth porcelain resting on a suitable plinth. The porcelain is, for constructive reasons, made hollow, the internal space being more or less perfectly cut off from the outer air. Where this construction has been employed, temperature differences between the air outside and within the insulator body have led to considerable condensation of moisture on the inner wall. This condensation diminishes the insulation of the line and raises the capacity of the insulator (and therefore the equivalent capacity of the whole line), since the inner surface of the insulator may be regarded as earthed by this film of condensed moisture. Under such conditions the only effective dielectric is the porcelain itself.

The prevention of this condensation would obviously enhance the value of the insulator, and, with this end in view, tests have been conducted on insulators in which the hollow space has been hermetically sealed by a cemented metal plate. The formation of a water film cannot be completely prevented by this means, and a better solution to the problem is to ventilate freely the inside of the insulator by openings in its walls. The accompanying illustration (reproduced from a recent issue of the *E.T.Z.*), shows such an insulator with three openings *o* connecting the hollow space *h* with the outer air. The porcelain body *p* is cemented on to a tray *s*, and provided with a cap *k*. The side openings can be arranged in any number and form, provided the requirements of mechanical strength are observed, and efficient ventilation is secured.

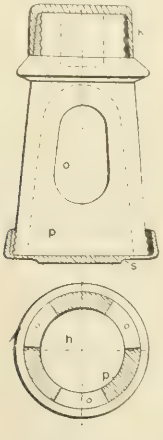


Fig. 6.—Ventilated Insulator.

The openings *o* permit free air circulation during the baking of the insulators, and thus secure quicker and more uniform drying while reducing the risk of cracks. The new construction offers important economies in material, price and weight of finished product.

A number of these insulators can be erected one above the other, progressively smaller sizes being used. The same perforated type of insulator illustrated, and the principle of ventilating internal spaces, are respectively applicable to various electrical apparatus and various types of insulators. In oil-immersed apparatus the side apertures ensure that the insulator shall become completely filled with oil, thus raising the total insulation of the whole.

New Polarised Telegraph Relay.

The Kamm polarised telegraph relay consists of a permanent magnet *n s*, a differential electromagnet E, E^1, and two armatures rigidly connected by a non-magnetic piece A. The permanent magnet induces similar poles at the ends of each armature, and the whole armature system is pivoted in a vertical axis. Connection is made to the lower end of the spindle through a mercury cup, and the upper end of the spindle carries a lever playing between two contact points. Currents flowing through the electromagnet windings induce opposite poles in E, E^1, the attractive and repulsive effects of which are clockwise or anti-clockwise as the case may be. The relay is specially applicable to high-speed telegraphy, and for use in conjunction with instruments requiring a very weak current. It enables 400 words to be received per minute with a working current of only 0·1 milliampere.

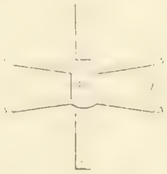


Fig. 7. Kamm Polarised Telegraph Relay.

Automatic Electric Range and Fireless Cooker.

The Copeman Electric Stove Co., Flint, Mich., has recently placed on the market a line of electric ranges in which automatic operation in combination with the fireless cooker princip noteworthy characteristic. These stoves are made in thr to serve from two to 20 persons, and on account of their automatic features are colloquially known as "silent servants." They are built with from one to three compartments, and are equipped with a special type of alarm-clock movement, which switches energy into circuit at a predetermined time, and an adjustable thermostat which cuts off the supply of energy after the temperature of the cooking compartments has risen to the point for which the thermostat has been set by the cook. The edibles then continue to cook by the retained heat of the ovens, the latter being enclosed by insulation which enables the food to be kept hot for hours without the consumption of additional energy.

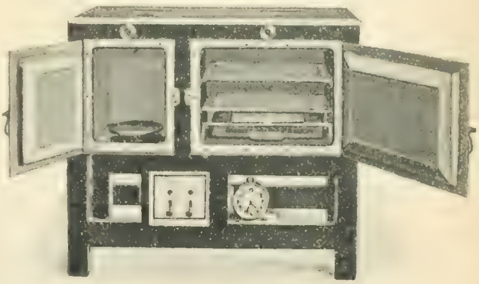


Fig. 8.—Automatic Electric Range and Fireless Cooker.

In the two-compartment stove, which is representative of the line, separate baking and boiling sections are provided, which can be operated independently or jointly. Both ovens are controlled through the circuit-breaker by means of the clock, or they can be set and operated manually. The dimensions of the boiling compartment are 13·5 in. × 10·5 in. × 10·25 in., the baking compartment being 13·5 in. × 18·75 in. × 12 in. The standard equipment for this stove is one 8-in. heater for the boiler, one bar heater in the oven, one heat shield and distributor, two wire oven racks, two receptacles on top to receive the heaters when external cooking or heating is required, and two snap switches for operating the top heaters. These extra heating units make it unnecessary to remove the heaters from the compartments except for cleaning purposes. The connected load is 1,815 watts at 110 volts. The largest stove of this type has a connected load of 3,960 watts, and the smallest size requires a maximum of 1,485 watts, assuming all units in full operation. Either alternating-current or direct-current supplies may be utilised. On account of its economical characteristics, the Copeman stove is not designed for high-speed cooking, as in a gas range, but the makers contend that the saving of a small amount of time is of less importance than the economical consumption of energy and the improved quality of cooking when the process is not hurried. The Copeman clock, which has been specially built for stove operation, resembles an ordinary alarm clock with the exception of the increased strength of the spring drive. The stove enables meals to be prepared and left to cook with a freedom impossible in a coal or gas range. The makers state that it will compete in economy with gas at $1 per 1,000 cb. ft. where electricity is utilised at 10 cents per KW.-hour or less.—*Electrical World.*

The Zipp H.T. Detector.

For some time the LAND UND SEEKABELWERKE A.G., of Cologne-Nippes, have been making a patented device for the purpose of detecting whether an A.C. conductor is alive or not.

The device is based on the principle of displacement currents, caused by the mounting in series of a condenser and current indicator with an A.C. conductor.

The condenser is tested to double the working pressure at which it is to be used, and a Geissler tube is used as the current indicator, mounted inside a strong glass tube, part of it being visible through a slot in the ebonite containing tube.

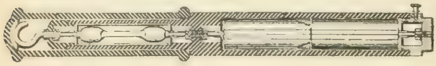


FIG. 9.—H.T. DETECTOR.

At one end is a hook, which is connected with the conductor to be tested, after an earth connection has been made to a terminal at the other end of the device. One condenser cell is supplied for each 5,000 volts, the condensers being mounted in series, and thus increasing the length of the ebonite tube according to the working pressure; a hollow handle is also provided, which can be unscrewed and attached as a cover over the opposite end of the detector carrying the hook, the device thus measuring 30 cm. long × 4 cm. diameter for up to 5,000 volts, with an additional 7 cm. in length for each condenser added.

DAMS FOR WATER.

[COMMUNICATED.]

ENGINEERS engaged on power work may frequently be called upon to design a small dam for a condensing pond, or a reservoir for general storage, or for softening work. Often it is desirable to use as a dam a brick wall set in cement mortar, or a brick tank may be built. The expense must be a minimum, but there must be no risk of accident. The stability of a brick wall has no relation to its length, unless this is so short as to enable a short dam to act as a beam. A short and unimportant dam wall may always be built as an arch convex to the pressure. But in the case of a long dam the arch principle cannot be carried out in its entirety, for an arch can only act by yielding to the stress upon it, and obvious difficulties arise where a yielding arch is joined to an unyielding bedrock, for there must be a gradual and not sudden transition from the dam as an arch to the dam as a fixture. Such cases are in the province of the civil engineer. For ordinary small work no brick wall should be less than $1\frac{1}{2}$ bricks thick, and it should be built with a collar joint of cement—*i.e.*, a solid line of cement running continuously through the wall in length and height at each course. As a rule, a wall so thin as 14 in. at the base will not be built. The collar joint is intended to form a watertight wall joining each horizontal bed of cement mortar.

A usual rule for the thickness of a retaining wall at its base is two-thirds of its height, in order to resist the overturning moment. The formula for overturning moment is $P = 10{\cdot}4\ H^3$ where H is the depth of water in feet and P is the pressure exerted at one-third the depth of water measured upwards—that is, 2 ft. from the base in 6 ft. of water; P is the value of the moment in foot-pounds, and must not exceed the moment of stability of the wall section. This moment is the product of 1-ft. length of wall by the distance from the outer toe of the wall to a perpendicular through the centre of gravity of the section. Thus in a pond 6 ft. deep, the overturning moment is $P \times 2$ and $P = 2{,}246\ H$, or $10{\cdot}4\ H^3$. P is supposed to be the water-pressure concentrated along 1 ft. length of wall at a height of one-third the depth. Then $P \times 2 = 4{,}492$ ft.-pounds. If the wall is, say, 2 ft. thick at the top, and 4 ft. thick at the base, and has equally battered sides, and 1 cb. ft. of brickwork weighs 150 lb., the moment of stability will be

$$\left(\frac{4+2}{2} \times 6 \times 150\right) \times 2 = 5{,}400 \text{ ft.-lb., or } 900 \text{ lb.}$$

in excess of the overturning moment. With the same bulk of material, the margin of stability would be materially increased by making the wall 18 in. at the top and 4 ft. 6 in. at the base. The resultant of the water-pressure and the wall weight ought to intersect the base at a point that is at least within the middle third of the thickness at the base. No special danger will arise if the intersection fell a little to the water face of the middle third, but this is unlikely.

In the figure this is shown graphically, P being $10{\cdot}4\ H^3$ as before. Here $a\ b = P$ to any convenient scale, and $a\ c = W$ where W = the weight of a foot length of wall of the section $e\ f\ g\ h$. The centre of gravity is at O; $a\ c$ is drawn vertically through O, and the diagonal $a\ d$ of the completed rectangle $a\ b\ c\ d$ cuts the base at n. Then $h\ n$ must be greater than one-third $h\ g$. For all ordinary purposes the water face $e\ g$ may be a straight line and vertical. But in high dams it is usual to shape the water face, as per dotted line, or, when the dam is empty, the pressure on the masonry at the base becomes excessive. This is of no moment for dams within the scope of this article.

Where a brick tank can be built more or less underground, a good plan to follow is to make an approximate calculation to ascertain how deeply the tank may be buried in order that the excavated spoil may be piled into a bank round the unburied part of the tank. This plan saves excavation, saves carting away of spoil, and saves brickwork. Even a rectangular tank will not fail inwards if the spoil is well rammed in the outer banks, and these are nicely smoothed and sodded. But if the dirt is not of the kind to be too stable in a bank, there may be internal counterforts built to stiffen the wall when the tank is empty.

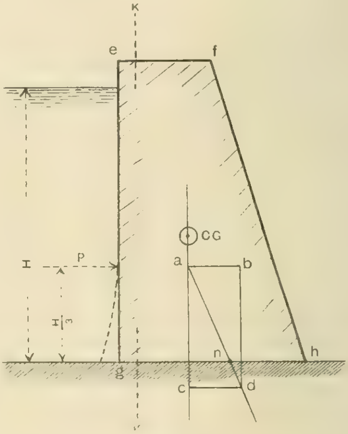


FIG. 1.

The best form of half-buried tank is circular. The writer has built these 12 ft. deep and 30 ft. in diameter, finished externally with grassed slopes so as to be hardly perceptible at some little distance. They may be covered with a concrete roof supported on girders with a pillar or two, and soiled over and sodded to keep them dark and cool. Such a tank need not be thicker than 14 in., the interior being of rough brick cemented smooth. The earth in the outer bank is rammed in layers, which slope upwards from the brick wall and give a maximum of resistance against the internal pressure. In a circular tank there is no fear of collapse from the outside.

When there is plenty of concrete material at hand, the wall may be of this material, a band of hoop iron being buried in the heart of the wall at intervals. Or round $\frac{1}{2}$-in. rods with their ends turned a couple of inches may be used, the rod ends lap-jointing a couple of feet upon each other, so as to secure continuity of tension effect. These circular tanks are built to a gauge board carried by two arms from a central pillar in order that the excavation and the building may be accurately circular.

In a dam such as fig. 1, hydraulic pressure must not be able to exert itself between horizontal joints, or it may overturn the wall. If the material is such that there is any fear of such an occurrence, a wall may be bolted to its foundation by bolts along the line K K. These would be a safeguard against any joint becoming opened. Another safeguard is to cover the whole water face with a sheet of tar laid on in several coats effectually to water-proof all the joints.

The writer has more than once come across water tanks in process of construction which would inevitably have failed when full of water, the line of pressure falling far outside the base. In one case the tank wall, itself insufficient, was built on the top of a retaining wall 17 ft. high, and no provision of any sort was made to prevent the prompt overturn of the entire wall.

Such construction jobs do occasionally fall into the hands of men who have no engineering training whatever. Any failure of their work would reflect upon any engineer who might happen to be associated with other parts of the work, and it certainly can do no harm to keep a watchful eye on such matters, for, after all, anyone who sees a danger and does not tactfully point it out is an accessory in a sense to the result. But in two cases in which architects have been warned the warning was received in no good spirit. Still, that does not justify one in letting a man fall over a precipice.—B.

SOME IMPRESSIONS OF THE BOSTON ELECTRIC SHOW.

By ELIZA J. DUGDILL.

On September 28th last, the largest and finest electrical exhibition the world has ever known was opened in the large Mechanics' Buildings, Boston, Mass., U.S.A.

It was impossible for a stranger to go within a mile of the "show" and not become aware that an electrical exhibition was in progress. Huntingdon Avenue, where the Mechanics' Buildings are situated—the widest thoroughfare in Boston—was lit as far as sight could reach with arc lamps, white and blue, in clusters of three and five, at intervals of a few yards. On the Mechanics' Building itself every ledge and angle was outlined with incandescent lamps, after the manner of our White City decorations; only here the lamps were coloured, and in prominent places and over doorways a perfect network of various-coloured lamps was arranged in fanciful patterns.

As our own goods were delayed in that most irritating place, the Customs—we had to pay 45 per cent. duty, while American fittings makers can send their goods into England free—I took the opportunity of a quiet walk round the Exhibition. The decorations alone were worth a visit. There must have been many thousands of lamps on each floor—basement, first floor and second floor. The ceilings were covered with festoons of lamps and coloured muslin; in the centre of the first floor, where the second floor formed a gallery, the festoons radiated from the centre of the ceiling, forming a canopy which was very picturesque, viewed from either above or below.

Regarding the exhibits, except in detail, there was nothing new to me after our London Exhibition in October, 1911, unless it be an apparatus for milking cows, and I found that, to the American electrician, our own goods were the only new things.

The Boston Show was a real live one; as different from our London exhibition as a busy workshop differs from a shop window show. Electricity was shown applied to the manufacturing of shoes, furs, candies, mineral waters. Pop-corns were roasted wholesale, ice cream frozen, meat preserved in electrical cold storage, and potato chips were fried. I hope we shall always veto the last of these from our English exhibitions. There was a large laundry; cleaners and dyers; and a bakery that turned out 700 loaves a day, which were untouched by human hand until extracted from the ovens. There was the electrical printing exhibit, where the type was set and cast, the Linotype and Monotype machines, where a *Daily Show News* was printed.

There were all kinds of farm implements to which electric driving could be applied, and besides these, there was the exhibition of goods, as seen in our English exhibition, lamp-making, &c.

Electric fittings made in America are clumsy when compared with English. There were a few handsome Louis fittings and the leaded glass standard, and a way of lighting a room by inserting lamps in saucer-shaped glass, suspended from the ceiling in baskets, the light being thrown upwards and producing a pretty effect.

Counterweights are not now allowed, and suspended cords are as thick as cables; they have a wood ball in the centre, with a hole through which the surplus cord is left in a loop. Lampholders are nearly as large again as our bayonet socket; the Edison screw seen here is not now allowed in America. The outer shell reaches to the bottom, and there is a lining of fibre. A gallery must be fixed on to hold the shade, or a piece of screwed tube forced on, the shade having a thread on the top opening to screw on, and not being held with a shade ring, as here.

There is a system in vogue of fitting American houses with fixtures that will do either for gas or electricity. I saw several of the dual fixtures in houses, and they were a positive eyesore, both in finish and design. An interesting exhibit was the long-distance telephone. Trumpets were hung on the walls, and notices, instructions, songs and music, were given through them to the whole room.

Crowds came every day. In one day we had as many as 45,000 visitors. The Edison Co., who promoted and financed the Exhibition, cleared all expense by the end of three weeks. I did not find that the exhibitors expected doing much business while the exhibition was in progress; the advertising spirit seems to be very strong in the American.

The relations between exhibitors and management were very cordial indeed. I do not remember hearing one complaint.

The terms used by electricians differ from ours. Lampholders are "sockets," fittings are "fixtures," aluminium is "alloominum." They talk of people coming "rubbering round" (Anglice, quizzing), and anyone over-curious is designated a "rubber-neck."

Visitors, instead of asking "What is the price?" say "What expense is it?" or "How expensive is it?"

Lectures in domestic applications were a popular feature of the Exhibition. The Exhibition was a well-earned triumph for, and a credit to, the promoters. I shall remember with pleasure my sojourn amongst the bluff, but kindly Americans.

Electric Heating of the Stands at Olympia.—An opportunity for the authorities responsible for the world's largest trade exhibition to show their enterprise presented itself in the problem of heating the show stands at Olympia, during the run of the Motor Exhibition. We are pleased to record that electric heating was decided upon, the contract being awarded to the General Electric Co., Ltd. This is probably the largest electric heating job undertaken by any firm, and was carried out as follows:—The company decided upon the principle of radiation as being the best system of transmitting heat quickly and efficiently, especially as unwelcome draughts are not always avoidable in a huge building like Olympia. Accordingly radiators, fitted with cheerfully glowing lamps, were employed. All the radiators were of the same pattern, specially made up by the General Electric Co., Ltd., for the Exhibition. Each radiator was fitted with four "Robertson" radiator lamps. The radiator bodies were of very neat design, and were constructed of sheet steel with a black matt finish. They were also equipped with copper reflectors, placed behind the lamps, to assist in the radiation. Switches allowed of proper control of heat. In no other way could local heating—which is a special feature of the electrical method—have been so effectively and easily employed.

Tools for Electricians in the Navy.—Lord Charles Beresford, in the Parliamentary Papers, asked the First Lord of the Admiralty whether the Admiralty would supply the following tools for the use of electricians of his Majesty's ships, viz., set of $\frac{1}{8}$ type, set of chasers, 8 to 24 threads, Whitworth thread gauge, set of small carriers, set of small tools for instrument repairs, small surface plate and scribing block, small American brace in lieu of Archimedean drill, and milling attachment of lathe; and whether he was aware that electricians had to borrow these tools from other parts of the ship, which caused confusion. Dr. Macnamara, in reply, said that the general question of tools was under consideration, and considerable additions had already been made. It would not be economical to provide all departments with the same tools, and a certain amount of borrowing must take place, but with proper organisation confusion should not arise from this cause.

Steel Transmission Structures.—The quantities of steel entering into the construction of some of the great transmission systems may prove surprising to those who underestimate the importance of tower structures. The Southern California Power Co. has used to date 20,000 tons of steel tower construction. For the 150-mile transmission from the Mississippi River development at Keokuk, Iowa, to St. Louis, 10,000 tons have been ordered. The Georgia Railway and Power Co.'s system comprises 5,000 tons, and the Connecticut Power Co.'s lines 3,000 tons. In comparison with these figures it is interesting to note that an average ten-story office building, occupying ground 80 ft. × 150 ft., requires about 1,200 tons of steel, and that the large Californian system above cited contains enough to build a dozen steel-arch bridges like that spanning the gorge at Niagara.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,195. "Magnetic separators or combined separators and screens." J. T. Pollard and R. Emmott. November 4th.

25,207. "Alternating-current generators." Ateliers de Constructions Electriques du Nord et de l'Est. (Convention date, November 8th, 1911, France.) November 4th. (Complete.)

25,225. "Telephone conversation cabins." F. J. J. Gibbons. November 4th.

25,258. "Locking devices for the gates or doors of electrically-controlled lifts and the like." F. Barlow. November 4th.

25,278. "Electrically-operated time-indicating devices and the like." L. J. Aron, C. E. Harrison and X. L. Electric Co., Ltd. (Addition to 20,268 of 1911.) November 4th.

25,286. "Automatic regulating devices for electric distribution systems." British Thomson-Houston Co., Ltd., and C. M. Jones. November 4th.

25,300. "Secondary batteries." A. M. Taylor. November 5th.

25,318. "Electric arc lamps." G. Nicholson. November 5th.

25,321. "Magnetic lock for railway carriages and the like." D. G. Thomas. November 5th.

25,356. "Alternators." E. Girardeau. (Convention date, November 6th, 1911, Germany.) November 5th. (Complete.)

25,359. "Electro-deposition of alloys." S. O. Cowper-Coles. November 5th.

25,366. "Dynamos." C. L. Breeden and H. E. Moore. November 5th. (Complete.)

25,370. "Refractory materials." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 5th.

25,372. "Thermo-electric batteries." H. O. Gross. (Convention date, November 6th, 1911, in Germany.) November 5th. (Complete.)

25,374. "Magneto trip-gear for internal-combustion engines." Bristol Wagon and Carriage Works Co., Ltd., and W. A. B. Copsey. November 5th.

25,382. "Printing telegraph systems." Western Electric Co., Ltd. (Western Electric Co., United States.) November 5th. (Complete.)

25,384. "Telephonic transmitters." E. A. Graham. November 5th.

25,386. "Engine starting and lighting systems for motor vehicles." J. B. Entz. (Convention date, March 11th, 1912, United States.) November 5th. (Complete.)

25,411. "Electrical relays and indicating, recording, and re-transmitting apparatus." J. S. Enright. November 6th.

25,420. "Switches for use in connection with the electric lighting systems of automobiles." B. Brooks and W. Holt. November 6th.

25,424. "Incandescent electric lamps." F. E. Wooldridge and E. B. Barlow. November 6th.

25,449. "Sourdine or damper for telephones and telegraphs." R. Schaefer. November 6th. (Complete.)

25,518. "Self-acting switch devices." Schott & Gen. (Convention date, November 13th, 1911, Germany.) November 7th. (Complete.)

25,519. "Miners' electric safety lamp." J. Field. November 7th.

25,531. "Driving magneto ignition devices." D. H. O'Flaherty. November 7th.

25,535. "Electric, gas, or oil sign reflector lamps." T. H. Williamson. November 7th.

25,536. "Reflectors for electric incandescent lamps." F. W. Suter. November 7th.

25,539. "Electric light wire casing particularly applicable to ships' panelling, partitions, and ceilings." W. G. Wakeham. November 7th.

25,540. "Electric signal." J. Fielder. November 7th.

25,551. "Alkaline electric accumulators." W. N. Stewart and E. Foss. November 7th.

25,554. "Boxes for electric batteries or accumulators." H. Lucas and O. Lucas. November 7th.

25,563. "Electric clock systems." A. R. Upward. November 7th.

25,580. "Sparking plugs." M. Naret. November 7th. (Complete.)

25,586. "Electric cooking apparatus." R. S. Downe and Brompton and Kensington Accessories Co., Ltd. November 7th. (Complete.)

25,591. "Controllers for electric motors." L. G. Riley. (Convention date, November 8th, 1911, United States.) November 7th. (Complete.)

25,603. "Dynamo-electric machines." B. Brooks and W. Holt. November 8th.

25,608. "Electric safety lamps and the like." A. Abell, W. E. Ross and A. E. Silkstone. November 8th.

25,633. "Electric pocket lamps and their application to signalling purposes." H. Neuburger. November 8th.

25,646. "Magneto-current generators." E. Podlesak. (Divided Application on 10,209/12, April 30th.) November 8th. (Complete.)

25,670. "Paper strip gathering devices, particularly applicable to telegraphic tape work." H. W. Higham and Remington Typewriter Co., Ltd. November 8th.

25,673. "Telephone instrument set adapted for two lines." Siemens Bros. and Co., Ltd., and E. A. Laidlaw. November 8th. (Complete.)

25,704. "Brush raising mechanism for dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 8th.

25,733. "Motor-car and other electric lamps which are furnished with parabolic reflectors." F. A. Griffin. November 9th.

25,734. Means for connecting wires to incandescent electric lampholders." F. A. Griffin. November 9th.

25,742. "Electrical conductors." M. J. Railing and L. C. Holt. November 9th.

25,748. "Method of and means for recording telephone calls." A. E. Lamkin and F. Mead. November 9th.

25,775. "Connectors for electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co., United States). (Complete.) November 9th.

25,784. "Depolarising agents for galvanic cells." British Ever-Ready Electrical Co., Ltd. (Albrecht Heil, Germany). (Complete.) November 9th.

25,787. "Electric time switches." W. Huttmann and C. Haberl. November 9th. (Complete.)

Electric Vehicles for South Africa.—The question is raised by the *South African Mining Journal* whether there is not a good opening in South Africa for the electrically-propelled wagon; the increasing cost of motor spirit, and the excessive noise prevailing in Johannesburg, are strong arguments in favour of the efficient, reliable and silent electric vehicle, which is also able to show lower running costs than the petrol-driven wagon.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Switches. G. H. White. 9,686. April 21st. (October 21st, 1911.)

Compensation of Polyphase Commutating Dynamo-Electric Machines. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 16,737. July 20th.

Heat-Storage Devices. British Thomson-Houston Co. (General Electric Co.) 18,676. August 18th.

Operation of Electrical Machines of the Induction Type. W. A. Price. 20,709. September 19th.

Dynamo-Electric Machines. E. R. Clarke. 22,987. October 18th.

Semi-Automatic Telephone Exchange Systems. F. R. McBerty. 23,508. October 24th. (October 24th, 1910.)

Means of Simultaneously Recording or Reproducing Sounds and Visible Movements Accompanying such Sounds. A. Rosenburg. 23,620. October 25th.

Automatic Electrical Signalling Systems for Railways and the like. W. C. Hawkes and E. J. Cleburne. 23,846. October 27th.

Electric Water Heaters. A. P. Nichols. 24,445. November 3rd.

Electrically-driven Planing Machines and Similar Reciprocating Tools. Vickers, Ltd., and A. D. Williamson. 25,459. November 15th. (Cognate application No. 5,544 of 1912.)

Process for Carrying Out Gas Reactions in an Electric Furnace. A. Helfenstein. 26,571. November 25th. (November 22nd, 1910.)

Apparatus for Heating, Evaporating, Volatilising or Distilling Liquids by Electricity. T. McClelland. 27,422. December 7th.

Electrical Accumulators. K. R. Smith. 27,542. December 8th.

Intercommunicating Telephone Systems. W. Fairweather. (Turner.) 28,165. December 14th.

1912.

Electrical Switches and Fuses Combined. R. W. Bill. 30. January 1st.

Electric Current or Energy Measuring Instruments. British Thomson-Houston Co. (General Electric Co.) 1,079. January 13th.

Manufacture of Electrodes for Galvanic Batteries. A. Wedekind. 1,198. January 15th.

Starting Switches for Rotor Circuits of Alternating-Current Motors having Wound Rotors and Slip Rings. J. G. Shaw and Shaw. 1,449. January 18th.

Electric Lighting Systems for Automobiles. J. Bijur. 1,753. January 22nd. (February 2nd, 1911.)

Electrical Heating and Radiating Apparatus. H. S. Martin. 2,764. February 2nd.

Registering Devices for Telephone Systems. E. M. Northum. 3,552. February 12th.

Electromagnetic Device for Warning against Theft and Burglary. H. L. C. Neuilly. 4,283. February 20th. (September 11th, 1911.)

Telephonic Transmitters. A. L. Struxiano. 6,893. March 14th. (March 14th, 1911.)

Galvanic Batteries. W. C. Banks and R. C. Wood. 6,758. March 19th.

Electrical Cut-in and Cut-out Devices for Use in Charging Accumulators. H. Leitner. 7,572. March 28th.

Electric Incandescent Lamps. P. C. Hewitt. 8,086. April 3rd. (April 8th, 1911.)

Electric Signal Switch. A. Beck and C. Beck. 8,714. April 12th.

Working of Metal. British Thomson-Houston Co. (General Electric Co.) 9,877. April 25th.

High-Speed Rotors for High-Frequency Multipolar Electrical Machinery. R. Goldschmidt. 10,507. May 3rd. (May 4th, 1911.)

Current Interruptor for High-Tension Lines. C. Clar and T. Clar. 12,320. May 24th.

Electrically-Controlled Signals for Use in Determining Temperature. A. McNab. 14,653. June 22nd.

Wave Detectors for Radio-Telegraphy and Telephony. L. J. L. D. Thibault. 16,163. July 10th. (May 24th, 1912.)

Receiving Apparatus for Electric Waves. F. Schneider. 18,188. August 7th. (Addition to 18,086 of 1912.)

Electric Mercury Motor Meters. H. Gottschalk and H. Aron Elektricitätszahlerfabrik Ges. 18,810. August 16th.

Street Accidents.—In the Parliamentary Papers last week, Mr. Watt asked the President of the Board of Trade whether, having regard to the accidents through the speed of tramcars and of motor-cars in busy thoroughfares in the large cities in the country, he would consider the advisability of appointing a committee to inquire into and seek to prevent or minimise these accidents, in view of the fact that such a committee had been instituted to deal with motor-omnibus accidents in London. Mr. Robertson, in reply, said that the maximum speeds to be observed on tramway systems were fixed by the Board of Trade after the routes had been inspected, and were governed by the varying conditions which obtain on different routes. They were, moreover, subject to revision if fresh conditions arose. Compulsory stopping places were also provided where necessary. So far, therefore, as tramway traffic was concerned, the present system appeared to provide sufficient means of control; and, having regard to the fact that each locality required separate consideration, he doubted if the appointment of a committee, such as suggested, would serve any really useful purpose. The question, so far as it affected motor-cars, was not for the Board of Trade.

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ENGINEERS IN PARLIAMENT.

WHY are there not more engineers in Parliament?

This is a question which must occasionally arise in the minds of those who have the interests of the profession and industry closely at heart. Without the smallest desire to disparage the engineers who do happen to occupy seats in the Lower Chamber, it cannot be denied that the profession is under-represented in that distinguished assembly. What is worse, it is clear from the ignorance often displayed at question time that there are but few private members competent to ask, and still fewer members of the Government competent to answer, any question which involves some degree of knowledge in the domain of technical engineering.

Let us enumerate some of the questions in the discussion of which the engineer could take a useful and informing part. In all matters concerning wireless telegraphy, telegraphs and telephones, motor-omnibuses, electric tramways, railways—including tube railways—and motor-cars, the views and arguments of a trained engineer would be of the utmost value. When a Bill dealing with any of these matters was before the House, it is obvious that an engineer would be better qualified to discuss it than the majority of his colleagues. Not only would his services be valuable in the House itself, but in Committee, where time admits of detailed consideration being given to a Bill, his technical knowledge would undoubtedly have an influence with the other members of the tribunal. A glance at the proceedings in the Commons Committees is sufficient to show that a large amount of time is wasted in explaining technical details to Members of Parliament who are innocent of all knowledge in matters pertaining to electricity and engineering.

If an engineer could be chosen by the Committee of Selection to preside over a committee which had to consider the promotion of a tube railway, or a Bill for the amalgamation of all the electrical undertakings in London into one vast system, a quantity of valuable public time and much expense might be saved.

That the engineer would be fitted by training, and in every other way, to do useful work in the House of Commons, there is no doubt. He is better qualified to occupy a public position than many of those who are at present earning £400 a year at Westminster. As he is concerned with large contracts, in the execution of which he has control over large bodies of workmen, he is naturally acquainted with much else besides mere technical details. He knows much of the conditions of labour in the mine, in the factory, and on the railway. In some sort, therefore, he might speak for the employer, who is insufficiently represented in a House where the influence of the proletariat is felt to a degree which is out of all proportion to the actual number of Labour Members.

Let us now examine some of the influences which are at work to keep the engineer from the House of Commons. Having done this, it will be time to consider the means whereby he can be enabled to take his place in the councils of the State.

Who, in the first place, are "the men in possession"? A large percentage consists of men of leisure who can devote the whole of their time to elections, Parliamentary debates and work in Committees. Even to those of them who are not zealous for work, the Lower Chamber and its precincts are convenient as a club. It has often been called "the best club in London." Another large batch of members is summoned from the ranks of Labour. Others come from remote country districts in Ireland. The vast majority of these men are Members of Parliament for purely Party purposes: they are not there as experts in any particular branch of knowledge. They are there to promote the advancement of certain questions.

Last, but not least, there are lawyers in Parliament. The discussion of the question *why there are* so many lawyers, throws much light upon the discussion of the further question—*why there are not* many engineers in this assembly.

The explanation of the fact that many members of the Bar find their way into the House of Commons lies in the fact that one of the main roads to fame and fortune in the profession of the law leads through Westminster. Politics and law walk hand in hand. A young barrister who fights a forlorn hope in some country constituency attracts the notice of the party leaders. Eventually he stands for a safe seat and is duly elected. A few years of faithful service, and he is made a Recorder. A few more, and he is made a Judge—with a pension to look forward to in his declining years. But apart from what he is going to get out of it, the House of Commons is an attractive, and, what is more, a possible place for a barrister. The hours suit him—he need only be at the Courts between the hours of 10.30 and 4.0; the situation suits him—it is not a far cry from the Temple to Westminster; the work suits him, because if he desires to take an active part in the proceedings, he has been professionally trained to speak in public, and to "think on his hindlegs."

A few moments' consideration will show that it is difficult for the engineer to follow his calling and give sufficient attention to Parliament to make himself a useful member. The young lawyer has time and opportunity to nurse a constituency, but the young engineer is generally in a salaried post, the duties of which wholly preclude his giving the necessary time to electioneering. Nor has he any special hope of professional or other advancement because he can put the magic letters "M.P." after his name.

Going one stage further, the consulting engineer is seldom in such a position that he could devote the necessary time and energy to political affairs. His office hours would not admit of his attending the House until late in the evening; and regular attendance at Westminster would involve his being cut off from the deliberations of those learned societies, at the meetings of which the man who is keen on his profession gains so much. Finally, unless his head office is in London, it is almost impossible—under existing conditions—for the consulting engineer to become a Member of Parliament in the true sense. His clients in Edinburgh, or Dublin, or Manchester, or wherever it may be, want to see him personally; he cannot entrust his consulting business to an underling: nor can he, like the manager of a great business, leave all the routine work to subordinates.

The head of a great firm of engineering contractors is not in much better case. We know of such a one in the House at the present moment, who is constrained by the exigencies of his world-wide business to be absent abroad for many months at a time.

These are a few of the points which may serve in some measure to explain the absence of engineers from the House of Commons. The £400 a year is not likely to induce many more of them to secure the support of those whose names are on the Parliamentary register; nay, it is more likely to increase the difficulty which now besets professional men when endeavouring to get into Parliament, because the competition of those who, for want of a better term, we may call "professional politicians" is all the more difficult to meet.

We have attempted to describe the disease and its causes, and have pointed out the need for a remedy. This is a comparatively easy part of our self-imposed task. A more difficult problem remains. What is the remedy?

So far as the Government is concerned, any steps taken to facilitate entry into Parliament would enure for the benefit of all others besides engineers. If the £400 a year were doubled, and returning officers' expenses were paid by the State, the race for Parliamentary honours would be keener than ever. It may be assumed, therefore, that matters cannot be improved by any direct legislative interference with the general methods by which men become entitled to sit in the House of Commons. Some reform of a more special character should be brought about. Why, for instance, should not an Institution have its own member—elected in a manner similar to that by which the great Universities send their representatives to Parliament? Even if such a reform be outside the domain of practical politics, something might, it is conceived, be done from within the profession itself. A Parliamentary fund could be formed to promote or assist the candidature of any engineer—whether Liberal or Conservative—who is seeking election in any part of the country. Given that it is desirable to have a particular man in Parliament because he is an engineer, his views on the broader political questions of the day would not greatly matter. We know enough of the profession to feel that whether he did, or did not, believe in Home Rule, or any other absorbing topic of purely political interest, the engineer would not sit quietly while the House discussed some technical question upon which he could speak with authority.

To look forward to a Parliament of experts is, of course, to dream of a pleasant Utopia: but the first step towards enabling the House of Commons to be what it ought to be—representative of all the intellectual classes in the community—might well be undertaken by the engineering profession.

Australian Trade.

We have received from Melbourne from the Secretary of the Australian Association of British Manufacturers and their Representatives a printed sheet showing the position of British trade in Australia in 1911. The total imports into Australia in that year are shown to be valued at £66,967,488, as compared with £60,014,351 in 1910. By deducting bullion and specie, live animals and certain non-competitive items, such as rice, tea, oil, &c., in which British trade cannot be said to be directly interested, the total competitive trade is valued at £52,295,529, as against £47,145,514 in 1910. Of this amount imports from the United Kingdom were valued at £32,140,488 or 61·45 per cent., those from Germany at £6,275,478 or 11·99 per cent., and those from the United States at £6,036,285, or 11·45 per cent. The proportion of the imports from the United Kingdom to the total has decreased from 63·43 per cent. in 1910, whilst the proportions of German and United States trade to the total have increased from 9·58 per cent. and 10·59 per cent. respectively.

The second half of this printed statement gives interesting details of the percentage of the United Kingdom trade to the total in each of the States of the Commonwealth, and the following are the details for "machinery," the only item of direct interest to readers of the Electrical Review.

Percentage of British Trade to Total Imports.

New South Wales ...	48·6	South Australia	48·4
Victoria	38·9	West Australia	53·2
Queensland	58·3	Tasmania	44·1

It will be noticed that in the machinery trade, at least, our position is worst in Victoria, and our manufacturers should take steps to find out why they are not doing better in that State. It will be remembered that some few weeks ago we referred to a decision of the Victorian Government to favour British tenders as against foreign. It is to be hoped that this decision will be taken advantage of, and that next year a different state of affairs will be noticeable.

The statistics we have before us are very lucid, and we again congratulate the Australian Association on having obtained the details from H.M. Trade Commissioner in Melbourne for the benefit of British firms. We should like to point out once more, however, that these figures would be much more useful if they were in greater detail, without being so exhaustive as to lose their clearness. We might suggest to the Association that they should issue separate sheets of interest to particular trades, so that a manufacturer in any given line might see the position in his own department without its being obscured by the inclusion of articles in which he is not directly interested. If this were done, the statement would be of much greater practical value, and, for ourselves, we should much like to see similar figures for at least the more important sections of the electrical trade.

Taxing Light. In these days of Continental models, the legislation of our neighbours is only too readily proposed by our own hasty legislators, and if the "light taxes" adopted in Germany and proposed in France should be introduced into this country, it would be a real national misfortune. Although the proposal to tax various methods of lighting has raised a storm of protest from the public and manufacturers concerned in the lighting industry of France, a Commission has been appointed to draw up a definite scheme for such taxation. The committee is composed of nine officials (representing the fiscal element), four industrial representatives, and two economists deputed to safeguard the interests of the public. The Government representatives are in strong majority, and our contemporary *L'Industrie Electrique* fears that the views of the minority will be of little weight in determining the issue.

In view of the enormous hygienic importance of liberal lighting, energy and apparatus for the production and application of light should be placed at the disposal of all at, as nearly as possible, the cost of their wholesale manufacture, and in resisting any taxation or other legislative measures which oppose the realisation of this aim, lighting engineers, manufacturers and consumers must co-operate, sinking for the nonce technical and commercial rivalry.

True national finance should relieve taxation on articles of necessity or beneficial effect, while surcharging luxuries and injurious commodities. Energy or materials for the production of light and the necessary apparatus for the utilisation of the latter certainly come within the first category. Natural lighting is a free gift which has, by our evolution, become imperatively necessary to us. Good artificial lighting is almost equally indispensable, and should be as nearly free as man can make it.

The idea of a tax on means of lighting and heating is not new, but is a financial expedient which has already been universally condemned, and one which, where it has been adopted, has failed to realise the hopes of its promoters. Walled-up windows all over the country bear gloomy witness to our own tax on windows, the effect of which has far from disappeared 61 years after the repeal of the impost. There is to this day a similar tax on doors and windows in France.

The taxes on petroleum have been urged as justifying the new proposals, but this appears to be excusing one industrial handicap by citing another. The French tax on the refinement of petroleums, which finally passed both legislative assemblies in 1903, has consistently shown its evil effects since that date. Not to mention its failure as a handsome source of revenue, the tax has led to a serious decrease in the petroleum imports of France, which fell from 371,000 tons in 1903, to 197,000 tons in 1908, this decrease being accompanied by a corresponding loss of profits and employment in the refinery districts.

The disastrous effects of the proposed taxes on the development of the lighting industry, on the output from gas and electricity works, and on public health, can hardly be exaggerated. By reducing consumption, the tax will decrease its own returns, and, unfortunately, the greater the punitive effect of the levy, the less will be its yield. In 1908 Bülow estimated the returns from his lighting tax proposals to be 50 million marks per annum. In adopting the scheme, the Reichstag reduced this estimate to 20 million marks, and, in 1910, the tax failed to yield even this amount.

Apart from the abstract objections to the tax and its probable effect on public health, there must be considered its serious direct influence on the capital involved in lighting industries and enterprises, and the complications which are likely to result in cases where lighting contracts have been concluded prior to the suggestion of the new tax. For years past, gas and electrical companies have been making every possible concession to consumers in order to encourage the more liberal use of artificial lighting, and, while coal and wages costs have steadily increased, the selling price per 1,000 cb. ft. of gas, and per KW.-hour of electricity, has as steadily decreased. Electricity works in some large towns have satisfactory balance-sheets, but the majority of electrical undertakings realise very inadequate returns on their capital, and would be very hard hit by any scheme of lighting taxation. Finally, the new tax would involve a fresh army of officials for its administration, and would apparently entail still further ingression of functionaries into the domestic affairs of the nation.

Belgo-German Enterprise in Russia. Although the present would appear to be rather an inappropriate period for the launching of a large undertaking for Russia, an official communication has been issued in Berlin announcing the proposed formation in Brussels this month of the Imatra Société Anonyme pour l'Exploitation et la Distribution d'Energie Electrique, which aims at the carrying-out of a scheme, to which reference has been made in this journal on previous occasions. The registration of the company is naturally a formal matter, but a powerful international syndicate has already been constituted to raise the necessary capital, the composition of the syndicate being such that, as in connection with similar enterprises on former occasions, a large amount of the work will be carried out by German firms. The Imatra Co. is to have a capital of £1,200,000 divided into 60,000 £20 shares; also 246,000 "ordinary shares," and the emission of bonds of from £800,000 to £1,200,000 is likewise contemplated in the course of the next three years. The promoters of the company are the three electric lighting companies in St. Petersburg—the Electric Lighting Co. of 1886, the Société Eclairage Electrique, and the Compagnie Générale Auxiliaire d'Entreprises Electriques—and the financial companies which are associated with them. In the first place, the company proposes to utilise the power of the small Imatra fall in Finland, and to transmit a portion of the power to St. Petersburg; and secondly, to work the concession recently granted for 41 years to the Electric Lighting Co. of 1886, to supply energy for lighting and power purposes in the district surrounding St. Petersburg, which is becoming increasingly used for the establishment of industries. At the same time the three existing lighting companies in the capital will also utilise the supply for their own purposes. It is further intended to devote a portion of the power obtainable at the Imatra Falls to the requirements of the country itself, and this part of the scheme will be undertaken by a separate Finnish and Russian company, the whole of whose capital will be permanently held by the Belgian Imatra company. Among the subscribers to the capital of £1,200,000 may be mentioned the financial institutions known as the Société Générale de Belgique, the Banque de Paris et des Pays Bas, the Deutsche Bank, two banks in St. Petersburg, the three supply companies in St. Petersburg, the Compagnie Centrale de l'Industrie Electrique, the Berlin Light and Power Investment Co., the Zurich Bank for Electrical Enterprises, and the Swiss Electrical Industry Co. Two-thirds of the capital of £1,200,000 are to be provided by the German-Swiss group, representing the interests of the A.E.G. and the Siemens and Halske Co., whilst Belgian concerns will furnish the remaining third. It is scarcely likely that the capital will actually be offered for subscription in the near future, having regard to the pressure exercised upon the economic life of European nations by the course of events in the Balkans, although the impending registration of the company, and the list of subscribers, show that powerful financial interests are already completing their arrangements in readiness for the emission when warranted by the circumstances. It may be added, as a matter of course, that the official communication refrains from mentioning the rival scheme, which, as previously reported, proposes to acquire waterfalls to the south of the Imatra, and, presumably, nearer to St. Petersburg.

THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

(*Concluded from page 823.*)

In addition to a range of high-tension magnetos, which have been brought well up to date in the way of rendering them watertight, the Eisemann Magneto Co. had two novelties on view—a lighting dynamo, and a combined lighting dynamo and ignition magneto, the latter being formed by the addition of a bevel gear-driven distributor. The machines are arranged to be driven at the same speed as the magnetos, thus avoiding any gearing-up arrangements. The circuit between the dynamo and battery is controlled by an electrical device mounted in a box-like casing above the commutator. The details comprise two independent magnetic relays, which act in step. The one serves as a cut-in at a speed of about 100 R.P.M., which acts automatically as the field strength increases with the speed of the armature. The other acts as a means of cutting-out or breaking the charging circuit through the cut-in, and and depends for its operation on the strength of the current from the battery. The cut-in has an oscillatory movement, whilst the cut-out consists of a trembler-like blade which is normally off contact, and only makes contact as long as the battery current remains constant.

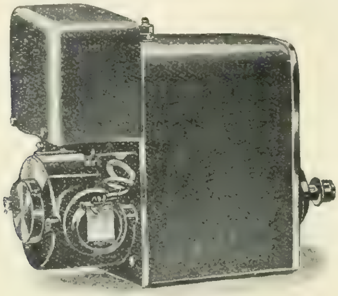


Fig. 4.—The Eisemann Lighting Dynamo.

The Mira magnetolite dynamo, made by the High Tension Co. is of the permanent magnet type, and outwardly closely resembles a magneto, there being only one moving part—the armature. Current is generated at speeds from 600 to 4,000 R.P.M., an automatic controller breaking the circuit when the engine speed falls below the minimum generating speed. A constant voltage is maintained by armature reaction, this, however, only balancing the field magnetism and in no way tending to de-magnetise the magnets.

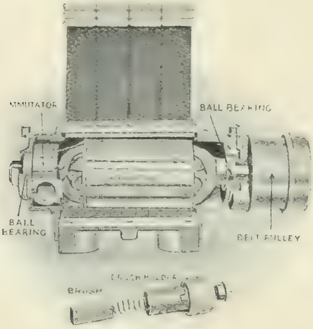
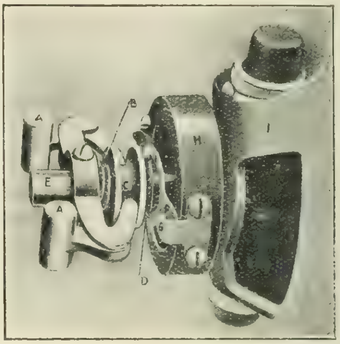


Fig. 5.—Section of Mira Dynamo

Messrs. George Polkey, Ltd., displayed the Polkey-Jarrott dynamo, the latest pattern of which embodies several improvements. The machine, which is of the two-pole shunt-wound type, formerly had a mechanical cut-out for preventing the current from rising above the safe maximum limit; it has now been equipped with a special form of shunt-field winding which renders the output self-regulating. A mechanical method is still retained for providing the minimum cut-out, this consisting of a positive double-contact switch operated by a centrifugal governor, which ensures that the battery and dynamo shall remain disconnected until the latter has reached a speed at which the pressure of its output is in excess of the battery pressure.



A, Governor weights; B, Governor spring; C, Sliding sleeve; D, Fibre washer; E, Armature spindle; F, Spring contact blade; G, Fixed contact; H, Fibre insulator; I, Body of dynamo.

Fig. 6. The Mechanical Cut-out of the Polkey-Jarrott Dynamo.

The latest competitor for public favour is the Rushmore lighting set introduced by Rushmore Lamps, Ltd. This is of American origin, and embodies several new points, chief among which are the means taken to secure automatic regulation of the current output. The dynamo is of the ordinary self-contained type, with a drum-wound armature and field magnets, on which there is a shunt winding opposing the main coils. Between the dynamo and the battery is a special form of regulator known as a "ballast coil." This consists of a certain length of iron wire, of a predetermined resistance, wound upon an asbestos reel, which, when cold, offers a comparatively small resistance to the flow of current from the dynamo. As the speed of the latter increases, more and more current is generated, and the iron wire ballast coil quickly begins to heat up. As it does so, however, the current has more and more difficulty in passing through it, and instead it passes by an alternative path to the shunt field windings; as a consequence the more the output of the dynamo tends to rise, the larger the current which passes to the shunt, and this being in opposition to the main field coils, the net effect is that the current is prevented from rising. A magnetic cut-out automatically disconnects the dynamo from the battery when its speed falls below the requisite minimum.

In addition to a full range of their standard ignition magnetos, the Simms Magneto Co., Ltd., are now making the Simms-Seabright combined magneto and electric light dynamo. The new model is claimed to be not only highly efficient in both of its functions, but has been rendered as simple and fool-proof as possible. In this machine the horseshoe permanent magnets are of considerable size, and contain in their tunnel two separate armatures, which, however, are geared together. One of the armatures is wound with both a primary and secondary winding for producing the high-tension ignition current, whilst the other is drum-wound and yields a low-tension current for charging the lighting accumulators. The first-named armature is driven direct from, and at the same speed as the engine, while the other one is driven from the lower armature by means of gears, the gear ratio depending on the speed of the engine to which it is fitted. It may be noted that there is no electrical connection between the two systems.

A free-wheel device is provided in one of the gear wheels thus enabling the machine to take up the load without shock, and also allowing it to run as a motor in the unlikely event of the cut-out failing to act.

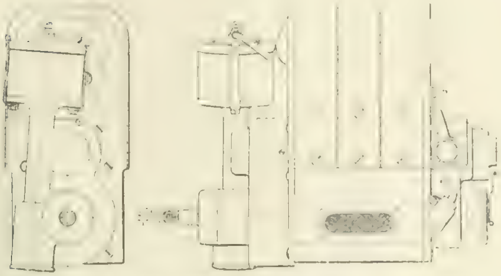


Fig. 7. Simms-Seabright Combined Magneto and Lighting Dynamo.

It is impossible fully to describe the machine on the present occasion, but it may be mentioned that the pressure is maintained at 12 volts by means of a regulator in the shape of an automatic reversing switch housed inside the magnets.

Messrs. Longstreth's, Ltd., are believers in low-voltage installations, and in this connection their 4-volt dynamo lighting set is of interest. The dynamo, which gives a charging current of 10 amperes, is of the ordinary type, contained within a waterproof case, which, upon being detached, allows every part to be got at instantly. The armature shaft runs on ball bearings. In place of an electrical minimum cut-out, a mechanical one is employed, this consisting of a modified centrifugal governor, the parts of which that fly outwards making contact with a couple of terminals on an insulated disk. A simple and effective means is employed to prevent the current rising, at increased engine speed, to an undue amount, this consisting of a patented arrangement of fine wire resistances contained within the switchboard.

The principal exhibit of Messrs. Lodge Bros. & Co. was this year their improved car-lighting installation. The dynamo, which is entirely enclosed, is of the permanent-magnet type, the armature running on ball bearings. The commutator is very massive, and the commutator brushes are all duplicated. The design of the dynamo is such that the current is automatically regulated without any additional mechanical or electrical contrivance. The improvements effected in the new pattern have enabled the output of the dynamo to be increased without any increase in the size. The brush gear has been improved, so that it practically requires no attention until the brushes are actually worn out. In addition to the usual minimum speed cut-out, which is neatly installed within the aluminium switchboard, a free wheel is mounted on the armature shaft, so that, in the rare event of the cut-out failing, no harm could be done to the battery.

The Ducellier lighting dynamo, which is of French manufacture, was shown by Mr. A. A. Godin. The machine is of the self-controlling type, having permanent field magnets, which are weakened as the speed of the armature increases by the action of an electromagnet wound to give a reverse effect. The commutator and its brushes are also so arranged that the output can be adjusted to comply with the demand made upon the battery by the various lamps. The minimum cut-out, which is operated electrically, is carried inside a separate weather and dust-proof brass case. The machine, which, it is claimed, can be used to run the lamps without the intervention of a battery, has a capacity of 14 to 15 amperes at 12 to 14 volts.

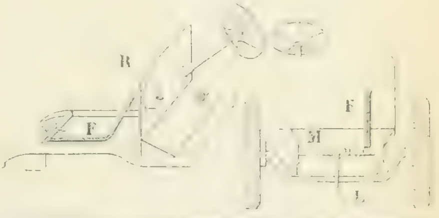
Another French-made machine is the Bleriot, exhibited by Messrs. Bleriot, Ltd. The dynamo in this case is of the compound-wound bi-polar pattern; its essential features are the casing, the two-field windings, and the armature rotating on ball bearings. The machine is provided with an automatic electrically-operated switch, which cuts in the battery when the speed of the engine has increased sufficiently to enable a 12-volt charging current to be generated (at about 600 r.p.m.), and cuts out the dynamo, so preventing the accumulators from discharging through the generator, when the motor speed falls below that mentioned above. The voltage is maintained between only slightly varying limits, notwithstanding the varying speed of the engine, by windings on the machine itself. Two sizes of the Bleriot dynamo are made—one giving 300 watts at 12 volts, and the smaller one, 150 watts at 8 volts, or 200 watts at 12 volts, each being supplied with the necessary switchboard and lamps.

A newcomer was seen in the E.B.C. system shown by Messrs. G. Davenport & Co., Ltd. This is a shunt-wound machine, with an armature running on ball bearings. The maximum output is attained at a speed of about 1,400 r.p.m.; the voltage in this case is maintained by mechanical means, that is, by means of a special slipping clutch. The latter comprises two cones, between which is placed a fibre lining; attached to the spindle between the driving and driven parts of the clutch is a group of small centrifugal governors which, when the maximum output is reached, bear against the driven clutch member and reduce the pressure between the clutch faces, causing slip to occur, and thus keeping the armature speed constant, irrespective of the engine speed. The usual cutting-in switch is also replaced by a ratchet device, which prevents the dynamo from being driven below a certain engine speed.

The En Route dynamo exhibited by the Motor Accessories Co. has the advantage of not only being simple but of being of low price. In this machine electrical means are provided in the windings of the fields to ensure that the output does not rise unduly, a simple solenoid cut-out being used for disconnecting the dynamo from the battery when it is running at an insufficient speed, or when the engine is stopped. The machine is completely enclosed, so that no working parts except the belt pulley are visible. To provide means of access to the carbon brushes and commutator, however, the aluminium lid which forms the top of the dynamo case is arranged to swivel round.

Other car lighting dynamos exhibited included the Omega B.R.C. shown by Messrs. Fenestre, Cadisch & Co.; the Fulmen displayed by Messrs. G. T. Riches & Co.; the "Perfect," made under the Vandervell & Midgeley patents, and marketed by Messrs. S. Smith & Sons; the "T. & M.," made by Messrs. Trier & Martin, Ltd.; the "Magician," exhibited by United Motor Industries, Ltd.; the Willocq-Bottin, made by the Willocq-Bottin Motor Lamp Co.; and the "Dependence" constant-current dynamo of Messrs. J. & R. Oldfield, Ltd.

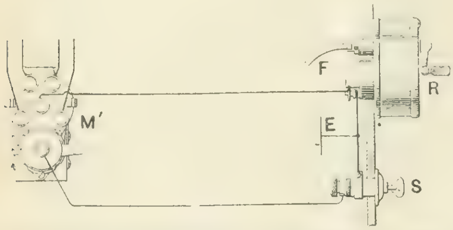
A full range of the extremely-popular—in motor manufacturing circles—Bosch high-tension magnetos, was displayed by the Bosch Magneto Co., Ltd. The feature of the latest patterns is the provision made to render the machines and their connections watertight, they being now completely enclosed, and the joints lined with felt. Various other improvements have been introduced with the view of rendering the distributor and contact-breaker readily accessible for cleaning and adjustment. The principal exhibit of interest was the new engine-starting magneto. Briefly this consists of a separate small enclosed magneto arranged to be mounted on the dashboard of the car. By merely turning a small handle, which by gearing, rotates the armature at a high speed, current is generated and transmitted to the main magneto by a single cable; from the latter, by a special distributor, a spark is caused in the combustion chamber of the cylinder which is in the most



F, Flexible shaft; M, Engine starting handle; L, Small sprocket driven by chain from starting handle; R, Auxiliary starting magneto.

Fig. 8.—Details of Bosch Starting Magneto Installation.

suitable position for firing, or, in other words, which contains a charge of compressed gas. Means are also provided for utilising the auxiliary magneto in conjunction with the engine starting handle at the front of the car, this being effected through the medium of a light chain and a flexible shaft, enabling even a cold engine to be put in operation on the first turn of the handle.



E, Earth connection; F, Flexible shaft; M′, Main magneto; R, Auxiliary starting magneto; S, Switch.

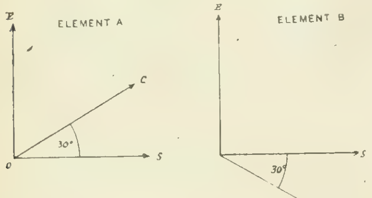
Fig. 9.—Diagram of Connections of Bosch Starting Magneto Installation.

AN APPROXIMATE METHOD OF DETERMINING POWER FACTOR IN THREE-PHASE CIRCUITS.

[COMMUNICATED.]

The following method enables an approximate estimate to be made of the power factor in any three-phase circuit provided with a three-phase meter containing two single-phase elements, the rotation of which can be observed. One of the most frequent applications of the method is in determining the approximate power factor of the load when testing such meters, but numerous other applications arise in practice.

Fig. 1.



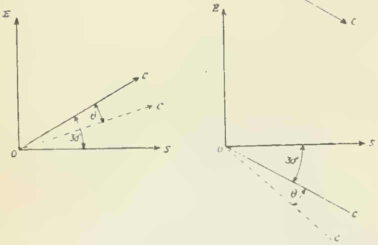


Fig. 2.

Referring to fig. 1, the voltage and current relationships in the meter elements A B, when connected in a three-phase circuit of unity power factor, are represented by the vector diagrams shown. O E represents the line voltage across each element; O S the current in the shunt circuit (assumed in quadrature with the line voltage); O C represents the current in the series meter coil. When the three-phase power factor is unity, the series current leads 30° on the shunt current in element A and lags 30° in element B, hence the power factor of each element = cos 30° = 0·866, *i.e.*, the relative speed of each element = 0·866, taking the element speed, under unity power factor in the element, to be 1·000.

In the general case in which the three-phase power factor = cos θ, the current in the A element leads ($30^\circ - \theta^\circ$), and the current in the B element lags ($30^\circ + \theta^\circ$), on the shunt current O S (fig. 2), hence, corresponding to a load power factor of cos θ, the relative element speeds are:—

$\cos(30^\circ - \theta^\circ)$ in element A,
and $\cos(30^\circ + \theta^\circ)$ in element B.

Corresponding values of θ, cos θ and the relative element speeds are shown in the following table:—

θ°	Three-phase power factor.	Relative speed element A.	Relative speed element B.	Ratio of element speeds B/A.
0	1·000	+ 0·866	+ 0·8660	+ 1·0
10	·9848	·9397	·7660	+ ·816
20	·9397	·9848	·6428	+ ·653
30	·866	1·000	·5000	+ ·500
40	·7660	·9848	·3420	+ ·347
50	·6428	·9397	·1737	+ ·185
60	·500	·8660	0	0
70	·3420	·7660	− ·1737	− ·226
80	·1737	·6428	− ·3420	− ·533
90	0	+ ·500	− ·500	− 1·000

The ratios of the element speeds (B/A) are shown as a function of the three-phase power factor in fig. 3, from which, having observed the ratio of the element speeds in any case, a sufficiently accurate value of the load power factor for practical purposes can be at once read off. It is important to note that this method is only applicable if the shunt connections of the meter are correct. If one of the shunt terminals is taken to the B phase instead of to the C phase, the ratio of the meter element speeds is unity at all power factors, and, though the meter reads correctly on non-inductive circuits, its error rapidly increases as the load power factor decreases, ultimately becoming infinite. An observation of the ratio of the element speeds on loads of approximately known power factor affords a check on the meter connections.

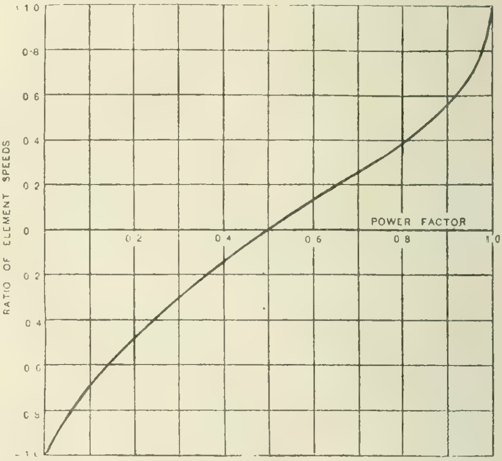


Fig. 3.

Insurance Act Hardship.—Mr. Harry Richardson, Corporation electrical engineer at Dundee, informed the Electricity Committee of the Town Council that considerable hardship had arisen to some members of his staff owing to the men being put under the Insurance Act. They had asked him to request the Committee to revert to the former system of paying salaries when they were off sick. The Committee agreed that the old system should be continued until January 15th, when the benefits of the Act come into operation.

NOTES FROM CANADA.

[From our own Correspondent.]

Owners of sawmills in the vicinity of Vancouver have asked the municipal authorities for permission to run wires and sell electricity generated by using their sawdust as fuel for boilers.

A report comes from Medicine Hat, Alberta, that an electric tramway has been proposed for the municipality, which, together with other industrial developments, is said to involve an expenditure of about £120,000; some English banking houses, it is stated, have prepared a report on the scheme.

At Esquimault, B.C., the Municipal Council intend to call for tenders for the installation of an electric lighting system.

The erection of a new power house to cost about £100,000 is proposed for Regina, Saskatchewan; extensions for next year, if the old plant be retained, include one 1,500-kw. unit complete and additional boilers for this unit; an item for meters, in which line British manufacturers seem to be gaining a hold over here, will amount to some £4,000.

The daily papers reported recently that the latest idea of the Hon. Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, is the organisation of a system of radial (light) railways in the province, the lines to be worked on the same principle as the hydro-electric scheme. A general meeting of representatives of different municipalities will probably be called to discuss the matter in the near future.

In the Electrical Review for November 1st, the editorial remark under the letter signed "Emigrant" is worthy of commendation, for while an "operator" here receives wages more or less on the scale indicated in the letter (though, perhaps, £3 5s. would be a better *average*), it must not be supposed that there are scores of vacancies here waiting to be filled by the 7s. 6d. men at home.

The Department of Mines has recently issued a very full report, giving details of the experiments on the utilisation of peat fuel for the production of power. A full description of the experimental plant, including a number of drawings, is given, besides complete records of the tests carried out, while in the introduction, the advantages of utilising peat for power purposes in the central provinces, which possess no coal or known lignite deposits of economic value, are set forth.

The same department has also recently opened at Kingston, Ontario, a new research laboratory, to be devoted to electro-chemical and electro-metallurgical work. Amongst the first work undertaken will be a series of researches on "The Metal Cobalt and its Alloys," in order to increase its industrial usefulness. The furnaces can be operated at any current up to 3,000 amperes, and the potential can be regulated up to 120 volts.

It seems unfortunate that no definite move has yet been made towards the formation of a Canadian Section of the I.E.E. The writer has had a number of inquiries made to him personally about this matter, some of them from engineers born over here.

The fact is that, owing to the recent great strides made by enterprising British electrical engineering firms in this country, British motors, transformers, meters, switchgears, &c., are gradually becoming known; not only so, but greater interest is being taken in old-country firms generally, and the writer has several times recently been asked what is the standing of some firm not yet represented here. When, as it happened, it was stated in reply in each case that the firm was of high repute, and had been in existence a good many years, the impression created by the answer was a good one, as people over here have hitherto had little opportunity of knowing the life history and record even of some of our best firms at home; the names are new to Canadians, and no one knows whether or no the firm is merely one of yesterday's growth.

Again, underground cable work, for instance, is being taken up seriously here, while large gas engines, steam turbines, &c., are sure to come, and surely I.E.E. papers from home on such subjects would be appreciated here even though the conditions might, in some respects, be somewhat different.

As already stated in these notes, the formation of a Canadian Section of the Institution would, in the writer's opinion, be a great boon, for, with an interchange of papers, which ought not be difficult to arrange, with occasional visits of British engineers to Canada, and, better still, of Canadian engineers to Great Britain, much good to both sides could not fail to result. What matters it that the Canadian Section might be small at first, and, perhaps, confined more or less to the province of Ontario, where the greatest number, probably, of members could be obtained? Under proper management it would grow, as the Sections of the A.I.E.E. are doing.

Some of the foregoing remarks may not be directly relevant to the subject, but they bear upon it, inasmuch as the formation of a Canadian Section would be sure to familiarise Canadian engineers with British firms and British methods, and generally bring the electrical engineers of both countries into closer touch. The B.E.A.M.A., too, ought to bestir itself as suggested some months ago in the editorial columns of this paper, for many things could be done by combined action for the benefit of British firms which cannot be attempted by anyone individually.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

I agree with "Sub-man" in his article on November 8th; what he says is only too true. As far as I can see the wages of sub-station engineers are going down, not up. In the particular sub-station I am stationed in, the men doing the same work 12 years ago received double the wages the present men get, and since then the capacity of the station has gone up seven times, and the responsibility has greatly increased.

I do not say that we should be paid large salaries, but what I do say is that we should get at least a tradesman's wage, and not less than some labourers.

Personally, I do not see what good the Institution does any sub-man; it certainly makes no attempt to better the lot of those of us who are so unfortunate as to be in charge of a sub-station.

Booster.

The Official Balance.

This interesting article by "A.M.I.E.E." in your last issue will have been read with much amusement by all electrical men engaged on warship construction, and also with a certain amount of sympathy, as they have all experienced similar difficulty in getting electrical gear to pass the insulation test.

There are, however, several points which call for criticism.

All sub-contractors to shipbuilders, whether private yards or dockyards, ought to know by this time that all gear, and especially electrical gear, is subjected to very rough and careless treatment on arrival at the yard and when placed on board ship, and unless precautions are taken to protect such gear, disaster will follow.

Electrical goods (other than apparatus permanently fitted in watertight boxes), especially dynamos and semi-enclosed motors, should be most carefully protected against rain and moisture before leaving the makers' works, and, if possible, the firm's representative should be present in person at the yard when the goods are delivered, so that they may be got under cover as soon as possible.

It must always be remembered that the goods may have to be out in the open for some time before being taken on board.

The writer lately saw a large dynamo yoke and fields, most inadequately protected, lying in the open in the pouring rain for days together.

It is not the writer's experience that compartments are regularly water-tested with motors already fitted in place, and he can only conclude that this was due to the gross negligence of the chief of the electrical department or the representative of the sub-contractor.

After installing large dynamos on board, it is usual to protect all vital parts with water-tight cloth, and to build a strong wooden case totally enclosing the machine, thus preventing any damage being done by the host of men who would find a commutator a very useful support for building scaffolding upon.

The writer cannot but think that this was "A.M.I.E.E.'s" first experience of ship work, which undoubtedly often calls for the greatest ingenuity and sustained effort from men engaged in erection of plant on board—a feature which at the same time constitutes its greatest charm.

The greatest difficulty a representative has is to convince his firm that all goods are subjected to the most careless treatment on board ship, and that every precaution must be taken by them adequately to guard against damage being done during the long interval between the dispatch of the goods from the works and the final test on board.

Electrical firms are the biggest sinners in this respect, and it is to be hoped that "A.M.I.E.E.'s" firm took to heart a very expensive lesson.

Representative.

November 23rd, 1912.

Trade with Roumania.

I have read your article of the 15th inst. on "British Trade in Roumania," and I beg you kindly to bring to the knowledge of your readers that I shall be glad to give any firm information and details with regard to standard designs and Government rules and regulations.

My candid opinion is that British material will be more than welcome on the Roumanian market; I have been working for these last six years with almost nothing else but British machinery and material, and have found that it is greatly appreciated by the consumer.

J. Colman.

Sos. Colentina 84,
Bucharest, Roumania.
November 20th, 1912.

Electrical Engineers in India.

I have read with much interest the article headed "Electrical Engineers in India," which appears on page 602 of your issue of October 18th, 1912.

As I have had over nine years' experience of electrical engineering in various parts of India, I hope you will not mind if I venture to criticise your article, which, although excellent as far as it goes, does not seem to me to deal with the subject quite fully enough.

The conditions of service which you mention in the last paragraph but one of your article, are all very well for "foremen" and men who have been used to "roughing it" in England, but I venture to suggest that they are far from being satisfactory for the type of man who is called out here a "Sahib," *i.e.*, a man who has been to a public school and a university, and received a practical training in some large works or electric supply company.

Anyone with experience of India will tell you that the "foreman jointer," for example, on Rs. 300 a month, is probably as well or better off than, say, the "chief assistant" on Rs. 750 per mensem! The "foreman" belongs to no clubs, and does not have to keep a carriage or do any entertaining worth mentioning. The "chief assistant," on the other hand, has to belong to clubs, keep a respectable carriage and do a certain amount of entertaining.

In India there is no "middle class." A man is either what is called a "sahib" and is in what is termed "society," or he is not. In the former case, he has to pay more for food, servants and everything else than in the latter case.

In my own career out here, I have been compelled to investigate and study most carefully the art of living cheaply, and am firmly convinced that, even in Madras (where it is well known that one can live far more economically than in Calcutta, Bombay, Rangoon or Karachi), an unmarried "sahib" cannot possibly manage on less than Rs. 500 or the married "sahib" on less than Rs. 800 per mensem, if he is to insure his life, keep out of debt, and save a little money.

If a man's salary is such that he cannot afford to insure his life for a reasonable figure or save a little money, he is, in my opinion, "existing" in a "fool's paradise."

In addition, therefore, to the sound advice which you have already given to men thinking of coming out to India, may I suggest that you also warn them to settle clearly in their minds the following questions:—

1. Are they going to live in India (or the East) as "foremen" or as "sahibs"?
2. Has their company got a provident fund or pension scheme which will enable its employés to provide themselves with, at any rate, a small competence for their old age?
3. Will they be able to afford to insure their lives for a reasonable figure?
4. Are the salary offered and the prospects such as to allow a man to have reasonable hopes of being able to marry by the time he is 35 years of age?
5. Does the company provide free medical attendance and medicine for its covenanted European employés?

I have put these questions in what I think is their true order of merit and importance.

Electrical Engineer *in* India.

[Such letters as the foregoing are always heartily welcome; it is most important that our young engineers should know exactly what to expect and what to guard against when going abroad. In justice to our correspondent whose remarks are here supplemented, we may add that he also is an "Electrical Engineer *in* India."—Eds. E.R.]

Difficulties of Foreign Trade.

Recently we had, from some electrical engineers in the East, an inquiry for a lighting plant.

We were first asked for a direct-coupled steam turbine set, and quoted accordingly. A little later we were asked to quote alternatively for a directly-coupled high-speed steam dynamo, and quoted in due course. Just after sending in this quotation they asked us to quote for a belt-driven oil engine, giving the name of the oil engine to be used.

With the first inquiry we quoted, as desired, for instruments for the switchboard, to be made locally. With the latest inquiry we were asked to quote for the switchboard complete with instruments fixed, but to give also an alternative with separate instruments not fixed.

Lastly, we are now asked for what we hope will be our final tender, as our friends state that they have decided that they would prefer another make of oil engine, and ask us to get particulars.

In each instance we have been asked to give full dimensions, shipping weights and plan showing the plant erected, and the amount of room it would take up, together with specification, &c.

We have now quoted on this final proposal, and hope that, before the gas turbine is perfected, the order may be placed.

Faint, Yet Pursuing.

The I.E.E. Examinations.

Being interested in the above, I was pleased to see a letter on the subject in your last issue. The proposed examinations, if carried on in the proper manner, will be a good thing for the Institution and the profession.

The suggestion for a *viva voce* examination, if arranged at various centres, would be an excellent one. At present only the following information is available:—That the candidates for Associate Membership will be required to pass an examination in general knowledge, and an examination in one of the following subjects:—(1) Lighting, power and traction; (2) telegraphy; (3) telephony; (4) electrochemistry and electrometallurgy.

Why not include mining electrical engineering, which is becoming one of the most important branches of the electrical industry? I write on behalf of a branch towards which the

Institution has not done its duty in the past, that is, "mining electrical engineering."

Some may say we have the Association of Mining Electrical Engineers; quite so, but if the I.E.E. had taken more interest in electricity as applied to mining, the Association of Mining Electrical Engineers would never have been formed. But now that it is formed and doing good work, the Councils of the I.E.E. and A.M.E.E. should work together and arrange that any member of the A.M.E.E. that holds a first-class certificate should receive exemption from the whole or part of the I.E.E. Associate Members' examination. I hope to read other opinions on the subject before the form of examination is decided on.

Colliery Electrician.

The Hong Kong University and the British Manufacturer.

I notice in your issue of November 15th an interesting article on the subject of the Hong Kong University and the invitation of Prof. C. A. M. Smith to British engineering firms to furnish the necessary machinery and engineering plant, free of charge, to the engineering school of that University. This Association is in thorough accord with Prof. Smith's view that it will be a great calamity if this absolutely British University is to be equipped with machinery supplied by our foreign competitors. The result would be a standing advertisement for such firms in the very home of British engineering in the Far East.

The bulk of the money which brought the Hong Kong University into being was provided by (1) a rich local Parsee merchant; (2) a British merchant; and (3) certain Chinese business men. It is to be hoped that British engineering firms, who, above all, are the people to whom this University will be of practical benefit, will find it worth their while to fall in with Prof. Smith's very reasonable proposal.

Before Prof. Smith left England he approached this Association on the subject about which he now writes to you. The purpose of this Association (which, as you are aware, is not a profit-making concern) is to overcome the obstacles which stand in the way of British engineering interests in China. As the offer of the Hong Kong University has a direct bearing on that question, and the indiscriminate sending out of machines by various makers may lead to confusion by duplicating the plant, I shall be happy to hear from any of your readers on the subject. In fact, in some of his letters to the newspapers Prof. Smith has referred manufacturers to this Association.

Stafford Ransome,
Secretary of the British Engineers' Association.

Caxton House, London, S.W.
November 19th, 1912.

[Our correspondent appears to have overlooked the much longer article on the Hong Kong University which was published in our issue of November 8th.

The advancement of British engineering in China is a subject in which we have long taken a keen interest, and for some years we have earnestly advocated the development of our trade with that vast area; it was, therefore, with sincere pleasure that we welcomed the newly-formed British Engineers' Association last May, with the same object in view, and we are glad to note that it is fully alive to the magnificent opportunity presented by the equipment of the new University.

While writing on this subject, we should like to remind our readers that we shall be glad to receive particulars of machines and apparatus that they are willing to present to the Engineering Department of the University.—Eds. E.R.]

Life in Brazil.

I want to publish a warning to all electricians who are coming out to Brazil, not to come out at the salary now being offered by agents at home, viz., £6 per week.

The present rate of exchange, cost of living, &c., requires £9 per week to recompense them, as there are no home comforts in this country, and living is very dear.

On £9 they will not save much.

G. F. Kenyon.

Brazil, *November 3rd*, 1912.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A New Westinghouse Showroom.

The British Westinghouse Co.'s supply department has recently opened new offices and showrooms at 14, Long Millgate, Manchester. The accompanying illustrations show the main showroom and one of the small demonstration rooms.

The basement is of considerable extent, and is utilised for storage purposes and for packing. On the ground floor are the sales depôt and dispatching department; the shop is handsomely finished, and a stock of everything electrical in the way of supplies is at hand. The provision of these "over-the-counter" facilities is greatly appreciated by contractors who are in a hurry for odd requirements for urgent orders.

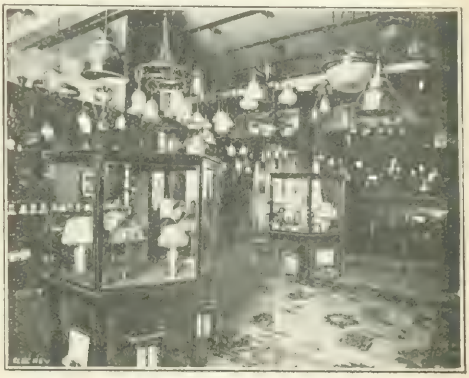


Fig. 1.—Fittings Showroom at Manchester (Westinghouse Co.).

The first floor of the Westinghouse supply department premises is given over to well-arranged and completely-equipped showrooms for the convenience of contractors to bring their customers right in amongst the goods. The main showroom is hung with a great variety of fittings, including Benjamin steel reflectors, Auriga-Holophane globes and fixtures suitable for large halls, hotel lounges, drawing-rooms, and the like. Every fitting can be lighted independently, and any fitting can be taken from the main showroom and hung and lit at a moment's notice in the model drawing-room and dining-room (to judge as to the effect) which is provided especially for this purpose.

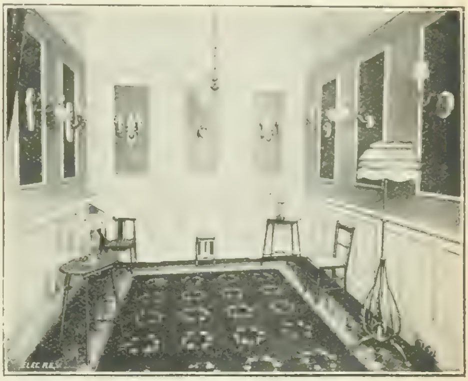


Fig. 2.—Model Drawing Room, Westinghouse Co.'s Manchester Showroom.

The second floor contains the supply department offices and an extensive stockroom for electric accessories. The third floor is the lamp store, where large stocks of all types and sizes of Auriga drawn-wire lamps are stored. On the fourth floor is the glassware store.

New Coupling for Overhead Wires.

Mr. R. Greenstreet, of 109, Tufnell Park Road, London, N., has patented an improved method of jointing, of which we give an illustration. The upper figure represents the old Britannia joint for comparison; the second, is a joint made with the patent coupling, with the wires in alignment. The component parts of the coupling, and the ends of the wire as prepared for making the joint, are shown in the other views.

The coupling consists of two half sleeves shaped internally to receive the ends of the wire, and tapered externally at each end to receive clamping ferrules similarly tapered. The ends of the wire to be jointed are provided with cup-shaped depressions by means of a tool designed for the purpose.

The prepared ends of the wire are placed between the two half sleeves of the coupling; the two ferrules are then pressed tightly over the ends, and the joint is made. For permanent work the central portion is soldered. Weakening of the line by annealing the bare wire, which occurs in other soldered joints, is avoided in this invention by confining the soldering to the space between the ferrules.

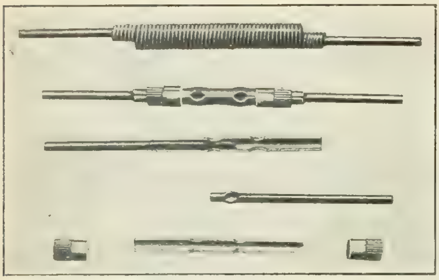


Fig. 3.—New Coupling for Overhead Wires.

This coupling is said to be particularly suitable for jointing hard-drawn copper wire of 200 lb. per mile and upwards; and for this purpose it is made in tinned copper.

Petrol-Electric Set for Arc Welding.

The **Parsons Motor Co.**, of Southampton, has recently supplied a 42-h.p. six-cylinder petrol-engine set, with dynamo and exciter mounted on the same channel-iron bed, for arc-welding purposes.

As the conditions for this class of work are most arduous, and very close governing is required, the Parsons Co. designed a special vertical enclosed sensitive governor, driven by enclosed gearing, which limits the variation to about 5 per cent. only on an output of 200 amperes at 70—110 volts. The electrical equipment was specially designed by the Lancashire Dynamo Co., and a thorough test of the complete outfit was made before delivery.

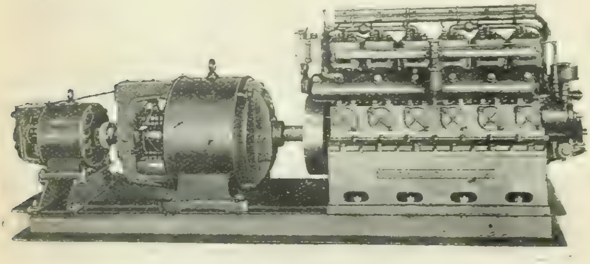


Fig. 4.—Parsons Motor Co.'s Arc-Welding Set.

The firm has orders on hand for several similar plants for welding purposes, for use in shipyards, which will use paraffin as fuel, and is in a position to meet all the requirements of this class of work satisfactorily.

A Molecular Air Pump.

An interesting device was recently described by Mr. W. Gaede to the Physikalische Gesellschaft, and in *La Technique Moderne.* It consists of an entirely novel form of air pump for extremely low pressures, which is illustrated in section in fig. 5. Here A is a cylinder revolving at a very high speed, which is surrounded by a box B B; a groove of width h is made in the wall of the box between the openings n and m. When A revolves in the clockwise direction, air is carried along the groove from n to m by gaseous friction, and on connecting the openings to a manometer a difference of pressure is observed between them, proportional to the speed of A and the internal friction of the gas. As the pressure inside the box is lowered (by other means), the difference of pressure between n and m remains constant, the internal friction of the gas being independent of the pressure; and if this rule held good throughout it would be possible to produce a practically perfect vacuum at n when the pressure at m was only a few millimetres. At the lowest pressures, however, it is the ratio of the pressures at the points n and m which remains independent of the degree of exhaustion.

In practice, using an ordinary type of pump to reduce the pressure at m to a low value, a vessel connected to n can be evacuated to a very high degree. It will be observed that no mercury is used, so that the vapour pressure of mercury, which limits the degree of exhaustion possible with mercury pumps, is here eliminated, and the simplicity of the pump is most striking.

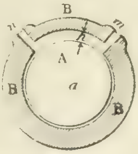


Fig. 5.—Gaede Molecular Air Pump.

W.E. Improved Adjustable Telephone Arm.

The **Western Electric Co.**, of North Woolwich, who first applied the principle of the "lazy tongs" to a telephone support, have just brought out an improved pattern, which is illustrated in fig. 6; great strength and durability have been the chief aims; and the arm supports with ease the heavy modern Post Office telephone. The "gate" members are of steel ¾-in. wide by ⅛-in. thick; the joint rivets are of much heavier section than usual; roller bearings are introduced next to the mounting bracket, where the greatest strain occurs, and the bracket-pin on which the arm rotates is a solid ½-in. steel rod, which is not reduced in diameter or weakened by exterior screw threads.

An ingenious arrangement of detachable spring clips for holding the flexible cord obviates the disconnection of the cord from the set, usually necessary in order to thread it through eyelets. Fixing brackets are furnished which allow of the arm being fitted to a roll-top desk (either side), wall or flat-top desk.

The Weenen Automatic Point and Signal Control.

The Weenen automatic point and signal control, which is being introduced by the **Stoffels Electric Switch Co., Ltd.**, 41, Eastcheap, E.C., is an electrical appliance by which one or the other of a pair of electric circuits, placed in the overhead line, may be closed at will by the driver of an electric street car, for the purpose of operating a switch, or a signal, or both.

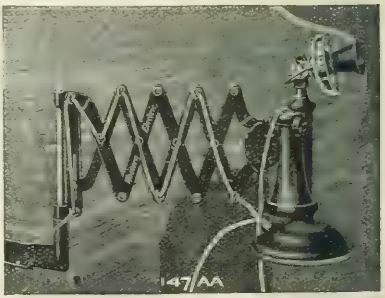


Fig. 6.—Adjustable Telephone Arm.

No constructional alteration is required in the vehicle; the coil for the operation of the points is only under current for the moment during which the current collector touches the contact; the points may be always moved by hand; no separate relay is required for the switching, and the driver does not need to ascertain either the lay of the switch or the position of the signal.

The construction and operation of the appliance are as follows:—

To the trolley wire A, fig. 7, is firmly attached, but insulated therefrom, a metallic contact bar B, which projects sufficiently below the trolley wire to detach the trolley when passing on to it. This contact bar carries a movable slide D, also metallic, and not insulated from but of shorter length than B.

By the forward movement of the slide D, two lever arms E_1 and E_2 are thrown over towards two insulators H_1 and H_2, which carry contacts at their upper ends. The lever arms are in two parts, of which the upper is hinged to the lower. The two parts are maintained in a straight line by a nickelin spiral spring so long as nothing is in the way of the upper part when the lever is moved.

The contact bar B carries, moreover, a coil F, wound with insulated wire, and containing an iron core K. The coil and core operate selectively on the lever arms and contacts for the purpose of controlling the direction of the current to the point or signal in the following manner: The core carries at each end a stud, and is maintained in one direction by means of a spring, so that one of the studs is placed in the plane of movement of one of the lever arms, whereas the other arm can move forward without impediment. One end of the coil F is attached to the trolley wire, the other to the contact bar B.

When, therefore, a car runs its trolley along the contact B, the trolley moves the slide D forward, and thereby moves both lever arms E_1 and E_2 in the direction of the contacts carried by the insulators. If the car, when operating the contact, is not under current, the core K remains at rest, and one of the studs at K obstructs one of the lever arms. The upper of the two hinged parts of the lever arms turns over the lower, but cannot touch the contact opposite to it: the other lever arm, however, being free to move, engages with the contact opposite to it. If, however, the trolley when passing under B is under current, in other words, if the driver has switched in his controller, the following process takes place: The trolley being detached from the line wire, cannot take current from it directly, but it can and does do so indirectly through the windings of the coil F, by which means the iron core K is displaced.

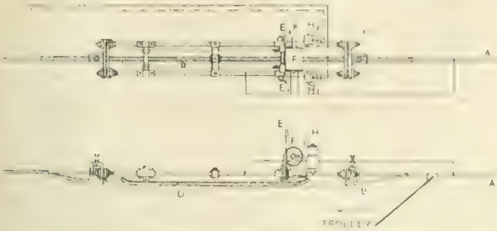


Fig. 7. Weenen Point and Signal Control.

By this displacement—which occurs as the trolley passes from the line wire to the contact bar B, and thus receives its current through the coil—when the slide D is moved forward, the stud which impeded the way of the one lever arm has been removed and the other stud has come in the way of the other lever arm. It depends therefore upon whether the controller is on or off, whether a circuit is closed through H_1 or through H_2, and this automatic action can thus be used for the operation of the points by means of solenoids, or for signalling an approaching car, or for both purposes simultaneously.

The circuits through H_1 and H_2 are carried, protected by fuses, to the apparatus actuating the point or signal.

The Micro-Monophone.

The Micro-Monophone is a tuning-fork kept in permanent vibration by means of a microphone contact. This apparatus, devised by **Emanuel Kostelecky**, of Postelberg, Bohemia, is preferable to the familiar tuning-fork interrupters in that its sound is much purer, while the current curve approaches much more closely to a sinusoidal form.

The arrangement of the apparatus is represented in fig. 8. A tuning-fork L is fixed on the centre of a resonance box R placed on a strip of cloth S. The resonance box may be mounted on feet, and the apparatus is then set working more easily, but the sound given off by the tuning-fork is weaker.

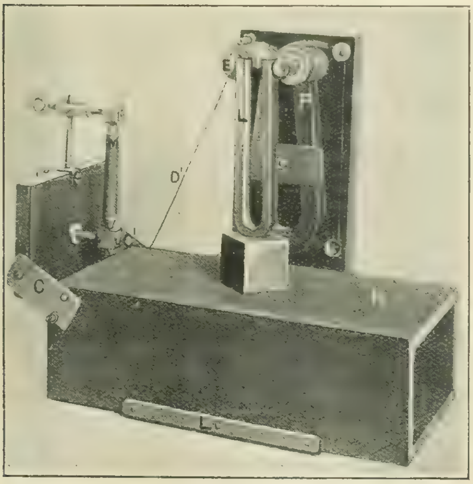


Fig. 8.—The Micro-Monophone.

The prongs of the tuning-fork are situated in the field of the electromagnet E, on which is superposed the field of the permanent magnet P. The coils of the electromagnet are arranged in series with the microphone M fixed with the hinges C C′ at the closed end of the resonance box. The hinges allow the microphone to be displaced within certain limits in adjusting the microphone contacts.

The current of the battery goes through the microphone, and by way of the wire D′ to the electromagnet E, thus reinforcing the permanent magnetic field.

In order to set the apparatus working, the microphone is inclined until the lower carbon electrode touches the resonance box. While the apparatus works with different inclinations of the microphone, and even in its vertical position, it is found to be most efficient when the electrode touches the sounding board. The tuning-fork having been set vibrating by means of one or two slight knocks, the vibrations are transmitted by the resonance-box to the microphone, and, when the battery circuit is completed, the magnetic field undergoes variations, which react on the tuning-fork, and thus on the microphone. On account of this mutual action the tuning-fork will vibrate as long as the battery circuit is completed. By reducing the current intensity the purity of the sound is increased. The microphone rod should have such dimensions as readily to follow the vibrations of the tuning-fork. After prolonged use, the contacts are liable to be impaired; the carbon rod should then be turned round so as to renew the points of contact.

When the currents produced by the Micro-Monophone are to be used for experimental purposes, the primary of a small transformer is arranged in series with the microphone and electromagnet, alternating currents being induced in the secondary of the transformer.

The fact that a telephone receiver and a microphone, under suitable circumstances, will whistle or sing, has been known for many years; the arrangement here illustrated is more elastic, and should be useful for many experimental purposes.

The Detection of Trouble by Noises.

Every engineer in charge of a power plant will be aware of the fact that a great deal of trouble can be prevented if care is taken to detect and account for any unusual noises which happen to make themselves heard. A knock on an engine, if left to take care of itself, will frequently lead to serious breakdown, and a trained engineer will therefore be able, even in the midst of the medley of sounds which arise from running machinery, to distinguish quite small and trivial noises in such a way that they attract his attention. In this way, a great many accidents have been caught in their early stages and prevented from becoming serious.

At the same time there are a number of minor sounds which, from their cause, cannot be of any great magnitude, and it is impossible to expect even the best engineer to hear these, either when passing the plant in question or even on a diligent search. Moreover, a good many sounds are extremely baffling in their nature, and it is not always easy to detect their origin. Those who have had to do with trial runs on steam power plant, for example, will be aware of the old method of taking a light lath of wood and placing one end of it on the teeth and the other on various parts of the engine which is being examined, in order that the source of any undue vibration or noise may be detected. This method, however, while useful is somewhat crude; an adaptation of the same principle developed into a scientific instrument has been brought out by the **Boston Talking Machine Co.**, of Boston, Mass., and is known as the Detectorphone. This is shown in fig. 9. and is as valuable to the mechanic as a stethoscope is to the physician. It consists of a light steel rod capable of transmitting any minute vibration to an electrical system, which is attached by means of a flexible cord to a telephone receiver, this being so arranged that, if necessary, it can be clamped to the head by means of the usual signal ear-piece headgear. It has been used very considerably, both in power plants and in hydraulic systems. The method adopted is to go over all the running machinery a few times a week with the instrument, and the use of the Detectorphone enables the engineer to know what is going on inside the pump and engine, and to find the exact position of trouble long before it becomes audible to the unaided ear. In pumps, for example, the engineer can locate any damage or leaking valves in the steam and water ends without external examination. He can also find whether steam is being admitted at the right time, and whether the piston rings are in good order. Not only is it used inside the pumping station, but in some water departments it

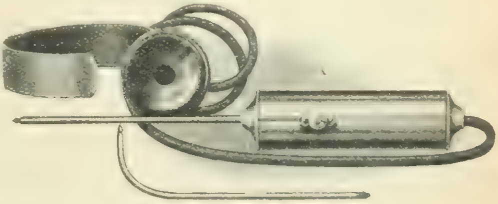


Fig. 9.—The Detectorphone.

is adopted in order to locate any leaks which may have been formed in the streets. The former method was to take up the street every few feet until water was found. By the use of the Detectorphone the point of the instrument is stuck into the ground directly over a pipe if the ground is soft, and the inspector, by listening, can detect the hiss made by the leak. If the ground is hard, an iron rod is taken and driven 4 or 5 in. into the ground just over the pipe, and the point of the Detectorphone is placed over the top of the rod. The hiss made by the leak is then followed up until the place of the loudest disturbance is reached. He can then be sure that he has found the position of the leak, and it becomes a simple matter to excavate and repair the leak. In running machinery a good many other troubles can be successfully examined. It has been adopted in the automobile industry and in other factories, and has been successfully employed in finding sand or dirt in ordinary bearings, and broken balls in ball bearings. It has been adopted, among other places, in the Navy Yard at Charlestown, of the United States Government, and similar large undertakings.

LEGAL.

Glasgow Tramway By-Laws.

The Justiciary Appeal Court in Edinburgh has decided an important case in an appeal at the instance of the Procurator-Fiscal of Glasgow, who, in the Police Court, brought a complaint against a passenger, charging him with having failed or refused to pay on demand to the conductor of a Corporation car the legal fare for the distance travelled by him, contrary to the by-laws and regulations of the Corporation of Glasgow, and particularly By-law 3. By-law 3 provides that every passenger shall, upon demand, pay to the conductor or other authorised officer the legal fare for the journey. By-law 4 deals with attempts to evade payment of the fare.

The Magistrate dismissed the charge as irrelevant, holding that By-law 4 as regards the taking of a ticket and the payment of the fare was the only provision applicable in a prosecution, and excluded proceedings solely libelled under By-law 3.

The Court sustained the appeal, holding that By-law 3 constituted an offence if read, as it must be, along with By-law 26, which imposed the penalty for contravention of the regulations or any part thereof.

The First Division of the Court of Session has ordered issues for the trial by jury of an action by a tramway passenger against the Corporation of Glasgow for £250 in respect of wrongful apprehension. Pursuer alleges that he could not find his ticket when an inspector demanded it, and that the inspector gave him in charge. For the defenders, it is pleaded that the actions of the inspector were privileged, and that pursuer refused to give his name and address.

The Telephone Arbitration.

(*Continued from page* 830.)

Continuing, the Solicitor-General submitted that the company's claim in regard to the stations was exaggerated. He pointed out that the company claimed £38 per station with 2·68 miles of wire, whereas the Post Office experience was that a station with 3·58 miles of wire cost under £32. If the company had the same amount of wire for each station as the Post Office their claim would be increased to £46 per station. Taking the cost of wire, Sir John pointed out that the company claimed £10 per mile of wires, as against the Post Office figure of £7.

Sir A. Cripps, interposing, said that further figures had been agreed upon between the parties, and other figures were under consideration with a view to an agreement.

On the question of depreciation in the value of the plant, the Solicitor-General argued that the Court was bound to take into consideration the fact that the life of the plant was threatened, and sometimes terminated, by the withdrawal of wayleaves.

Sir A. Cripps said his clients had taken the natural life, which was shorter than the average wayleave life.

His Lordship regretted that the question of the extent to which wayleaves were taken away was not properly developed when the witness gave evidence.

Sir J. Simon contended that the Court had not been left absolutely without guidance on the point. He mentioned that the Postmaster-General took over 427,547 poles at the commencement of the present year, and in six months wayleaves affecting 850 poles had been withdrawn. The company would have the Court look at the matter as if the whole of the undertaking had suddenly become paralysed and fossilised, never to go on any more, and then say, "Now how much should be given for it." That was an altogether wrong assumption; the plant continued to go on and run its due course, and it was impossible to try and apply highly problematical and theoretical conditions to the problem.

In concluding the summing-up of the case, the Solicitor-General said the amount of the stake was a large one, and he wished to say as the representative of the Crown that he was deeply grateful to the Court for the care and attention it had bestowed upon the matter as he had tried to present it. It was most important that a proper figure should be fixed, not only on account of the large sum involved, but also on account of the desirability that the telephone service of the future should not be overloaded with capital charges.

Sir A. Cripps, on behalf of the National Telephone Co., said that the Court had to deal with the valuation of an artificial and statutory character, and not a value which could be regarded as a business arrangement. The whole bedrock of the Postmaster-General's case appeared to be that he had instructed Mr. Snell, the consulting engineer, to throw over the tramway principle of the value to the vendor for value to the purchaser. In his opinion, the Court had to put the vendor out of consideration altogether. What they had to see was, not what it did cost, but what it would cost anyone to successfully construct and put into complete working order the plant in question. Continuing, he said the proposition he desired to submit was that the life of the plant for the purpose of calculating its value on December 31st, 1911, under the agreement was the length of the period of its efficient use under the conditions then existing, having regard to the conditions of a changing business in the future. They were bound to eliminate the business element when considering the real value of the plant under the Tramways Act. As to the suitability of the plant for the Postmaster-General's service, the Court had not considered suitability in reference to conditions in the future but to the conditions as they were. In dealing with depreciation, he maintained that in dealing with depreciation the Court ought not to deduct a farthing in respect of deterioration of cables by electrolysis. The company's engineer-in-chief (Mr. Gill) said that in estimating the life of cables he took into consideration all kinds of disease to which the cables were liable, but he could not say that he allowed any diminution of life on account of electrolysis, because the risk of disease was very slight. The evidence showed that the disease was theoretically possible, but practically negligible. Counsel maintained it was monstrous that the witnesses should endeavour by innuendo to cut down the sum due to the company. If electrolytic action was a practical factor, Mr. Slingo, the engineer-in-chief to the Post Office, ought to have produced evidence on the point. He would admit, however, that he could not produce any such evidence.

The Solicitor-General said that was not quite accurate.

Sir Alfred Cripps replied that he certainly said he could not produce any instances. Continuing, counsel contended that he had made out the company's claim to £1,649,720 for establishment charges, whilst the Post Office estimate did not include anything outside the engineering charges.

(*To be continued.*)

TRADE STATISTICS OF NEW ZEALAND.

The following figures, showing the imports of electrical and similar goods into New Zealand in 1911, are taken from the recently issued official trade figures. Details for 1910 are added for purposes of comparison, and notes of any increases or decreases are added:—

	1910.	1911.		Increase or decrease.
	£	£		£
Asphalt.				
From United Kingdom ...	2,000	2,000		—
" Other countries ...	2,000	1,000	—	1,000
Total ...	4,000	3,000	—	1,000
Leather belting.—				
From United Kingdom ...	4,000	4,000		-
" Other countries ...	2,000	2,000		
Total ...	6,000	6,000		—
Belting other than leather.—				
From United Kingdom ...	26,000	27,000	+	1,000
" Australia	2,000	2,000		—
" United States ...	3,000	3,000		
" Other countries ...	1,000	2,000	+	1,000
Total ...	32,000	34,000	+	2,000
Engine packing.—				
From United Kingdom ...	12,000	12,000		—
" Australia	3,000	2,000	—	1,000
" Other countries ...	3,000	2,000	—	1,000
Total ...	18,000	16,000		2,000
Rubber goods.—				
From United Kingdom ...	4,000	3,000		1,000
" Australia	8,000	5,000		3,000
" Other countries ...	2,000	2,000		—
Total ...	14,000	10,000	—	4,000
Scientific instruments.—				
From United Kingdom ...	5,000	6,000	+	1,000
" Other countries ...	2,000	2,000		—
Total ...	7,000	8,000	+	1,000

	1910.	1911.	Increase or decrease.
	£	£	£
Rails.—			
From United Kingdom ...	141,000	154,000	+ 13,000
,, Belgium	—	6,000	+ 6,000
,, Other countries ...		3,000	+ 3,000
Total ...	141,000	163,000	+ 22,000
Telegraph and telephone wire, iron.			
From United Kingdom ...	6,000	11,000	+ 5,000
Electric machinery.—			
From United Kingdom ...	136,000	177,000	+ 41,000
,, Australia	21,000	23,000	+ 2,000
,, Germany	12,000	16,000	+ 4,000
,, United States ...	27,000	31,000	+ 4,000
,, Belgium	6,000	4,000	– 2,000
,, Other countries ...	5,000	6,000	+ 1,000
Total ...	207,000	257,000	+ 50,000
Steam engines.			
From United Kingdom ...	11,000	8,000	– 3,000
,, United States ...		1,000	+ 1,000
,, Other countries ...	1,000		– 1,000
Total ...	12,000	9,000	3,000
Gas and oil engines (except for motor-cars).—			
From United Kingdom ...	67,000	105,000	+ 38,000
,, Australia	3,000	3,000	
,, United States ...	16,000	20,000	+ 4,000
,, Other countries ...	4,000	2,000	2,000
Total ...	90,000	130,000	+ 40,000
Boilers for engines.			
From United Kingdom ...	7,000	8,000	+ 1,000
,, Other countries ...		1,000	+ 1,000
Total ...	7,000	9,000	2,000
Mining machinery.—			
From United Kingdom ...	19,000	22,000	+ 3,000
,, Australia	6,000	6,000	—
,, Germany		1,000	+ 1,000
,, United States ...	7,000	11,000	+ 4,000
,, Other countries		1,000	+ 1,000
Total ...	32,000	41,000	+ 9,000
Other machinery (except agricultural, printing, sewing, textile, &c.).—			
From United Kingdom ...	64,000	82,000	+ 18,000
,, Australia	14,000	10,000	4,000
,, Germany	4,000	2,000	– 2,000
,, United States ...	19,000	25,000	+ 6,000
,, Other countries ...	3,000	3,000	—
Total ...	104,000	122,000	+ 18,000
Meters: Water, gas and electricity.—			
From United Kingdom ...	26,000	27,000	+ 1,000
,, Australia	2,000	2,000	
,, United States ...	1,000	2,000	+ 1,000
,, Other countries ...	1,000	1,000	—
Total ...	30,000	32,000	+ 2,000
Railway and tramway plant.—			
From United Kingdom ...	55,000	43,000	12,000
,, Australia	3,000	2,000	1,000
,, Other countries ...	1,000	1,000	
Total ...	59,000	46,000	– 13,000
Lamps and lanterns.—			
From United Kingdom ...	26,000	33,000	+ 7,000
,, Germany	9,000	11,000	+ 2,000
,, United States ...	9,000	15,000	+ 6,000
,, Other countries ...	4,000	7,000	+ 3,000
Total ...	48,000	66,000	+ 18,000

University Students in England and Wales.—Our contemporary, *Nature*, states that in the State-aided Universities of England in 1910-11, there were 1,015 full-time students in engineering, 735 in technology, and 1,723 in pure science. The corresponding figures for Wales are 43, 22 and 254. In "Engineering" is included naval architecture, and in "Technology" mining, metallurgy and architecture.

LOCAL AUTHORITIES AND OMNIBUS TRAFFIC.

BY OUR LEGAL CONTRIBUTOR.

The extraordinary success which has attended some of the motor-'bus companies during recent years is naturally turning the attention of tramway authorities to this means of locomotion. "Why not scrap our tramways and take to motor-'buses?" is even the cry from some directions!

If a tramway is run by a limited company, there is but little to prevent their taking this course, and it may be that the advantages would far outweigh the drawbacks. Consider some of the advantages—no further payment of rates in respect of a track; no cost of promoting a Bill in Parliament; no limitation of fares; no confinement (except to a limited extent) to any particular route. On the other hand, of course, it might be necessary to obtain an Act of Parliament to free the company from its obligation to run a continuous service of tramcars.

To a local authority again, the advantages of a 'bus system may appear to be very great, as compared with electric traction. But assume they gravely decide to abandon the one in favour of the other—what are their powers? Can they do it with a stroke of the pen, without a private Act of Parliament?

Assuming that they do start running 'buses without any shadow of right, what can the ratepayers do?

Supposing that the ratepayer ascertains that the rates which he is paying are being used for an unlawful purpose, what remedy can he invoke? Has he the power to bring an action against the rating authority for breaches of trust? For that is what it really amounts to. It appears that he has this power; but it is a power which can only be exercised at great expense and grave risk to his pocket should he be unsuccessful in his appeal to the Courts of Justice. The Court may intervene to prevent the doing of an act by any Corporation which is *ultra vires.* For instance, a local authority could not without statutory power establish a system of tramways. It could not, if it already possessed a system of tramways worked by electric power, use any portion of the electricity generated for the purpose of the tramway for supplying electric light to the public.

The case of the Attorney-General *v.* the Lord Mayor and the Citizens of Manchester, which was decided some years ago, illustrates two things:—(1) That a local authority must pay strict attention to the statutory limits which are imposed upon it; and (2) that where those limits are exceeded a ratepayer who is affected may appeal to the Courts for protection. In this case there arose one other point to which we should draw attention, and it is that although the plaintiff was successful in showing that the Corporation of Manchester had exceeded their powers, he was nevertheless deprived of part of his costs.

The facts of the case may be stated in a very few words. The Corporation of Manchester owned certain tramways within the city, which were worked by statutory powers. They also leased certain other tramways in the neighbourhood. On all these tramways they had power to carry passengers and parcels. In connection with their parcel business they established depôts, provided horses and carts and undertook the delivery of parcels, not only by means of the tramcars but by means of the horses and carts which carried parcels from place to place wholly independently of the tramlines. The plaintiff in the action was a carrier in the district. He felt the stress of competition and sought to restrain the Corporation from carrying on the business of a common carrier. Mr. Justice Farwell, as he then was, held that in so far as the Corporation carried parcels on their own lines and delivered those parcels to persons living near the tramway, or collected parcels for the purpose of carrying them on their tramway, they were acting within their powers, but he came to the conclusion that the Corporation were not entitled to carry on the business of carriers independently of their tramway, and that the Court would interfere to prevent the expenditure of borough funds on such a venture. "It is obvious," he said, "that a delivery service by carts to and from villages not connected with the company and a general agency for all railway companies must entail expense, even if the same carts and men be used as are employed ordinarily in the tram service proper. I cannot believe that a large general delivery service and a general railway agency can be added to the service limited to communication with the trams without expense." In the end he made a declaration that the Corporation were not entitled to act as common carriers, but in view of the fact that the plaintiff had only succeeded as to part of his case (for he had disputed their right to collect or deliver goods at all) the learned judge only awarded the plaintiff half his costs against the Corporation.

Dealing first with the law of this decision, we confess that we find it a little difficult to understand, having regard to previous decisions. The powers of the tramway company incidental to the conveyance of parcels, provided that the tramways might be used for the purpose of conveying and delivering parcels amongst other things. Does such a power enable the Corporation to collect parcels at people's houses and to deliver them elsewhere? In the case of the London County Council *v.* Attorney-General, which was heard in 1901, it was decided that the County Council could not carry on the business of omnibus proprietors, by virtue of their statutory power to run tramways. By the London Tramways Co. Act, 1896, Sec. 31, the County Council were empowered to buy the tramways, and any works and property connected therewith, including, therefore, omnibuses and horses, and, further, it was argued that they were impliedly authorised to work the omnibus traffic. This argument, however, did not prevail. In giving judgment in the

House of Lords, Lord Macnaughton said "The London County Council are carrying on two businesses—the business of a tramway company and the business of omnibus proprietors. For the one they have the express authority of Parliament; for the other, so far as I can see, they have no authority at all. It is quite true that the two businesses can be worked conveniently together, but the one is not incidental to the other." In effect, therefore, the House of Lords held that the bringing of passengers to the tramway terminus was not incidental to the business of the tramway. Why, then, should it be incidental to the business of a tramway company acting as a carrier of goods to bring those goods to and from the tramway?

We have pointed out that this decision is of importance from the point of view of those who are opposed to municipal trading. In the case above referred to, the fact that the Corporation of Manchester were exceeding their powers was brought home to one who acutely felt the stress of competition. We should be interested to see a table drawn up showing the powers which are exercised by local authorities in all parts of the country. We know that in carrying out the business of electric light supply, many Corporations and other local bodies are somewhat apt to exceed their powers. The case to which we have referred is given as an illustration of the fact that if it can be shown that these powers are being exceeded, the Courts will intervene. Doubtless the remedy is costly, but if those in the electrical trade were to combine together in their capacity as ratepayers in any particular district, we venture to think that the alleged abuses, as to which there is often such loud complaint in these columns, could be brought to an end. One word as to the general attitude of the ratepayer in these matters. We have pointed out in an earlier part of this article that there is a large body of ratepayers who are practically indifferent to an increase in the rates. Many rating authorities adopt the principle of compounding, that is to say, instead of collecting the rates themselves, they accept 80 per cent. from the landlord of a group of tenants, and allow him to collect the full amount from his lessees. Under this system, if the rates are increased, the tenants think that the landlord is putting up the rent, and they are indifferent, not only to the increase in the rate, but to the object to which the rate is to be devoted. Under these circumstances, it is not surprising that there should be apathy on the part of ratepayers in this country. They ought, however, to know enough to prevent a local authority from running 'buses when their powers limit them to tramways.

BUSINESS NOTES.

Consular Notes.—Holland.—The Austrian Consul at Amsterdam reports that the manufacture of metallic-filament lamps in Holland has recently witnessed considerable expansion, mainly as a result of increased demand for exportation, and the Dutch incandescent lamp works in general have enjoyed most favourable and profitable business.

Spain.—The Austrian Consul at Barcelona reports that, in numerous industrial establishments throughout Spain, extensive reforms have been effected in recent years in order to put manufacturing methods on to a modern basis. In the course of carrying out these reforms, electrical power has largely displaced steam, and old machinery has been replaced by modern and improved plant. As a result of these improvements, the electrical industry in the country began to witness an important development, and new electrical undertakings were rapidly formed to utilise the numerous waterfalls existing in Spain, and particularly in the Pyrenees. Electrical energy for feeding the industrial machinery became cheaper year by year with the increasing competition caused by the establishment of new undertakings, and this development of industrial conditions and methods has created a growing demand for electrical installations, motors and other machinery. These accessories came chiefly from abroad, by far the larger part of the machinery, motors, &c., from Germany; the goods supplied by Great Britain have been of very high quality and dear in proportion. The participation of Austria, curiously enough, has been very small. The demand for electric motors and machinery, it is anticipated, will be very much greater than formerly, and the present is an excellent opportunity for extending business relationships with the country. New companies are continually being established for the appropriation of water-power, and towards the end of 1911 three new electrical companies were established in Barcelona itself for the production and distribution of electric energy for lighting and power purposes. The importation of electric motors has increased from 10,100,000 pesetas in 1909, to 10,200,000 pesetas in 1910, and 12,100,000 pesetas in 1911. The imports of insulated cable and wire for electric transmission amounted to 1,500,000 pesetas in 1911, more than half that amount being credited to Germany; there is a rapidly increasing demand for these goods. The demand for telephone and telegraph instruments and electric meters is also showing rapid expansion, the yearly increase being about 250,000 pesetas; the imports in 1911 were valued at 1,800,000 pesetas, the largest share being taken by Germany, and smaller shares by Great Britain, France and Sweden (the last-named country chiefly telephone instruments). The trade in electric incandescent lamps shows remarkable development; in 1909, Spain imported goods of this class to the value of 2,200,000 pesetas; in 1910, 2,600,000 pesetas; and in 1911, 3,700,000 pesetas. Although in recent years several factories for the production of these lamps have been established in the country, and have placed lamps in the market at a price cheaper than that of the imported variety, the demand from abroad has not diminished. The price of imported lamps is about 90 pesetas per 100. In this section, again, the largest share of the trade is taken by Germany, and advertising in this trade is a most important factor in securing business. The demand for fixed steam and gas engines has declined, the imports in 1911 being valued at 2,300,000 pesetas, as against 3,000,000 pesetas in the previous year. The decline may be ascribed to the increased use of electrical power, but a large demand still exists for gas engines and small steam engines; the chief supplying countries are Great Britain, Germany, France and Belgium. The imports of tubular boilers have increased from 3,100,000 pesetas in 1910 to 4,800,000 pesetas in 1911; Great Britain, Germany, Belgium and France supply the needs of the market. For all kinds of machines in general the demand is increasing, in consequence of the rapid industrial development of the country; in many works machine production is replacing hand labour, and in other works new plant is being installed. The imports of machinery not separately mentioned (*i.e.*, excluding that mentioned above, agricultural machinery, pumps, machine tools, &c.), increased from 15,300,000 pesetas in 1909 to 18,900,000 pesetas in 1910, and 23,100,000 pesetas in 1911.

Later in his report the Consul states that the erection of new wireless telegraph stations throughout Spain is being rapidly carried forward. The Compania Nacional de Telegrafia sin Hilos, which has its headquarters in Madrid, and is concessionaire of the official wireless telegraphy service (Marconi system) for Spain, has installed four new stations—in Barcelona (Prat de Llobregat), Cadiz, Santa Cruz de Tenerife and Las Palmas. The erection of further stations in Madrid (Aranjuez), Vigo, and Soller (Mallorca) was being carried out at the time of writing, and the company also proposed to take up the question of international service with the foreign wireless telegraphy stations of the Marconi system. The charges fixed are as follows: (*a*) for Spanish vessels, 7·50 pesetas for the first 10 words and 75 centimos for each additional word; (*b*) for foreign vessels, 8·50 pesetas for the first 10 words and 85 centimos for each additional word.

Turkey.—The British Consul at Damascus reports that the Société Anonyme for the electric tramway, light and power continues to do excellent business; the tramways gross receipts have lately increased while working expenses have been reduced. The average annual kilometric receipts and expenditure amount to about 60,000 fr. and 40,000 fr. respectively. The use of electric power is increasing, and the profit from electric lighting would also increase to a much greater extent were it not for the frequent cases that come to light of the fraudulent use of surreptitious wires, internally and externally. Eventually the electric lighting wires will have to be placed underground, but that would cost at least £100,000. The proposed prolongation of the tramway reported last year is still under deliberation by the municipality, and makes very slow progress.

Dorman, Long's Installation.—The directors of Messrs. Dorman, Long & Co., Ltd., in their annual report, say that the capital expenditure for the year was chiefly incurred in the erection of an electric generating station to utilise the exhaust steam at the Britannia steel works. This is working to the complete satisfaction of the directors, and is supplying all the current required for the Britannia Works, the electrically-driven mills and the wire works, at a greatly reduced cost.

Club Dinner.—The Telac 20 Club 1912, a social club comprising certain members of the staff and works of Messrs. J. H. Tucker & Co., electrical accessory manufacturers, Birmingham, held their first annual dinner on Saturday, November 23rd, at the Colonnade Hotel, New Street, with the president, Mr. J. H. Tucker, in the chair. The evening opened by the "20" sitting down to an appropriate menu of more or less electrical dishes, the last item being "cheese (high tension), and salary, fourpence deducted." There was also a footnote to the effect that any complaints *re* delivery must be reported to the Works Office. The remainder of the evening was devoted to a smoking concert, with toasts at intervals. After the usual loyal toast, that of "Our President," proposed by Mr. Jas. J. Evans, was responded to by Mr. Tucker, who, in the course of his remarks, referred to the value to the business of harmony existing between employer and employé and the various sections. For this reason he was very pleased that such a club had been formed and wished it every success. Mr. J. A. Crabtree proposed the toast of "The Telac 20 Club." Mr. A. O. Davis acted as secretary for the occasion.

The Shops' Act.—The Southend-on-Sea T.C. on November 19th issued an order for dealers in electric fittings to close on Wednesdays, at 1 p.m., with Saturday as an alternative day.

Wilson's Trust.—Under the bequest of the late Mr. Samuel Wilson it is possible for young business men in need of loans to obtain these at 2 per cent. interest under certain conditions The matter is referred to in an advertisement appearing in this issue.

Shop-Window Displays.—Among numerous effective window displays resulting from the advertising campaign recently conducted by the General Electric Co., Ltd., that of Messrs. A. F. Smith & Sons, of Gillingham, is particularly interesting, and it forcibly conveys the idea of strength of the Osram drawn-wire lamp. Mr. Shirley Smith designed special apparatus used in connection with signs, posters and other decorations. A miniature electric car, running on an inclined track across the width of the shop window, carries an Osram drawn-wire lamp suspended. When the car starts at the extreme left, the upper end of the gradient, the words, "Still another try to break my filament," appear in the frame in the centre of the window. Dashing down with increasing momentum, the car, with the lamp, strikes the buffer at the lower end of the incline with considerable force. Instantly, by aid of an electrical arrangement, the words, "Impossible—I am an Osram," appear in the same frame, instead of the other words above-mentioned. Special mechanism draws up the car to the top of the incline, and the same operation is repeated.

With reference to the publicity literature issued by Messrs. Siemens Bros. Dynamo Works, Ltd., in connection with their lamp-selling campaign of the current season, we have received a picture of the shop-front view of Messrs. Bucknell's, Ltd., in Park Street, Camden Town, a well-known North London electrical contractor. It is easy to imagine how excellent a means of exciting public interest in electrical appliances a well-arranged shop window may be. The window in question is a good example of what may be done with tantalum and "Wotan" display material.

Private Arrangement.—Aish's Stores, Ltd., 89, Old Christchurch Road, Bournemouth, electrical engineers, &c.—Pursuant to the provisions of the Companies' (Consolidation) Act, a meeting of the creditors of the above was held on Tuesday, at Salisbury House, London Wall, E.C., the chair being occupied by the representative of Messrs. Crowden & Garrod, the principal creditors. It was reported that resolutions for voluntary liquidation had been passed by the shareholders of the company, and Mr. C. R. Blissett, chartered accountant, of Bournemouth, had been appointed to act as liquidator. It was stated by the liquidator that it was not possible for any definite offer to be made to the meeting, but negotiations had taken place with a view to the sale of the business as a going concern. The position was discussed at considerable length, and eventually it was decided that application should be made to the Court for the appointment of Mr. G. G. Poppleton, of Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., to act as the liquidator of the company. A committee of five of the principal creditors was also elected. The following are creditors:—

Armorduct Manufacturing Co.	£21	Hill, Fredk., & Co.	£50
Blissett, C. R.	81	Marsh, Sons & Co. ..	24
Crowden & Garrod	73	Walsall Hardware Manufacturers	52
Evered & Co.	40	Welsbach Agency.. ..	30
Fordham & Co.	30	Veritys, Ltd.	31
General Electric Co.	22		

Bankruptcy Proceedings.—Wesley Sutton, electrical engineer, and traveller for electrical manufacturers' agents, Liverpool (formerly carrying on business with S. Lord and J. W. Garsden, as the Howe Electrical Engineering Co.).—First meeting December 5th; public examination, December 16th, both at Liverpool.

R. E. Walker, electrical engineer and cycle agent, Hereford.—Last day for the receipt of proofs for dividend, December 7th. Trustee: Mr. M. J. G. Soobie, 2, Offa Street, Hereford.

Catalogues and Lists. — The British Thomson-Houston Co., Ltd., Rugby.—The company has just issued in its usual convenient form illustrated and descriptive price lists, with drawings showing dimensions and connections, as follows:—No. 370, B.T.-H. motor control panels for c.c. circuits; No. 374, B.T.-H. type O, form A, oil break switches; No. 375, B.T.-H. aluminium lightning arresters for a.c. circuits; No. 376, lightning arresters, type MD2; No. 377, magnetite arc lamps for c.c. circuits; No. 378, time limit fuses.

The Premier Accumulator Co., Ltd., Cattle Market Road, Northampton.—Sixteen-page catalogue of Premier accumulators. The illustrations include views of the batteries supplied to Norwich and Hammersmith electricity works, and to Wallasey and Northampton tramway power stations. Tabular particulars, prices, dimensions, &c., are set out of batteries for central station service, country house lighting, small lighting installations, and so on. Information respecting renewals and accessories, and instructions for working the batteries, are given.

Messrs. W. Geipel & Co., London, S.E.—Ten-page pamphlet dealing with electric measuring instruments and stating prices.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Small pamphlet (S.P.D4) in novel form showing, and stating prices of, their Holophane types of reflector fittings for offices, shops, galleries and public institutions.

The London Electric Warehouse Co. (Department of the Brush Electrical Engineering Co., Ltd.), Manners Street, York Road, London, S.E.—Six-page list giving tabulated particulars and prices of "Metallum" lamps. The illustrations are very effective, being produced in life-like night-time fashion, the lighted lamps standing out well on a black background. The contents include lamps of from 25 to 260 volts, and from 4·5 to 67·5 British c.p., also high c.p. lamps, train lighting lamps, and "Candolite" electric candle fittings.

Messrs. Siemens Brothers Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—New list (16 pages) giving illustrations, brief particulars, and tabulated price and other information respecting various electrical supplies for cinematograph theatres, including bioscope carbons, Wotan and tantalum lamps, glass and bead shades, electric signs and outside lanterns, fittings, distribution boards, small motors and fans, motor-generator sets, and so forth.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—Small eight-page booklet of "Novel Christmas Gifts," electric kettles, "Pygmy" heaters, flat-irons, "Eco" clocks, pocket electric lamps, and electric hair dryers. Prices are given. A number of copies can be obtained by those interested. A November stock list of d.c. and a.c. motors has also be issued.

The Dowsing Radiant Heat Co., Ltd.. 105, Great Portland Street, London, W.—Illustrated and priced folding sheets showing numerous designs of luminous and convector radiators, hot-bar heaters, red-glow heaters, &c., for the 1912-13 season.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Publication No. 718, giving prices and illustrations of "Z" lamps of various shapes, sizes, candle-powers, &c.

The Cruse Controllable Superheater Co., 1, Parsonage, Blackfriars, Manchester.—List containing detailed drawings and other particulars relating to their patent sectional type heat accumulator superheater, also extracts from a report on plant at a Macclesfield mill

Messrs. S. H. Heywood & Co., Ltd., Reddish, near Stockport.—Eight-page reprint from *Engineering*, giving a detailed description of a 30-ton electrically-operated traverser with revolving table.

The Power Plant Co., Ltd., Temple Bar House, Fleet Street, London, E.C.—Catalogue No. 5 (30 pages) containing illustrations of, and brief notes concerning, their double-helical cut gears. The pictures include a view of the factory at West Drayton.

Messrs. D. H. Bonnella & Son, Ltd., 58 and 60, Mortimer Street, London, W.—Eight-page list (No. 352), giving illustrated particulars and prices of electric lighting accessories, including wall and floor sockets, pressel switches, &c.

Messrs. A. Emanuel & Sons, Ltd., 13, George Street, Manchester Square, London, W.—32-page supplementary catalogue of electric light fittings for the current season, containing illustrations and prices of a variety of brass brackets, cord pendants, bowl lights, ceiling and reflected light fittings, pendants for various classes of rooms, inside and outside lantern fittings, luminous radiators, fancy glass and bead shades, &c. A leaflet states prices of "Acson" metal-filament lamps.

The British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, London, E.C.—We have before us a copy of the first bound catalogue issued by the Lamp and Wiring Supplies Department of this company. It is a very fine production of over 400 pages, and has been produced in only three months. The cover is a dark red cloth, bearing the company's monogram in gold, and the art paper printing of both text and illustrations is very satisfactory. A very complete system of indexing is employed, both at the opening and in each of the sections, and each article in the volume has both a number and an indicator letter, the latter showing the section. Our readers need hardly be told that the work deals chiefly with material and accessories appertaining to electric lighting, heating and small power work. The different sections will be supplied separately bound, if desired. All the sections will be kept up to date by the issue from time to time of extra sheets. The introductory section gives an illustrated description of the B.T.-H. organisation, and of the various works and branch offices which it comprises. This section also contains a page of electrical and lighting definitions, an interesting article, illustrated by diagrams, on illumination work with useful tables relating thereto, and technical data on heating and cooking apparatus and small power motors. The introductory section concludes with some comparative tables of English and foreign currencies and measures. The first section of the body of the catalogue deals with Mazda, Gem and B.T.-H. Edison carbon lamps, and gives price tables and illustrations of the various lamps, as well as technical data on lamp efficiencies and performance. This includes a number of curves and tables which have not been published before.

The remaining sections are in the following order:—"A," wiring accessories; "S," shades and reflectors; "E," electric light fittings and lanterns; "B," bells, telephones and batteries; "M," miscellaneous (theatrical apparatus, signs and flashers, and automobile accessories); "W," wires, cables and accessories; "T," conduit fittings and accessories; "C," arc lamps, power, heating and cooking appliances. Of course, it would be possible to devote a great deal of space to merely summarising the general features of the catalogue and its contents, but our readers are by this time pretty familiar with the scope of the activities of the B.T.-H. lamp and wiring supplies department—or they ought to be—and we have said quite sufficient to indicate the usefulness of the volume to those who are interested in these particular departments of the electrical industry.

Messrs. Stewarts & Lloyds, Ltd., Winchester House, London, E.C.—Catalogue illustrating tubular steel poles and towers for traction, light and power transmission.

Book Notices.—"The Book: What they say about the Electric Light" is the title of an excellent booklet issued by the West Ham Corporation electricity department. It contains the signed testimony of bakers, drapers, jewellers—some ten or a dozen trades—to the "outstanding advantages" of electric lighting and power as tested by experience in their own establishments. The enthusiasm of these gratified users is striking, and their unanimous verdict is that great savings are effected not only in the bills for energy, but also in the reduced cost of decorations, absence of deterioration of goods, &c. Rubber, woollen, cotton and leather goods exposed to the fumes from gas lighting perish, linen goods turn yellow, cigars are rendered unsaleable. These and other points are strongly emphasised in this convincing collection of opinions.

Electric Mining Rules and Data.—A neat little handbook with this title has been issued by Messrs. W. T. Glover & Co., Ltd.; it brings together in convenient form for the waistcoat pocket the code of Special Rules and the Home Office Memorandum, which form rather more than half the contents, the remainder of the space being occupied by illustrations of the publishers' mining specialities, followed by a few notes and tables bearing on the subject.

"Annual Report of the Royal Technical College, Glasgow." October, 1912. Glasgow: The College.

"The Beginner's Guide to the Microscope." By C. E. Heath. London: Percival Marshall & Co. Price 1s. net.

"*Mechanical World* Electrical Pocket Book for 1913." Manchester: Emmott & Co., Ltd. Price 6d. net.

"The Principles of Applied Electrochemistry." By A. J. Allmand. Price 18s. net. "Electroplating." By W. R. Barclay and C. H. Hainsworth. Price 7s. 6d. net. 1912. London: Edward Arnold.

"Deutscher Kalender für Elektrotechniker." By F. Uppenborn and G. Dettmar. 1913. Berlin: R. Oldenbourg. Price M.5.

"The Indicator Handbook." Part II. By C. N. Pickworth. Fifth edition. Manchester: Emmott & Co., Ltd. Price 3s. net.

"Will on the Law of Electric Lighting, Power and Traction." Fourth edition. By W. E. Tyldesley Jones. 1913. London: Butterworth & Co. Price 27s. 6d.

The P. & O. S. Navigation Co., Leadenhall Street, E.C., have issued their large coloured wall sheet, as usual, showing dates of homeward and outward mails by their vessels during 1913 to Egypt, India, China, Japan and Australia.

Dissolutions and Liquidations.—DOWSON ECONOMIC GAS AND POWER CO., LTD.—A meeting is called for December 31st at 39, Victoria Street, London, S.W., to hear an account of the winding up from the liquidator, Mr. J. E. Dowson.

IMESON FINCH & CO., LTD.—A meeting is called for December 23rd at 4, Victoria Buildings, Stockton-on-Tees, to hear an account of the winding up from the liquidator.

KLEIN ENGINEERING CO., LTD.—A meeting will be held on December 30th at 60, Spring Gardens, Manchester, to hear an account of the winding up from the liquidator, Mr. A. A. Gillies.

WORSLEY & PAGE, LTD.—The summary of receipts and payments issued by the liquidator shows that after paying to unsecured creditors a first and final dividend of 14s. in the £ on £199, there is a balance of £1 2s. due to him.

LEA & WARREN, lighting, &c., engineers, Kettering.—Messrs. A. H. Lea and J. B. Bent have dissolved partnership. All communications respecting debts, &c., should be addressed to the old firm. Mr. Lea will continue to transact business under the firm's name at Kettering and at 7, Victoria Street, London, S.W. Mr. Bent will carry on business on his own account at Montague Street, Kettering.

LIGHTING and POWER NOTES.

Barking.—The town clerk reports having received notice from the County of London Electric Supply Co. of its intention to apply, during the ensuing session of Parliament, for a provisional order to authorise it to supply electricity in bulk in the urban district.

Barnes.—The U.D.C. is considering the best means of making known the advantages of the E.L. undertaking in view of the enterprise recently shown by the Brentford Gas Co.

Batley.—Municipal electricity display as an adjunct to shopping schemes is to be tried on the Friday, Saturday, Monday, and Tuesday preceding Christmas. The local Tradesmen's Association and the Corporation Gas and Electricity Committee are taking the matter in hand, and the centre of the town is to be illuminated in a special manner to aid the shopkeepers at Christmas time. It is hoped that the authorities will make some special display on the lines of the Coronation illuminations.

Belfast.—At the fortnightly meeting of the Tramways and Electrical Committee last week, the electrical engineer, Mr. Bloxam, presented supplemental reports regarding the proposed extensions of the electricity undertaking, whilst the tramways manager, Mr. Nance, submitted a report on the supply of electrical energy for the tramways only. The latter report was referred to the engineer, and copies were ordered to be circulated amongst the members, and legal advice taken on the former reports.

Brechin.—In the course of a discussion over a proposal to acquire the gasworks for the Corporation, it was suggested that the T.C. should also consider the question of electric lighting. Ultimately it was decided to postpone the question.

Broadstairs.—Arrangements have been made for the Park to be lit by electricity by the Isle of Thanet Electric L. & T. Co.

Bude.—The U.D.C. has under consideration a tender from the Electric Light Co. for public lighting for a period of five years.

Buxton.—A loan of £1,000 for electricity purposes has been applied for by the U.D.C. A thorough system of canvassing for new consumers is to be carried out.

Canada.—The Regina T.C. is considering a scheme to be submitted to the voters for the erection of a new power house at a cost of £77,000. The demand for power is increasing at the rate of about 75 per cent. per annum. The present plant carries an overload, and is not worked economically. About one-third of the city's water supply is at present used for cooling purposes, and is afterwards pumped back into the mains. It is proposed that the new power house shall be at a distance from the city where ample water is available.

Carnarvon.—The new electrical installation at the infirmary has been brought into use. It consists of a 5-KW. 140-volt dynamo driven from an existing laundry engine, and a 55-cell battery equal to running 95 lamps for 10 hours, the lighting being from either the dynamo or battery. The installation was carried out by the National Electric Construction Co.

Chesham.—The U.D.C. has referred to a Committee the question of purchasing the undertaking of the E.L. company, which has for some years held the contract for public lighting.

Continental Notes.—FRANCE.—La Compagnie Electrique du Nord has recently completed its electric power transmission line—at 45,000 volts—between Pont-a-Vendin and Saint Quentin la Fere, and is now supplying current to a number of local distributing companies in the departments of Aisne and La Somme. The company is also putting the finishing touches to a new generating station of 8,000-KW. capacity, at Beautor, near La Fere.

The municipal authorities of Chalons-sur-Marne have granted the concession for the supply of electrical energy for power purposes (but not for lighting) in the town, to La Société Generale Electrique.

RUSSIA.—The six principal Russian banks, in concert with a powerful Belgian group, have obtained imperial sanction for the company to be formed for utilising the available water-power in Finland, including the lesser Jmatra and three other falls, as well as the Russian falls on the Volkhov River, to supply electrical energy to St. Petersburg and environs. The scheme comprises not only lighting and power for the city and suburban industries, but for extensive undertakings like the circular electric railway round St. Petersburg and the electrification of the existing railways for suburban traffic.—*Morning Post.*

Coventry.—The City Council has decided to adopt a recommendation of the Electric Light Committee that application be made to Parliament in connection with the local Bill which is being promoted by the Corporation, for power to extend the area of electricity supply to the parishes of Allesley, Binley, Coundon, Keresley, Stoneleigh, Walsgrave-on-Sowe, Willenhall and Wyken. Councillor Lee (chairman of the Committee) stated that the extensions of the power station would enable the Committee to supply these villages direct.

Croydon.—The B.C. decided on Monday to determine its agreement of October, 1907, with the County of London Electric Supply Co., for the supply of electricity in bulk to areas beyond the borough boundary. This is the outcome of the company's decision not to proceed further with the proposed revised agreement, and it was stated that possibly it contemplated opening generating works in the district concerned, or laying mains from Wandsworth.

Dalkey.—At the special meeting of the Urban Council held last week to consider the electric lighting question, the Town Clerk read a letter from the Dublin and Southern District Electric Supply Co. asking the Council to waive the right to notice of the company's intention to proceed to obtain a provisional order for the purpose of supplying electric light to Dalkey district. The company added that the Council would not be binding itself to anything in the provisional order. After a lengthy discussion, it was decided to waive the right on the lines of the Kingstown resolution on the subject, with an added safeguard for the Council.

Douglas.—A long discussion took place at the T.C. as to a recommendation of the Electrical Undertaking Committee, that the first section of the scheme submitted for the electric lighting of the town should be carried out. There was strong opposition, mainly on the ground that the ratepayers had not been afforded an opportunity of pronouncing their opinion on the scheme. It was ultimately decided that a plebiscite be taken on the whole scheme. Several members of the Committee at once tendered their resignations, the chairman characterising the proceedings that had led up to the Council's decision as a farce.

Dublin.—Last week Mr. P. C. Cowan, of the L.G.B., held an inquiry into the application of the Corporation for a loan of £28,100 for the purpose of extensions by the electricity department. The Lord Mayor said that the reason for applying for these loans was the substantial increase in the number of consumers, which at present stands at about 5,000. This year the undertaking had a surplus of over £4,000. He suggested that the money which was being made ought to be put to a reserve fund. The application was not only one of importance and urgency, but was absolutely essential. He felt so strongly on the matter that he would decline to take the responsibility of being on the Electric Lighting Committee for one week except he were assured that they would be facilitated in getting the necessary additional machinery by the L.G.B. at the earliest possible moment.

Edinburgh.—It is understood that at the present rate of increase in electrical supply, both for power and lighting, in Edinburgh, the existing stations will prove inadequate in about three years' time. Before then the Corporation will be under the necessity of making new arrangements to meet the ever-growing demand for electricity.

Notice of motion has been given at the T.C. remitting to the Cleaning and Lighting Committee to report as to the cost of the disposal of refuse by the destructor, and to consider and report as to the advisability of closing the destructor.

Fleetwood.—Owing to the increase in the number of consumers of electricity, the works in Copse Road are now running at their full capacity, and the electrical engineer (Mr. Millar) has received instructions from his committee to prepare plans and details of proposed further extensions at the works.

Foleshill.—The R.D.C. has under consideration the question of the lighting by electricity of parishes in its area. Certain of these parishes are included in the Bill which is being promoted by the Coventry Corporation, and the point raised at the meeting was whether Bedworth would come in. The Leicestershire and Warwickshire Electric Power Co. contemplates laying cables into Bedworth, but the clerk to the R.D.C. was instructed to inquire from the Coventry Corporation whether it would entertain an application from Bedworth.

Giffnock.—There is a desire at Giffnock, near Glasgow, to get the Strathclyde Electricity Supply Co., which has the sole rights over the district, to extend the supply to Giffnock. It is understood the company is considering the matter.

Glasgow.—At the last meeting of the T.C.'s Committee on Electricity, the engineer reported that applications had been made by the Fairfield Shipbuilding Co., Messrs. Beardmore & Co., Messrs. Collins & Co., Messrs. Braby & Co., and others, for very large supplies of electrical energy, and set forth the terms on, and the rates at, which such supplies should be granted. A Special Sub-Committee has been appointed, with powers to deal with the matter.

It is currently reported that Messrs. Stewart & Co., Ltd., the well-known tube manufacturers, are in negotiation for the acquisition of ground in the north-east of Glasgow for the purpose of erecting an extension to their works. In the proposed addition the motive and necessary heating power will be entirely derived from electricity.

Greenock.—The Corporation has agreed to apply to the Secretary for Scotland for power to borrow £60,000 for the purposes of the electricity undertaking, and to meet the expenditure to be incurred in supplying power users in the neighbouring burgh of Port Glasgow. The engineer estimates the total cost of the Port Glasgow scheme at £34,529.

Grimsby.—In view of the necessity of extending the plant at the electricity works to meet the estimated additional load for the next three years, the Committee has decided to install an 800-KW. to 1,000-KW. mixed-pressure turbine, with condensing plant, pipes and all accessories, at an estimated cost of £8,000, which sum is made up as follows: Turbine generator and plant, £6,500; switchboard panel, £150; foundations, &c., £150; pipework (steam exhaust and water), £800; contingencies, £400.

Hastings.—A report presented to the T.C., by the electrical engineer (Mr. R. Ferguson), shows that during the last 15 months the number of private consumers has increased from 1,193 to 1,398, equal to 17 per cent. There are now 47 miles of mains in the borough and over 700 street incandescent lamps.

Hayward's Heath.—So much progress has been made with the proposed E.L. scheme for the town that a prov. order is to be applied for by a local syndicate. A provisional site for the generating station has been selected in New England Road.

Hereford.—The quarterly return to the T.C. shows that the number of units sold during the September quarter was 112,242, bringing in a revenue of £1,126, as against 100,724 units, valued at £1,024, in July-September, 1911. In addition there was a revenue of £115 in respect of energy supplied to the Territorial Camp. New rules and conditions of supply have been authorised.

Herne Bay.—A special meeting of the Council has agreed to the transfer of the E.L. order to the local gas company.

Hinckley.—The Leicestershire and Warwickshire Electric Power Co., which is situated on the outskirts of Hinckley, has during the last few days got into working order, with the result that many of the manufacturers and tradespeople of the town are having electric light installed on their premises. In view of this competition, the Gas Committee of the Urban Council has decided to reduce the price of gas to consumers.

Hindley.—The B. of T. has informed the U.D.C. that it is prepared to defer until the end of November the question of the revocation of the E.L. order, with a further extension if a scheme is then submitted. The Council has decided to carry out the order and to apply for a loan of £2,000 for cables for the compulsory area. Current will be obtained under an agreement from the South Lancashire Tramways Co.

Kingswood.—For the purposes of supply under the E.L. Order of 1904, the Electric Supply Co. has applied to the B. of T. for permission to erect in the town overhead lines for the transmission of current at a pressure of 460 volts.

Leatherhead.—The Leatherhead and District Electricity Co., which is at present supplying direct current in Leatherhead, Ashtead and Mickleham, is extending its sphere of operations to surrounding districts and installing H.T. three-phase plant for transmission purposes. The company already has sanction to supply certain consumers in Oxshott, Cobham and Bookham under the 1909 Electric Lighting Act, but is now applying for a prov. order to embrace the additional area, with the approval of the local authorities concerned. It is anticipated that a general supply over the whole of the new area will be available by the summer of 1913.

Leeds.—In connection with a scheme for the destruction of refuse, the Sanitary Committee proposes that a new destructor be erected and that the heat shall be applied for the generation of electricity, which the Electricity Committee will dispose of.

London.—St. Pancras.—The Electricity Committee reports that on July 3rd last, the Council accepted a tender for the supply of two 1,000-KW. motor-generators. The Committee then reported that it had adjourned for further consideration the 12 offers received then for the supply of a 5,000-KW. turbo-set at prices ranging from £12,040 to £17,000, the lowest figure not, however, including the cost of foundations. Since that date attention had been directed to the Ljungstrom turbine, and, after carefully considering its reported advantages, it was decided to examine and test the working of a 1,000-KW. turbine, installed in Sweden. After two days' test the engineer stated that from the efficiency results obtained he was confident that the installation of a turbine of this make would result in very considerable economies in the cost of generation above those of the other turbines for which quotations were received. The turbine in question, the Committee continues, is being manufactured in this country by the Brush Electrical Co., which is at present preparing a 5,000-KW. set, the size of machine required for the Council's work. Negotiations were opened with the firm, and an offer has been received from it to build and supply a 5,000-KW. Ljungstrom turbine to be installed in the autumn of 1914, provided the tests of the present 5,000-KW. set which it is constructing come up to expectations, enabling it to comply with figures given in the quotation. Inasmuch as it is urgently necessary that an additional turbine should be available at the King's Road generating station during the winter of 1913, the company offers, upon the acceptance of its quotation for the 5,000-KW. set, to supply on loan a 1,000-KW. Ljungstrom turbine similar to the one which is at present installed in Sweden, and to replace this by the 5,000-KW. set when completed. The Committee has decided to accept the tender of the Brush Electrical Co. at £14,050, exclusive of foundations (estimated at £1,000); also the firm's offer to lend the 1,000-KW. set for £1,500. The Committee has also decided to install an additional feeder from the King's Road generating station to Camden Circus, at an estimated cost of £1,700; and to increase the section of mains in four streets at an estimated cost of £300, to meet the demand of new factories requiring power supply.

Hampstead.—Many of the Garden Suburbs that are now being developed are great friends of the electrical industry, and already the users of electricity as an illuminant nearly run into four figures on that at Hampstead. A week's demonstration of cookery by electricity has just been concluded by Mr. F. S. Grogan in the fine showrooms of the General Builders, Ltd., who occupy one of the new shops which have been erected by the Hampstead Tenants, Ltd.

Peterborough.—On Tuesday night the T.C. decided several important electricity questions. The Electric Traction Co. asked for terms for the supply of energy to be resold to the Parish Council of Walton (a village beyond the borough boundary) for power in a new sewage works about to be installed. The Committee agreed that energy so supplied should be included in the company's existing contract, but the Council deferred the matter. The scale of charges for the supply of electrical energy for power purposes was revised as under:—50,000 to 75,000 units per quarter, 1d. per unit; the next 25,000 units per quarter, ·9d.; the next 150,000 units per quarter, ·8d.; in excess of 250,000 units per quarter, ·75d. This is in view of applications by existing and prospective firms for special prices.

Rawtenstall.—The borough electrical engineer has been requested to prepare and submit to a future meeting of the Health Sub-Committee an estimate of the cost of supplying electricity for the lighting of the smallpox hospital at Hareholme.

Runcorn.—The Children's Home at Dutton, which is being erected by the B. of G., is nearing completion. The Guardians at their meeting last week dealt with the question of lighting the home, the Children's Home Committee having recommended electricity as "the safest, most economical and convenient system." An estimate of the cost of production and installation is to be furnished at the next fortnightly meeting, when a final decision will be made.

Sevenoaks.—The newly-formed electricity company is applying for a prov. order for the rural parishes of Westerham, Brasted, Sundridge, Chevening, Riverhead, Sevenoaks Weald, Seal, Kemsing, Otford, Dunton Green, Halstead, Shoreham, Oxted, Limpsfield, Titsey, and Tatsfield

Stirling.—The question of the electric lighting of the West and East Churches is being considered by Mr. J. W. Papworth, burgh electrical engineer, and a Committee.

Tynemouth.—The abstract of accounts of the Corporation shows that the gross income of the municipal electricity works for the past year amounted to £18,176, compared with £17,880 the previous year and £16,924 the year before. The net result of the year's working is a surplus of £1,305, which is applied towards wiping out the accumulated deficiencies of previous years. The net debt of the undertaking is stated at £67,284. The suspended deficits now stand at £1,646, which, it is confidently anticipated, will be wiped out during the ensuring twelvemonth. Although the undertaking has never contributed anything towards the reduction of the rates, it has not, on the other hand, been in any way a charge upon them.

Uruguay.—The law for the nationalisation of electricity having been adopted, the Government will forthwith begin the building of 16 electric generating stations, which will be installed in the following localities:—La Paz, Las Piedras, Pardo, Punta del Este, Maldonado, San Carlos, Santa Lucia, Canelones, Rosario, Dolores, Nico Perez, Sarandi di Yi, Treinta y Tres, San Fructuose and San Ergenio. Each station will cost between 25,000 and 30,000 gold pesos.—*Elek. u. Masch.*

Venezuela.—A central electric lighting station is being established near the town of Manoa: water-power is being utilised. It is reported that an English company is in negotiation for the purchase of the undertaking of the Valencia Electric Lighting Co., of Valencia.

Watford—At the last meeting of the R.D.C., a draft of the proposed agreement with the Watford U.D.C. as to the supply of current to Abbots Langley, Sarratt and Watford Rural District, was submitted. The provisions of this agreement are to the effect that mains are to be laid within two years, and that except in the case of Abbots Langley, the charge per unit is to be the same as in Watford. With regard to Abbots Langley, the Council agreed that, for a period not exceeding seven years, a charge of ½d. per unit in excess of the charge in Watford Urban District be made, unless there are 50 consumers. When this number has been obtained, the price is to be the same as in the other districts. Mr. Purse, electrical engineer to the Watford U.D.C., who was in attendance, promised to recommend his committee to accept these terms.

Willesden.—Application is to be made to the L.G.B. for sanction to borrow £14,000 for mains and services.

Wood Green.—The Tottenham and Edmonton Gas Co. is applying for an order to take over the E.L. prov. order of the U.D.C.

Worcester.—The City Council has approved of the Electricity Committee's recommendation in regard to proposed extensions and additional plant at Hylton Road. In urging the necessity of carrying out the work immediately, the chairman of the Committee (Mr. R. Clarke) asked that, in view of the increased cost of labour and metals, the original amount of £7,400 should be altered to £7,900, making the total expenditure £8,150. The Council agreed to this.

TRAMWAY and RAILWAY NOTES.

Asiatic Turkey.—A Consular report from Damascus says:—The Société Anonyme for the electric tramway, light and power, continues to do excellent business; the tramway gross receipts have lately increased, while expenses have been reduced. The average annual kilometric receipts and expenditure amount respectively to about 60,000 fr. and 40,000 fr. The use of electric power is increasing, and the profit from electric lighting would also increase to a much greater extent were it not for the frequent cases which come to light of the fraudulent use of surreptitious wires, internally and externally. Eventually the electric lighting wires will have to be placed underground, but that would cost at least £100,000. The proposed prolongation of the tramway mentioned in last year's report, is still under deliberation by the municipality, and makes very slow progress.

Australia.—With reference to the proposed substitution of electric for steam traction on the railway between Adelaide and Glenelg, South Australia, a distance of 6¾ miles, at an estimated cost of about £115,000, it is notified that a plan of the railway may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade in London.

Baildon (Yorks.).—The District Council has decided to apply to the B. of T. for a prov. order granting it powers to continue the tramway route from its present terminus at Baildon Bridge to Browgate, Baildon. The length of the additional track will be nearly 1 mile. The Council further intends to apply for powers authorising it to supply the district with electricity, and also the new section of the tramway.

Bradford—Huddersfield.—A conference has been held at the Halifax Town Hall between the Halifax Tramways Committee and representatives of the Corporations of Bradford, Huddersfield and Brighouse in regard to the question of tramways in the Borough of Brighouse. The Halifax Corporation is the only authority with tramways at Brighouse, and application is being made to Parliament for powers to extend these to the Huddersfield boundary, *viâ* Rastrick. The Brighouse Corporation has consented to support the Halifax proposal to the exclusion of any other authority laying tramways in the borough. On the other hand, Bradford Corporation is constructing a tramway from Wyke to Bailiffe Bridge, and, it is understood, wishes to run over the Halifax Corporation's line from Bailiffe Bridge to the centre of Brighouse, while Huddersfield Corporation desires to extend its tramways to Brighouse, so that a thorough service may be established between Bradford and Huddersfield. Such a service will, of course, only be possible by some arrangement being made with Halifax by the authorities concerned. Nothing definite was agreed to at the conference, but negotiations are to be continued at a further meeting, the date of which is to be fixed later.

Canada.—The construction of the electrical tramways at Brandon, Man., is proceeding so rapidly that it is anticipated that the line will be opened by May 1st, 1913. The laying of the track is nearly completed. The erection of the steel standards and overhead work will go on during the winte

Regina.—In the plans for the new municipal power house, provision is being made for the possible inclusion of plant to operate a tramway.

Colne.—The Corporation is to promote a Bill in Parliament, for, amongst other purposes, obtaining powers for the acquisition of Colne and Trawden Light Railway undertaking. At the last meeting of the Council, it was stated that a provisional order would be applied for to secure the necessary sanction for purchase. A departure from this course has now been agreed to, the explanation being that the notice for a Bill to be promoted in the next session of Parliament should be published not later than a week previously. Moreover, had the Council proceeded with the provisional order, the longest period for the repayment of the loan would have been 20 years. There is every reason to assume that Parliament would give a longer term for this purpose. The extra cost by the present course of procedure will be easily met, therefore, if the Corporation obtain a longer period for repayment.

Continental Notes.—Austria.—The intended electrification of the Langeck-Bludenz section of the Arlberg line, which is to cost 11,000,000 marks, is temporarily interrupted owing to the necessity of finding additional clients for the current produced by the hydroelectric station. The Railway Department is in treaty with sundry possible concessionaires, so that a solution of the difficulty may not be long delayed.—*Elektrotechnische Nachrichten.*

Plans are being prepared in respect of a projected electric narrow-gauge railway between Badgastein and Hofgastein (Salzburg).

Spain.—La Compania Ferrocarril de San Sebastian-Hernani has applied for a concession for the construction and working of an electric tramway in the town of San Sebastian.

Russia.—The Commission for New Railways has granted a concession to the Lodzer Electric Railway Co. to build the following electric lines: Pabianice to Lask, Sdunska, and Wolja (32 versts); from Lodz and Bresing to Kolucski (32 versts), and from Kudr to Petrokow (49½ versts). The concession is for 60 years, with a right of redemption in 20 years.

Several more lines of the newly electrified tramways in Odessa have lately been completed and opened for traffic. Altogether about 37 miles of electric tramways are at work in the city.

Plans are in course of preparation in respect of a projected electric railway between Moscow and Odinzowo.

Germany.—The Prussian State Railway Administration already possesses 137 accumulator motor wagons, and a further 41 are on order. These motors are considered, all circumstances weighed, to be superior to the steam locomotive.—*Elek. v. Masch.*

Switzerland.—A concession is granted to the Société Anonyme du Chemin de Fer sur Route de St. Moritz for the construction and working of an electric railway from St. Moritz village to the Lake of Campfer.—*Board of Trade Journal.*

Italy.—It is anticipated that in the course of next year the following lines will be added to the number of those electrically worked in Italy:—The Milan to Lecco; Savona to S. Giuseppe and Ceva; Bussoleno to Bardonecchia and Modana; Sanpierdarona to Ronco (in continuation of the Govi line); and the line leading to the city and Port of Genoa. In following years further important lines will be converted, among others the Porrettana and the Neapel to Solerno. The length of Italian railways electrified will then total about 200 km.—*Elektrotechnik und Maschinenbau.*

Coventry.—The Corporation is promoting, in the next session of Parliament, a Bill authorising the introduction of a motor-omnibus service in connection with the tramway service of the city. By the new service, it is proposed to give transit facilities to several rural parishes.

Dundee.—Recently the Magistrates refused to license a lad of 15½ years as a conductor on the railless trolley cars, and as a sequel the Tramway Committee discussed the question of boy labour. Mr. Peter Fisher, the manager, said these lads were not being employed in order to get cheaper labour. In most cases there were no conductors on railless cars, and, indeed, it was not a job for a man at all. In the end it was agreed to leave the whole matter in the hands of the manager.

Glasgow.—The T.C.'s Tramways Committee has appointed a special Sub-Committee to report upon a proposal on the advisability of putting under the control of one Committee, the generation of electricity for all purposes. Similar action has been taken by the Electricity Committee.

The Sub-Committee on Tramways Extensions is to consider a resolution asking for a report to the T.C. as to the advisability of acquiring, in connection with the tramway service, a number of motor-'buses for the purpose of (*a*) tapping the districts in the neighbourhood of the various tramway termini: and (*b*) being utilised for the conveyance of passengers in the city at night or early morning after the service of tramway cars has ceased.

India.—According to *Indian Industries and Power*, arrangements have been practically completed by which Mr. Merz will visit Bombay and advise the B.B. & C.I. and G.I.P. Railways, as well as the Bombay Port Trust, as to the system most suited for electrifying the local lines of these bodies in Bombay. The Port Trust has acquiesced in the desirability of electrifying its local lines. This will lead to the electrification of the new goods yard at Wadala. This consideration, says our contemporary, practically eliminates the introduction in Bombay of any system except the single-phase alternating current and everything points to Mr. Merz recommending this system to be installed in Bombay.

Lancaster.—The Lancaster and District Tramways Co., which has had a precarious and unprofitable existence for about a quarter of a century as a horse traction line, has served notices of its intention to apply for powers to electrify. It will be remembered that in 1900 the Corporation proposed to purchase the company's track from Lancaster to Morecambe, but owing to the directors and shareholders refusing to accept the terms offered, the negotiations were broken off. Since then two abortive attempts have been made by a Birmingham syndicate to get sanction to electrify the line, but the Corporation, with an eye to further powers, withheld its consent. Meanwhile, the increased prosperity of Morecambe has shown the absolute antiquity of the present system. Thousands of passengers were missed last season through insufficiency of cars. It remains to be seen whether the Corporation will block the new scheme, or enable Lancaster to be properly linked with Morecambe.

Llandudno.—The draft agreement for the electric tramway extension between the Llandudno U.D.C. and the Llandudno and Colwyn Bay Electric Railway Co. was considered and passed for sealing at the meeting of the Council on Friday. One of the points of the agreement with the company was that to avoid the disturbing of visitors at the North-Western Hotel by the noise of the cars passing over fixed points, the early workmen's cars should be suspended during the summer months. The clerk explained that this had now been dropped. He communicated with the Colwyn Bay Council to inquire whether it approved the proposal for the suspension of these cars, and the reply was in the negative. There was also a protest from the Penrhyn Parish Council against it, as the cars were a great convenience to workmen.

London.—It is officially announced that a new company—the London and Suburban Traction Co., Ltd.—will take over the amalgamated Metropolitan Electric and London United Tramways.

Mexborough.—The desire for railless traction is rapidly spreading in the West Riding. The Mexborough and Swinton Tramways Co. has now decided to promote a Bill in Parliament, with a view to securing powers for the establishment of services in the locality, which would serve a populous mining district.

Newcastle-on-Tyne.—The Corporation proposes to apply to the B. of T. for a provisional order, to be confirmed by Parliament, for tramway extensions recommended by the Council. It is intended to construct tramways from Neville Street and Westgate Road, and from Collingwood Street and St. Nicholas' Square, to the High Level Bridge end, for the purpose of dealing with the traffic that comes and goes across the bridge from and to Gateshead. The other extension proposed is that at Heaton—a junction from the Heaton Road terminus to Stephenson Road.

Southport.—It is reported that the Lancashire and Yorkshire Railway Co. has under consideration the construction of a new line from Ainsdale to Kew Gardens.

In a special report on the tramway undertaking, Mr. C. W. Mallins, tramway manager to the Liverpool Corporation, recommends the construction of tramways along the promenade for 5¾ miles, which might ultimately be linked up with the Liverpool tramways on the south, and carried north across the Ribble to join the Blackpool tramways. By this means the distance between Southport and Blackpool would be shortened by 24 miles, and that between Liverpool and Blackpool by 14 miles. The introduction of a Sunday service is also recommended.

Stirling.—Councillor McElfrish has given notice at the T.C. that at the next meeting he will move that it be remitted to a special Committee to gather information, consider and report on the whole question of tramways for the burgh and district. It is believed that electric traction will be approved of, to take the place of the present horse tramways.

U.S.A.—It is stated that the mountain section of the Denver and Rio Grande Railway will shortly be electrified; the first section to be taken in hand, from Helpa to Salt Lake City, is 114 miles long, and following this a further 87 miles will be electrified over the Tennessee Pass. Ultimately all the mountain division is to be electrified, and the cost is expected to amount to 20-25 millions.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telephony.—Arrangements are being made to modify the tariff for telephoning between England and France. The price of conversation between Paris and London will be reduced from 8s. to 4s.; between Lyons and London the charge will be 6s. 2d. instead of 10s., and between Bordeaux and London 8s. instead of 10s. The rate for telephoning between Marseilles and Edinburgh will remain at 12s. 6d.

Argentina.—A telegraph line is to be constructed in the province of San Juan, between the departments of Jachal and Iglesia, the cost of which is estimated at about £3,940.—*Board of Trade Journal.*

Chelmsford Wireless Station.—The steel mast, 450 ft. in height, which has been erected by Marconi's Wireless Telegraph Co. at their new works at Chelmsford, has now been completed; it weighs 70 tons, and is composed of steel cylinders formed in four sections, bolted together after being hoisted into position. The inside diameter of the mast is 3 ft. 5 in., and the outside diameter of the flanges 4 ft. 6 in. Over 2,000 2-in. bolts were used in the construction of the mast, and the steel cable supports are attached to four huge concrete anchor blocks, each representing a weight of 120 tons. In connection with each of these anchor blocks, 260 small piers of asbestos and mica plates, covered with lead caps, have been erected on 4 ft. of concrete, and the remainder of the block is built over them. The effect of the little piers is to give the perfect insulation which is so necessary to effective working. The 250-ft. mast, which had previously been used by the company, has now been taken down, and another mast of 450 ft. will shortly be erected.—*The Marconigraph.*

Imperial Wireless System.—On Wednesday last week, when the inquiry respecting the Marconi agreement was resumed, the chairman said he had received a letter from Mr. Beech Thomson stating that he had been informed by his company that since November 7th they had maintained continuous communication between San Francisco and Honolulu at all times of the day with their new Poulsen generator, using 40 KW. The chairman also read a letter from the Foreign Office to the Post Office, communicating a telegram dated November 15th and received from the British Consul-General at San Francisco, which stated that the Poulsen Wireless Telegraph Co. informed him that they had not yet succeeded in establishing communication with Honolulu by day. Sir Alexander King was again recalled, and stated that to put pressure on the Marconi Co. by threatening to withdraw their licence would have been a disgraceful proceeding. In his opinion, the terms were fair. He did not think the contract would be a financial advantage to the company, though it was important to the latter. The agreement in no way conferred a monopoly upon the company. The Post Office had no reason to doubt the validity of the patents held by the company. The Government ran no risk; if the patents were proved invalid, the royalties would cease. As there was no other company capable of doing the work, it would have been ridiculous to invite tenders. If the agreement were ratified by January 1st, the Post Office would choose the sites, by the beginning of May; the foundations would be finished in three months, and the company's work had to be completed within 12 months. The position of the Post Office under the agreement was quite strong enough. They would not betray the secrets of a new company to the Marconi Co. Unless they proceeded with the matter without delay, they might be forestalled; the French Government had a scheme under consideration.

On Thursday the examination of Sir Alexander King was concluded. He stated that the Foreign Office had been informed by the Consul-General at San Francisco that he had communicated with the Consul at Honolulu by day by the Poulsen system, and the messages were correctly transmitted. The agreement was the result of the deliberations of the Post Office, the War Office, the Admiralty and the Treasury, who were all equally responsible. No favour had been shown to the Marconi Co.; for years the Post Office had been fighting them. There was no foundation for the suggestion that any Minister or official had been biased in favour of the company, or for the charges made against the witness by a certain newspaper. No pressure had been put upon him by any of his chiefs to accept any condition which, in his opinion, was not a proper one. No pledge of secrecy was ever exacted from persons the Post Office was negotiating with. The Post Office did not regard the Admiralty figures for the cost of an Imperial system as a business proposition; they used the Admiralty as a lever to get better terms from the Marconi Co.

Mr. H. A. Madge, wireless expert to H.M.S. *Vernon*, and a member of the Technical Sub-committee, said the price of the stations was reasonable, but the royalty was rather high. A more definite statement should be obtained from the company as to the time in which the stations would be erected. The company should be debarred from charging the Government an excessive price for the use of new patents, and from obtaining information as to naval inventions in connection with wireless telegraphy.

On Monday Mr. Madge was further examined. He stated that he was now convinced that the Poulsen system could do the work. He was rather surprised that the report of the Technical Sub-committee was not considered by the Imperial Wireless Committee. He considered that simplex high-speed working was nearly as good as duplex in the circumstances. He was with the Marconi company before he joined the Admiralty nine years ago. In the main the Admiralty had been working on lines independently of Marconi; at present they used a spark system. Wireless telegraphy was liable to be tapped, and "jamming" took place when other stations confused the signals that a station was receiving. The scheme which he had outlined for Admiralty long-distance stations would have become clear of the Marconi patents in 1914, that is, by the time they would have been completed. Witness was asked to hand in some "rough notes" to which he referred, but objection was raised to their disclosure on the score that they were confidential.

New Zealand.—The Postmaster-General in a recent speech said that the use of the telephone was restricted in certain towns, owing to the fact that with one central exchange as at present it was necessary to give each subscriber a wire from the exchange to his premises, with the result that comparatively high charges had to be levied after the first mile. The automatic system, on the other hand, lent itself to the establishment of branch exchanges, which required no attendants. In Wellington, for instance, instead of an average length of wire of 78 chains, the automatic would require for each subscriber an average length of 45 chains. It should then be possible to give subscribers within an extended area full exchange privileges at the minimum rates. He stated that the recent arrangement under which "deferred" cables were sent at half rates was, in his opinion, by no means satisfactory, and no effort should be spared to secure reduced rates on ordinary cable messages. From calculations which had been made, he did not doubt that the laying of an Atlantic cable, as proposed, with other arrangements to be made, would enable the charge on ordinary cable messages between New Zealand and Great Britain to be reduced from 3s. to 2s. per word. The new cable between Sydney and Auckland should be working by December. The Department was now capable of building wireless telegraph stations and carrying on the work in a most satisfactory manner. The general public and the shipping community largely used the facilities afforded by the Wellington station, and when this was removed to a more advantageous position on the Tinakori Hills, with an increase of power and a greater height, the range should be considerably extended and working generally made more effective. The installation of the first high-power station in the Dominion at Awanui was being rapidly pushed forward. A low-power station was to be erected on the new post office at Auckland. A high-power station similar to the one at Awanui was to be erected near Bluff. A site for a wireless station at Chatham Island had been secured, and an endeavour would be made to erect the station and begin working within the next six months.

The wireless station at Wellington has been opened, and New Zealand is now in constant communication with Australia by means of wireless telegraphy. Australia in turn will communicate direct with the Imperial station at Singapore.

Spain.—A wireless station has been established 5 miles west of Barcelona. A station has also been erected at Alicante and another at Soller, on the Island of Majorca.—*Industria e Invenciones.*

Trans-Pacific Wireless.—The Marconi Co. is erecting at San Francisco and Honolulu long-distance stations of the same type as those which it is proposed to construct for the British Imperial scheme. The station at Honolulu is intended later to communicate with similar stations to be erected by the company at Yokohama and in the Phillipine Islands.—*The Marconigraph.*

Wireless Rescue.—The steamship *Oravia* was wrecked off the Falkland Islands on November 12th, on a rock at the entrance to Port Stanley, at 10 o'clock at night. Blinding snow and intense darkness made it impossible to see anything. Assistance was summoned by wireless telegraphy, and five whaleboats arrived three hours after the ship struck. The *Oravia* broke in two and sank. There was no loss of life.

CONTRACTS OPEN and CLOSED.

OPEN.

Abertillery.—December 16th. 100-KW. Diesel engine and dynamo, water-cooling apparatus, pipework, overhead crane and switchboard panels and connections, for the U.D.C. See "Official Notices" to-day.

Australia. — South Australia. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" November 1st.

December 18th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" November 8th.

December 17th.—Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

Victoria.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

January 24th, 1913. Two 4,000-KW. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" to-day.

New South Wales.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" November 1st.

Austria.—Trient.—The T.C. has voted 700,000 kronen for the acquisition of three new units of 1,500 KW. each, in connection with the enlargement of the Sarca power station.

Aldershot.—December 3rd. 1,000 tons of small pea or bean coal for the U.D.C. electricity department. See "Official Notices" to-day.

Balderton (Notts.).—December 14th. The Parish Council invites tenders for an electrical installation for street lighting. For further particulars see this column last week.

Beckenham.—December 9th. Electricity meters, for the U.D.C. See "Official Notices" to-day.

Blackpool.—The Tramways Committee has decided to advertise for tenders for the supply of a motor tower wagon.

Brazil.—January 16th. No award has been made in respect of the Jaraguá (Alagoas) Harbour Works contract recently considered, and the matter is again open to tender. Upset value, £780,000. Six movable electric cranes and a lighting installation are included. A copy of the *Diario Official* containing particulars can be seen at the Board of Trade Com. Intel. Dept. in London.

Dewsbury.—December 17th. Two water-tube boilers, superheaters, mechanical stokers, &c., for the Corporation electricity works. See "Official Notices" to-day.

Dublin.—December 2nd. Electric lighting of Cook Street Dwellings, for the Corporation Improvements Committee. Specification (10s. 6d., returnable) from the City Electrical Engineer, Fleet Street, Dublin.

Eastbourne.—December 16th. 99 long-burning flame arc lamps for street lighting, and sale of 99 open-type double-carbon lamps to be displaced, for the Corporation. See "Official Notices" November 22nd.

France.—January 15th. Concessions for six railway schemes in the Department of Calvados, France, are offered for public competition, being respectively, Lisieux to Ticheville, Sap-Potigny to Mézidon, Vire to Tessy sur Vire, Trouville to Honfleur, Condé sur Noireau to Villers Bocage, and Condé sur Noireau to Vassy. The lines are to be of 1 metre gauge, and the service to be either electric or steam. Proposals, plans, tariff of fares to be charged, &c., to be forwarded to the Prefecture of Calvados (second division) by January 15th.

Gravesend.—December 2nd. High-tension cables, for the Corporation. See "Official Notices" November 22nd.

Haiti.—Port-au-Prince.—Offers required for the work of conversion to electric working of tramways, including the line to Carrefour, and enlargement of power house. Offers to, and particulars from, Messrs. G. Keitel & Co., Port-au-Prince.

Ieremie and Les Cayes.—Erection of power house and installation of an electric service. Apply to Banque Agricole et Foncière, Port-au-Prince, or Monsieur Neuda, Brussels.

Halifax.—December 3rd. Two water-tube boilers, with superheaters and mechanical stokers, for the Corporation Tramways and Electricity Committee. See "Official Notices" November 22nd.

Leeds.—December 2nd. Electrical equipment required for combined centrifugal sewage pumps. Mr. G. A. Hart, Sewerage Engineer, 26, Great George Street, Leeds. (Deposit £10, returnable).

London.—Hackney.—December 12th. Open type and flame arc lamp carbons, for the B.C. See "Official Notices" November 22nd.

Malay States.—A sum of £101,400 has been voted by the Government for the improvement of the telephone and telegraph network in the Peninsula. Some 35 stations will also have to be equipped with new instruments.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps of British manufacture only. Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

January 6th, 1913.—Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Pembroke.—December 3rd. Refuse destructor at the U.D.C. electricity works, South Lotts Road. Specification, &c. (5s., not returnable), at the Town Hall, Ball's Bridge.

South Africa.—Cradock.—December 2nd. Municipal Corporation, Cradock, Cape Province; works in connection with the municipal electric supply undertaking. A copy of the general conditions, specification, form of tender and forms of agreement may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. The contract comprises (Section A) two 50-KW. Diesel engines and dynamos complete with pipework and accessories, battery of accumulators, balancer, booster, switchboard, accessories, and foundations for same; (Section B) underground feeder cables, aerial distributing lines, street lamps, fittings and accessories, feeder pillars, service cut-outs, meters, &c.; and (Section C) buildings.—*Board of Trade Journal.*

Spain.—The municipal authorities of Calanas (province of Huelva) have just invited tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Toledo.—The Municipality is open to receive offers for the lighting of the city of Toledo for a period of ten years from January 1st, 1913.

Trimdon Grange (Co. Durham).—December 7th. Electric fittings for a year, for the Trimdon Grange Colliery. The Storekeeper.

Vienna.—December 9th. Tenders are required for the supply and erection of an electrically-worked locomotive turntable in the Mährisch-Ostrau-Oderfurt railway station. Particulars of the K.k. Nordbahndirection, Vienna.

CLOSED.

Aldershot.—The Lighting Committee of the U.D.C. has accepted the tender of the Rees Roturbo Co., Ltd., for a balancer, at £109.

Australia.—According to *Tenders* (*Mining and Engineering Review*) the following contracts were placed in October:—

P.M.G.'s Department, Tasmania. Switchboard, common battery, £318, J. Bartram & Son Pty., Ltd.
Port Melbourne Electric Supply. 2,400 yd. cable, £398, Henley's Cable Co.
Heathcote Shire Council. Copper and aluminium cables, £570, W. G. Watson & Co., Ltd.

The Electric Light Committee of the Sydney Municipal Council has recommended the acceptance of the following tenders:—

Two electrically propelled motor lorries (1) 3,000 lb., £1,632; (2) 4,000 lb., £1,990.—Nicholson & Bainton, Ltd., Sydney.
Steel poles.—F. Lassetter & Co., Ltd., Sydney.
Installation of clinker breaking table at power house, £105.—Gordon Mair and Sons, Ltd.

Blackpool.—The Corporation has again ordered chain grate stokers for firing its B. & W. boilers at the electricity works from Messrs. Ed. Bennis & Co., Ltd.

Cardiff.—The contract for coking stokers and self-cleaning compressed-air furnaces for the electric light and tramways department, Roath power station, has been placed with Messrs. Ed. Bennis & Co., Ltd.

Colchester.—The T.C. has accepted the tender of Messrs. Cory & Son, Ltd., for Shirebrook nutty slack and Mansfield slack for the electricity works, at 15s. per ton.

Croydon.—The tender of Messrs. Wm. Cory & Son, Ltd., has been accepted for 7,000 tons of coal at 17s. 3d. per ton, for the electricity works.

Dover.—Messrs. Venner & Co. have received an order for equipping the Corporation tramcars with Chamberlain and Hookham car meters.

London.—L.C.C.—It is recommended by a Committee that water-level indicators be provided at the new engine house at Abbey Mills pumping station, with necessary telephone apparatus and electric wiring. Messrs. Gent & Co. will provide the transmitters, for £58; Messrs. Foote & Milne, Ltd., will lay the necessary cables, at £68. Messrs. Cox-Walkers will supply the illuminated scale indicators.

The following tenders were received for electric wiring and fitting work required in connection with the enlargement of Crossness pumping station:—

Pinching & Walton (recomm.)	£139	F. Lawrance & Sons	£185
Tilley Bros.	147	W. Dickinson & Co. ..	195
W. C. Tackley & Co.	168	G. Weston & Sons	196
Sydney Hunt	172		

Estimate of the chief engineer, £167.

Battersea.—The tender of the Western Electric Co., Ltd., has been accepted by the B.C., at £34, for the supply of intercommunication telephones at the central generating station.

Norbreck (near Fleetwood).—The contract for the fitting up of the old and new premises of the Norbreck Hydro with bells and telephones has been secured by Mr. R. Barron, of Fleetwood.

Norwich.—The T.C. has accepted the tender of Messrs. Herbert Morris, Ltd., for an electric overhead runway for the coal store at Trowse sewage pumping station, at £210.

Rawtenstall.—The T.C. has accepted the tender of Messrs. Whipp & Bourne for the lighting of the Central Market Hall extension with electricity. It has also accepted the tender of Messrs. Yates & Thom for a new Lancashire boiler for the electricity works.

Walthamstow.—The tender of Mr. J. W. Pearce has been accepted by the U.D.C., at £18,548, for doubling certain portions of the tramway track.

Willesden.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., to supply a rotary converter, as a stand-by plant, at an estimated cost of £745.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week:—

Monday, December 2nd.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, December 3rd.—"B" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Thursday, December 5th.—"C" Company. Company training, 7 to 10 p.m.

Friday, December 6th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, December 7th.—"B" Company. Run at Fort Coalhouse. Parade at Fenchurch Street Station at 8 p.m. Dress: Service dress, putties and greatcoat. Headquarters will be open from 10 a.m. till 12 noon for regimental business only.

Signed) J. H. S. Phillips, Major,
For Officer commanding L.E.E.

FORTHCOMING EVENTS

Association of Engineers-in-Charge.—Saturday, November 30th. Social Dance.

Royal Society of Arts.—Monday, December 2nd. At 8 p.m. Cantor Lecture on "Methods of Economising Heat," by Mr. C. R. Darling. (Lecture I.)

Institution of Electrical Engineers (Manchester Section).—Tuesday, December 3rd. At 7.30 p.m. At the University, Manchester. Paper on "Some Factors in Traction Development: Street Railway Feeding Networks," by Messrs. J. G. and R. G. Cunliffe.

Institution of Electrical Engineers (Scottish Students' Section).—Tuesday, December 3rd. At 8 p.m. At the Royal Technical College, Glasgow. Paper on "Ampere-hour Meters for Direct Currents," by Mr. A. C. Howard.

Illuminating Engineering Society.—Tuesday, December 3rd. At 8 p.m. At the Royal Society of Arts. Paper on "Modern Methods of Indirect Lighting: Their Advantages and Merits," by Messrs. F. W. Willcox and H. C. Wheat.

Institution of Electrical Engineers (Students' Section).—Wednesday, December 4th. At 7.45 p.m. At the Institution, Embankment, W.C. Discussion on "Passenger Transport in London."

Institution of Electrical Engineers (Birmingham Section).—Wednesday, December 4th. At 7.30 p.m. At the University, Birmingham. Paper on "Street Railway Feeding Networks," by Messrs. J. G. and R. G. Cunliffe.

Institution of Electrical Engineers (Yorkshire Section).—Wednesday December 4th. Meeting at 7 p.m. At the University, Leeds.

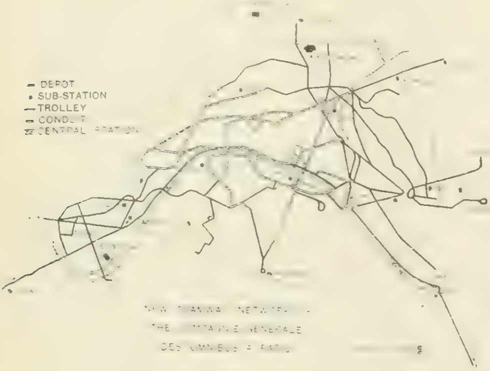
NOTES.

The "Thomas" Electric Gas Meter.—In our issue of February 4th, 1910, we gave a description of an electrical means of measuring the rate of flow of gases—the Thomas meter, consisting of screens whose relative resistance determines the amount of heating produced, on the quantity of gas passed, by an electric heater interposed between the two screens. The difference of temperature is, of course, inversely proportional to the quantity of gas passed so long as the heating effect of the heater is constant. An important installation has recently been carried out where a meter of this type measures the gas used as fuel in the pumping station which has been installed in connection with the sewerage and drainage of East St. Louis. Here the drainage and sewage water from the city is pumped against the head of the Mississippi River when the latter is above the level at which this water will drain into it by gravity. There are five 290-h.p. and two 200-h.p. internal-combustion engines driving centrifugal pumps, the normal supply of gas being obtained from the St. Clair County Gas and Electric Co., of East St. Louis. As an emergency fuel supply, a gas producer is installed at the pumping station. The pumps are operated intermittently, the period of operation and number operated at any one time being dependent on the rainfall and the height of the river. Gas is supplied through a special 6-in. pipe line entering the station under pressure, and an automatic governor inside the station reduces the pressure to a constant value for all engines. In the gas line just inside the station is a main stop valve, which must be opened in order to draw in gas from the supply line. This valve is fitted with an electric switch, so that when it begins to open it throws into service the Thomas meter, which measures the gas until the valve is entirely shut again. As long as the valve is closed tightly the meter is out of service, and all electric supply to it is cut off. The meter is installed in the supply line between the main stop valve and the reducing governor, and measures the gas under pressure. The recording panel is placed in a position where the instrument can be readily observed by the meter readers of the gas company, and also where the station operator may conveniently watch the graphic chart. The meter receives its electrical energy supply from a city line running into the station at 110 volts alternating-current, single-phase, 60 cycles. The control mechanism is enclosed in a locked case to keep it free from dirt, and the recording instruments are provided with locks and seals. The meter has a maximum capacity of 40,000 cb. ft. per hour. An integrating meter shows the totalised value of the gas flow in cubic feet at 30 in. mercury and 60° F., while the graphic meter shows at a glance whether gas is being used, and if so, the rate at which it is being consumed in cubic feet per hour at 30 in. mercury and 60° F. The installation is a good example of the application of this electric meter to the measurement of fuel gas for the supply of internal-combustion engines, especially when the gas is under pressure. It also shows its flexibility of installation and adaptability to intermittent service. The fact that this meter is operating in a position where there is no continuous and reliable source of heat to prevent freezing renders it superior to the more usual forms of large-capacity gas meters. For these particulars we are indebted to the Cutler-Hammer Manufacturing Co., Milwaukee.

Reorganisation of Paris Tramways.—The Compagnie Générale des Omnibus (of Paris) has decided to adopt d.c. electric traction over the whole of its tramways, suppressing and replacing the numerous other systems at present in use in parts of the system. The accompanying map (reproduced by courtesy of *L'Industrie Electrique*), shows the new scheme to be adopted. The overhead trolley system is to be used in the outer areas and the conduit in the centre of Paris. The extension of the trolley system to the Jéna Bridge will provide electric traction over the whole of the Louvre-Sèvres route.

Up to now, the various traction systems in operation in Paris have included steam traction (Serpollet, Rowan and Purrey systems on the Ivry-les-Halles, Louvre-Charenton, Bastille-Porte-Rapp and other routes); compressed air (Mekarski cars on the Montrouge-Gare de L'Est, Cours de Vincennes-Saint-Augustin and other lines); and, finally, accumulator traction on the Louvre-Vincennes and Cours du Louvre Vincennes routes. In a few months' time, these equipments will have been replaced by an installation technically superior, and offering greater comfort and convenience to passengers.

The new network will be supplied from six sub-stations receiving current at 12,500 volts, 25 cycles from the St. Denis and de Vitry central stations and delivering at 600 volts D.C. from converters. Three of the sub-stations (at St. Martin, Point du Jour and la Vallée) are installed in old depôts, and the remainder are to be built at Nation, Dulong and Alma. Thirteen tramway depôts will ultimately be in service; one is already finished, and five are nearing completion.



Two types of tramcar are to be chiefly employed, one seating 53 passengers, and mounted on bogie trucks with unequal wheels, for use on busy lines without severe gradients, the other seating 48 passengers and mounted on a truck with 3·6 m. wheel base, for use on busy routes with severe gradients. A third type of motor-car, of short wheel base, mounted on parallel-axle trucks and carrying 42 passengers, will be used on lines with moderate traffic. The trailer cars are of unique type, carried on bogies with equal wheels, and seating 54 passengers.

The compressed-air system, in particular, has proved very inefficient in use. Enormous thermal loss has occurred, owing to cooling of the compressed air in the depôt reservoirs, and the further cooling during its expansion in the driving cylinders in the cars has necessitated the provision of coke fires to preheat the air. The impending reorganisation and extensions will greatly improve the energy and maintenance efficiency of the whole system, while increasing the traffic facilities and public value of the tramways.

London Railway Schemes.—Parliamentary notice has been given by the Central London Railway of a Bill authorising the construction of an extension of its line from Shepherd's Bush to the South-Western line at Gunnersbury. The *Times* considers that this indicates an alliance with the South-Western Co. on the same lines as the arrangement with the Great Western Co.

A provisional agreement has been entered into between the Metropolitan District Railway and the promoters of the authorised Wimbledon and Sutton Railway, under which the District Co. will acquire the Parliamentary powers granted to the Wimbledon and Sutton Railway Co. in 1910, with a view to the dissolution of that company and the construction of that railway as part of the District Railway system. This agreement will require confirmation by Parliament.

Football.—On Saturday, November 16th, the G.E.C. football team played the Drake & Gorham team at Manor Farm, Ealing, the match resulting in a victory for the former by 5 goals to nil. We understand that the "Davis Cup" football matches arouse a great deal of interest in electrical circles, being recognised as official contests held each year among teams representing the electrical firms in London. The following table is the standing at this stage of the season:—

	P.	W.	L.	D.	Goals for.	Goals against.	Points.
G.E.C.	1	1	0	0	5	0	2
Ediswan	1	1	0	0	3	2	2
St. James'	2	1	1	0	7	5	2
Drake & Gorham ...	2	1	1	0	4	7	2
Elec. Installations ...	1	0	1	0	2	3	0
Glengall Works ...	1	0	1	0	1	5	0

Electric Steel.—According to M. Robert Pinot, secretary-general of the Comité des Forges de France, the production of steel in electric furnaces during the last three years was, in tons:—

	1909.	1910.	1911.
Germany	17,773	36,188	66,654
United States	13,762	52,141	29,105
Austria-Hungary ...	9,046	20,028	22,867
France	6,456	11,759	13,850
Total	47,039	120,116	126,476

The United Kingdom has hardly commenced to produce for the general market. The predominating lead of Germany and the drop in the electric steel production of the United States are notable features of last year's figures. Activity in France lies more in the field of ferro-alloys. Of these, France made altogether, in 1904, 34,200 tons, which amount had increased to 60,200 tons by 1910; the figures for ferro-alloys made in electric furnaces were respectively 5,756 and 23,800 tons; the electrically-produced alloys amounted in 1909 to 14,900 tons, and varied little in the years 1906 to 1909.—*Mining and Engineering World.*

The Dynamicables.—The next dinner of the Dynamicables will take place at the Hotel Cecil on Wednesday, December 11th, with Mr. J. S. Highfield in the chair.

The Bradford Dispute.—A correspondent writes:—"Both sides in the electricians' dispute at Bradford appear very determined to hold out, for though the Lord Mayor of the city (Alderman Fred. Foster, J.P.) offered to endeavour to settle the matter by arbitration, this has been refused by the employers. Previously the men had refused an offer of arbitration by the Government, and the masters hold that, this being the case, there could be no civic intervention for the removal of what they consider to be indications of obduracy. Warm appreciation is expressed of the Lord Mayor's offer to the parties. As matters stand the masters are gradually filling up vacancies, and many of the strikers will be unable to return to their former employment when the strike ceases."

Parliamentary Notes.—As usual in the month of November the *London Gazette* has, in its last few issues, contained notices of many electrical and other applications to Parliament and the Board of Trade. We shall refer to these in our usual form when the notices are complete.

Glasgow Tramways.—Last week Mr. Watt asked the President of the Board of Trade whether his department had power to insist on speed indicators being installed in the tramway cars run in the busy thoroughfares of Glasgow; how many speed indicators were used in such cars; and whether the intention of the Board of Trade was to increase the use of these, in view of the number of deaths and accidents caused by fast speeds on the steep gradients there. Mr. Robertson, in reply, said the Board of Trade had power to require a speed-indicating apparatus to be fitted to the Glasgow Corporation tramcars, but had not exercised that power owing to the difficulty of procuring a reliable apparatus, and the cost involved. The information in his possession did not support the view expressed in the last part of the question that a number of deaths and other accidents were due to fast speeds on steep gradients. None of the fatal accidents this year occurred on steep gradients, and from the reports made by the Corporation, the speed did not appear to have exceeded 12 miles an hour.

Qualifications of Factory Inspectors.—In the Parliamentary Papers, the Home Secretary, in reply to Mr. Gill, gives the qualifications of the inspectors of factories and workshops who have been appointed during the present year. Of the 11 male inspectors appointed the qualifications of four were as follows:—(2) Apprenticed to a firm of engineers, assistant in designer's office of same firm; teacher of engineering, technology, and geometry technical classes; assistant in department of design of electrical machinery at City and Guilds Institute; B Sc. (London); Associate of the City and Guilds Institute; Associate Member of the Institution of Electrical Engineers. (8) Apprentice with firm of electrical engineers. Draughtsman in the same firm. General foreman to another firm of electrical engineers. Intermediate examination for B.Sc. engineering (London). (9) In the employ of an electrical engineering firm, designing and testing machinery; workshop experience with firm of hydraulic engineers. Engineering tutor. B.Sc. (London), honours in engineering; City and Guilds honours certificate in electrical engineering, &c. (10) Underground electrician at a colliery; assistant works manager of colliery and by-product works, &c. Lecturer in electrical engineering. Lecturer to Fife County Council in electrical engineering and mining. B.Sc. (Edinburgh) engineering.

Fatalities.—Wynberg (S.A.).—Cape Colony newspaper reports are to hand respecting a fatality which occurred on October 20th to a boy aged 11 years, who climbed a pole of the Wynberg electric supply system, and received an electric shock. Mr. G. H. Swingler, electrical engineer in charge of the undertaking, said that the lights failed, and subsequently it was found that the boy was suspended from one of the lines. Asked whether he could make any practical suggestions for safeguarding the public, he said he could only suggest putting a few strands of barbed wire round the pole about 8 ft. from the ground.

Cape Town.—An accident, which was the result of handling a revolver without first ascertaining whether or not it was loaded, caused the death of Mr. Percy C. Roberts, an electrician. Mr. Roberts had only returned to South Africa from England a week or two, and had an appointment under the Union Government in connection with the lighting of the new Law Courts in Cape Town. The deceased was 29 years of age, and was a married man with one child.

Preston.—At the electrical works of Messrs. Dick, Kerr & Co., Strand Road, Preston, on the afternoon of November 21st, a moulding box was being hoisted when it fell, and struck a man named Arthur Yates, aged about 40. It was found that his neck was broken, and death was almost instantaneous. At the inquest on Friday, the jury returned a verdict of "Accidental Death."

France.—The *Daily Express* reports that a gang of navvies engaged on the construction of a branch railway line near Nice on Tuesday were the victims of an electric shock under curious circumstances. A large crane came in contact with some overhead electric wires charged with a pressure of 10,000 volts. The current was communicated by the crane to the lines on which it ran, and on which the navvies were working. The men in contact with the rails received the full effects of the shock, three of them being killed on the spot, while five others were taken to the hospital in a critical condition.

Electrical Trades Union.—A course of lectures will be given during winter months by the North-West Branch of the Electrical Trades Union, at the Princess of Wales's Hotel, corner of Belsize Road and Abbey Road, N.W., covering electrical and other subjects. The first one will be delivered on Tuesday, December 3rd, at 8.30 p.m., when Mr. H. Springfield will take as his subject "Charles Bray—his life and teaching." All electrical workers are invited to be present.

Sentences.—At the Leeds Assizes, before Mr. Justice Bailhache, on Saturday, George Chubb, aged 59, an electrician, pleaded guilty to the fraudulent conversion of £47, belonging to the National Union of Gasworkers and Labourers, at Sheffield. He was sentenced to six months' imprisonment with hard labour.

For stealing goods to the value of £787 from houses in South Belgravia, Cadogan Square, Bayswater, and other London districts, to which he had obtained an entry by describing himself as an electric light inspector, Richard Way was sentenced at the Middlesex Sessions to five years' penal servitude.

The Insurance Act: Electrical Prosecution.—According to the *Times*, at Marlborough Street Police Court on 22nd inst., Gratz, Ltd., electrical engineers, of Whitfield Street, Tottenham Court Road, were summoned before Mr. Mead for failing to pay contributions due in respect of three workpeople under the Insurance Act. There were in all nine summonses. Mr. Travers Humphreys prosecuted on behalf of the Insurance Commissioners. According to evidence given, it appeared that Mr. E. V. Gratz, the managing director of the firm, told an Inspector that he had not stamped any cards, and had no intention of complying with the Act.

Employés were called, who testified to the wages, sick pay and maternity allowances paid by the firm, and who had said that they would tear up insurance cards if given to them, and that if any money were stopped from their wages for insurance they would leave their employment.

Mr. Blanco White, who defended, said in such circumstances employers were surrounded by considerable difficulties. Appeals were pending on the points that had been raised in connection with the working of the Act. Mr. Travers Humphreys said that cases had been stated on the question of the validity of the regulations and other points, and the matter would soon be argued.

Mr. Mead adjourned the summonses *sine die*, until he heard the result of the appeal.

Appointments Vacant. — Chief assistant electrical engineer, for the Hastings Corporation (£150). Assistant electrical engineer, for the Bray U.D.C. (£104). Switchboard attendant, for the Bermondsey B.C. (32s.). Assistant mains engineer (£30 per month) and shift engineer (£21 per month) for the Shanghai Municipal Council. Signal and telegraph engineer (£540) and two assistant telegraph engineers (£360), for the Railway Department of the Federated Malay States. Electrical engineer and tramways manager, for the Bexley U.D.C. (£300). See our advertisement pages in this issue.

Conspiracy.—On Saturday last, at Bow Street, sixteen young men employed by the London Electric Railway Co. were charged with conspiring to defraud the company. They were either liftmen, ticket collectors or booking clerks, and, according to the details published in the daily Press, tickets which were purposely left unclipped by the first mentioned were reserved by the second class of employé, and reissued by the last of the three parties. The accused were remanded.

Educational.—The Institution of Heating and Ventilating Engineers offers two "Heating Studentships," tenable in the Faculty of Engineering at University College, London, each of the value of £50 a year, together with 11 guineas for payment of college fees. The object of these studentships is to encourage research in heating and ventilating engineering. Candidates must produce evidence that they have already pursued a course of engineering training, and are familiar with the work of an engineering laboratory. Full particulars may be obtained from the Secretary, University College, London.

Prices Realised at the McKenna Sale.—At the English McKenna Process Co.'s sale held at Birkenhead on Tuesday and Wednesday [this week] by Messrs. Wheatley Kirk, Price & Co., the works and contents realised about £50,000 (the stock and some plant having been previously sold by private treaty). Following are the prices realised for some of the leading electrical items:—10-ton overhead electric traveller, £350; 10-ton Goliath crane, £660; three turbo-generators, £825 each; two Belliss exciter sets, £200 each; six 500-H.P. motors, £200 each; three-core cable, 18s. per yard. On each day there was a large company, and prices realised throughout were fairly good.

Driving Breakers and Stamps.—In the majority of cases stone crushers, breakers, and stamps have to be driven at comparatively moderate speeds, especially on the larger sizes, while, on the other hand, the most economical system of electric drive is the use of electric motors of fairly high speed. Hence it is the usual custom in order to obtain the necessary speed reduction, and also to provide an elastic medium between the stamp and the motor, to drive the former from the latter by means of belts. The practice of using very tight belts for driving heavy machinery such as breakers and stamps has been the cause of seizing of many bearings which would otherwise have stood up to their work perfectly well. This is due to the fact that the attendants, as soon as they see that the belts show signs of slipping, immediately think it necessary to tighten them up. The result is that in many cases during the night when the plant is shut down, owing to considerable changes of temperature, especially in tropical climates where the nights are relatively so much colder than the day, the belts will become so tight as to cause the brasses to seize. It is, therefore, well to remember that wherever the necessary ground space can be secured it is better to have a fairly long drive with the belt just taut, but not strained, and then to utilise a suitable amount of belt compound. This will be found to cure the trouble.

Such belt compounds must not be used too freely, as the use of too much compound, any excess of which may cake on the pulleys and belts, has been the cause of many belts being ruined when they were comparatively new. Cases have been known where beautiful 24-in. belts driving stamps have been rendered useless in three months owing to the use of too much compound and the subsequent caking process. The actual action which seems to take place is that the inside ply is torn away from the other plies and the result of this is that flapping of the belt ensues, and the belt is subsequently soon done for. Moderation is therefore necessary in applying belt compound. A small amount of dressing applied only in the middle of the belt makes it grip and saves it from sticking too much to the pulley, as the sides of the belt are free from dressing. Moreover, as soon as any lumps appear to be forming, the belt should be stopped, the lumps scraped off the belt and the pulley, and the latter should be cleaned with petrol before the motor is started again.

Whist Drive and Dance.—The third annual and successful function of the Electrical Engineer Ex-Apprentices and Apprentices' Association, Devonport Dockyard, was held at Sambell's Criterion Restaurant on Wednesday, November 20th, consisting of a whist drive and dance. During the first hour of the evening a musical programme was rendered by Mrs. H. Blake (contralto), Mr. T. Hulson (tenor), Mr. A. Bollard (bass), Mr. E. T. Crocker (bass). Dancing started about 11 p.m., Mr. Harris being the hon. accompanist, and Messrs. Uglow, Mildren and Woodley officiated as masters of ceremony. Among the large number present were Mr. and Mrs. Z. H. Kingdon (chief electrical engineer), Mr. and Mrs. G. R. Battle (second assistant to electrical engineer), Mr. and Mrs. J. C. Uglow, Mr. and Mrs. T. Hulson, Mr. and Mrs. H. Blake, Mr. and Mrs. J. Wotton (inspectors of the department). The general arrangements were carried out by Mr. H. R. Kelly, the hon. secretary of the Association.

Electric Shocks.—Lecturing recently on "The Dangers of Electricity from the Clinical, Forensic, and Hygienic Points of View," Prof. Jellinek, of Vienna, said he could not agree with those who saw no danger in currents of 300 or 350 volts. He had seen various fatal cases with 100 volts, and he had even seen a death where the current had only 65 volts pressure. There was the same difficulty in attempting to determine the fatal quantity of amperes. Electricians were in the habit of regarding a tenth of an ampere as safe, but so small a quantity as a thousandth might prove fatal. The skin of the body was a great protector against electricity, as it was against other dangers, but the resistance of the skin was a varying quantity. Experiments had shown that the electric current passed both over and through the body, and it made considerable difference whether the current was taken by accident or knowingly. It was possible for a man to take a current at between 100 and 1,000 volts if he took it knowingly, whereas if he took the same amount unwittingly at another time it might prove fatal. It was necessary to realise that surprise played an important part in deaths from electricity, and it was because of the absence of shock that electrocuted prisoners did not lose consciousness.

Litigation in Connection with Motor-Car Lighting Dynamos.—In view of the greatly increased number of special dynamos that has lately been put on the market in connection with the electric lighting of motor-cars, it is, perhaps, not surprising to learn that litigation is likely to be heard of in this connection. News has just come to hand from New York that the General Electric Co., of Shenectady, is bringing an action against the Rushmore Dynamo Works, of Trenton, New Jersey, for infringements of the Barry and Steinmetz patents, which are alleged to cover certain principles of winding and regulating electric dynamos.

Institution and Lecture Notes.—Textile Society.—At Huddersfield Technical College on Monday evening, Mr. E. Brook (E. Brook, Ltd.) gave a lecture to the members of the Society on "The Practice of Driving by Electric Motors." The chair was occupied by Mr. A. B. Mountain, the Borough electrical engineer. Mr. Brook discussed the three-phase system, which was put in by the Huddersfield Corporation three years ago, and gave comparative costs of driving looms by motors in groups and of driving each loom by a separate motor. This was followed by descriptions of installations at different works and mills in the district, which were equipped with motors, such as the ironworks of Messrs. C. W. Holmes & Co., the factory of Messrs. Liddell & Brierly (Marsh), the mills of Messrs. T. & H. Blawer's, Ltd. (equipped with about 65 motors giving 680 h.p.), and the works of Messrs. Read, Holliday & Co., Ltd. (where there are 70 motors with a total of over 1,400 h.p.).

Association of Mining Electrical Engineers.—A meeting of the East of Scotland Branch was held at Dunfermline on Friday last, when Mr. H. Gordon Fraser, the vice-president, submitted an interesting paper on the lessons to be learned from the fatal and non-fatal electrical accidents in Scottish mines during 1911. In the course of his lecture, Mr. Fraser urged that it was important that one man at least in a brushing squad should have electrical knowledge. In the discussion, Mr. J. Gillespie said he did not know how that knowledge was to be acquired unless the electrician in charge of a colliery undertook the tuition of a class composed of firemen, machinemen and brushers. There was such a class at a colliery in Fife. Mr. H. J. Humphreys said that it would be an advantage to have rules printed in pamphlet form instructing firemen, when going their rounds, carefully and periodically to inspect the important points of an earthing system.

The British Fire Prevention Committee has strengthened its Council, the various vacancies having been filled by Lord Montagu of Beaulieu, Sir Aston Webb, Sir Maurice Fitzmaurice, Mr. W. Slingo, and Mr. H. J. Blanc. The Executive, as re-elected, includes Mr. E. O. Sachs as chairman, Mr. H. S. Folker as honorary treasurer, and Mr. E. Marsland as gen. hon. secretary. The Committee has just completed its fifteenth year.

The Concrete Institute.—At the meeting on November 14th, the President, Mr. E. P. Wells, said that the total membership of the Institute was now 938. He then delivered his presidential address. Mr. H. P. Boulnois, in proposing a vote of thanks, said that materials could be standardised, but, unfortunately, one could not standardise men, and the personal element came into the work enormously. The best design might be ruined by bad workmanship. Mr. C. S. Meik, who seconded, expressed the opinion that for all work in reinforced concrete the men should be specially trained, and one should make sure that there was not a man amongst them who had been accustomed to make concrete as it used to be made. The old-fashioned method of making concrete was quite out of place when dealing with materials like reinforced concrete, and the labourer who had been used to the old style could not be made to do good work in the new style.

Institution of Electrical Engineers (Birmingham Section).—A meeting was held on the 27th inst., at Birmingham, when a paper was read by Mr. J. S. Peck on "Earthed *v.* Unearthed Neutrals on Three-Phase a.c. Systems." The reading of the paper was followed by a discussion.

A lecture under the auspices of the Swansea Y.M.C.A. was delivered on Tuesday last week by Mr. R. Borlase Matthews on "The Latest Appliances of Electricity."

Clyde Electricians Locked Out.—Our correspondent writes that the strike of the electricians in the employment of a number of Clyde shipbuilding yards (reported in last week's Review), has assumed more serious proportions. The employés of the members of the Electrical Contractors in the Glasgow district employed in the yards and city have been locked out, the result being that about 1,500 men are now idle. There were no new developments in the dispute at the time of going to press, the employers apparently having no intention to make an initial move towards settlement. It appears that the shipbuilders have now got several of the more pressing of the war vessels completed, and expected to be able to do without the services of the strikers for some time. The city employers have stated their intention to stand by the shipbuilders till the end of the dispute.

Finsbury Technical College O.S.A.—The seventh annual dinner will be held at the Trocadero Restaurant, Piccadilly Circus, on Saturday, December 7th, at 7 for 7.30 p.m. The chair will be taken by Mr. Julian L. Baker, F.I.C., President of the Association. The following guests have signified their intention of being present:—Prof. H. E. Armstrong, Prof. E. G. Coker, D.Sc., Mr. S. W. Luard, Prof. R. Meldola, Prof. John Perry, Sir William Ramsay and Prof. S. P. Thompson. It has been decided to hold the dinner on a Saturday, so as to enable provincial members to attend. A seating plan composed of round tables accommodating four and eight persons will be adopted. A professional musical programme has been arranged. Communications should be addressed to Mr. Harley F. Knight, 14, Old Queen Street, Westminster, S.W.

Twenty-One.—On November 22nd, in celebration of the twenty-first anniversary of the firm of Robert. W. Paul, the staff and employés were invited to tea, followed by a visit to the Wood Green Empire. The outing, which was made in private motor-'buses, was much enjoyed.

Will.—Mr. J. E. Hodgkin, managing director of the Pulsometer Engineering Co., Ltd., who died last month, aged 82, left £30,115 gross and £26,373 net personalty.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Forty-one applications for the post of assistant electrical engineer were received by the Bray Urban District Council, and a Southampton gentleman was appointed. He had, however, received an appointment in London in the meantime, and was unable to go to Bray. The Council decided to re-advertise the position in the Electrical Review and the Dublin morning papers. At its last meeting, the Council fixed the salary to be paid to Mr. D. E. McDonnell (resident engineer *pro tem.*) at £240 per annum.

Mr. W. E. Kidner has been appointed, subject to the usual sanction, assistant electrical engineer to the Barking undertaking at a commencing salary of £130 p.a. Mr. Kidner was previously at the Leatherhead Electricity Works.

Mr. J. Baldwin, late of the Kent Electric Power Co., has been engaged at Grays Electricity Works in place of Mr. A. E. Saville, who is taking up an appointment in San Francisco.

General.—Mr. L. S. Richardson has resigned his position as manager of the electrical department of Messrs. Fred. Wilkins & Brother, Ltd., and joined the staff of the Ridings Arc Lamp Co., of Liverpool, as assistant manager.

It is announced that the directors of the Electric Construction Co., Ltd., have appointed Mr. P. E. Beachcroft chairman of the company, and have elected Mr. William Bullock to the seat on the board rendered vacant by the death of Sir Irving Courtenay.

Mr. R. Doderick, who is leaving the Anchor Cable Works, Leigh, Lancs., has been presented with a Sheraton clock, suitably inscribed, and a pipe. The presentation was made by the works manager (Mr. Bowyer).

Mr. Stevenson has been unanimously re-elected convener of the Edinburgh Corporation Electric Lighting Committee. Mr. Harrison has been appointed convener of the Tramway Committee.

Mr. John D. Martin was the recipient of a gold watch, suitably inscribed, from his fellow workmen of the Kilmarnock Electricity and Tramway Department, on the occasion of his departure to take up an appointment as electrician at Annandale Colliery.

Mr. Cecil C. Higgens has resigned his post as assistant engineer with Messrs. Ozonair, Ltd., of Westminster, to take up an appointment as sectional engineer with the Yorkshire Electric Power Co.

According to the *Railway Gazette*, Mr. C. H. Merz, on leaving Melbourne, will proceed to Bombay to report on the suggested electrification of the suburban railways there, reference to which was made in our issue of November 1st, page 701.

A complimentary dinner will be given to Mr. Frank Bailey, chief engineer and joint managing director of the City of London Electric Lighting Co., Ltd., at the Waldorf Hotel, on December 12th. Many past and present members of the engineering staff of the City of London Electric Lighting Co. will be present. Any of our readers who are interested, but have not received particulars, are asked to communicate with the joint secretaries, Mr. P. Rycroft, Electricity Department, Hounslow; and Mr. F. Sumner Smith, Amberley House, Norfolk Street, Strand, London, W.C.

Obituary.—F. M. N. Dresing.—The telegraph world has again to mourn the loss of one of its prominent members, Frederik Michael Nicolai Dresing, R.D., C.St.O., C.C.P., K.C.R.S., C.C.D., K.S., Advisory Director in the Imperial Chinese Telegraphs, who died, in Pekin, of pneumonia, on the 15th inst. Dresing was the youngest son of the well-known Danish politician, Landstingsmand, Stats-revisor, F. N. Dresing, and was born at Voerbjerggaard, Nörresundby, Jutland, in January, 1867. In 1884 he entered the Great Northern Telegraph Co.'s service, where his great ability and untiring energy were soon apparent; and he was utilised and trained at several of the company's stations both in Europe and China. In the Far East he organised and directed important cable work for many years, and when in 1900 the political state of affairs made it imperative that Shanghai should be brought into cable communication with Northern China, the work was entrusted to Dresing, and accomplished by him to the entire satisfaction of all parties concerned. In 1903 Dresing was offered, and accepted, the leadership of the Chinese School of Telegraphy in Shanghai, where the young Chinese receive their technical education before their appointment to the different stations of the Chinese Empire. When Dresing, in the following year, left the Great Northern Telegraph Co., the Chinese Government, which had long noticed and appreciated his many and varied capabilities, made him Advisory Director. From this date until his death, and in spite of his always delicate health, an enormous work has been done by Dresing for the development of telegraphy in China, not merely from a technical standpoint, but by important concessions and treaties with foreign powers which he negotiated and carried through with ability, energy, and keen sightedness, as well as diplomatic tact. The many decorations which he received, not only from Denmark, China, and Japan, but many European countries, also testify to the appreciation of his work and talents. To these brilliant gifts was added an amiable and pleasing personality with good conversational powers, so that in social life, too, he will be much missed. He was hospitality itself, and his house at Shanghai, always full of guests, was almost an international rendezvous. He was always ready to render, not only good advice, but a helping hand to all who needed it; first and foremost to his own countrymen, two of whom watched at his bedside until the last. Dresing was 45 years of age, and unmarried.

Dispatches from Reuter's Paris agent published in the daily Press state that there has just passed away, "poor and unknown," Charles Borseul, "the first discoverer of the principle of the telephone" whose claim was "recognised 30 years ago by Dr. Graham Bell and Mr. Edison. It was in 1855 that Borseul, who had studied telegraphy "propounded the theory of the telephone." His chiefs allowed him to publish his discovery, but warned him to devote his attention to more serious matters.

NEW COMPANIES REGISTERED.

Krupka & Jacoby, Ltd. (125,368).—This company was registered on November 11th, with a capital of £[illegible],000 in £1 shares, to carry on the business of importers of, and dealers in, electric lighting appliances in succession to the business carried on by O. Krupka & H. A. Jacoby, as "Krupka and Jacoby. The subscribers (with one share each) are :—H. Barrett, 2[illegible], West Street, Finsbury Circus, E.C., solicitor; R. E. Koch, 66, Gordon Road, Ilford, cashier. Private company. The number of directors is not to be less than two or more than three; the first are O. Krupka and H. A. Jacoby. Registered office, 11, Queen Victoria Street, E.C.

Kilmarnock Industrial Development Syndicate, Ltd. (8,430).—This company was registered in Edinburgh on November 8th, with a capital of £1,000 in £1 shares, to carry on the business of makers of electric lamps or other light-giving bodies. The subscribers (with one share each) are :—F. H. Pegu, Manna Road, Prestwick, electrical engineer; J. Smith, 60, Bank Street, Kilmarnock, accountant. Private company. Table "A" mainly applies. Registered office, 67, Bank Street, Kilmarnock.

James Lowden & Co., Ltd. (3,965).—This company was registered in Dublin on November 7th, with a capital of £5,000 in £1 shares, to carry on the business of contractors, sanitary, heating, lighting, electrical and general engineers, &c. The subscribers (with one share each) are :—J. Lowden, Easton Avenue, Belfast, contractor; J. W. Lowden, Harton, Cyprus Gardens, Belfast, contractor; R. H. Lowden, Easton Avenue, Belfast, contractor. Private company. The first directors are J. Lowden, J. W. Lowden R. H. Lowden; qualification, 100 shares. Registered office, 46, Ann Street, Belfast.

M.E. Syndicate, Ltd. (125,279).—This company was registered on November 9th, with a capital of £20 000 in £1 shares, to carry on the business of a light and power company in all its branches, and that of electricians, electric, water, gas and mechanical engineers, &c. The subscribers (with one share each) are :—A. A. Amos, 28, Liverpool Road, Leyton, clerk; G. E. Sanders, The Priory, West Molesey, clerk. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; remuneration as fixed by the company. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

London and Suburban Traction Co., Ltd. (125,469). Registered November 20th, by Bircham & Co., 50, Old Broad Street, E.C. Capital, £3 250,000 in £1 shares (1,500,000 preference). Objects: To acquire and hold shares, stocks, debentures, debenture stocks, bonds, obligations and securities issued by the Metropolitan Electric Tramways, Ltd., the Tramways (M.E.T.) Omnibus Co., Ltd., and the London United Tramways, Ltd., or any other companies, having for its objects the business of proprietors or operators of tramways, railways, light railways, omnibuses, cabs, vans or other public or private conveyances of any description, or generally of carriers of passengers or goods by any form of traction; to put forward a "Scheme for Consolidation of the interests of the shareholders in the Metropolitan Electric Tramways, Ltd., the Tramways (M.E.T.) Omnibus Co., Ltd., and the London United Tramways, Ltd.," a print of which has for the purpose of identification been subscribed by two of the subscribers to the memorandum of association; to construct or acquire tramways, railways and light railways in the United Kingdom, and to equip, maintain and work by electricity, steam or other mechanical power, or by horse traction, all tramways and railways belonging to the company, to carry on the business of tramway, railway, motor-omnibus and van proprietors, carriers of passengers and goods, jobmasters, vehicle manufacturers and repairers, coach house and stable builders, &c. The signatories (with one shares each) are :—Emile Garcke, 1, Kingsway, W.C., director; J. Devonshire, 1, Kingsway, W.C., director; E. R. Loames, 1, Kingsway, W.C., director of tramways (M.E.T.) Omnibus Co.; W. M. Acworth, The Albany, Piccadilly, W., barrister; H. H. Stanley, Electric Railway House, S.W., railway director; C. H. Dade, 1, Kingsway, W.C., joint manager, British Electric Traction Co., Ltd.; A. L. Barber, 1, Kingsway, W.C., secretary, Metropolitan Electric Tramways, Ltd. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are to be appointed by the signatories; qualification, £100; remuneration, £1,200 per annum, divisible; directors' borrowing powers restricted to one-half the aggregate nominal amount of the share capital for the time being issued and outstanding.

Gillespie Partners, Ltd. (125,411).—This company was registered on November 16th, with a capital of £1,200 in 1,000 preference shares of £1 each and 4,000 ordinary shares of 1s. each, to carry on the business of manufacturers of and dealers in railway and tramway permanent way materials, wheels, axles and general rolling stock equipments, &c., and to adopt an agreement with J. D. Gillespie, C. G. Gillespie and J. E. Fraser. The subscribers (with 20 shares each) are :—J. D. Gillespie, 81, Gracechurch Street, E.C., merchant; C. G. Gillespie, 81, Gracechurch Street, E.C., merchant; J. E. Fraser, Hendon Park, Mill Hill, N.W., merchant. Private company. The number of directors is not to be less than three or more than four; the first are J. D. Gillespie, C. G. Gillespie and J. E. Fraser; qualification, £20. Registered by Godden, Son & Holme, 34, Old Jewry, E.C.

National Electric Times Co., Ltd. (125,486).—This company was registered on November 21st, with a capital of £5,000 in £1 shares, to take over the business of an electric clock manufacturer, carried on by H. B. Swift, at 15, Great Sutton Street, Clerkenwell, E.C. The subscribers (with one share each) are:—Col. Sir T. Sturmy Cave, K.C.B., Kilworth, Woking; H. B. Swift, A.M.I.E.E., 15, Great Sutton Street, Clerkenwell, E.C., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, 100 shares; remuneration, £50 each per annum (chairman £75), and a percentage of the profits. Registered office, 15, Great Sutton Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bourton-on-the-Water Electric Light and Power Co., Ltd. Particulars of £750 debentures, created August 12th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Second mortgage debenture, dated October 24th, 1912, to secure £250,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Lloyds Bank, Ltd., Newcastle-on-Tyne.

Dixon & Corbett and R. S. Newall & Co., Ltd.—Particulars of £30,000 debentures, created by resolutions of June 14th and October 25th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

Lea, Son & Co., Ltd.—Particulars of £500 debentures, created October 26th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Orford Electric Light and Power Co., Ltd.—Particulars of £500 debentures, created May 21st, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £350. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Electromobile Co., Ltd.—Issues on September 30th and November 6th, 1912, of £787 10s. debentures, part of a series of which particulars have already been filed.

Imperial Tramways Co., Ltd.—Capital £400,000 in 20,000 pref. and 20,000 ord. shares of £10 each. Return dated February 28th (filed September 10th, 1912). All shares taken up: £100,000 paid; £300,000 considered as paid. Mortgages and charges: £300,000.

Foster Engineering Co., Ltd.—Issue on November 13th, 1912, of £1,000 debentures, part of a series of which particulars have already been filed.

Perceval Spencer, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated November 14th, 1912, to secure £1,600. Holder: W. Jones, Nassau House, Eccles, near Manchester. Memorandum of satisfaction in full on November 14th, 1912, of debenture dated October 8th, 1906, securing £371, also notified.

Rhondda Tramways Co., Ltd.—Particulars of £240,000 debentures, created by resolutions of March 13th, 1911, and November 8th, 1912, and secured by trust deeds dated March 24th, 1911, and November 13th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £40,000. Property charged: Tramways and right of user of same, and lands with generating station and other premises, together with tramway equipment, &c., and certain purchase moneys, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Law Debenture Corporation, Ltd., 41, Threadneedle Street, E.C.

Mechanical Appliances Co., Ltd.—A memorandum of satisfaction in full on October 26th, 1912, of debentures dated December 31st, 1906, securing £300, has been filed.

Fredk. Jones & Co., Ltd. (110,247).—Return dated September 27th, 1912. Capital, £15,000 in £1 shares. All shares taken up. £7 paid. £14,993 considered as paid. Mortgages and charges: Nil.

Electric Reduction, Ltd. (54,724).—Return dated November 14th, 1912. Capital, £40,000 in £1 shares (16,200 preference). All shares taken up. £13,000 paid on 13,000 preference. £27,000 considered as paid on 3,200 preference, and 23,800 ordinary. Mortgages and charges: £7,500.

Rochdale Asbestos Co., Ltd.—Mortgage dated November 1st, 1912, to secure £1,700, charged on certain lands and premises in Shawclough, Rochdale. Holder: H. Bland, Lee Cottage, Shawclough, Rochdale.

X. L. Electric Co., Ltd.—Two debentures dated October 30th and November 1st, 1912, to secure £1,250 and £750 respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Capt. C. Wiener, Ewell Castle, Surrey.

J. Kirby & Co. (Leeds), Ltd.—A memorandum of satisfaction in full on November 6th, of debentures dated August 17th, 1912, securing £300, has been filed.

Llanelly and District Electric Lighting and Traction Co., Ltd.—Trust deed dated November 11th, 1912 (supplemental to trust deed dated August 3rd, 1911), to secure £15,000 debenture stock ranking *pari passu* with £60,000 like stock issued under principal deed, charged on company's lighting and tramway undertakings and its leasehold power station, car-shed and other assets, including uncalled capital. Trustees: Century Insurance Co., Ltd., 18, Charlotte Square, Edinburgh.

Mexican Fuel and Power Co., Ltd.—Issue on November 19th, 1912, of £600 debentures, part of a series of which particulars have already been filed.

British Electric Traction Co., Ltd.—Mortgage dated November 19th, 1912, to secure £20,000, charged on leasehold premises known as Electrical Federation Buildings, Kingsway, W.C. Holders: Alliance Assurance Co., Ltd.

Victoria Falls and Transvaal Power Co.—On October 1st last the reduction in the standard price per unit, in accordance with the provisions of the licences issued to the Victoria Falls and Transvaal Power Co., Ltd., and the Rand Mines Power Supply Co., Ltd., came into force. The net earnings of the combined companies for the month of October, including the output from part of the Vereeniging station at present in commission, amounted to £35,134.—*Financial News.*

Canadian General Electric Co.—A quarterly dividend of $1\frac{3}{4}$ per cent. on the common stock for the three months to December 31st is announced, together with a bonus of 1 per cent. making a total of 8 per cent. for the year.

CITY NOTES.

City and South London Railway Co.

Mr. C. B. Stuart Wortley, M.P. (chairman), presided on Tuesday at the Great Eastern Hotel, E.C., over an extraordinary meeting of the shareholders, in connection with the scheme of arrangement with the Underground Electric Railways Co., Ltd.

The Chairman said the board met the shareholders with mingled regret and pleasure; regret that they should have to ask them to part company with the board, and pleasure that they were offering what they considered to be a substituted investment of an advantageous kind. They had for some months been in a position of some natural anxiety, while their stock had been the sport of rumours that neither shareholders nor board could prevent. The actual effective negotiations that produced the offer they were submitting began only quite recently. They were, however, the resumption of conversations that had been interrupted for some months by events that were beyond the board's control. During those months they were not in a position to say that absolutely nothing was taking place; while any rumour that they contradicted would have been taken to imply the confirmation of some other among the many rumours not covered by the particular contradiction. He assumed that each of them had read the circular that they had addressed to the holders of the ordinary stock. He had, therefore, not to repeat, but only to explain or amplify, the statements that the circular contained, and he would have to add some assurances that were due to other classes of proprietors. It was to be supposed that the ordinary stockholders whom he addressed all belonged to some one or other of three possible classes. They might be (1) of those who desired to accept this scheme and see it go through; (2) of those who did not for themselves accept the scheme, and who did not desire to see it go through; and (3) of those (and they knew from letters received that there were such) who did not care to accept the scheme for themselves, but who desired, nevertheless, that it should go through. Let him address himself to the latter class first. Here they had those who thought it would be best for them to remain in the concern with a single new and influential and powerful partner substituted for a number of unorganised individual partners who were neither influential nor powerful. To those he ventured to say that, under the inexorable conditions under which most enterprise was carried on, they could not have things both ways. The acquisition by the Underground Co. of a controlling interest in the City and South London Railway might, indeed, have the effect of bringing them a rejuvenated plant, new and valuable connections and extensions, and a revenue to correspond. But the danger was that if even only a small number of their stockholders should (by refusing their assent now) try to gamble themselves into the position of being left in the concern, either alone or with very few others, to share in all the advantages he had named, their example might be followed by too many others, with the consequence that the influential partner and rejuvenated plant, and the improving revenue, might never come into existence at all. In that case their last state would be worse than the first, for they would be left to their fate, knowing always what their fate might be. Coming to those, if there were any such, who neither accepted this scheme themselves nor wished others to do so. Now, ought they to refuse acceptance? And why did they say that those who did accept were right in accepting? What was the prospect for those who refused if their policy should be found on December 5th to have been also that of a number of stockholders holding stock sufficient to stop the scheme? In answering this question he naturally did not wish to "bear" their own stock, or to exaggerate anything for argumentative purposes. He had no need to go beyond plain and published facts. In July, 1911, they paid £1 15s. per cent. on the ordinary stock. In January, 1912, they paid £1 10s. In July, 1912, they paid £1 5s. Their weekly published traffics of the current half-year up to Sunday last showed a decrease of £5,116. That was for 21 weeks. For 26 weeks, at the same rate of decrease, the falling off would be £6,334. To pay 5s. per cent. for 26 weeks on the ordinary stock required £1,850. The loss of the £6,334 was, therefore, equivalent to a reduction of about 15s. per cent. for the half-year in the dividend on the ordinary stock. He would be glad to be able to set off against these figures any prospect there might be of a fall in the price of coal. But they met no-one just now who foretold anything but a rise in coal, and therewith the rise in prices of stores and materials of all kinds that always accompanied a rise in coal. Add to this that the motor-'buses had by no means developed to the full the services they might give along the Clapham Road, and so far as concerned districts beyond Clapham, such as Balham and Tooting, whence they still got many passengers, the motor-'buses could hardly be said to have begun at all to give a through service to London. Now, what did the Underground Co. offer to the ordinary shareholders in place of the prospects they now had if they remained as they were? They were offered a participating share in a traffic which was not only growing already, but of which the possible extended sources were by no means fully developed. The London Electric Railways had a system which enabled people to be carried underground through the heart of the West End to, and from, Finsbury Park, Highgate, Golder's Green, Hampstead, Hammersmith, Kensington, and the Elephant and Castle. They touched the great railway termini at King's Cross, St. Pancras, Euston, Marylebone, Charing Cross and Waterloo. Through the lines of other companies connected with them they reached Liverpool Street, London Bridge, the Bank, Oxford Circus, Marble Arch, Shepherd's Bush, and all their own stations to Clapham Common. Their contemplated extensions would see them at Paddington; and beyond Paddington at Queen's Park, where they would get a contact with the suburban traffic of the London and North-Western Railway, which at one time they hoped the London and North-Western were going to give to them. And northwards they were to extend beyond Hampstead to Edgware. Their tunnels were of the more modern and larger calibre; their stations and their carriages were such as enabled them to carry far more passengers in a given time than the South London with their present resources could ever hope to take. Their 4 per cent. preference stock stood to-day at 80. The £40 of that stock that they were offered in part exchange for their £100 of City and South London ordinary had, therefore, a market value of £32. Its dividend was protected by an earning power evidenced by the fact that on their ordinary stock of more than 9 millions, a dividend of 1 per cent. had already been paid. They were offered in further part exchange a participation in the present, and all future, earnings of that ordinary stock. That London Electric ordinary stock had at present no quotation, being all in one ownership and never having been put on the market. Should this scheme result in bringing into existence some thousands of new owners of this stock, a Stock Exchange quotation would be properly asked for. But at present they must value it for themselves as best they could. A stock which, in the last completed year, divided £93,000 odd, and carried over £12,000, would, in their opinion, be most conservatively valued at 30. At that price, the £25 of that stock which was offered in completion of what they were to get for their £100 C. & S.L. ordinary must be worth £7 10s. Added to the £32 he mentioned a few moments ago, the £7 10s. made £39 10s., as the value of what they were being offered. If they took the London Electric Ordinary at 35, they would be getting not £39 10s., but £40 15s. for their £100 of C. & S.L. ordinary. In this connection, let him remind them that it was not 12 months since their own stock was at no more than 27, before rumours began to fly around, and after a half-year in which a dividend at the rate of so much as £1 15s. per cent. had been paid. So much for capital. As to their future income, assuming a dividend of 1 per cent. on London Electric Ordinary, they would be getting an income of no less than £1 17s. per annum on every £100 of C. & S.L. ordinary that they exchanged under this scheme. And any increase in the dividend on London electric ordinary would not only increase their income and the capital value of their London Electric ordinary, but it ought to increase the capital value of the London Electric preference as well. They submitted, therefore, that the value that they had the chance of getting in exchange for their present holding was not only good value at the present moment, but gave them also a share in prospective values of a promising kind. This was a meeting of ordinary stockholders, and what he had said so far had been addressed mainly to them. But there was also the large and important body of holders of their £850,000 of preference stocks, all of whom deserved no less than the ordinary did to have their interests protected by the board, and who looked to them to see to it that the new state of things would be an advantage also to them. The preference stockholders would, of course, have an opportunity later on of giving their votes at a Wharncliffe meeting, when the main operative part of the scheme, namely, the application to Parliament for powers to enlarge their tunnels, came forward for the sanction of the statutory proportion of stockholders. But they were justified in expecting also, now and at this earlier stage, information over and above that which the circular gave to holders of ordinary stock. The preference stockholders were, of course, not concerned with the estimates of what ordinary stockholders would get if they elected to go out. They had to think of the situation as it would be if and when the present ordinary stockholders had gone out, and the Underground Electric Co. had become the owner of a governing proportion of the ordinary stock. In that case he repeated to the preference stockholders the warnings that he had already addressed to ordinary stockholders as to what awaited them if things went on as they were now. Let him add to those warnings that he believed they could not hope to regain the customers they had lost, unless they increased the speed of the trains and the comfort of the carriages. That meant improved or new engines and larger tunnels. There was only one direction in which they could extend to a new territory; and to do that they would require, besides some added miles of line and tunnel, greater carrying capacity in the trains, which meant that they must be either more frequent or longer. In either case that meant a complete re-equipment of the line. All these were possible improvements, if only they could raise the large sums of money that they required. He submitted that with their present financial resources, these things were impossible; and that the only thing that could make them possible was some such alliance as that which they were proposing, and which did offer the higher speed, the larger tunnels, the longer carriages, and, moreover, a through connection with the Hampstead and Golder's Green district, which was at present beyond their reach. The new physical connection intended to be established at Euston between the Hampstead Tube and their line would enable passengers in the future to be taken through without change of carriage, possibly every minute and a half, right away from Hampstead, Golder's Green or Edgware to the Bank and beyond that to all their stations on the south side of the river. Under this alliance, if accepted, the preference stockholders would have a new and powerful partner interested in improving and developing to the utmost the earnings of the line and especially the dividend on the ordinary stock, which was the preference holder's margin of security. That partner was, moreover, the part-owner of the very motor-'buses from whose competition they were now suffering. He was in a position to make that competition yet more damaging to them than it already was. The arrangement they proposed would change him from a competitor and an enemy into a co-operative friend and a feeder of their system. Let him add a word for the further assurance of the preference stockholders. It was part of the scheme that their present old-fashioned tunnels of only 10 ft. 2 in. and 10 ft. 3 in. diameters should be enlarged to the diameter of the up-to-date tubes of the London Electric Railways Co. Their engineers assured them that this could be done without interruption to traffic. But in order to provide against all risks, the Bill to sanction these works would ask for powers to indemnify the preference stockholders against loss of dividend during the period of reconstruction. With regard to the future constitution of the directorate, the arrangements were not yet complete, but they must, of course, be in accord with the requirements of those who, if the scheme went through, would have a controlling interest in the undertaking. The City and South London Co. would remain in legally separate existence, and it was right that they should know that it was intended that, subject to re-election at the proper times, he would remain its chairman. They would have to regret the disappearance of some valued friends, but he had reason to think that his was not the only familiar face that at their future meetings they would continue to see on this side of the table. It was usual, and, he thought they would say, just, that directors retiring should receive reasonable compensation, and they had made the proper disclosure of the fact that that was to be so in this case. It was not usual to go further into particulars unless the compensation was intended to be out of proportion to what precedent would justify. A subject of proper anxiety, both on the shareholders' part and of the board, was the future of their loyal and excellent staff. He was glad to say that they had assurances that all that was possible would be done by way of absorbing them in the combined staff of what would be much like a joint undertaking, and that cases not so provided for would be dealt with in the same spirit as those of retiring directors. The stockholders in this railway were those who either initiated or had since supported an enterprise which had been and still was of great service to the toiling millions of London. As pioneers they had gained experience which had greatly profited the newer undertakings of the kind. Both those who left the City and South London and those who remained in it deserved very well of the London public. Like the London public they were all interested in having the greatest possible efficiency given to the various transit facilities and services available to the London public. This scheme recognised that present community of interest, as well as the risks taken and services rendered in the past. The board believed it to be good for the shareholders for the same reasons that made it good for the public; and with much respect, but without doubt or hesitation, they advised them to take it while they had the chance.

Mr. Campbell said it appeared to him the company were suffering from being pioneers. Other lines had had the benefit of their experience, and, in consequence, had been able to outcut them in a way. He saw nothing but for the shareholders to accept the scheme. He would like to know how long it was anticipated that the enlargement of the tunnels would take: what amount of money was required for that, and who would raise it? He took it that if the shareholders stood out they would be left in the cold for a considerable time before receiving any dividends. He would like to know if the Underground Co. would hold the common stock of the City and South London, or did they intend to convert it in any way?

Mr. Barker said that if money had to be raised for enlarging the tunnel and reconstructing the generating station, and so on, their dividends would disappear for many years, and hence he readily fell in with the proposals.

Mr. Vest asked how the transaction, if carried out, would be to the benefit of the London Electric Co? The Underground Co. were the purchasers, but were doing so by unloading their stock in the London Electric.

The Chairman said he could hardly answer the question of how long it would take to enlarge the tunnels, but two years after getting the Parliamentary powers would be the minimum. He was also very reluctant to say what sum would be required, for he knew from bitter experience the great danger of doing so, but they could take it that these possibilities had been gone into by the experienced gentlemen who advised the Underground Co. The capital would technically be raised by the City and South London Co. if the scheme went through. The controlling interest would be held by the Underground Railway Co., and it would be to their interest to see that the capital was raised in a way most advantageous to them as holders of ordinary stock. The Underground Co. had assured the board that they would hold the stock for a considerable time, and what that time might be they could judge for themselves. If they attempted to convert or get rid of it before the reconstruction had taken place they would not be likely to do so on advantageous terms. They would be deeply interested in getting the reconstruction made speedily and efficiently. In answer to Mr. Vest, the London Electric would get a new and valuable connection to the Bank.

Mr. Highton asked if the works would be carried out by their own engineers or by those of the London Electric Co., and was it proposed to give their generating station up?

The Chairman said that obviously this was a matter which must be dealt with by the reconstituted board, but at present the intention was to employ their own engineers.

A Shareholder asked why it was that the price of the stock fell two points when the terms of the arrangement were made public?

The Chairman said this was due to market anticipations having gone beyond what was proper whilst the present quotation accorded with the actual value of what was being offered.

No resolution was proposed.

Mr. Young, in moving a vote of thanks to the chairman, said he had attended 40 half-yearly meetings of the company, and had watched the hopes and fears of the company. They had always had skilful chairmen. As he sat there, he had wondered if the shade of their old friend, Mr. Mott, who was the originator of the line, was present. If Mr. Mott were alive, he would deplore what they were doing, but his sound common-sense would approve of it.

Col. Perry seconded the motion, and it was carried.

Malaga Electricity Co., Ltd.

The sixteenth ordinary general meeting of the shareholders of the above company was held on Tuesday, at the offices, 39, Coleman Street, E.C., Mr. F. Belcher, F.C.A., the chairman, presiding. The proceedings were private, but from a copy of the report supplied to us we gather that the sale of current in 1911 amounted to 218,192 ptas., as against 221,551 ptas. in the previous year, a decrease of 3,359 ptas. The total income from all sources amounted to 260,176 ptas. as against 268,516 ptas. in 1910, showing a decrease of 8,341 ptas. The number of 8-c.p. lamps on December 31st, 1911, was 26,083, as compared with 25,489 in 1910, an increase of 594. The expenditure in Malaga has decreased from 205,975 ptas. in 1910 to 171,511 ptas. in 1911, a difference of 34,464 ptas. The profit for the year, apart from any depreciation, is £2,859, an increase from last year of £973. Practically the whole of this profit has been applied to depreciation, and there is a balance to carry forward of £73, as against £7 in 1910. The engineer, Mr. Crawshaw, reports that the upkeep of the plant has been well maintained, and that the cables, transformers and sub-stations are in good condition. The directors announce the decease of the chairman, the late Mr. R. C. Wyatt, who had occupied that position since the incorporation of the company. The vacancy thus caused on the board has been filled by the directors appointing Mr. A. de Zulueta.

Stock Exchange Notices.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

British Columbia Telephone Co., Ltd.—£400,000 4½ per cent. first mortgage debenture stock.

New York Telephone Co.—£1,750,000 4½ per cent. first and general mortgage bonds (Nos. E 12,501 to 17,500 of £200 and C 30,001 to 37,500 of £100 each), in lieu of the scrip.

Victoria Falls and Transvaal Power Co., Ltd.—Further issue of 180,000 preference shares of £1 each, fully paid (Nos. 1,708,001 to 1,888,000).

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved:—

British Power, Traction and Lighting Co., Ltd.
Chipping Norton and District Electric Light and Power Co., Ltd.
Electrical Corporation, Ltd.
S.M.H. Tramway Syndicate, Ltd.

Prospectus.—*Utilities Improvement Co.*—Lloyd's Bank, Ltd., has been receiving applications for the purchase of $5,000,000 of 6 per cent. cumulative preference stock in this company at 86. The company is largely interested in American gas and electrical undertakings.

Adelaide Electric Supply Co., Ltd.—The directors have (according to the *Financier*) declared a final dividend of 5 per cent., making 10 per cent. for the year, together with a bonus of 2 per cent., both free of income-tax, on the ordinary share capital of the company in respect of the financial year to August 31st.

STOCKS AND SHARES.

Tuesday Evening.

Foreign political complications are once more playing a jangling part in the markets of the Stock Exchange. Nobody believes that Europe will be plunged into war simply because Austria and Servia cannot agree about a port; but, on the other hand, it is not pleasant to have these continual telegrams as to mobilisations of various armies abroad. Their influence is as effective as it is indirect. It wet-blankets enterprise and speculative courage, while the investor himself prefers to keep money at the bank on deposit rather than buy stocks and shares at a time so unquiet as the present.

Since our last report was written, the principal feature has been the announcement that the Speyer group proposes to bring the Central London Railway and the City and South London into the Tube and Tram circles which it controls. This came as a surprise, and not a few people think that the South-Western Railway—and possibly the Great Western—have made a great mistake in allowing the Central London to slip through their fingers into the hands of such keen competitors as the Tube people are.

Upon prices in the stock market the first effect has been distinctly disappointing to holders of the securities. Some attempt was made at a bullish demonstration upon the news becoming public, but this fizzled out, and manifestly the people who had got in earlier in the month on advance information—or guess—as to what was going on, were anxious to take their handsome profits. Consequently, all the three ordinary stocks of the Central London show substantial falls, and a drop of 4 took place in City and South London. Tuesday's meeting to approve the scheme failed to stimulate the price. On the other hand, Metropolitans were run up to 57½, the assumption being that the Speyer group would not remain satisfied until they had completed their work by the acquisition of the Metropolitan Company also, which would, of course, include the Great Northern and City. This seems a reasonable supposition, and those who take up Metropolitans at the present time will probably see good profits sooner or later, though it may be a waiting game. The price subsequently eased off to 57, and Districts, after being 41½, went back to 40¾.

Following upon the Central London sensation came a sharp rise in London United Tramways Preference shares, which put up the price to 6⅝ before it reacted to 6, while Metropolitan Electric Tramways Ordinary at $1\frac{5}{16}$ show $\frac{1}{32}$ reaction. Quotations had been lower, but were stiffened again on publication of details as to the manner in which it is proposed to carry out the amalgamation of the two undertakings. A new company is to be created called the London and Suburban Traction Company, the securities in which are to be offered in exchange, optionally, for those at present existing in the other concerns. Dealings have already begun in London and Suburbans, for special settlement, the Ordinary being about 9s., the Preference 16s. 3d., and the Debenture stock 90.

Underground Electric Ordinary lost 5s. of their big improvement of last week, and the company's Income Debentures are two points lower.

A word of warning may not be amiss in connection with these London traffic schemes. This is not the column for the discussion of public benefits or disadvantages arising out of the business; but we may be forgiven, perhaps, for venturing to suggest that investors should not overlook certain considerations which would be obvious enough were it not that a glamour of success and popularity at present hangs over these arrangements. The careful observer can hardly fail to be struck by the accumulating discontent against the motor-'bus. To examine the subject thoroughly would require a column or two, instead of a paragraph, but a few words are sufficient to draw attention to the protests arising in various parts of London against the development of motor-'bus traffic. The London General Omnibus Company is one of the most profitable links in the traffic chain, but that some kind of legislation will be directed against its exuberant enterprise there seems to be little doubt. Also it needs to be remembered that one man will only require two journeys a day to get him to and from his work; some people talk as though traffic in London were illimitable; and they use that same man over and over again in their calculations per diem. Maybe the wise man is he who is taking advantage of the present buoyancy of such shares as London United Tramways Preference to slip out of his holdings.

The Electric Lighting market is steady, with very few alterations. South London Ordinary went back ⅛, and South Metropolitan 7 per cent. Preference are $\frac{1}{32}$ better. These are the only changes on the week. One hears on all sides that certain negotiations are in progress which will vitally affect the interests of metropolitan electric lighting shareholders; but, on the other hand, those who are in the best position to give an opinion say that too much is being made of these expectations, and that they are still premature. Obviously, however, the matter must be farther advanced than it was six months ago, since it has not been dropped; and illumination of the mystery, as we suppose it must be called, is awaited with keen interest.

The Foreign Tramway and Power group is quieter than usual. In the Mexican division changes are mostly against holders as regards the Common shares, though for the bonds there is still steady demand. British Columbia Electric Preferred Ordinary rose a point to 120. Canadian General Electric Common shares are similarly better. Para Electric Railway Ordinary slipped back $\frac{1}{16}$ after their rise last week. The Anglo-Argentine Tramways group maintains its firmness.

Telegraph and Telephone issues show a rising tendency. The improvements are small, but well distributed. The feature is a rise of 10s. in Great Northerns, which show indications of throwing off their recent depression. Eastern Extensions continue to make headway, and Eastern Telegraph Ordinary stock is a point up. Anglo-American Deferred rose ⅛. The fluctuations amongst the bonds are slight. National Telephone Deferred is unchanged on balance; and Marconis, after having been a strong market, eased off considerably in sympathy with the dulness of other speculative shares produced by the news from abroad.

The Manufacturing division is firm. Telegraph Constructions put on £1, and Henley's rose ¼. Castner-Kellners are $\frac{1}{16}$ harder again, the recent meeting being regarded as satisfactory. A fall of 10s. in India-Rubber shares lowered the price to 9. Rubber shares are better, although the vague talk of a coming rise in the raw product is more in evidence than is business in the share market.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc
Aberdeen	Nov. 20	2,886	+ 176	25	39,187	+ 495	14·4	..
Ayr	„ 23	394	+ 28	27	10,310	+ 265	8	..
Birmingham Corp.	„ 16	22,004	+5,229	33	852,688	+106,967	57·17	..
Blackburn	„ 20	2,315	+ 208	$34\frac{2}{7}$	41,876	+ 809	14·62	..
Blackpool Corp. ..	„ 21	900	+ 107	..	61,755	+ 5,770	11·87	..
Blackpool-Fleetw'd	„ 23	502	— 19	20	24,039	— 501	8	..
Bournemouth ..	„ 20	2,970	+ 118	$33\frac{2}{7}$	65,349	+ 1,992	21·95	..
Bradford	„ 16	10,679	+ 609	33	185,167	— 82	56	..
Brighton	„ 24	1,690	+ 45	34	86,927	— 390	9·5	..
Bristol	„ 22	12,940	+1,649	..	325,991	+ 27,079	30·5	..
Brit. Elec. Trac. Co.								
‡Airdrie	„ 15	600	+ 75	46	13,783	+ 3,443	3·65	..
Barnsley	„ 15	995	+ 22	„	8,324	— 216	..	..
Barrow	„ 15	660	+ 66	„	17,525	+ 3,248	5·37	..
Devonport ..	„ 15	1,016	+ 16	„	24,789	+ 1,705	8·85	..
Gateshead ..	„ 15	2,161	+ 57	„	48,115	+ 67	11·25	..
Gravesend ..	„ 15	426	+ 19	„	9,744	— 184	6·5	..
Greenock.. ..	„ 15	1,514	+ 147	„	37,328	+ 3,881	7·25	..
Kidderminster ..	„ 15	196	+ 1	„	5,526	+ 98	..	..
Merthyr	„ 15	407	— 3	„	9,282	— 379	2·9	..
Metropolitan ..	„ 15	16,983	+ 197	„	404,161	— 1,282	22	..
Middleton ..	„ 15	601	+ 10	„	15,424	— 327	8·5	..
Mid. Joint Com'tee	„ 15	6,579	+ 409	„	150,939	+ 7,879	..	..
Oldham—Ashton	„ 15	1,185	+ 41	„	28,164	+ 1,623	9·18	..
Peterborough ..	„ 15	238	+ 15	„	6,821	+ 356	5·31	..
Potteries	„ 15	4,803	+ 74	„	88,782	— 1,371	23	..
Rothesay	„ 15	95	+ 20	„	10,448	+ 491	2·75	..
Southport ..	„ 15	608	+ 26	„	13,907	— 226	8·17	..
S. Metropolitan..	„ 15	1,507	+ 25	„	39,051	— 920	..	..
Swansea	„ 15	2,277	+ 84	„	53,154	+ 275	12·5	..
Tynemouth ..	„ 15	802	+ 9	„	11,826	— 932	3·75	..
Weston-s-Mare ..	„ 15	64	+ 1	„	6,790	— 1,298	[illegible]	..
‡Worcester ..	„ 15	502	+ 13	„	12,780	+ 1,092	5·75	..
Wrexham ..	„ 15	225	+ 20	„	6,307	+ 590	..	..
Yorks. Wool. Dist.	„ 15	2,157	+ 71	„	49,889	+ 1,212	17	..
Miscellaneous ..	„ 15	402	— 8	„	10,673	+ 173	..	..
Burnley	„ 23	2,941	+ 283	..	..	.	12 44	·7
Burton-on-Trent ..	„ 24	617	+ 20	34	9,816	— 460	6·6	..
Bury	„ 24	2,416	+ 18	34	44,695	— 178	22·5	..
Cardiff	„ 23	4,666	+ 264	34	83,582	— 1,471	17·85	..
Chatham and Dist.	„ 21	1,570	+ 62	47	40,293	+ 1	14·95	..
Cork	„ 21	670	— 11	47	22,656	— 939	9·89	..
Croydon	„ 15	3,345	+ 89	33	60,234	— 822	11·6	..
Darlington	„ 23	452	+ 4	34	7,682	+ 87	4·87	..
Darwen	„ 22	558	+ 46	34	9,579	+ 807	4·36	..
Dover	„ 16	389	— 20	33	8,512	— 595	4·75	..
Dublin	„ 22	10,541	+ 56	..	122,060	— 8,172	54·26	..
East Ham	„ 23	2,071	+ 27	34	36,575	— 849	7·87	..
Glasgow	„ 23	37,839	+ 480	..	473,662	— 8,283	98	..
Hastings	„ 21	1,451	+ 27	..	..	..	19·3	..
Hull	„ 23	6,028	+ 15[illegible]	34	100,595	+ 1,301	13·5	..
Ilkeston	„ 14	110	— 7	33	3,722	— 725	..	..
Ipswich	„ 16	741	+ 81	33	15,907	— 174	10·5	..
Kilmarnock.. ..	„ 23	305	+ 9	27	4,539	— 156	4·25	..
Lancashire United	„ 20	2,586	+ 97	47	63,889	+ 110	[illegible]	..
Leeds	„ 23	15,209	+ 874	34	266,553	+ 9,070	65	7·5
Leicester	„ 23	5,156	+ 285	47	120,093	+ 3,926	20	..
Leith	„ 23	1,218	+ 98	$27\frac{2}{7}$	18,995	+ 507	8·72	..
Liverpool	„ 16	24,153	+1,268	$45\frac{2}{7}$	550,291	+23,545	119	3
†L.C.C.	„ 13	81,810	—4,653	..	1,374,447	—73,007	141·1	—1
London United ..	„ 23	10,784	+ 172	..	293,581	—13,460	..	..
Lowestoft	„ 23	339	+ 9	7	1,897	— 19	3·5	..
Manchester ..	„ 23	82,748	+1,112	34	572 906	+20,145	105	..
Newcastle	„ 23	9 049	+ 655	..	150 354	+ 2,958	31·3	..
Newport	„ 16	1,497	+ 59	33	23,437	— 405	7·25	..
Oldham	„ 24	3 860	+ 144	35	72,291	+ 4,504	28	..
Pontypridd	„ 18	843	+ 11	33	13,169	— 644	5·5	..
Preston	„ 20	1,531	+ 112	34	28 357	+ 1,802	10	..
Rotherham	„ 20	1,756	+ 412	$33\frac{2}{7}$	25,746	+ 2,068	18	6
Salford	„ 25	10 131	+ 376	$31\frac{1}{7}$	172,565	+ 4,105	41	..
Sheffield	„ 26	13,993	+1,234	..	234,297	+10,188	40	..
Southampton ..	„ 20	2,1 6	— 37	33	42,674	— 210	11	..
Southend-on-Sea ..	„ 20	1,086	+ 166	34	28,559	+ 2,948	7	..
South Shields ..	„ 23	1,168	+ 44	34	21 848	+ 253	10·25	..
Tyneside	„ 20	900	+ 55	21	10,339	— 586	11	..
Wallasey	„ 23	1,969	+ 106	$33\frac{2}{7}$	38,474	— 2 6	8·72	..
Walthamstow ..	„ 23	1,282	+ 64	34	25,168	— 1,078	[illegible]	..
West Ham	„ 14	5 062	— 298	$32\frac{1}{7}$	86,162	— 3,532	16·4	1·2
Wolverhampton ..	„ 20	1,953	+ 129	24	34,606	+ 864	18·75	..
Cen. London Rly...	„ 23	11,072	+ 588	21	101,377	+ 2,992	6·78	·4
City & S. Lon. Rly.	„ 24	5,936	— 725	21	61 347	— 5,116	7·26	..
Dublin-Lucan Rly.	„ 22	223	+ 9	21	3,155	— 87	7	..
G.N. and City Rly.	„ 23	2,982	— 248	21	29,459	— 450	3·5	..
L'pool Overh'd Rly.	„ 24	3,114	+ 289	..	34,525	+ 2,884	6·6	..
Llandudno-Col. Bay	„ 22	284	+ 31	51½	16,039	+ 783	6·5	..
Lond. Elec. Ry. Co.	„ 23	28,910	— 45	..	271,850	+ 4,615	21·26	..
Mersey Railway ..	„ 23	4 571	+ 257	21	44 873	+ 4,564	4·5	..
Metropolitan Rly...	„ 24	24,915	— 197	21	355,530	+ 5,419	25·75	..
Met. District Rly...	„ 23	27,013	+2,080	..	261,249	+ 21 130	25	..
Anglo-Argentine ..	„ 18	114,383	+11,396	..	2,360,369	+111,435	..	..
§Auckland	Oct.	19,071	2.586	4	78,029	+13,172	24·1	·8
Bombay (B.E.T.) ..	Nov. 1	6,124	615	43	132 252	+ 5,181	..	..
§Brisbane	Sept.	22,700	+1,560	9	181,094	— 3,566	..	..
Calcutta	Nov. 23	8 583	+ 619	..	..	..	..	..
§Kalgoorlie, W.A...	Oct.	2,955	..	..	31,743	..	20·5	..
Madras	Nov. 15	1 617	+ 196	..	34,859	+ 3,791	14·7	2
§Montevideo ..	Oct.	28 488	+ 3 454	12	346,306	+47,753	..	..
Perth (W.A.) ..	Nov. 22	8 831	+ 513	..	87,844	12,420	29	..

* Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

Continental.—GERMANY.—The Rheinische Schuckert Gesellschaft für Electrische Industrie, of Mannheim, is declaring a dividend of 7½ per cent. for the last financial year. It is also proposed to increase the capital of the concern from £275,000 to £400,000.

Mackay Companies.—The usual quarterly dividend of 1½ per cent. on the common shares has been declared.

Cable Factory for Southampton.—The *Star* states that, "Subject to confirmation by the local authority, negotiations have been concluded for the acquisition of 10 acres of land at Southampton by a firm of electric cable manufacturers. The site is part of the reclaimed land on the western shore, and the company propose to erect works at a cost of £200,000. Between 500 and 600 men will be employed, and the weekly wage bill is expected to absorb £1,500."

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9½ — 10½	..	5 4 9
Do. 4½ % Pref...	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 — 100	..	4 10 0
Brompton & Kensington, Ord...	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 — 100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅜	..	4 13 0
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 8 4
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 — 122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	106 — 108	..	4 7 5
County of London, Ord... ..	10	6	4†	11⅝ — 11⅞	..	5 3 8
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 — 108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 — 101	..	4 8 3
Edmundson's, Ord.	5	Nil		7/16 — 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3 — 3½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½ — 8	..	5 12 6

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8⅛	.	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	..	1⅞ — 2⅛	..	3 10 8
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3¾ — 4¼	..	5 3 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼ — 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 — 102	..	4 8 8
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 — 100	..	4 10 0
Newcastle-on-Tyne 5 % Pref., Non Cum.	5	5	5	4⅝ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ — 101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9⅞ — 10⅜	..	4 15 8
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	2⅞ — 3⅛	⅛	5 18 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 — 101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅜ — 1½	+ ⅛	5 [illegible]
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord...	£3	Nil	..	¼ — ½	..	..
Do. 5 % Cum. Pref.	5	2	..	2⅜ — 3⅛	..	..
Do. 4½ % First Mort. Deb...	100	4½	4½	84½ — 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾ — 5¼	..	4 5 3

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅝	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅞ — 7⅛ xd	..	5 19 4
Do. 5 % Pref.	5	5	5	4¹⁵⁄₁₆ — 5¹⁄₁₆	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	93½ — 95½	+1	5 4 9
Canadian Gen. El. Com. ..	$100	7	7	118 — 122	+1	5 14 8
Do. 7 % Pref.	$100	7	7	118 — 122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	⅞ — 1	..	8 0 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 8 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95 — 97	..	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	85 — 88	..	5 13 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	¹⁄₁₆ — ³⁄₁₆	..	Nil
Do. 6 % Pref.	1	6	6	⁹⁄₁₆ — ¹¹⁄₁₆	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 — 106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 — 105	..	4 15 8
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 18 8
Mexican Lt. & Power, Common	$100	4	4†	84 — 88	—1	4 11 0
Do. 7 % Cum. Pref.	$100	7	7	103 — 106	+1	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	84 — 87	..	5 15 0
Montreal, Lt., H. and Power ..	$100	8	9†	234 — 239	..	3 15 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5*a*	34 — 38	..	..
River Plate, Ord.	Stock	10	..	240 — 250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106 — 111	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 — 104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 — 100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	140 — 141	..	3 9 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 — 108	.	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ — 102½ xd	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ — 101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½ — 96½	+ ½	5 3 8
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅞d.	¹⁵⁄₁₆ — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½ — 105½	..	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	10	4	..	7½ — 8¼	.	4 17 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	+ ½	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	145 — 147	—1	5 8 10
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	3	3	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½ — 111½	..	5 7 8
Do. Def...	Do.	30/-	..	25¾ — 26	+ ⅛	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 — 104	.	4 16 2
Chili Telephone	5	7	8	7½ — 7¾	..	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	..	4 16 8
Cuba Telegraph	10	6	6†	9 — 10 xd	..	6 0 0
Do. 10 % Pref...	10	10	10	16 — 17 xd	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref... ..	5	10	10	6⅞ — 7	— ¼	7 2 10
Direct United States Cable ..	10	5	4	7⅛ — 7⅜	..	6 11 2
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98½ — 100½	+ ½	4 9 7
Eastern Telegraph, Ord. Stock	Stock	7	7†	131 — 134	+1	5 4 6
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	76½ — 78½	..	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	— ½	4 2 1
Eastern Extension	10	7	7†	12⅞ — 13⅜	+ ⅛	5 4 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12⅝ — 13⅛	..	4 11 4
Great Northern Telegraph ..	10	18	18	28½ — 29½	+ ½	6 2 0
Indo-European Telegraph ..	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common ..	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5½ — 5¾	— ³⁄₁₆	3 16 4
Do. 7 % Cum. Partic. Pref.	1	17	..	4½ — 4¾	— ⅛	3 11 4

NAME.	Stock or Share.	Dividends 1911.	Dividends 1912.	Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
Monte Video Telephone, Ord. ..	1	6	6†	1⅛ — 1⅜	..	5 13 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 14 8
National Telephone Def. ..	Stock	6	.	151½ — 153½	..	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	98¾ — 99¼	+ ½	4 10 8
Oriental Telep. and Elec. ..	1	8	6†	1⅜ — 1½	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1¹⁄₁₆ — 1³⁄₁₆	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	10⅞ — 11⅜	..	8 16 2
Submarine Cables Trust ..	Cert.	6	6	126 — 129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ — 101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1¹⁄₃₂ — 1³⁄₃₂	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3¹⁄₁₆ — 3⁷⁄₁₆ xd	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½ xd	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10 xd	..	6 0 0
Do. 5 % Debs.	100	5	5	101½ — 103½	+ ½	4 16 7
Western Telegraph, Ltd. ..	10	7	7†	13⅛ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	95½ — 97½	— ½	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 — 101	..	4 9 1

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* Unless otherwise stated, all shares are fully paid.   *a* Paid in deferred interest warrants.   † Interim Dividend.   ‡ 3s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	1/16— 3/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16— 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	..	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	36 — 39	..	..
Do. 5 % Perp. Deb. ..	100	5	5	92 — 96	+2	5 4 2
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	3	3†	81 — 83	—4	3 12 8
Do. Pref.	100	4	4	81 — 83	—4	4 16 5
Do. Def.	100	2	..	81 — 83	—2	2 8 2
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1½	1¼†	38 — 39	—4	3 9 7
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	107 —109	..	4 11 9
Do. Do. 1901	100	5	5	107 —109	..	4 12 7
Do. Do. 1903	100	5	5	107 —109	..	4 11 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼— 2¾	—½	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	11/16— ¾	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5¾— 6¼	—½	..
Do. 4 % Deb.	100	4	4	72 — 76	+1	5 5 8

NAME.	Stock or Share.	Dividends for		Closing Quotations Nov. 26th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	56¾— 57¼	+2½	2 16 9
Do. Surplus Lands	100	2⅝	2¾†	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	40 — 40½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	98 —100	..	4 0 0
Do. 4½ % First Pref.	100	4½	4½	88 — 90	..	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1¼— 1½	+ ⅛	4 7 3
Do. Def.	1	Nil	..	[illegible]	..	Nil
Do. 5 % Pref.	1	5	5	[illegible]	+ 1/32	5 3 2
Do. 4½ % Deb.	100	4½	4½	93 — 95	..	4 14 9
Do. 5 % Deb.	100	5	5	94 — 97	—1	5 3 1
Potteries, Ord.	1	3½	..	¼— ⅜	..	..
Do. 5 % Pref.	1	5	5	21/32— 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88 xd	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	4¼— 4⅜	+ ¼	Nil
Do. "A"	1/-	..	..	21/32— 23/32	..	..
Do. 6% First Cum. Inc. Deb.	100	..	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	88 — 90	—2	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼— ¾	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	..	4 5 9
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16— 5 1/16	..	5 3 6
Do. 2nd Pref.	5	5½	5½	4 11/16— 4 13/16	..	5 17 4
Do. 4 % Deb.	100	4	4	93 — 95	.	4 4 3
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99½—101½	..	4 18 6
Auckland Trams, 5 % Deb. ..	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16— 7 5/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	144 —149	..	5 7 5
Do. Pref. Ord.	100	6	6	118 —122	+1	4 18 4
Do. 5 % Pref.	100	5	5	107 —110	..	4 11 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	100 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	5¾— 6¼	..	5 9 10
Do. 5 % Pref.	5	5	5	4 15/16— 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	[illegible] xd	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 1/16— 5 3/16 xd	..	4 8 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜— ½	..	..
Do. Pref.	1	6	..	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	90 — 93	..	5 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	111 —116	—1	6 0 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	95½— 97½	+ ½	5 2 7
Do. 6 % Bonds	100	6	6	101 —103	+ ½	5 16 6
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7⅛— 7⅝	—1/16	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	96½— 98½ xd	..	5 1 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5†	1⅛— 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½— 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	5	5†	..	..	..
Do. 1st Mort. 5 % Bonds ..	..	5	5	101½—103½	..	4 16 7
Do. 5 % Mort. Bonds ..	100	5	5	96½— 98½	..	5 1 6
Sao Paulo Tram, Lt. and P. ..	$100	10	10†	..	..	..
Do. 5 % 1st Deb.	$500	5	5	103 —105	+ ½	4 15 3
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	½— ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/16— 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	[illegible]	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝— ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½— 8	..	6 5 0
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	½— ¾	..	Nil
Do. Deb...	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10½— 11½	..	6 13 4
Do. Pref.	5	5	5	4¾— 5¼	..	4 17 7
Do. Deb...	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	15†	3¾— 3⅞	+ 1/16	5 3 1
Do. Deb...	100	4½	4½	105 —108	..	4 3 4

Crompton & Co.	8	Nil	..	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16— 13/16	..	..
Do. Pref.	1	6	6	13/16— 15/16	..	6 8 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	¼— ⅜	..	Nil
Do. fully paid	5	Nil	..	1¼— 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	13/16— 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12¼— 13	+ ¼	6 10 9
Do. Pref.	5	4½	4½	4 1/16— 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	8½— 9½	— ½	..
Do. Pref.	10	5	5	9½— 10½	.	4 17 7
Telegraph Construction.. ..	12	17½	5†	35½— 37½	+1	5 10 0
Do. Deb...	100	4	4	97 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛— ¼	..	Nil
Do. Pref.	5	Nil	..	½— 1	..	Nil
Do. Deb...	100	4	4	58 — 60	..	6 13 4

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* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1912.

The October returns of electrical exports and imports, which we give below, show that the former reached £755,185 in value, an even bigger total than in the preceding month. As was the case on that occasion, October's good showing is due in part to the inclusion of a large telegraphic export—in this case, to the States.

The general business done, however, exclusive of telegraphic material, reached well over half-a-million pounds—a very satisfactory figure, which includes over £200,000 due to machinery and some £139,000 for cable exports, which are breaking all records.

Telephonic exports doubled the previous month's figure, but the lamp business appears to be stationary. The improvement is not confined to the export section, for the imports amounted to £267,328 in October, as compared with £205,656 in the preceding month. The improvement appears to be general and the electrical machinery entering this country was valued at over £117,000. Lamp imports were slightly on the up-grade, lamps and parts being valued at about £38,000. The re-exports also increased from £20,115 in September to £27,491 in October.

In view of its large telegraphic total, the U.S.A. takes precedence in the export section of the table, with Canada as second best, with a total of £76,319—a figure which is higher than the totals of such good customers as Japan, India, New South Wales, Argentina, &c.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,623	85	231	304	30	283	14,835	741	1,607	20	893	9,742	30,394
Germany	1,948	...	7	...	670	122	1,585	...	12	78	167	660	5,249
Netherlands, Java & Dutch Indies	937	2,412	134	...	11	162	2,553	50	65	...	2	353	6,679
Belgium	543	585	232	54	95	...	2,092	267	...	308	370	431	4,977
France	587	...	4,499	60	97	37	11,430	225	70	..	240	149	17,394
Portugal	97	87	31	35	...	...	3,164	30	47	16	66	894	4,467
Spain and Canary Isles	2,212	9,157	281	...	...	1,318	5,160	39	11	...	333	973	19,481
Switzerland, Italy and Austria-Hungary ...	357	110	54	39	57	...	4,724	104	15	576	227	900	7,163
Greece, Bulgaria, Roumania and Turkey ...	608	2,071	20	23	...	...	513	75	20	...	11,005	5,783	20,118
Channel Isles, Gibraltar, Malta and Cyprus...	102	53	75	46	...	138	208	2	...	13	55	6,401	7,093
U.S.A.	819	...	34	...	...	...	1,370	...	..	55	...	138,168	140,446
Canada and Newfoundland	1,569	10,101	2,444	560	19	4,095	19,983	475	5,048	...	386	31,609	76,319
British West Indies and British Guiana ...	71	...	222	38	...	...	190	15	36	...	57	69	728
Mexico and Central America	8	36	...	...	...	5	469	...	4	...	...	120	642
Peru and Uruguay	...	462	64	62	...	26	760	...	21	...	...	671	2,066
Chile	385	590	203	...	...	75	11,394	1,395	236	12	1,297	1,788	17,375
Brazil	940	4,255	1,524	559	...	88	5,096	117	29	21	1,837	1,469	15,935
Argentina	1,848	14,722	1,124	773	50	586	7,346	6,162	3,404	95	10,295	4,080	50,485
Colombia and Venezuela	55	...	50	...	...	...	1,319	...	...	...	...	...	1,424
Egypt, North Africa and Persia	527	490	172	90	17	12	2,319	269	397	2	470	432	5,197
British West Africa and St. Helena ...	336	180	202	78	...	...	394	256	114	11	11	68	1,653
Rhodesia, O.R.C. and Transvaal	3,320	757	671	552	53	134	3,314	7	811	63	333	996	11,011
Cape of Good Hope	1,242	3,706	383	597	...	1,021	4,628	336	2,571	...	718	1,906	17,111
Natal	1,127	8,880	916	60	64	16	2,422	4	53	58	20	186	13,806
Zanzibar, Brit. E. Africa, Mauritius and Aden	52	...	15	40	30	...	85	260	37	...	108	158	815
Azores, Madeira and Portuguese Africa ...	351	726	198	...	38	19	1,163	...	...	32	...	171	2,698
French African Colonies and Madgascar ...	7	11	...	6	...	...	5	...	...	...	...	46	75
China and Siam	1,135	1,079	440	870	...	1,522	2,241	...	254	...	66	124	7,731
Japan and Korea	624	22,478	754	405	16	1,112	17,758	3,704	8,978	...	163	13,910	69,902
India	4,778	15,123	3,794	2,217	239	1,211	9,811	7,639	4,402	177	2,371	5,243	57,035
Ceylon	102	2,171	584	...	...	...	504	56	169	...	45	284	4,515
Straits Settlements, Federated Malay States and Sarawak	672	3,332	386	107	...	286	4,182	633	71	10	642	134	10,455
Hong Kong	568	1,997	37	62	...	124	917	142	38	...	...	18	3,903
West Australia	340	1,557	234	246	...	167	1,288	427	63	...	5,182	5	9,509
South Australia	677	1,802	156	238	...	...	388	460	56	6	87	900	4,770
Victoria	2,263	9,666	1,199	952	14	254	4,068	144	165	...	1,986	312	21,023
New South Wales	5,900	10,978	374	1,246	...	1,300	25,926	1,782	4,655	...	3,443	1,082	56,686
Queensland	420	1,870	118	118	...	1	1,474	...	79	...	1,888	403	6,371
Tasmania	136	262	32	...	...	...	31	190	...	100	88	67	906
New Zealand and Fiji Islands	1,584	7,198	1,455	633	...	717	3,363	921	396	11	1,691	3,606	21,575
Total, £	41,170	138,989	23,379	11,100	1,530	14,831	180,472	26,957	34,237	1,667	46,542	234,311	755,185

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Norway, Sweden and Denmark	895	12	...	296	23	...	6,030	42	724	...	7,628		15,650
Germany	7,310	11,952	3,752	20,144	10,414	8,316	77,270	511	4,819	10,251	27,620		182,359
Holland	...	...	...	824	1,301	...	76	...	...	76	311		2,588
Belgium	700	2,041	135	299	225	12	3,678	1,867	65	9	6,674		15.705
France	269	1,088	503	1,161	279	551	223	5	725	3,891	437		9,132
Switzerland	553	122	25	199	60	129	33	...	...	13	50		1,184
Italy	75	510	...	...	...	...	86	...	...	...	4,014		4.685
Austria-Hungary	...	583	...	883	52	...	...	...	30	187	...		1,735
United States	1,532	375	505	1,427	623	502	19,058	8,698	148	644	185		33,697
Canada	115	...	15	...	...	...	...	...	...	...	21		151
Total, £	11,449	16,683	4,935	25,233	12,977	9,510	106,454	11,123	6,511	15,071	46,940		266,886

Additional imports : Spain, carbons, £346 ; Natal, fittings, £7 ; Victoria, machinery, £89.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Various countries, mainly as above ...	16,301	554	....	1,686	368	...	7,960	...	166	435	21		27,491

Total Exports : £755,185. Total Re-Exports : £27,491. Total Imports : £267,328.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

MORE NOTES ON ELECTRIC WELDING.

By V. D. GREEN.

(Concluded from page 849.)

When it is remembered that a great deal of energy is turned into heat within a limited space, it is evident that unless some method is employed of dissipating the heat formed at the dies, they will soon become red hot. The two methods generally adopted are air and water cooling. In discussing their relative advantages we must not lose sight of the practical object, viz., to keep the welding dies reasonably cool without undue cost. The cooling effect of air is different to that of water. In the former case the heat is removed from the dies while still on the surface and before it has had time to soak into the copper. Air cooling is therefore of very little use if a machine is once allowed to get hot all over. In the latter case the heat can only be dealt with after the dies become sufficiently hot to raise appreciably the temperature of the jaws, for owing to the difficulty of making a water-tight joint between the removable dies and the permanent jaws the water channels seldom run into the dies themselves. Each case must therefore be judged on its own merits, because in some classes of work the shape of the dies and the method of working only lend themselves to one way of cooling. Each method has its limitations. For heavy work it would not pay to install a blower large enough to pass sufficient air over the dies to keep the temperature down to a reasonable limit; while, on the other hand, for small fast working machines, especially if portable, there is no doubt that the flexible pipes (which almost invariably leak over the machine sooner or later) are a great drawback. Air cooling, however, soon reaches its limit on account of the scaling of the work due to oxidation produced by the blast.

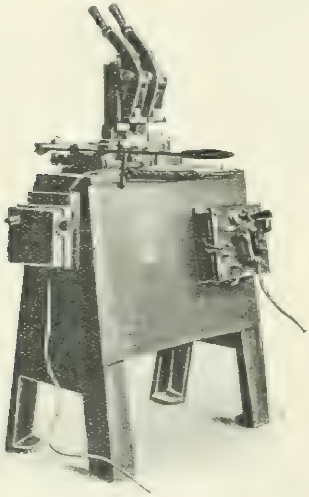

Fig. 12.—Old Pattern 5-kw. Butt Welder for Rings, showing Automatic Switch (Cover Removed).

It frequently happens that it is required to swage out the burr produced by the upsetting action without removing the stock from the machine. In this case it is not sufficient, as would at first appear, that a suitable die should descend on an anvil with the weld between, for this would crush the weld out of shape. Both anvil and die must advance towards the weld at equal speeds, and therefore some sort of cam is imperative. Above everything, a welding machine must be solid and substantial. It would not seem probable at first sight that anyone would be able to break a ¾-in. iron casting across by forcing a badly-adjusted toggle lever into the locking position by main force, or that the owner of a welding plant should feel mildly surprised at a machine giving up the ghost after standing all night under a small water-spout from a leaking roof: but such things do happen sometimes, and I have come to the conclusion that it is best to rate both the electrical and mechanical parts a great deal more liberally, and to protect and insulate the live parts much more carefully than would be necessary in the ordinary way.

I will now show you one or two types of butt-welding machines which my firm has turned out. All these are of 15-kw. capacity.

Fig. 13 shows a hand-controlled and hand-operated welder of what we term the A type. This is a machine used principally for jobbing work, or for wire mills where the operator has always a fair amount of skill in welding, and where, on account of the comparatively small and intermittent output required, a large capital expenditure is not warranted. The work is gripped by means of hand-wheel controlled jaws, and a spring for following up the softening metal at the weld is provided. The switching-off is controlled by the operator, and the welds have therefore to be done fairly slowly. I should consider an output of 100 ¼-in. welds or 50 ½-in. welds per hour on such a machine good, but in point of fact some method of cooling would have to be added if it had to work continuously.

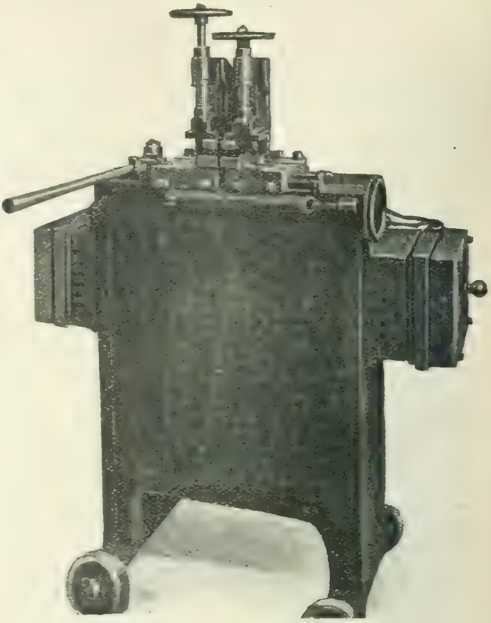

Fig. 13.—"A" Type Butt Welder: Special Portable Pattern for Wire Mills.

The next illustration, fig. 14, shows the B and C types, which are alike as far as external appearances go, and are adapted for repetition work. The B type is capable of a large output per hour depending, of course, upon the quickness of the operator. The "upsetting" action of the movable jaw and the point of cutting off the welding current are automatically controlled, and within its rated capacity its limit (apart from the natural speed limitations already dealt with in this paper) is reached only when the man working it welds so fast that he gets mixed up in the cycle of operations now and then, and starts making scrap in consequence. The speed of this machine, judging from the average results, would not exceed 200 welds per hour if the treadle operated swaging jaws for removing

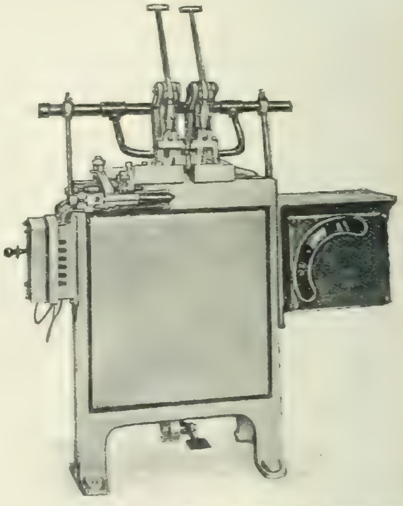

Fig. 14.—"C" Type Butt Welder with Swaging Device; Hand Automatic, Fool-Proof, Air Cooled.

the burr formed by the weld are used, or about 400 welds per hour if this swaging operation is omitted.

The C type enables a still greater speed to be attained by eliminating the risk of making scrap by careless handling, and thus enables either a greater number of welds to be turned out by the same operator, or cheaper labour to be employed. This is accomplished by means of the patented control switch already described. A fair estimate of the welding speed of this machine is about 300 welds per hour when the burr is swaged out, or 500 when it is merely welded.

The fourth type, or D type (fig. 15), is used where a large output is required, but where, owing to various circumstances, the capital expenditure necessary to purchase a completely automatic machine is not warranted by the amount of material of one size likely to be required. It must be remembered that the cost of a completely automatic machine is probably three times that of a hand-automatic machine, but the output is only 50 per cent. more—if as much. Moreover, owing to the numerous adjustments necessary, a completely automatic machine may easily take two or three hours to prepare for a run, as against 20 minutes at most for the hand-automatic type.

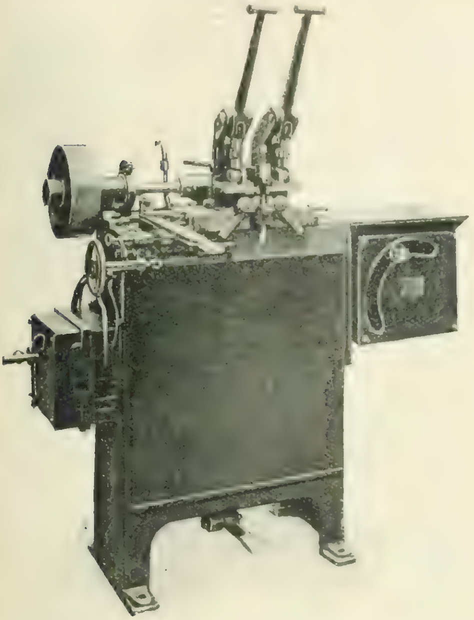

Fig. 15.—"D" Type Butt Welder, with Swaging Apparatus, Water Cooled, Fool-Proof, and Partly Power Operated.

The D type fills this gap very conveniently. Its rate of output—from 400 to 500 welds per hour when the burr is swaged out, or about 600 to 700 when the stock is welded only—compares very favourably with that of a completely automatic welder; its price is lower, and it is simpler and less likely to give trouble in setting up or running. As will be seen, it is partly hand-operated and partly power-driven. It is also fool-proof.

We have even now done little more than touch the fringe of the arc and butt-welding processes from the practical, commercial and technical sides of the question. I am conscious that this paper is a rather disconnected one, but I venture to think that some of the points raised may be new.

Electric Steel.—At the R. Lindenberg Steel Works Remscheid-Hasten, one of the few companies specialising in the manufacture of electric steel, a new 25-ton electric furnace has been in operation for several weeks. This is the largest electric furnace erected for this class of work, and is worked in conjunction with the Thomas steel plant, being charged directly with raw molten Thomas steel. The results have been very satisfactory, 28-ton charges being worked regularly, and they strengthen the previously expressed view that with sufficiently large furnaces it will be possible to manufacture electric steel more cheaply than Martin steel is made at the present time. The Gelsenkirchen Co. have ordered a furnace of the Lindenberg type for their new works at Esch, in Luxemburg, and intend to use it chiefly for smelting ferro-manganese. A licence for the use of the Lindenberg patents has been granted to the Witkowitzer Co., one of the largest of the Austrian steel companies, and it is expected that they will begin the manufacture of electric steel very shortly. This will be the first plant for the electrical production of steel erected in Austria.—*Manchester Guardian*

PROCEEDINGS OF INSTITUTIONS.

The Institution of Electrical Engineers.

(*Abstract of Inaugural Address delivered in London, November 14th, 1912, by* William Duddell, F.R.S., *President.*)

(*Concluded from page 850.*)

Another development of great engineering interest is the construction of alternators of sufficiently high frequency for direct connection to the aerial. In this case the wireless station becomes very much like an ordinary generating station, only that, instead of producing alternating current at 50 frequency, alternating current of, say, 50,000 frequency is generated and is supplied straight to the aerial. This, of course, does away with all questions of sparks and arcs, and I must say that, from an engineer's point of view, it is a very attractive solution. Alternator designers will, however, readily appreciate the difficulties in designing alternators for these frequencies. In order to get space for the poles, the peripheral speed of the rotor must be made as high as possible and the details of the mechanical design must be first class. In spite of the difficulties a number of machines have been made by the General Electric Co., of America, which will produce 1 kw. at 100,000 frequency. They are of the inductor type, and details of their design have recently been published by Mr. Alexanderson. Another most ingenious alternator is that designed by Dr. Goldschmidt, in which advantage is taken of the reaction of the stator current on the rotor and the rotor current on the stator to step up the frequency of the machine. By this method Dr. Goldschmidt has reached frequencies of 50,000 with several kilowatts output, and he is now engaged in building some very much larger machines to give over 100 kw. each.

The present position is that we have in the field three systems actually at work—the loosely coupled spark system, the shock excitation system, and the arc system. Within a very short time we shall, no doubt, have high-frequency alternators at work, and it is probable that at least one other system will be under practical test.

Turning to the receiver, the changes that have been made are not so striking. The coherer has become practically obsolete. The magnetic detector which replaced the coherer about ten years ago still holds its own, although it is not very sensitive. Its reliability in action, and the fact that it is almost fool-proof, are, for many purposes, convincing arguments in its favour.

The electrolytic detector has been but little used in this country. The Fleming valve and the crystal detector have come into considerable use. They are both highly sensitive; the property which makes them useful as detectors is in each case their unilateral conductivity. The high-frequency currents induced in the receiving aerial by the incoming waves are not generally sufficiently strong to affect any of our ordinary alternating-current measuring instruments. If, however, they can be rectified and converted into continuous currents, then it is easy to detect them, for it is common knowledge that direct-current measuring instruments are in general hundreds, if not thousands, of times more sensitive than alternating-current ones.

Corresponding to each spark at the transmitter a train of oscillations is received, and these trains of oscillations are rectified by the detector, and in general are passed through a telephone as an indicator. At each spark a click is heard in the telephone, so that with 600 sparks a second the diaphragm is attracted 600 times, producing a somewhat musical note.

Herein lies one of the great advantages of high spark frequency. There seems no doubt that the combination of the human ear and a telephone is much more sensitive for high-frequency notes than for low ones. In some tests I have made, using an alternating current to determine the minimum power required to produce an audible signal in a telephone receiver at different frequencies, I found in one case that the power was reduced from 430 micro-microwatts at 300 frequency to 7·7 micro-microwatts at 900 frequency. At higher frequencies it increased again.

Due to atmospheric causes, there are generally audible in the telephone receiver clicks and noises commonly spoken of as atmospherics or strays. With high spark frequencies the human ear easily distinguishes the musical note from these atmospherics; this enables the operators to read through a large amount of extraneous interference. The elimination or compensation of these atmospherics is one of the most important outstanding problems in wireless telegraphy.

When operating with continuous waves, practically no note is heard in the receiver telephone unless the currents are chopped up into rapidly recurring groups of waves either at the transmitter (tone sender) or at the receiving end (ticker).

In order to make a permanent record of the signals, and to allow of high-speed working, the rectified current from the detector may be passed through a galvanometer or a relay, and here we come to one of the difficult problems which requires solution, namely, the construction of a relay or recording instrument which will make a record of the very small received currents at high speeds. The Einthoven, or string galvanometer, which is at present used for this purpose, is delicate and gives a photographic record. Although the difficulties may be minimised, I do not feel at this moment that the photographic method of recording with the attendant chemicals, and the necessity of handling moist slip, can be looked upon as the final solution from the point of view of commercial telegraphy.

The problem of constructing a relay for this purpose is a very difficult one. The mean current strength of the signals, after rectification by a high-resistance detector, is of the order of $\frac{1}{10}$th to $\frac{1}{100}$th of a micro-ampere and the amount of power available to work the instrument is only of the order of a few micro-microwatts. For high-speed reception, the number of contacts to be made and broken per second may be anything up to 50. The problem before our instrument makers is to construct a relay or recorder which will operate with a power not exceeding a few micro-microwatts at the rate of 50 signals per second.

Recent experiments by Kiebitz have drawn attention to the fact that quite good reception of the long waves from distant stations can be obtained without high aerials. A single wire supported on insulators near the ground, or even resting on it, gives quite good results. Whether similar antennæ can be efficiently employed for transmission is a matter for further experiment.

I have for some time felt that it would be of very great interest if some authority like the Post Office, which has available many miles of overhead wires, would make some experiments at comparatively low frequencies. We know that Mr. Marconi, in his trans-Atlantic work, is working with frequencies as low as 50,000; high from the station engineer's point of view, but low from the wireless point of view. Now, an alternator for 10 or 15,000 frequency is not at all impracticable. Supposing an ordinary telegraph landline on fairly high poles, four or five miles long, was used as an antenna, and fed from a 10,000-frequency alternator, how would it behave as a wireless transmitter? There are reasons which make one think it might be satisfactory.

The radiation in wireless telegraphy is similar to light, therefore it is of interest to compare the human receiver of this radiation, namely, the eye, with the receiver of a wireless station.

According to some recent experiments by Messrs. Paterson and Dudding a light of $\frac{1}{10}$th of a candle at a distance of a kilometre is near the limit of visibility. Assuming the square law, this corresponds to a candle-power of 2,560 at 100 miles. With our present incandescent lamps this would require 2½ KW. In wireless, to cover the same distance, it is usual to install what is nominally a 1½-KW. station.

Taking, however, Drysdale's figures for the rate of radiation of energy in the visible spectrum (about 0·1 watt per C.P.) our source of light is radiating energy at the rate of about 250 watts. Very accurate figures for the rate of radiation from a wireless antenna are not available, but assuming our overall efficiency at 20 per cent., the radiation of the wireless antenna is 300 watts. It would seem, therefore, that there is a remarkable similarity between the sensibility of our eye to radiation of the short wave-length which constitutes light, and the sensibility of our wireless receiving apparatus for the long wave-length radiation used in telegraphy.

According to Lord Rayleigh's experiments, if a tuning fork is producing sound at the rate of 42 ergs per second, it will just be audible at a distance of 30 yards. This corresponds to a source of sound giving out 0·0056 watt being audible at 1 km., or, assuming no absorption or bending of the sound waves, 143 watts at 100 miles. We, therefore, have the curious result that, if it were possible to radiate energy at a given rate, either as sound waves or as light waves, or as long Hertzian waves, we should be able to detect them at approximately the same distance by means of our ear or our eye or the receiving apparatus of a wireless station.

Wireless time signals are regularly sent out each day from the Eiffel Tower and other stations for the use of ships at sea. In view of the fact that wireless signals are received practically simultaneously everywhere on the globe, they form, in conjunction with transit observations, a ready means for the determination of differences of longitude, to a high degree of accuracy. It is claimed that, in recent tests, using the signals sent out by the Eiffel Tower, differences of time were determined to an accuracy of $\frac{1}{100}$th of a second, which corresponds to an uncertainty in position of only 5 yards at the equator. The surveying of difficult country may be expected to be greatly facilitated by this new means of determining the difference of time.

Of the sister science, namely, wireless telephony, there is not so much to relate. A certain amount of progress has been made, but the details of the methods used have not been made public. The difficulties are mainly in the transmitter. First, we require a perfectly steady source of continuous oscillations, and secondly, a microphone capable of modulating the large powers required to transmit any distance. Over short distances of a few miles there are no difficulties. It is only when we come to distances of 50 to 100 miles that the engineering problems become troublesome. In view of the progress that is being made in the high-frequency alternator, and of how much more easy it is to modify the power given out by an alternator, it will not be surprising if as soon as high-frequency alternators are in use wireless telephony over comparatively long distance becomes a working possibility.

The amount of power installed for chemical and metallurgical purposes is very large indeed. Exact data are wanting, but it seems probable that the power employed in these processes in Norway and at Niagara may already reach 1,000,000 KW. The only hydroelectric stations of any size in this country are used for electrochemical purposes. The production of aluminium alone at Loch Leven absorbs some 30,000 KW.

The application of electric heating either in the arc furnace or in the induction furnace is making considerable progress in the smelting and refining of iron and in the manufacture of special steels and alloys, and it seems as if we are on the verge of extensive application of the electric furnace.

My predecessor in office, Mr. Ferranti, in his presidential address two years ago, pointed out that if very cheap electrical power were available all these industries might flourish in this country; although we have not yet attained Mr. Ferranti's ideal, the ever-increasing demand for electrical power for all purposes is causing the price per unit to decrease in a most satisfactory manner.

In Poplar the formation of a solution of chlorine in water by means of electrolysis is in practical use. If the demand for electrolytic disinfectants all over the country was the same as in Poplar, it would require about 2,000,000 units per annum, all of which could be supplied at such times as would help to level up the load curve.

I know that I shall be touching on a somewhat delicate question if I refer to the medical properties of electricity. The terms "electric" and "magnetic" when applied to certain articles are often intended to mislead the public into thinking that they have a somewhat miraculous property. It is very unfortunate that this use of the terms should have grown up, because there are without doubt many diseases in which electricity can be applied beneficially, and, further, it leads the public to disbelieve in results which are genuinely attained by electrical means.

As electrical engineers, we should endeavour to supply the medical profession with the very best apparatus for this purpose. I have often wondered why so much of the apparatus used for medical purposes comes from abroad, and I feel confident that not only is the apparatus capable of being made in this country, but that a much better class of apparatus could be made here if only electrical engineers and the medical profession would co-operate. It may be said that apparatus of this kind is of no importance to the electrical engineering industry, but when I mention that the value of the exports of electromedical and electrodental apparatus from Germany in the year 1910 was returned at the sum of about £132,000, of which just under 10 per cent. was purchased by this country, you will see that it is not quite negligible.

We have discussed frequently the great advantages that will be obtained by a more extended use of electricity for domestic purposes. To extend domestic uses it is most important that the apparatus should be really appropriate to its purpose. The substitution of gas for candles involved quite a considerable change in our methods of lighting. The great superiority of the electric light over all other forms of illumination has made the change from gas to electricity easier, but the designs of our electric light fittings are still largely reminiscent of gas and candles. In some artistic fittings no adequate provision has been made to allow of the introduction of the wires which are still necessary to convey the current to the lamps, and even where channels for the wires have been provided they are often left in such a rough condition inside as to endanger the safety of the insulation. Of late years very considerable progress has been made in the redesigning of the fittings of our homes so as to make them at the same time both serve their proper purpose and be pleasing to look upon.

Electrical cooking and heating apparatus has advanced during the last decade, but there is one difficulty which is not often referred to when one compares electrical heating apparatus with heating by means of flames—the difficulty of limiting the temperature rise. If we could obtain materials for our heating apparatus which could be run continuously at a very high temperature, this difficulty would be to a large extent overcome.

A further advantage of high temperature of the heating part is that it enables heat to be transferred from one place to another by radiation, a method which we know from experience is very suitable for many heating and cooking purposes. The last few years have seen great progress, and I see no reason why still greater progress should not be made in the near future. What I wish to emphasise is that, in my opinion, the Institution as a body has not sufficiently discussed and considered these matters.

Turning next to the subjects on the borderland between electricity and the other sciences, we are all of us acquainted with the brush discharge, yet how much do we know of its mechanism? Nearly all the information in our *Proceedings* deals with the question how to avoid it.

Now the electric discharge has a peculiar property of producing that modification of oxygen known as ozone, which is without doubt a strong sterilising agent, and which may in the future have considerable applications. A modification of the conditions of the production of the discharge will cause the formation of oxides of nitrogen instead of oxides of oxygen. Oxides of nitrogen are of great commercial importance, and their production by electrical means will probably be one of the most important industrial applications of electricity. Already in Norway between 100,000 and 120,000 KW. is employed working day and night for this purpose, and it is stated that this power will shortly be increased to nearly 250,000 KW.

The properties of the different compounds of oxygen and nitrogen and the active modifications of oxygen and nitrogen—for an active modification of nitrogen has lately been discovered by Prof. Strutt—are really in the domain of chemistry, so we are here on the borderland between electricity and chemistry, a borderland in which one of the largest of electrical industries is already in its inception. Possibly a simple observation of some peculiarity of the electrical discharge may form the key to greatly improving the efficiency. Should this be the case, a large nitrate-producing industry may grow up around the coalfields of this country, an industry which will be of considerable value to agriculture.

Last year about 125,000 tons of nitrate were imported into this country. To produce the equivalent amount of fixed nitrogen per annum would, on the basis of Norwegian plants, require about 150,000 KW. At the moment I believe that the cost of electrical power is the chief stumbling block to the introduction of the manufacture on a large scale in this country.

The borderland between electricity and the science of sound is so far less fruitful in interesting results. This may be due to the fact that sound consists of air vibrations; therefore, all electrical methods of producing sounds resolve themselves into designing electrical motors whose work is to shake and vibrate the air. Now the telephone receiver is such an electrical motor, and the laws that govern the efficiency of electric motors in general also govern the action of the telephone receiver. There is no special difficulty in measuring the electrical energy supplied to the telephone receiver to a moderate degree of accuracy. The real difficulty is the determination of the amount of energy of the sound waves. If we possessed any apparatus by means of which we could measure the energy of sound waves, we could not only determine the efficiency of the telephone receiver, but the apparatus would have many other useful applications. This want of standards and methods of measurement is, I believe, one of the causes that has retarded progress in the science of sound.

As a means of warning ships of the dangers of the coasts, submarine sources of sound and electrical means of detecting them are destined to play a considerable part in the future. A number of stations and ships are already equipped.

The production of electrical currents whose variations reproduce the variations of the air pressure in the sound waves is of the greatest importance. The present microphone is only able to deal with comparatively small currents, and therefore, good as it seem, it has serious limitations. Probably a thorough investigation into the nature of contacts would reveal much useful information not only on the theoretical but on the practical side, and provide data for the design of new microphones, and for the contacts used in electrical apparatus.

One of the most fascinating subjects on the borderland between electricity and the other sciences is the connection between electrical energy and radiant energy, and the possibility of the mutual conversion of one form into the other. This subject is of the utmost importance. Something like 500 million units are used annually for lighting purposes. Light is a short wave-length radiation. If we think of the large plants that are installed, boilers, turbines and generators, and all the money spent in laying mains in the streets, and if we think of this simply as a means of producing a short wave-length radiation for the purpose of lighting our rooms and our public streets, we are led to inquire what sort of efficiency we are obtaining.

According to some tests by Dr. Drysdale, a 1-C.P. source of light which emits all its energy in the visible spectrum, say between the wave-lengths 0·39 and 0·76 μ, and so distributed as to produce white light, will radiate energy at the rate of about one-tenth of a watt; or if the whole of the energy were to be concentrated in the wave-length to which our eyes are the most sensitive, say in the yellow-green, the rate would be about one-seventeenth of a watt per candle-power.

Even with the best forms of modern metallic-filament lamps, the efficiency of the conversion of electrical energy into radiation of a wave-length suitable to our eyes probably does not exceed 5 per cent. The efficiency of transformation of the heat energy of the coal into radiant energy as light is well under 1 per cent. There is, therefore, plenty of room for improvement. The real reason that sources of light consisting of heated solid bodies are so inefficient is that these hot bodies radiate so little of their energy at wave-lengths suited to our eyes.

In the incandescent lamp practically the whole of the electrical energy is converted into radiant energy, yet unfortunately over 90 per cent. of this energy is produced at wave-lengths which are too long to affect our eyes. We can shorten the wave-length at which the hot filament gives out the bulk of its energy by raising its temperature, but there is a limit to this in the temperature which the filament will stand. Probably the main reason that the metal-filament lamp is more efficient than the carbon-filament lamp is that its filament is capable of being used at a much higher temperature. This, however, need not be the sole reason, as there are some bodies which tend to concentrate their radiation in certain regions of the spectrum. The processes that are taking place in a solid body when it is radiating are not fully elucidated.

Sir J. J. Thomson has built up a wonderful theory of the constitution of matter, in which the atoms of all bodies contain small discrete particles of negative electricity which he calls corpuscles. These corpuscles, irrespective of the nature of the body or of its state, always carry the same charge of negative electricity, and it is the movement of these charges of electricity that constitutes our electric currents.

The sudden starting or stopping of these corpuscles, or any change in their movement, will produce varying electric and magnetic fields which, by Maxwell's theory, will constitute an electromagnetic radiation in the form of light, the wave-length of which will depend upon the suddenness of the starting or stopping.

According to Lorenz, collisions between the corpuscles and the atoms give rise to the radiations which we know as heat and light, and it is the nature of these collisions that determine the wave-length in the solid bodies. If some such theory as this be correct, that light is produced by the starting and stopping of electrical particles, it would seem as if we ought to be able to devise some method of producing radiation of the correct wave-lengths to suit the eye without producing a number of other wave-lengths we do not require. With regard to the very long wave-lengths such as are used in wireless telegraphy, the result has already been accomplished, and we can produce a radiation of practically one wave-length direct with a comparatively high efficiency. Can we do the same thing with a short wave-length? In wireless telegraphy the wave-length of the radiation is in general several times as long as the aerial conductor used as a radiator. As light radiations have a wave-length of only $\frac{1}{2000}$ of a millimetre, we should require wireless stations to produce light having aerial conductors some $\frac{1}{10000}$ of a millimetre long; in other words, our wireless station must be almost of molecular size.

In gases the corpuscles move about very much more freely, and we are consequently able to influence their movement by electrical means very considerably. If we make them collide violently, either with the remaining atoms of the gas or with the electrodes, radiations are produced, and these radiations are in some cases of sufficiently short wave-length to constitute light. The light given out by an atom in, say, a vacuum tube or flame has quite definite characteristics depending upon the nature of the material. It seems as if each atom contains, or has circulating around it a number of corpuscles, which can vibrate or move in certain definite manners depending upon their arrangement, and that these corpuscles emit, depending on their movement, radiation of certain definite wave-lengths producing the lines in the spectrum and the characteristic colours of the light of flames, &c. In the case of the flame arc we are already taking advantage of the light-emitting properties of heated gases. In the mercury arc we have another case of the production of light other than by the heating of solid bodies. In both these cases the high efficiency is probably due to the substitution of a gas for a solid body as the light-giving agent.

Lately it has been suggested to use molten cadmium, which gives a very much more pleasant light than mercury. A minute trace of mercury is said to improve the efficiency greatly; according to Wolfke an efficiency of 6 Hefner candles per watt has been obtained.

Some progress is being made in electric lighting by means of the passage of electricity through gases. Many members will remember the vacuum tube 176 ft. long which was used to light the courtyard of the Savoy Hotel. That tube, I believe, contained nitrogen, and according to the tests of Prof. Fleming gave an efficiency of 0·56 candle per watt. About a year ago I saw a tube, not such a long tube, filled with the rare gas Neon obtained from the residues in the manufacture of liquid air. This tube gave a most beautiful rose-coloured light. If this rare gas were obtainable in sufficient quantities we might have a rival to the flame arc. I may mention in passing that tubes containing Neon are now commercially obtainable, and are claimed, in the larger sizes, to have an efficiency as high as 2 C.P. per watt. Further researches on the borderland between electricity and radiation will no doubt provide us with still more efficient sources of light.

I have spoken of the production of radiation by means of electricity. Can the electrical engineer solve the converse problem on a commercial scale? When we think that the whole of the energy which is now available, either stored in the coal or in the waterfall, has reached us in the form of radiant energy from the sun, one wonders whether there is not some method by which we can trap that radiant energy and convert it direct into electrical energy without the intermediary of the plant-life of past ages which has formed the coal, or the evaporation of the mighty ocean which supplies the waterfalls.

On a clear day in September last year the maximum rate of radiation in South Kensington was as high as 0·07 watt per sq. cm., and the mean value between sunrise and sunset 0·04. On a dull day in October the mean radiation between sunrise and sunset was still as large as 0·007 watt per sq. cm., so that as a rough figure one might take the mean rate of radiation as being $\frac{1}{100}$ of a watt per sq. cm. for 10 hours a day. Hence each square kilometre of the surface of London is receiving energy at the average rate of 100,000 KW. during the day time.

If an efficiency of transformation of 10 per cent. could be obtained in converting the energy of radiation into electrical energy, we should have available 10,000 KW. per sq. km., which would more than suffice for the present demands. The average total connections of the supply authorities in the 25 sq. miles north of the Thames amount to about 3,300 KW. per sq. km.

In the clear atmosphere of the Alps the radiation is much more powerful: according to Millochau and Féry, it may reach 0·17 watt per sq. cm., so that the power available is probably two or three times that mentioned above.

We are at present very far from any practical means of converting the energy of radiation directly into electrical energy, although on a small scale this conversion really takes place in many photo-electric arrangements. For instance, the action of the light on the liquid potassium-sodium alloy has been shown by Prof. Fleming to produce a voltage as high as 0·6 volt when the liquid alloy and a platinum plate are enclosed in a highly exhausted tube, and the liquid alloy is illuminated strongly. There seems little doubt that the current that is generated in this case is produced from the energy of the light that is absorbed.

The effects so far obtained are extremely small. At the most only a few microamperes are obtainable with very strong illumination. Nevertheless, this property of sensitiveness to light, though at the moment it has no practical applications, may at any time be found to fill some useful purpose and make another case, illustrating how observations that are one day on the borderland of science may shortly afterwards be of practical use in engineering.

When it is remembered that the water power in Norway alone is estimated to produce several million kilowatts, it is evidently better, for the present at any rate, for engineers to utilise the solar radiation by harnessing the waterfalls rather than by attempting to build radiation traps in the Sahara.

I have touched very lightly on many subjects, more with a view of drawing your attention to the many ramifications of our science and industry than of giving a review of any branch. If I have succeeded in showing the need for the Institution to take an active interest in as wide a field as possible, and for it to take, in the future, an even wider outlook on the various branches of the industry, I have attained my object.

Mechanical Handling of Coal for British Locomotives.

By C. J. B. Cooke, M.Inst.C.E.

(*Abstract of paper read before the* Institution of Civil Engineers. *November 26th*, 1912.)

Owing to the growth of traffic and the heavier loads which have to be hauled at the present time, it has been found expedient to adopt, at the extensive running shed of the London and North-Western Railway Co., at Crewe, some more expeditious method than "man-handling" for loading engines with coal, and after much deliberation the mechanical coal-handling plant described in this paper has been installed. The plant was made by Messrs. Babcock and Wilcox, and is the joint design of the author and that firm.

The plant consists of a wagon-tippler, an underground hopper, a tipping-tray conveyor, an elevated bunker, and shoots—including calibrating chambers—for discharging coal on to the tenders.

The tippler is capable of tipping a wagon in about five minutes, when attended by two men. It is driven by a 660-volt direct-current electric motor of 5 H.P. The hopper holds about 20 tons; the coal is fed therefrom by a jigging tray through an adjustable door into a two-roll breaker, where the large lumps are reduced to 8-in. cubes. The breaker is belt-driven by a D.C. motor of 10 H.P., which also operates the jigging tray. The coal passes through the breaker to the conveyor-trays, which carry it to the overhead storage.

The conveyor runs at a speed of 70 ft. per minute, and is capable of lifting about 60 tons per hour. The driving-gear is situated at the top under the bunker-housing, and consists of a 660-volt D.C. motor of 9 H.P. All the coal is delivered over the end of the conveyor-track, when it has only a fall of about 1 ft. on to the inclined shoot which delivers it to the requisite division of the bunker.

The bunkers were designed to hold 300 tons, which is more than enough to coal all engines during the night without the conveyor working, it being possible to send up during the hours of daylight all the coal required, thus saving the double-manning of the wagon tippler and conveyor.

There is an outlet on either side of each division of the bunker, so that the tenders can be coaled on both sides at the same time. On opening one of the doors, coal is permitted to flow out into a calibrating chamber capable of holding 10 cwt., whence it is allowed to slide on to the tender by means of a lever conveniently situated.

The speed of coaling by this plant is quite satisfactory—as much as 6 tons being put on in 3 minutes, as against 5 tons in 15 minutes with the old system under the most favourable circumstances.

An ash conveyor has been installed in conjunction with the coaling plant. The conveyor, which is of the bucket type, has a capacity of about 15 tons per hour, and is driven by a 3-H.P. D.C. motor.

Institution of Electrical Engineers (Scottish Section).

The opening meeting of the Scottish Local Section was held in Glasgow on the evening of the 12th inst. when the new chairman, Mr. Wm. M'Whirter delivered an address. The chairman at the outset dealt with the progress made in the 19th century in discovery and invention; no department of science had made greater progress than that of electricity, and its twin fellow, magnetism. In his opinion the ability to carry out exact electrical measurements did more for the advancement of the electrical industry than any other factor, and they should not forget that for the splendid system of electrical units now at their command, they were indebted to the British Association, who, in 1861, appointed a committee to determine what form and dimensions those units should have.

At that time measuring instruments of any kind were practically unknown, or were only then coming into use in the Postal Telegraph Department and by railway companies. Generally there were no means whatever of locating a fault on telegraph lines, and the reports of faults to the linemen consisted in the intimation that a contact or earth existed upon certain lines between test boxes probably 50 miles apart. For the measurements of currents, no instruments existed, and such attempts as were made were merely guesswork. So long as batteries, instruments and lines were of high resistance, it was possible to form some idea of the battery condition by using an ordinary detector galvanometer, but when railway train-signalling, requiring the use of considerable currents, was introduced, then the resistance of the instruments and circuits was kept low, and proper testing (owing to the lack of some instrument measuring in units) was wanted very badly. The first attempt to remedy this was by the introduction of a galvanometer graduated in units called chemics. This was based upon the well-known law that in electrolysis a known current would always liberate a definite weight of metal from any metallic solution, the amount, of course, varying with the metal used. The instrument introduced by the speaker was divided in the usual way to read to tenths of the unit of current, but the telegraph inspectors and linemen had great difficulty in recording the reading correctly. This was overcome by using an extra scale, divided up and marked with the words, "Very good," "Good," "Fair," "Requires Attention," and "Bad." The galvanometer was wound to 100 ohms resistance so as to represent an average circuit, including the instruments, line, earth, &c., and when applied to the battery terminals, at once showed the condition of the cells. This rough arrangement was very successful, and reduced faults by nearly 90 per cent. For testing the insulation of telegraph lines, which had to be checked daily, the Post Office had introduced a form of tangent galvanometer, with shunts, &c. This instrument was not suited for quick and reliable work, and so he introduced a form of galvanometer, which was graduated to read in volts, vebers and ohms. It was made by Mr. Sprague, of Birmingham, to the author's firm's specification, and proved to be a most useful instrument for general tests. In tracing the history of electric lighting, the chairman said that, in looking back, he often thought of the audacity with which the electrical engineers of those early days undertook all manner of work, and generally carried it through with a fair measure of success. After all, however, they were now only touching the fringe of the work which was before the Institution. The splendid researches carried out during the last century by Faraday, Maxwell, Kelvin, Hopkinson and a host of others, had raised their profession to an exact science, and had given to electrical engineering an importance which could not have been foreseen 30 years ago. As to the future advance of electricity, his opinion was that the consideration of new sites for power stations required the utmost care, and it might be found expedient to locate these at the coalfields, provided condensing water was also available in abundance. It would certainly be cheaper to transmit electricity than to carry coal to the power station, and vast stores of coal might easily be accumulated at moderate cost. After a reference to the last coal strike, and a word of commendation to those in charge of power stations for keeping up the electrical supplies, and in some cases increasing them, the chairman pointed out that they had on several occasions, been warned recently of the slow but sure exhaustion of their coal supplies. Although coal might, and would, doubtless be discovered in virgin fields, yet there was little hope in Britain of any great additions to their reserve, and, therefore, the water power at their command in Scotland would become increasingly valuable. As a substitute for, or a means of, supplementing the coal supply, he suggested the utilisation of the water power which could be derived from the splendid chain of lochs which formed the Caledonian Canal, and which could supply an amount of water power which would far exceed anything they had at present. With their present knowledge of high-pressure electrical power distribution, the power available could supply all the energy required in the vicinity of Glasgow.

Sooner or later such schemes would be carried out, and Scotland, by reason of her water powers, should be able to supply most of the energy required by her industrial population.

Just as the inventions of Watt and others had created the factory system by bringing crowds of workers together, in order that they might collectively use the power of the steam engine, was it not possible that the erection of power transmission lines all over the country, bringing power to every village and hamlet, might be the means of sending certain industries back to the villages and country cottages, thus preventing the overcrowding of large towns and cities, and directly assisting in solving the problem now so much debated—namely, how to get the people "back to the land."

THE LOADING OF SUBMARINE TELEPHONE CABLES.

A Comparison between Coil-Loaded and Continuously-Loaded Cables.

By J. G. Hill.

This subject has, at one time or another, aroused considerable attention and discussion, and a new phase of the question has recently been entered upon by the laying, in the Straits of Dover, by the French Administration, of a continuously-loaded cable, side by side with the coil-loaded gutta-percha-insulated cable laid by the British Post Office in May, 1910. During the brief period which has elapsed since the latter cable was laid, however, a considerable advance in the design of this type has been made, inasmuch as Messrs. Siemens Bros. have succeeded in producing a modified gutta-percha dielectric with a considerably less leakance than that employed in the Anglo-French cables; a cable of the improved type was laid between England and Belgium in 1911. The three types of cables referred to afford material for an interesting comparison of the two methods of loading as applied to gutta-percha-insulated submarine cables, based on data which have only recently been made available.

The details of the cables referred to are given in Table I. It may be remarked that the two Anglo-French loaded cables are of the same total efficiency, the coil-loaded cable having a slightly greater (*i.e.*, less favourable) attenuation constant and a correspondingly shorter length; in practice, the difference between the two cables cannot be detected in conversation between London and Paris. The weight per naut of the conductor in the case of the coil-loaded cable is, however, 160 lb., whereas the continuously-loaded cable has conductors weighing 300 lb. per naut. The leakance in

TABLE I. Details of Recent Cables.

Cable.	Effective values per naut at 1,000 periods per second.							Wt. of G.P. per naut	Wt. of copper per naut.
	R + R₁.	L.	K.	S/K.	β Observed	β Calculated	Z Observed.		
Anglo-French coil-loaded	22·6	0·1	·138 × 10⁻⁶	120	·021	·0203	1,000	300 lb.	160 lb.
" continuously-loaded	8·51	·0135	·176 "	109	·0185	·0181	278	300 "	300 "
Anglo-Belgian coil-loaded	27·8*	0·1	·162 "	12	·0192†	·0185	800	150 "	160 "

R = Ohmic resistance of conductors per naut R₁ = Effective resistance of loading-coil ; S = Leakance in micromhos

L = Inductance per naut in henrys K = Capacity wire to wire per naut in farads Z = Characteristic impedance.

β = Attenuation constant. * Including loading coil in phantom circuit. † At frequency $2\pi n = 6{,}000$.

both cables is much in excess of that obtained in the Belgian cable, and, moreover, the weight of gutta in the coil-loaded cable is greater than will in future be employed in cables of that type.

It will also be seen that the Anglo-Belgian cable, with half the weight of gutta-percha and a little more than half the weight of copper, has nearly the same efficiency as the continuously-loaded cable. Here again, however, as pointed out above, the leakance of that cable is much more favourable than in the other cases, so that no very definite conclusions can be deduced as to future progress, without corrections being made for leakance, and a comparison being made on a uniform basis.

The details of the continuously-loaded cable are given by M. Devaux Charbonnel in an article in *La Lumière Electrique*, dated June 15th last. The effective values per kilometre loop are :—$R = 4{\cdot}60$; $L = 7{\cdot}26 \times 10$; $K = 0{\cdot}095 \times 10^{-6}$; $S = 1{\cdot}032 \times 10^{-5}$; $\beta = 0{\cdot}00992$: $Z = 278\, e^{\ 2\ \ 17'}$.

For the purpose of comparison, the values have been converted to nauts in Table I. The attenuation measurement was made by M Devaux Charbonnel at 1,000 cycles per second, although the usual practice in this country is to regard the "β" at 800 cycles as giving the same attenuation as the human voice. This is in accordance with the recommendation of the International Conference of Telegraph and Telephone Engineers, held in Paris in 1910. As the precise experimental values at a frequency of 800 cycles in the case of the continuously-loaded cable are not known to the writer of this article, the constants of the English cables have been corrected to 1,000 cycles for the purpose of comparison.

In the article by M. Devaux Charbonnel already referred to, that writer makes an interesting comparison between the electrical qualities of the two kinds of cables, without seriously considering their relative cost, and, as the matter will probably be new to many English readers, I propose partly to cover the same ground and to continue the study of the subject further, so as to show the monetary considerations involved in the adoption of the one type or the other. For the reasons already given, it will be necessary to make the efficiency comparisons at a frequency of 1,000 periods per second. It may, however, be incidentally remarked that the actual experimental results on the Anglo-French cables, as shown in Table I, and verified by speech test, indicate that comparisons at this frequency are quite valid, and are supported by practical results.

As is well known, the electrical difference between the two methods of loading consists in the method of inserting inductance in a cable, and also in the amount of inductance which it is possible so to insert. The insertion of coils at regular intervals is relatively easy, and any desired amount of inductance may be obtained by this method within reasonable limits. Incidentally, however, the added inductance is always associated with increased resistance, and in a well-designed coil the increased resistance is proportional to the added inductance, so that the ratio R_1/L is constant (R_1 is the effective resistance of the coil at a given frequency and with a specified current flowing through its coils, and L is the inductance in henrys in the coil). Owing to researches quite recently made, it is now possible to obtain a coil with a constant such that $R_1/L = 60$ at 1,000 frequency and 1 milliampere current.

In the case of the Anglo-French continuously-loaded cable, the inductance is added by means of a winding of steel wire 0·012 in. (12 mils) in thickness, the wire being closely wound upon the conductor. The addition of the inductance also involves the addition of resistance in this case, and M. Devaux Charbonnel finds that this added resistance (which it will be convenient to call R_2) bears a constant relation to the inductance added, so that $R_2/L = 110$ at 1,000 cycles. Assuming that the two sets of constants are taken with the same current, we are now in a position to compare the transmission efficiencies of the two types of cable at 1,000 cycles.

As a first step in this direction it will be interesting to see which type is the more efficient fundamentally, assuming that an unlimited amount of inductance can be obtained in both cases. This is far from being the case at present, however, in the case of the continuously-loaded cable, but hopes are entertained that future research will result in a materially greater permeability being obtained, and, in any case, the point in question appears to be an interesting one.

The next step proposed is to compare the cables from the point of view of their present possibilities, and to compare the prices for a given transmission efficiency.

The attenuation constant β, which determines the transmission efficiency of a loaded cable, may be calculated from the well-known formula—

$$\beta = \tfrac{1}{2}\,(R + R_1 + S/K\ L)\ \sqrt{K/L}, \qquad (1)$$

where R is the loop resistance of the cable; R_1 the effective resistance of the coils at 1,000 cycles and 1 milliampere current; S the leakance in micromhos; K the capacity, wire to wire, in farads; and L the inductance in henrys, all per unit length.

If this expression be differentiated so as to find the value of L for minimum β, we have (as is also known)—

$$L = \frac{R}{R_1/L + S/K}, \qquad (2)$$

therefore
$$R = L\,(R_1/L + S/K). \qquad (3)$$

Let $R_1/L + S/K$ be designated by A_1. Then in equation (3) $R = L\,A_1$, and by substitution of (3) in (1), the minimum β (β_m) may be written—

$$\beta_m = \sqrt{K\,R\,A_1} \qquad (4)$$

in the case of any loaded cable.

Incidentally, we may see from these formulæ that inductance may be added to a cable until the energy losses involved in $L\,A_1$ are equal to the resistance of the cable itself, but no further with advantage.

Let the β_m of a coil-loaded cable be $\sqrt{K\,R\,A_1}$, and the β_m of a continuously-loaded cable be $\sqrt{K\,R\,A_2}$, where—

$$A_2 = R_2/L + S/K.$$

(R_2 is the added resistance, per unit length, due to continuous loading.) Then, if the two cables be compared, as we have the same K R, *i.e.*, the same weight of copper and capacity, the relative β's are—

$$\beta_{m_1}/\beta_{m_2} = \sqrt{K\,R\,A_1}/\sqrt{K\,R\,A_2} = \sqrt{A_1/A_2}.$$

Take the case of two ordinary gutta-percha cables having the same weight of copper and the same capacity. In such a case S/K may be taken in each instance at 120, and we have—

$$A_1 = R_1/L + S/K = 60 + 120,$$
$$A_2 = R_2/L + S/K = 110 + 120,$$

that is—
$$\beta_{m2}/\beta_{m1} = 1{\cdot}13.$$

This means that the minimum β of a continuously-loaded cable is 13 per cent. higher (*i.e.*, more unfavourable) than the minimum β of a coil-loaded cable having the same weight of conductor and capacity (that is, assuming that the former cable could be loaded with the required amount of inductance, which is only the case for very heavy gauge cables, as will presently be shown).

Moreover, if instead of ordinary gutta-percha the modified gutta-percha used in the Anglo-Belgian cable be considered, we have $S/K = 12$ instead of 120, as in the previous case, and $A_2 = 110 + 12$, also $A_1 = 60 + 12$, therefore—

$$\sqrt{A_2/A_1} = 1{\cdot}3.$$

So that if the most modern and efficient type of gutta-percha insulation is used, the continuously-loaded cable in the most favourable possible case has a β at least 30 per cent. higher than the coil-loaded cable, and this state of things must continue, even if the permeability of the iron winding is improved, unless also the ratio R_2/L is made less. If, however, it were decided to superimpose, then the superiority of the coil-loaded cable would not be so marked, because it would then be necessary to increase R_1/L from 60 to 72 (the latter figure has quite recently been obtained). We then have $A_2 = 122$ as before, $A_1 = 72 + 12 = 84$, therefore—

$$\sqrt{A_2/A_1} = 1{\cdot}2.$$

So that the coil-loaded cable would still have a minimum β 20 per cent. more favourable than the other type of cable in question.

On the subject of superimposing on submarine cables, it may be remarked that it has not been found possible altogether to avoid some degree of overhearing between the direct circuits in the cable and the extra circuit superimposed upon them. The difficulty is not confined to the coil-loaded cable, and it arises mainly from the great difficulty in balancing circuits of very high capacity. In attempting to provide such circuits, however, no overhearing is produced from one direct circuit to the other, and with the present highly-efficient loading coils, the attenuation constant of the ordinary circuits is not much increased. The extra circuit obtained, if workable, is of great value, so that attempts to provide such circuits will doubtless continue to be made.

(To be continued.)

CENTRAL STATIONS.

By CALCULUS.

On looking back at the central stations as they stood some 20 years ago, and comparing them with those now in existence, one cannot help admiring all the good work that has been done by the busy engineers engaged in the electrical industry.

Life in the power house of to-day is far less exciting than in the past, for with plant of modern design it is seldom that anything serious happens, and, on the whole, central-station engineers now enjoy a far more comfortable existence than those who went before them.

I can remember when it was considered an exceptionally good piece of luck to get through the evening shift without some trouble arising, and I have not the least doubt that there are many readers of the Electrical Review who can recall those days also. Alternators, as built at that time, had the undesirable habit of burning out, and I have known no less than two machines do this in the same evening. In fact, in one station, things became so bad that we had to keep a man on the evening shift for the purpose of smelling alternators. Still, with all their faults, the old central stations always fascinated me, and whenever I come across a plant that bears the stamp of old age, I am compelled to linger and admire it. Perhaps there are others like me.

They were queer old places these early electric lighting stations, and possibly that is why I have so much regard for them. The old low-speed engines and generators, the curious switchgear and odd arrangements of steam pipes, are still fresh in my memory, and at times I have almost been tempted to ask why electrical engineers of 20 years ago were so foolish. But, as a matter of fact, they were very clever and deep-thinking men, and the things they accomplished are to be regarded as truly remarkable when we consider what a scanty training in electrical engineering they had to work upon.

It is interesting to compare an up-to-date station with some of these old monstrosities. The turbine has simplified the engine-room equipment immensely. It has no cranks or pistons, occupies small space for its output, and from the point of view of simplicity it is all that a prime mover should be. The turbine is a machine that requires practically no attention, and once it is set to work it will go on running indefinitely. One is apt to smile on comparing the turbine with some of the old engines that had to be saturated with oil to make them perform their duty. In all the modern turbine stations there is not a single man who can lay claim to the dignified title of greaser. The turbine, like the modern high speed engine, greases itself, but whereas in the latter the cylinder oil finds its way into the exhaust, the steam which leaves the turbine is perfectly clean, for the turbine does not require lubricating internally. The only parts of a turbine that need oil are the bearings, and it is, therefore, easy to conceive that this prime mover has an immense advantage over some of the old engines that consumed large quantities of this expensive fluid.

But notwithstanding all the advantages which these high-speed prime movers possess, the turbine has recently met with a great rival in the form of the Diesel engine. Some engineers seem to believe that this comparatively new and efficient machine will eventually find a place in every electric lighting station, but there is such a thing as being a little too enthusiastic. Looking at the matter from an entirely unbiased standpoint, one is bound to admit that the Diesel engine admirably meets the requirements of engineers responsible for the working of the smaller stations, but when we come to the large electrical undertakings which supply current to our principal cities and towns, then I would vote for the steam turbine.

The turbine shows up to its best advantage when it develops large outputs, and the greater the capacity of a set the lower the steam consumption and capital outlay per kilowatt. It is estimated that the steam consumption of the 25,000-KW. Parsons machine now under construction for the Commonwealth Edison Co., in Chicago, will be something like 10 per cent. lower than anything that has hitherto been obtained with steam plant. This represents a saving of approximately 2 tons of coal per hour when working at full load.

If oil engines are to be used on large electric supply systems, I would advocate that they take the place of converting machinery in sub-stations. The Diesel engine in its present stage of evolution undoubtedly presents great advantages, and one of the most noteworthy is that it eliminates stand-by losses.

When the turbine secured a place in central stations, a great step was made towards simplifying the plant, for the turbine is unquestionably the simplest prime mover that has been evolved; for, whereas in steam, gas and oil engines we have to convert a reciprocating motion into a rotary one, the turbine gives a rotary motion at the outset, and many heavy and expensive parts are thus dispensed with. Turbines are consequently exceedingly cheap machines to maintain, and it is common knowledge that they have been known to work for years without a penny having been spent on their upkeep.

But in spite of all this I firmly believe that if steam plant is to hold its own with internal-combustion engines, some radical changes must be made in the boiler house. For, whereas there has been continual effort to raise the efficiency of the plant in the engine room, the changes made in the boiler house are, comparatively speaking, insignificant.

In this matter I quite agree with Mr. George Wilkinson, of Harrogate, who recently said that we have been too long content to use boiler plant furnishing an average of from 2 lb. to 3 lb. of steam per hour per sq. ft. of heating surface. Such practice involves the use of steam generating equipment having dimensions out of all proportion to the size of the engine-room plant. Mr. Wilkinson has directed attention to the fact that the solution of the problem appears to lie in the introduction of gas firing by means of flameless surface combustion on the lines first discovered by Sir Humphry Davy and recently developed by Prof. Bone.

Those who visited the recent machinery exhibition held at Olympia probably saw the Bonecourt patent boiler, which was fired in accordance with this new system. Boilers fired in this manner are claimed to have an efficiency of no less than 95 per cent. The normal evaporation is 20 lb. per hour per sq. ft. of heating surface, and this can be raised to 30 lb. in cases of emergency. An efficiency of 95 per cent. is truly a remarkable result, but it is well to note that this figure is arrived at from the heat in the steam generated and the calorific value of the gas. If the system of firing were put into use in central stations, gas producers would be employed and the efficiency of these must be considered when comparing the new system with the ordinary coal-fired boiler. One attractive feature of the scheme is that the scale does not adhere to the tubes, this having been proved by a test carried out over a considerable period. In fact, I believe that this was predicted by one of the engineers of a well-known insurance company before the boiler was put into service. Those who saw this boiler at Olympia must have been struck with the simplicity of the system, for it was devoid of all the paraphernalia commonly adopted for coal firing. Still, we must not forget the gas producer.

It is difficult to prophesy with any degree of certainty what changes will take place in the design of central stations in the future, but it seems reasonable to suppose that in the case of steam plants, the boiler house will undergo modifications in the near future, since, apart from the introduction of various forms of mechanical stokers, no radical departure in the methods of raising steam has been made. There is, of course, a possibility of the gas turbine coming into use, but we need not pay much attention to this at present. The difficulties attending the construction of machines of this type are well understood, but it would be folly to assume that these will never be surmounted.

All who have studied this question are aware that one of the obstacles in the way of building an efficient gas turbine is the task of finding a suitable material for the blades. It is true that gas turbines have been constructed, but taking everything into account, it is conceivable that the efficiency of the machine in its present stage of evolution is no better, and possibly a great deal worse, than other forms of prime movers of less recent origin. I shall welcome the gas turbine if ever it comes, because, as I have intimated, I like anything that introduces simplicity.

Things in the power house were assuming a very good form just before the advent of the oil engine. Almost every central station engineer saw the great advantage of the turbine with its even turning movement. Machines with pistons and cranks were rapidly disappearing, and this is not only true of the main generating units, but also of the auxiliaries, for whereas, a few years ago, feed pumps were invariably of the plunger type, more modern machines are built on the centrifugal principle.

There are now many feed pumps of this type in use, and some are driven by small steam turbines. But the modern internal-combustion engine threatens to spoil this simple state, and much as I admire the great ingenuity that has been exercised in the evolution of the latest examples of oil engines, I have no particular desire to renew my acquaintance with prime movers having pistons, cylinders and crankshafts. I recognise perfectly well that my great appreciation of the turbine is the outcome of my environment, for I came into contact with the turbine soon after it commenced to establish itself in electrical power stations. It would be folly for any engineer to shut his eyes to the great economy of the modern internal-combustion engine in spite of its somewhat high capital cost. Not only is it highly economical as regards the actual fuel consumption whilst running, but it also scores heavily over steam and gas engines owing to the entire absence of stand-by losses. But even the strongest advocates of the oil engine will admit that in order to secure reliability first-class attention is necessary.

In a paper on the Diesel engine read before the Institution of Electrical Engineers by Mr. Sowter, it is stated that 90 per cent. of the troubles experienced in running are caused by the neglect of attendants. But taking into account the fact that a man who is thoroughly capable of running a Diesel engine can demand a good wage, Mr. Sowter estimates that the cost of labour on moderate size installations is substantially less than that of a steam plant. Having regard to the expense entailed in working a boiler house, there is probably a great deal of truth in the statement.

Lastly, I may direct attention to the fact that we have arrived at a time when the problem of deciding which type of prime mover should be put down is sometimes difficult. In the early days of electric lighting stations steam engines were universally employed, but to-day the engineer has several distinct classes of prime movers to choose from. So far as generalisation is possible, it appears that turbines should be used when the employment of large units is desirable, whilst the oil engine's sphere of application is in connection with stations of small and moderate outputs.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"T. S. F." writes :—"I shall be glad if you will kindly let me know whether it is legally essential to obtain the sanction of the owner of premises where it is proposed to lay a service.

"An opinion on the following matter would also be appreciated :—The service is laid into a consumer's premises, the premises not belonging to the consumer. The lines pass under land over which the consumer has a right-of-way for access to his premises. A subsequent owner of the land, for petty reasons, requests the removal of the service lines. Is he legally entitled to do this ?"

⁂ As to the first question, a service can only be laid on premises with the sanction of the owner or the occupier. If the occupier, being a tenant, has covenanted with his landlord not to allow a service to be laid, the landlord may have an action against him for breach of covenant, but the owner would not have any right of action against the supply authority. To any such action the authority could at once plead the leave and licence of the tenant. Sec 27 (1) of the schedule to the Electric Lighting (Clauses) Act, 1899, clearly enables the authority to supply the owner or the occupier.

As to the second question, the fact that a consumer has a mere right-of-way over certain land does not entitle him to allow that land to be excavated for the purpose of laying service mains. In this instance it is conceived that the person who owned the freehold could maintain an action for trespass against the authority for disturbing his land, and he could also sue for damages for trespass at any time within the period prescribed by the statute of limitation.

Tanning by Electrolysis.—Electrochemistry is one of the most highly specialised branches of industry at the present time, and it touches many questions of mechanical and electrical design and construction and operation as closely as any department of applied science that can be named. Dr. L. A. Groth, K.G.V., a Swedish scientist of repute, domiciled in London, and a specialist in electrolytic matters, has for years devoted much time to researches and investigations in this connection, and we are informed that he has now obtained results of a surprising character, which he is demonstrating upon a commercial basis and which therefore deserve the fullest attention of those specially interested.

A demonstration plant upon a commercial basis of Dr. Groth's system of tanning by electrolysis is now being erected at the tan yard of Mr. Columbus Smith, of Kidderminster, by the Kidderminster and District Electric Lighting and Traction Co., Ltd., under the supervision of Dr. Groth. We may add that Messrs. Nalder Bros. & Thompson, Ltd., of London, have acquired the exclusive rights to manufacture the instruments of Dr. Groth's special construction.

The great advantage claimed for Dr. Groth's system is that a pure and strong tannage of heavy hides is effected in six weeks or less, as compared with many months by any ordinary process, whilst the quality of the leather produced has been pronounced to be extremely good. Dr. Groth has so successfully completed his system, that the application, regulation and recording of the electric current is done by specially constructed controlling instruments and automatic indicators, by means of which the current may be properly applied as easily as an ordinary electric lamp is switched on. By means of a safety device any injury to the hides and skins or tanning liquors is entirely prevented. If an irregularity of any kind should occur, the indicators automatically and immediately notify this by ringing bells or lighting lamps at the spot where it may have happened, enabling the attendant to rectify the matter instantly and without difficulty. The tannage is thus made entirely automatic, requiring only the attendance of two lads during the whole tanning process. We understand that the cost of production is much less than on the ordinary system. As the current is used day and night, and the load factor is quite 90 per cent., the system should be of interest to electricity supply authorities.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,796. "Sparking plugs suitable for internal-combustion engines." G. N. Hall. November 11th.

25,803. "Fool-proof gravity starting panel or electrical machinery." W. H. Ashby and J. Hargreaves. November 11th.

25,831. "Electric meters and meter systems and relays adapted to control the same and for other purposes." Siemens Schuckertwerke G.m.b.H. (Convention date, November 11th, 1911, Germany.) November 11th. (Complete.)

25,846. "Telegraph, telephone and like cables." A. J. Stubbs. November 11th.

25,881. "Electromagnetic apparatus." L. Weigert-Sterne. November 11th.

25 896. "Telephones." P. L. Jensen and E. S. Pridham. November 11th. (Complete.)

25,899. "Reproducing process and copying apparatus for use in conjunction therewith." A. Hervert, B. Hervert and O. Jahn. (Convention date, December 31st, 1911, Austria.) November 11th. (Complete.)

25,902. "Method of and apparatus for annealing magnetic material." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 11th.

25,910. "Telephonic transmitters." E. A. Graham. November 11th.

25,911. "Loud-speaking telephonic apparatus." E. A. Graham. November 11th.

25,950. "Magnetos." R. O. Harper. November 12th.

25,966. "Electric lighting of motor-cars and similar vehicles." G. H. Skinner. November 12th.

25,976. "Manufacture of objects from molybdenum." Chemische Fabrik von Heyden Akt. Ges. (Convention date, June 19th, 1912, Germany.) November 12th. (Complete.)

25,981. "Multiple wire-drawing machines." F. W. Le Tall. (Soc. Anon. Trefileries et Laminoirs du Havre, Anciens Etablissements Lazare Weiller, Soc. Co-operative de Rugles et La Canalisation Electrique Reunis, France.) November 12th. (Complete.)

25,982. "Multiple wire-drawing machines." F. W. Le Tall. (Soc. Anon. Trefileries et Laminoirs du Havre, Anciens Etablissements Lazare Weiller, Soc. Co-operative de Rugles et La Canalisation Electrique Reunis, France.) November 12th. (Complete.)

25 996. "Combined mechanical lock and electric circuit-breaker." Electro-motor Equipment Co., Ltd., and W. H. Brenner. November 12th.

26,002. "Incandescent electric lampholders." C. A. Maby. November 12th.

26,007. "Automatic timing devices for magneto-electric ignition apparatus of internal-combustion engines." B. Brooks and F. H. Alston. November 13th.

26,082. "Electric furnaces and process of operating the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 13th.

26,094. "Flexible metallic covering for unarmoured electric cables and the like." F. H. Morley. November 13th.

26,099. "Telephonic transmitters." E. A. Graham. November 13th.

26,107. "Telegraphy." H. W. Sullivan. November 14th.

26,140. "Electric lamp reflector." L. Pepe and A. Baird. November 14th.

26,143. "Adjustable magnetic shunt for magneto indicators." Siemens Bros & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 14th. (Complete.)

26,145. "Electrically-controlled point-shifter." G. Davidson. November 14th. (Complete.)

26,151. "Magnetic separating machines." H. H. Thompson and A. E. Davies. November 14th.

26,156. "Electric igniting means for gas burners." South Metropolitan Gas Co. and J. M. Somerville. November 14th.

26,163. "Apparatus for taking radio-active measurements and determining the loss of the electric charge of insulated parts." C. D. Haeussler v.d. Burgstall. November 14th. (Complete.)

26,164. "Apparatus for charging liquids and gases with radio-active emanation." C. B. Haeussler v.d. Burgstall. November 14th. (Complete.)

26,165. "Electric electrode furnaces." Jossingford Manufacturing Co. A/s. (Divided application on 8,193/12. April 4th. Convention date, April 4th, 1911, Norway.) November 14th. (Complete.)

26,169. "Electrolytic cells." E. A. Allen and H. I. Allen. November 14th. (Complete.)

26,177. "Electrical machine." G. Plaisant. (Convention date, November 24th, 1911, France.) November 14th. (Complete.)

26,186. "Incandescent electric lamps." J. T. Robin. (Addition to 6,856/11.) November 14th. (Complete.)

26,194. "Striking mechanism for electric clocks." L. Asprey and E. Farrow. November 14th.

26,214. "Terminal or other couplings for electric cables." P. M. Thompson. (W. G. McGregor, High Seas.) November 15th.

26,223. "Wiring electric trough reflectors." H. G. Bennett, E. J. Wilson and A. Groves. November 15th.

26,224. "Electric tubular lampholders for trough reflectors." H. G. Bennett, E. J. Wilson and A. Groves. November 15th.

26,241 "Moving coil electrical measuring and like instruments." J. W. Record. November 15th. (Complete.)

26,242. "Moving coil electrical measuring and like instruments." J. W. Record. November 15th. (Complete.)

26,243. "Gas, electric light and the like fittings." G. Hulme and J. Booth, trading as S. Booth & Co. November 15th.

26,249. "Supports for metallic filaments of electric incandescent lamps." H. A. Gill. (Wolframlampen Akt-Ges., Germany.) November 15th. (Complete.)

26,255. "Method of and means for cleaning, electro-plating and finishing articles, more particularly small articles." G. P. M. Lee and W. A. Brame. November 15th.

26,256. "Electric heating devices for buildings and vehicles." T. J. Digby. November 15th.

26,287. "Manufacture of ductile and malleable bodies of tungsten or molybdenum or their alloys, especially wires or filaments for electric incandescent lamps." Westinghouse Metallfaden Gluhlampenfabrik G.m b H. (Convention date, November 20th, 1911, Austria.) November 15th. (Complete.)

26 288. "Metal filament carriers for electric incandescent lamps." Westinghouse Metallfaden Gluhlampenfabrik G.m.b H. (Convention date, November 20th, 1911, Austria.) November 15th. (Complete.)

26,289. "Metal filaments for electric incandescent lamps." Westinghouse Metallfaden Gluhlampenfabrik G.m.b.H. (Convention date, November 20th, 1911, Austria.) November 15th. (Complete.)

26,295. "Electric-magnetic track brakes." Magnetbremsen G.m.b.H. (Convention date, January 9th, 1912, Germany.) November 15th. (Complete.)

26,305. "Electric transmission of signals." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 15th. (Complete.)

26,306. "Electromagnetic perforation of strips in accordance with the depression of the keys of a keyboard for telegraphic or like purposes." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) November 15th. (Complete.)

26,309. "Electric secondary clocks." T. Rushton. November 15th.

26,318. "Differential arc lamp with inclined converging electrodes." Korting & Mathiesen Akt.-Ges. (Convention date, December 22nd, 1911, Germany.) November 16th. (Complete.)

26,323. "Electromagneto generator." W. P. Thompson. (Splitdorf Electrical Co., United States.) November 16th. (Complete.)

26,337. "Connection apparatus for electric circuit conductors." T. E. Murray. (Divided application on 19,535, 1912, August 26th. Convention date, February 9th, 1912, United States.) November 16th. (Complete.)

26,338. "Magnetic compasses." Kelvin & James White, Ltd., and J. T. Bottomley. November 16th. (Complete.)

26,344. "Electric railways." W. B. Purvis and A. D. Gritman. November 16th. (Complete.)

26,346. "Apparatus for making insulating ropes or hoses." W. Korting. November 16th. (Complete.)

26,347. "Electric heating devices." M. Albrecht. November 16th. (Complete.)

26,351. "Electric relay apparatus." J. D. Taylor. (Convention date, July 25th, 1912, United States.) November 16th. (Complete.)

26,359. "Electricity meters." W. Hamilton and Ferranti, Ltd. November 16th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Battery Lamps. C. V. A. Eley. 8,446. April 5th. (November 6th, 1911.)

Application of Radio-active Phenomena to Telephony. A. Vojen. 17,028. June 26th. (March 4th, 1911.)

Electric Railway Systems. K. E. Stuart. 18,998. August 24th. (September 9th, 1910.)

Switching Apparatus for Interconnecting the Lines of an Automatic Telephone System. Western Electric Co. (Telephon Apparat Fabrik E. Zwietusch & Co. Ges.) 21,259. September 26th.

Switching Apparatus for Interconnecting the Lines of a Semi-Automatic Telephone System Western Electric Co. (Telephon Apparat Fabrik E. Zwietusch & Co., Ges.) 21,260. September 26th.

Dynamo-electric Machines. Hon. C. A. Parsons and A. H. Law. 21,489. September 29th.

Devices for Electrically Driving Planing and other like Reciprocating Machines. B. Wiesengrund. 23,639. October 26th.

Electrically-heated Cooking Ovens and the like. A. F. Berry. 24,027. October 30th.

Protection of Feeders of Electrical Distribution Systems. C. H. Merz and P. F. Hunter. 24,0[illegible]0. October 30th.

Apparatus for Electrically Igniting Gas. E. W. Havers and Telephos Domestic and Street Lighting Co. 24,448. November 3rd.

Battery Switches. E. C. R. Marks. (Siemens Schuckertwerke.) 24,460. November 3rd.

Electric Light Fittings. W. J. Hollick. 24,584. November 6th.

Method and Apparatus for Producing a Gaseous Reaction by a Silent Discharge. British Thomson-Houston Co. (General Electric Co.) 27,951. December 12th.

Apparatus for Photometrically Testing Burners for Gas or Electricity. W. Gordon. 27,978. December 13th.

Fusible Cut-outs for Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 28,199. December 14th.

Production of Electrical Oscillations adapted for Wireless Transmission. H. Heinicke and M. Jasper. 28,351. December 16th.

Electric Automatic Switchgear. Crompton & Co. and J. G. Murray. 28,52[illegible]. December 18th.

1912.

Electric Couplings. H. Appenzeller. 4,3[illegible]3. February 20th. (Convention date not granted.)

Page-printing Telegraph Receivers. P. Etienne. 4,584. February 23rd. (February 24th, 1911.)

Process of Manufacturing Negative Electrodes for Alkaline Accumulators. Svenska Ackumulator Aktiebolaget, Jungner. 5,545. March 5th. (March 7th, 1911.)

Dynamo-electric Machines. M. M. Fouque and C. H. Ruelle. 6,099. March 11th.

Means for the Transmission of Signals, Telegraphic and other Communications, over High-tension Transmission Lines. F. Giraud-Teulon. 6,441. March 15th.

Electromagnets. A. T. Dowell. 9,804. April 25th.

Telephone Indicating and Metering Apparatus. H. von Laskowski. 12,929. June 1st.

Induction Coil or Transformer for the Transmission of Speech. J. Simpson and R. Simpson. 13,295. June 6th.

Apparatus for Selective Electric Signalling. A. H. Nicholson. 13,430. June 7th.

Apparatus for Singeing Textile Fabrics by means of an Electric Current. G. H Gin. 13,805. June 12th. (June 12th, 1911. Addition to [illegible],856 of 1908.)

Means for Telephonic Communication with Mine Cages. J. H. Reineke. 19,102. August 20th. (August 29th, 1911.)

Means for Telephonic and Telegraphic Communication with Mine Cages. J. H. Reineke. 19,103. August 20th. (Addition to 19,102 of 1912.)

Electric Furnaces. G. Massip. 19,172. August 21st. (August 22nd, 1911.)

Switching Apparatus for Interconnecting the Lines of an Automatic Telephone System. Western Electric Co (Telephon Apparat Fabrik E. Zwietusch & Co. Ges.) 20,943, 20,944, 20,945 and 20,946. September 13th. (Divided application on 21,259 of 1911. September 26th.)

Telephone Systems. Western Electric Co (Telephone Apparat Fabrik E. Zwietusch & Co., Ges.) 20,946. September 13th. (Divided application on 21,260 of 1911. September 26th.)

Electrically-driven Clocks. W. H. Burgess. 22,604. October 4th. (Divided application on 23,558 of 1911. October 25th.)

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TERMINOLOGICAL INEXACTITUDE.

WHEN Mr. James Swinburne talked to the Institution of Electrical Engineers, on December 4th, 1902, about the Presidential Address which he had written, he related that, wishing to find out what entropy was, he asked Lord Kelvin. The reply was, "Well, entropy is a very bad name for it," and that was all Lord Kelvin said about it.

In *Engineering* for August 30th of this year, there was published an article entitled "Meta-mechanics; a Plea for Precision," and, even at this late date, we commend this article to the notice of our readers. Its general trend is a protest against slackness of definition, especially on the part of those whose duty it is to instruct the rising generation. Such slackness is only too likely to cause a confusion of ideas which is exceedingly difficult to get rid of in after life. Yet the tendency towards slackness is as natural as the confusion to which it gives rise.

The author of the article, who disguises himself under the title "An Old Millwright," takes objection, in the first place, to all talk of transference of motion from one body to another. Motion is a condition, and so cannot have a concrete existence. It is a property of anything which is not at rest, and a property—of this kind at all events—cannot be transferred.

In explaining this kind of idea to students, however, and showing, for instance, that when a billiard ball in motion runs against one which is at rest, the ball at rest moves and the moving one travels more slowly than before, a teacher is apt to seek for some homely and easily understood method of bring this notion home to his hearers. There are people who will not believe in any measurement that cannot be made with a pint pot. What is easier, then, than to represent what actually happens as the pouring of a portion of the motion of the moving ball into the one which is at rest? The fact is, that it is the dodging of difficulties instead of clearing them resolutely out of the road that is responsible for most of the ills which our understandings contract and suffer from. Our understandings are not heirs to such ills, although the expression comes naturally to the pen. To be heir to anything implies a right to its possession and an obligation to take up the duties attached to the possession of the estate. There is no obligation on anyone to take up foggy notions and try to make the best of them, and the student who does so is laying up ashes and dust instead of treasure in heaven. The word "student" in this connection includes not only the young man at college, but any engineer who still finds, as all ought to find, continued interest in the work which he is called upon to do; and who, while thankful for the mercies of the past, is anxious to see what to-day and to-morrow have in store, instead of wishing to live yesterday over again.

Let all such students, then, make up their minds to fight their difficulties and conquer them. Let them walk over the Hill Difficulty, instead of travelling by the level paths which seem to be inviting them to circumvent it. The parallel holds good to the end, for one path led into a great wood—the wood of confusion of thought—and the other led into dark mountains, where the traveller stumbled and fell.

The writer of the article in question expressly states that he does not wish to appear pedantic; if it were not for this statement we should be inclined to think that occasionally he was striving after a meticulous and undesirable precision of expression which would leave one no latitude at all, and for the full carrying-out of which life itself would be too short. There can be no doubt, however, that it is well for all workers and thinkers, in whatever province of learning they may be engaged, to halt and take stock of their position. Those who read the article will in all probability be induced thereby to try to remove as many as possible of the weeds which thrive among their ideas, and to appreciate that there is a science of metamechanics, as there is one of metaphysics. It is "that which is beyond mechanics," as metaphysics is that which is beyond physics. It is only by looking beyond, in this way, that progress can be made, and it will ultimately be found that the series will converge, and that all the separate sciences, branches of learning, and subjects requiring understanding, will find their final solution in one great and supreme Mind.

But we are allowing ourselves to get beyond the province of a technical journal. Let us conclude by borrowing the concluding words of our author's plea for precision: "In the meantime, let everyone deal with facts as he finds them, making sure that he understands them, and not misleading himself or others by inventing explanations, however plausible, of the non-existent."

DEPARTMENTAL METHODS.

During the last few years employers of labour have gradually become accustomed to finding the Government ranged on the side of Labour in every trade dispute. So long as this formidable ally of the Trade Union comes out into the open, there is little to complain of. It is of the essence of party government that Ministers in power should actively support those who have put the reins of office into their hands. If the Trade Union is encouraged by Act of Parliament, or assisted by Government intervention in a dispute which may be pending, that is one thing; the employer at least has a visible foe to combat; but when a Government or a department seeks to bring pressure on employers by roundabout methods—to use an inoffensive adjective—the case is very different.

An example of such methods has recently been brought to light. In 1911 a strike for a 50 hours' week was forced by the London Society of Compositors. This was while a conference was pending as to hours. The conference resulted in an agreement for 51 hours for the whole country outside London, the London Unions having broken away from the other Unions and called their men out. The London houses eventually conceded the 50 hours temporarily, pending an agreement between the Master Printers' Association and the Unions. No such agreement and no settlement has ever been arrived at. Two-thirds of the London printing houses are non-society houses, nearly all of which work more than 50 hours, and half the workpeople returned are working more than 50 hours per week.

The parties being thus in negotiation, the Government in July last invited employers in the printing and book-binding trades to furnish a return as to the weekly hours of labour. This was to "be regarded as hitherto as strictly confidential, and will be used only in the compilation of general statistical results."

Having got the necessary information by this means, the time arrived for Mr. Masterman to act, and on October 29th he announced that unless firms tendering for and undertaking Government printing would at once agree to reduce hours to 50 by January, 1913, they would no longer be regarded as qualified to contract.

Discussion in the House of Commons has elicited that this decision was arrived at because 50 hours was the period of employment predominating. Yet the Fair Wages Clause provides for an adjustment in accordance with the hours prevailing among good employers. It seems that according to the strange arithmetic of the present Government, the hours worked by 46 per cent. and 45 per cent. of the principal classes of men, the compositors and machine men, in some of the largest, best conducted and most important houses in the trade, are not "hours prevailing among good employers."

The results of the action of the Government in this matter are far-reaching. If 50 hours is declared to be the standard in houses which are doing work under Government contracts, how shall it ever be exceeded in any other house?

It is small wonder that the Master Printers' and Allied Trades Association should have passed a resolution protesting against this unprecedented and arbitrary action of the Government in intervening in the printing trade dispute. No such intervention was proper until after a full and impartial inquiry.

It only remains, as it seems to us, for the printing trade to hang together, and this unwarrantable move on the part of the Government can be checkmated. An example has recently been afforded by the action of the medical profession of the use of legitimate and effective methods of bringing pressure to bear upon a member of the Government. Could the printing world boast a similar unanimity, equally gratifying results could be attained.

London Traffic Developments. The recent shuffle in ownership of London tube, tramway and omnibus undertakings has naturally attracted considerable attention in the daily Press, and many and various surmises have been made by different writers as to the causes and effects of the recent amalgamations. Thus, a correspondent in the *Morning Post* refers to the fresh competition possibilities created, the Speyer lines with their tramways and 'buses being arrayed against the Metropolitan, Great Northern and City group, behind which stand the Great Western and Great Central Railways, as joint owners of some portions of the Metropolitan lines; in view of this dependence of the latter railway, it is considered certain that the former railways would oppose any scheme for the acquisition of the Metropolitan. The future of the Great Northern and City, when physically connected to the Metropolitan, is also a matter for speculation; the *Standard* points out that an extension of this line northwards in competition with the Great Northern is prevented by agreement, but that in other directions there is scope for extension by its new owners, who have already notified their intention of prolonging the line citywards to the Bank, with a view to tapping the Waterloo and City railway traffic. Behind this there is the obvious suggestion that the Metropolitan and its big partners, in acquiring the Great Northern and City line, had far more in view than a link to Finsbury Park.

With regard to the Underground Co., which is purely a holding concern, and the railway, tramway and omnibus undertakings which it now controls, a writer in the *Daily Telegraph* considers the tramway combination the most interesting and significant part of the recent deal, and asks whether it means that the Speyer group has had enough of tramways, and is going to let somebody else give them a trial. The experience of the London United Tramways has not been a particularly happy one, and there are more promising ventures on hand at the present time. Under the new scheme the management of these tramways passes from Underground control to that of the Metropolitan Electric Tramways, while the 'bus subsidiary of the latter—the Tramways (M.E.T.) Omnibus Co.—passes under the management of the London General Omnibus Co., the earnings of the combined concern being shared with the two companies.

The amalgamated tramways will be known as the London and Suburban Traction Co., and the fact that the British Electric Traction Co. (from its holding in the Metropolitan Tramways) will be very largely interested in the new concern, leads to a suggestion by the *Daily News* that the opening up of closer relations between the B.E.T. is a possible development, while a *Times* correspondent infers that some of the provincial undertakings of the latter may be worth making a bid for.

With regard to the further two railways—the Central London and City and South London Railways—which will now be added to the Underground traction system, the former, if anticipations are correct, will greatly benefit in traffic by the linking-up of its Shepherd's Bush terminus with the Great Western line at Ealing, and its position will be further strengthened when the much-talked-of Thames Valley extension matures. The latter, it was generally understood, would be competitive with the South-Western lines in the same area; at any rate, it obtained local support on that hypothesis, but, judging by the recent notice given by the Central London Co. of its application for powers to build a line from Shepherd's Bush to Gunnersbury on the South-Western line, an understanding or an alliance appears to have been arranged which will not lead to the anticipated competition.

The original proposals have, however, served a good purpose if they are responsible for the recent announcement by the South-Western Co., of its intention to electrify the Kingston and Hounslow loop lines, and the Shepperton and Hampton Court lines, within two years.

The City and South London line, as our readers are aware, is to be modernised by its new controllers, that is to say, it will be reconstructed and re-equipped presumably on similar lines to the London Electric tube railways, and this is expected to take three years to complete. Rumour has it that this line will be physically connected with the Hampstead Tube (which is to be extended to Edgware), and that it may be extended towards Balham and Tooting, south of the Thames, thus giving another north and south route.

The District, another member of the group, has announced its intention, apparently, of absorbing the authorised Wimbledon and Sutton railway, and of constructing this line, which will tap a preserve of the Brighton Co., and may thus lead to further electrification by that company. Lastly, as it will be gathered that this amalgamation of interests all tends to the unified control of London traffic, much speculation naturally exists as to the future of the L.C.C. tramways when, and if, competition becomes more pronounced than at present. One writer regards as a plausible contingency the purchase by the Council of the joint system of the new tramway group, and it must be remembered that joint services are at present worked by the Council and the Metropolitan Tramways Co.

The Earthing of the Neutral.

The paper by Mr. J. S. Peck, which was read at the Institution of Electrical Engineers on November 28th, and is abstracted elsewhere in this issue, is noteworthy for several reasons. The first is that the author appears to have condensed into so short a space that it is difficult to summarise it any further, all the information available on this important subject. If, however, it were possible further to condense it, Mr. Peck himself did so in the admirable little speech with which he introduced it to the meeting. We have often urged that papers should be distributed to members in advance and introduced briefly at the meeting by the authors, and the excellence of this plan was well illustrated on this occasion. It may have appeared to some that practice was already so standardised, so cut-and-dried, that it would not be easy to impart any interest to the subject; but without intruding his own views too dogmatically, Mr. Peck has contrived to present the question in all its bearings, as it appears to him, and the widespread interest taken in the matter is evidenced by the fact that before the paper was read in London it had already been discussed by the members of the Local Sections of Manchester and Birmingham. It will also be discussed at Newcastle.

An interesting discussion took place, and we noticed with considerable pleasure the complete absence of a tone which prevailed some time ago, and which we may indicate by this sort of opening:—"I have not had time to read the paper myself, but if there is one individual in the whole of the electrical profession and industry who is abysmally ignorant of this particular question, it is the author of this paper; and whatever he does know, I taught him." Members who are not familiar with the contents of a paper, but who nevertheless presume to discuss it, are guilty of a grave discourtesy towards their fellow-members, and especially to the author.

Mr. Brazil suggested that it was desirable to insert between the neutral and earth a resistance with a negative temperature coefficient, and described one which was cheaply constructed, and which had been in use for a number of years, carbon powder being the principal constituent. Some years ago the British Thomson-Houston Co. used cylindrical resistances composed of a mixture of carbon and clay, in connection with spark-gaps used for minimising the effect of surges on the lines. This mixture had a negative temperature coefficient, and we should scarcely have thought that there was anything very novel in the idea. Mr. Brazil's design is more adaptable, perhaps, and certainly is inexpensive.

Mr. Partridge pointed out the desirability of providing a definite metallic path back to the generators, when the outer of a high-tension cable is earthed at the station, and the middle point of the transformer secondary is earthed at the sub-station. If a spark-gap is provided at the distant end of the high-tension line, between the outer and earth, then, in the event of a connection between the primary and the secondary of the transformer, there will be a metallic return *via* the spark-gap, obviating the necessity which would otherwise exist of a considerable flow of current through the earth to the station. The fact that Mr. Partridge, following the single-phase practice, earths one phase of his three-phase system throughout, and has had no trouble therefrom, is very interesting.

Of course Mr. Peck considers pressures of all magnitudes, and it was a sign of the times to hear him speak of 2,000 and 5,000 volts as "low voltage." It requires more than this, however, to justify Mr. Edgcumbe's animadversions on electrostatic voltmeters. Twelve years ago we were familiar with many examples of such instruments in use on ordinary low-tension circuits, and on circuits of 2,000 volts—and that was about as high as could readily be found in the United Kingdom at that time. We, therefore, fail to find justification for Mr. Edgcumbe's statement that 12 years ago electrostatic voltmeters were so unreliable as to be practically useless. Moreover, it is within our knowledge that in German practice of the last two or three years, the vogue of streaks of lightning, and skulls and crossbones, to which he referred, has ceased.

Mr. Trotter, who had already spoken at one of the sectional meetings, spoke again from the point of view of the safety of the public. We cannot agree with Mr. Peck that having the system entirely insulated obviates danger to human life, or even minimises it to any great extent. To run with one phase-wire earthed, as Mr. Chamen suggested, is much worse, from this point of view, than to run with an earthed neutral. But, after all, everyone knows that the live wires are dangerous, and it is only a question of degree. We remember that at a meeting held in Glasgow in 1901, concerned with railway work, Mr. Alexander Siemens said that he would have no notices of danger, but rather, "You may touch everything; it is perfectly safe." This can never be the case with live cables, and we are quite against any attempt to try to make them safe, except by treating them as dangerous, and taking all proper precautions. We are reminded of the "arguments" that used to be used in favour of insulating the frames of motors.

Our general impression of the evening's work was that while in most cases it is advisable to earth the neutral, yet local conditions must influence the matter considerably; and we think that engineers who are in charge of undertakings in which this system is used are, as a rule, fully alive to the necessities of the situation. A significant remark was let fall by Mr. Trotter with reference to overhead mains—namely, that the adoption of these would be facilitated in districts where they are not at present permitted, if the neutral point were earthed through a resistance and a trip coil cutting off the mains at a low current.

ELECTRIC TRAVELLERS.

Travelling cranes are as a general rule fitted with three or more motors. If three are employed, the first is for hoisting, the second for cross traverse, and the third for longitudinal motion.

Supposing it to be a four-motor crane, the arrangement is, first, for main hoisting; secondly, for auxiliary hoisting; thirdly, for cross traverse; and fourthly, for longitudinal motion.

The main hoist motor is geared to the large barrel of the crab, and is used for ponderous work. The gearing of this barrel is often arranged to allow two speeds by the movement of a lever, which can be operated from the cab of the crane. The auxiliary motor is geared to a smaller barrel, and lifts the lighter loads or assists the main hoist, being entirely separate from other parts of the crab as far as gearing is concerned. The cross traverse motor is also fitted on the crab, and is geared to the wheels which carry the crab along the girders. The longitudinal motion motor is fitted to the centre of the main girder. Frequently two crabs are erected on one pair of girders, which would make a total of seven motors on one crane, *i.e.*, three on each crab, and one longitudinal traverse motor which is fitted to the main girder. To supply current to the motors on the crabs, collectors are fitted under the crab and make connection with the motor leads by sliding contact. These collectors are shown in the accompanying drawing at A, B, C, D. The

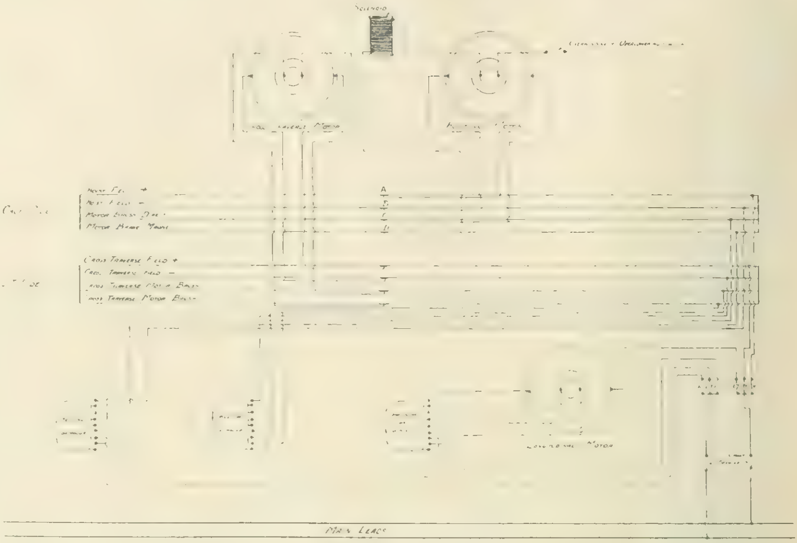

Diagram of Connections of Direct-Current Crane.

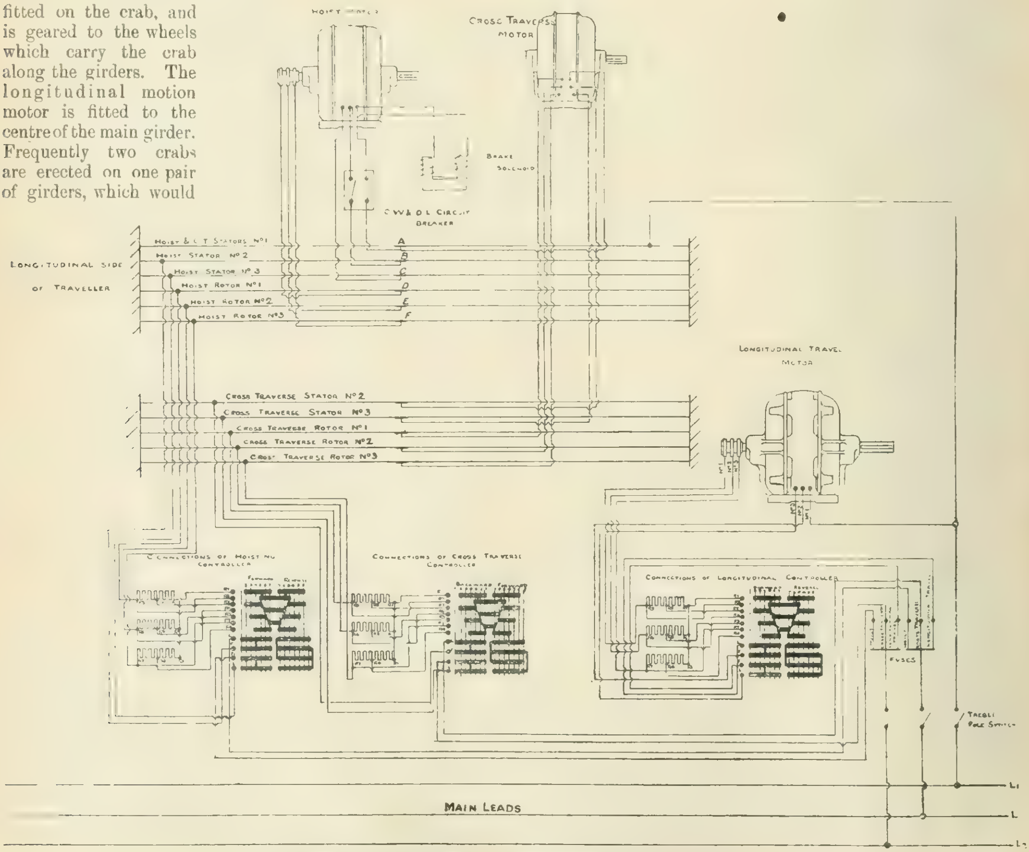
Hoist Motor
Cross Traverse Motor
Brake Solenoid
C W & O L Circuit Breaker
Longitudinal Side of Traveller
Hoist & C T Stators No 1
Hoist Stator No 2
Hoist Stator No 3
Hoist Rotor No 1
Hoist Rotor No 2
Hoist Rotor No 3
A
B
C
D
E
F
Cross Traverse Stator No 2
Cross Traverse Stator No 3
Cross Traverse Rotor No 1
Cross Traverse Rotor No 2
Cross Traverse Rotor No 3
Longitudinal Travel Motor
Connections of Hoisting Controller
Connections of Cross Traverse Controller
Connections of Longitudinal Controller
Fuses
Treble Pole Switch
Main Leads
L1
L
L2

Diagram of Connections of Alternating-Current Crane.

motor leads are generally placed along the inside of both the main girders, and are of copper wire of sufficient carrying capacity. They are drawn tight on insulators which are fixed on brackets at each end of the main girders.

The current employed may be alternating or direct; in the former case it is generally three-phase. The best arrangement for three-phase motors is to have a common line for one stator cable from each motor, thus saving both copper and space.

DIRECT-CURRENT CRANES.

The motors used on direct-current cranes are series wound, and are controlled by dry or liquid controllers. There are four cables from each motor, which, in the case of main hoist and cross-traverse, are connected to the motor leads as follows :—

Hoist motor on cage side.	**Field.** " Armature. "	**Cross-traverse** motor on L.T. side.	**Field.** " Armature. "

The field or armature circuit is broken by an overwinding switch and brake solenoid. It is immaterial whether the solenoid and overwinding switch are placed in the armature or field circuit, as one operates in conjunction with the other. The above arrangement is shown in diagram on the opposite page for a two-motor crab, but in case an auxiliary motor is added, the motor leads would be :—

Cage side	**Hoist field.** " " " armature " " **Auxiliary field.** " "	L.T. side	**Auxiliary armature.** " " **Cross-traverse field.** " " " " " armature. " " "

This arrangement balances the number of motor-leads on the inside of each girder.

The longitudinal traverse motor being stationary on the crane, enables the cables to be fixed along the platform of the crane, and straight to the switchboard and controllers in the driving cage. The drawings will show the connections of the main leads which supply current to the crane.

ALTERNATING-CURRENT CRANES.

A systematic arrangement of the motor-leads is necessary. The six motor-leads on the longitudinal side of the crane are connected to the main hoist motor. This will be seen from the drawing, but it will be noticed that the top lead is made common to both. The arrangement of the cables to the motor-leads is as follows :—

Longitudinal Side of Traveller.—Hoist and cross-traverse stator No. 1 ; hoist stator No. 2 ; hoist stator No. 3 ; hoist rotor No. 1 ; hoist rotor No. 2 ; hoist rotor No. 3.

Then having arranged that the cross-traverse stator No. 1 is connected on the same motor-lead as hoist stator No. 1, the other cables from the cross-traverse motor are arranged :—Cross-traverse stator No. 2 ; cross-traverse stator No. 3 ; cross-traverse rotor No. 1 ; cross-traverse rotor No. 2 ; cross-traverse rotor No. 3.

An overwinding switch is fitted in circuit with two phases of the stator of the hoist motor, and is automatic, so that when the hoisting block is wound too high, the stator circuit is broken, and a possible disaster averted. This action also takes place when the hoisting block is run too low.

Also there is fitted on the crab a magnetic brake solenoid, the connections being taken from the second and third stator connections of the main hoist motor. When current is on the main hoist motor this solenoid lifts the brake off, but the brake is always on when no current is on the motor. The accompanying drawing will make clear the connections for the overwinding switch and the brake solenoid and also the connections to the collectors.—S.A.K.

What is Coming in China.—As bearing upon the vast requirements of China in the near future, a German journal, quoting a Far Eastern report, says that Dr. Sun Yat Sen, chairman of the Commission of inquiry into the construction of Chinese railways, has prepared a scheme for the building of *62,000 miles of railways within ten years*, at an estimated expenditure of over £23,000,000. The money required for work during the first five years would have to be obtained abroad ; after that period, it is considered, receipts from operating lines would, together with the money that could be raised in China, enable the construction of the other lines to be proceeded with.

THE COMMERCIAL DEVELOPMENT OF ELECTRICITY SUPPLY.

III.—PUBLICITY METHODS.

UNDER this heading it is proposed to deal with measures for effectively placing before the general public the advantages and latest applications of electricity. There is no intention of considering methods whereby the doings of any particular individuals may be chronicled in the technical Press, or certain undertakings placed prominently before the industry generally ; such objects may be attained by big drum tactics not within the scope of this article. However sweet the uses of self-advertisement, little benefit accrues to the industry at large, and it behoves all whose connection with electricity supply is of moment to work together wholeheartedly and loyally for development on broad lines.

In spite of the fact that many undertakings have been in operation for upwards of 20 years, there still exists on the part of the general public stupendous ignorance and monumental misconception of the ordinary commercial uses of electricity, and the removal of these obstructions to progress must now be seriously taken in hand. It is still the rule rather than the exception, for the average non-consumer to regard electricity as necessarily expensive and the service unreliable. The basis of such an opinion is of course sheer ignorance, which must be dispelled by real spade work.

Another point which must be driven home to laymen is that electricity in addition to not being a luxury, must be regarded as an every-day necessity on the grounds of economy, health and saving of labour, and that it can be operated more easily and safely than other systems with which, owing to long acquaintance, they are thoroughly familiar. The investing of electricity supply with the mysterious may add to the importance of junior members of staffs, but it has a serious retarding effect on progress.

Lack of expansion may also be attributed to the attitude adopted in some quarters whereby electricity supply undertakings have been regarded as the monopoly of professional men who, by strict observance of the rules of hide-bound etiquette and tradition, have preserved their escutcheon unsullied by cold-blooded commercialism. Such an academic attitude is quite appropriate in the case of the occupant of a professorial chair at a university, but in the business world the position is untenable.

In considering the elimination of the reactionary and obsolete methods which have hitherto been in vogue, it is quite possible that susceptibilities may be wounded, but it will certainly be to the ultimate advantage of the industry thoroughly to adjust various myopic and astigmatic defects previously existing in administrative vision, so that the position may be viewed in true perspective.

Throughout the business world, which does not up to the present appear to have included the electricity supply industry, strenuous efforts are devoted to obtaining and retaining the interest of the purchasing public, and the co-operation of specialists who can materially assist in achieving those objects is eagerly sought, and suitably acknowledged, as it is recognised that their efforts have a distinct influence in augmenting financial returns. As the mountain exemplified in the general public has not evinced any particularly keen inclination to approach the electrical Mahomet, it is now necessary for Mahomet to take the quickest and most direct route to the mountain.

It may be that the criticism expressed will be considered in many quarters as too caustic, and tending to exaggerate the gravity of the situation, but no useful purpose can be served by continuing to live in a fool's paradise, or, ostrich like, persuading ourselves that disaster may be averted by inserting the head in the sand of nonchalance. Disquieting symptoms may continue to be ignored for a little while, but if the circulation of the blood of the industry is to be permanently aroused from its stagnant condition, remedies, however unpalatable, must be applied for the benefit of the whole body.

Most undertakings have in the past been able to proudly draw attention to a normal annual increase in connections and revenue, and have regarded such returns with great self-satisfaction, conscientiously believing that all that was possible had been done to develop business. Without wishing to belittle such achievements, it must, however, be conceded that for many years new customers belonged to the upper classes, to whom the expense of installation was not of serious consequence, and who would in any case use electricity as it became the vogue. Supply authorities have, therefore, been content in the knowledge that supply had been given to light the largest and wealthiest establishments within their territory, maintaining stolid indifference to the enormous possibilities of business in the lower strata of society. The lower middle, and even humbler, classes provide the bulk of the revenue for wideawake gas companies, and as electricity supply authorities have practically skimmed off the cream of the business in nearly every instance, whatever further progress is made must be largely in connection with the smaller consumer. This latter problem, however, cannot be tackled without thorough organisation, which has up to the present been non-existent. There still exists a great field for further use of current for power purposes, and in regard to heating and cooking, very little of value has been attempted.

With so much to strive for, in the face of strenuous competition, the futility of further somnolence must be apparent. Treating the prospective consumer with indifference and platitude will not meet the case, and sound publicity schemes must be established. Efforts must be made, and not of the hesitating, intermittent or spasmodic order, and the organisation of the business-getting machinery must ensure that all parts work smoothly and in unison. In the first place, it is necessary to arrest the attention of the public, and, having done so, to proceed to interest them. When the intelligent interest has been obtained, demonstration and facts in support of the claims of electricity should be given. In this sequence the activities of publicity departments should ultimately result in increase of business. Consideration of the equipment of the department whereby the foregoing object may be achieved, might be now given. The main weapon in the armoury should be advertisements, Press notices, literary matter, canvassing, and demonstration, which might be amplified or supported by other means according to special circumstances or requirements.

Advertisements.—Advertising announcements are recognised media for attracting general attention, and may take the form of posters on hoardings, Press advertisements, &c. The subject matter for these should always be drawn up in good taste, and preferably in simple and telling form. These announcements should also be devoid of irrelevant or contentious details, and if reference to competitors must be made, remarks of an offensive nature should be avoided, as abuse cannot be regarded as sound argument. Discrimination should be exercised in respect to the publication of advertisements, particularly with due regard to the season of the year, special local circumstances, and the system under which such announcements will be followed up.

Permanent notices might also be fixed on street lamp standards, public conveniences, and tramcars where suitable arrangements can conveniently be made, and as is already the practice in many districts, on prominent buildings in course of construction. Jointers' trucks and all vehicles in use by supply authorities might also be pressed into the service, and no doubt many other opportunities will occur as a result of local conditions.

Press Notices.—It should not be a matter of great difficulty to enlist the good offices of the local Press, more especially if the advertisement columns of the newspapers in question are judiciously supported. Editors often find a bright, well-written article acceptable, and it is quite possible to describe suitably the various uses of electricity in such a way as to make the article of general interest. Special local installations might be written up, more particularly where buildings are ancient or have special local interest. Reports of the opening of new business premises or public buildings present an opportunity for some mention of electricity, and an occasional paragraph describing novel inventions or improvements might also find favour.

Literature.—The contention may be raised that the industry is already burdened with a surfeit of literature. In a sense this is correct, as a large amount of printers' ink has been applied to an immense area of paper, and disposed of with no very appreciable benefit. The great mistake has been made of persistently generalising. It must be distinctly and prominently borne in mind that the greater part of the field now available for activity is composed of that section of the community to whom the question of cost is all-important, and however desirable, convenient, &c., the service of electricity is stated to be in grandiloquent pamphlets and circulars, little headway will be made unless it is possible to obtain an intelligent conception of the cost of operation. Thoroughly acquainted with the performance of older methods, the cost of which is within their means, such people cannot afford to incur unknown expense, and therefore require some more convincing information than a coloured picture and laudatory letterpress in general terms. Such literature is useful up to a point for introductory purposes, but beyond that something is required with a bite in it.

The gradation of literature also requires attention. To send to the occupant of a £25 or £30 house a pamphlet illustrated with views of rooms in a wealthy establishment replete with every evidence of luxury is absurd, and tends to sustain the deep rooted impression that electricity is intended for the service of the rich only. Similarly it would be almost equally inappropriate to send to the owner of a lordly mansion details of the equipment of a small artisan's dwelling.

Testimonials from satisfied consumers carry great weight, and the embodiment of a selection in pamphlets, &c., has a very convincing effect. In regard to power, a few illustrations and costs of local installations would be more effective than comic pictures by even eminent artists. Broadcast and indiscriminate distribution of literature is really of little avail, and amounts to extravagance. Literary matter should be carefully compiled, or judiciously selected, and the distribution should be systematic and timely.

Canvassing.—This little understood, but what might be eminently efficient, branch of the service should receive really serious attention. At present canvassing operations are not universal, and where employed are in many cases not properly organised. The canvasser is regarded generally as a tout, and little interest is taken in his welfare. As long as his returns are maintained, his qualifications and methods of obtaining business are not inquired into too closely, but should returns fall, whether from causes beyond his control or not, his services are dispensed with. The influence which a good canvassing staff can bring to bear on the fortunes of an electric supply undertaking is great, but until this fact is generally realised, and the occupation placed on a more dignified footing, the right class of men will not be attracted to the service.

Men of good education and address, with a sound practical knowledge of installation details are required, and should be regarded as responsible representatives of publicity departments. It is essential to success that members of the canvassing staffs should be accorded a good reception by prospective consumers, and they should be in a position to handle business on behalf of their department. Although the ranks of canvassers are stiffened by a leaven of qualified men at the present time, a large percentage are men totally unfitted for the work. Indifferent clerks and nonentities are at present endeavouring to cope with requirements with small success, and to the detriment of the industry.

The labours of an efficient canvassing staff should receive the systematic assistance of literary and Press work, and energy should not be wasted in disjointed operations. It is disheartening for a man to feel that he has no backing, and is expected to wait on doorsteps until applications are signed, and to go to the length of inserting his foot between the door and its frame when an attempt is made to stem the flow of his eloquence. It is radically wrong to compel him to make himself an unmitigated nuisance in order to obtain business. Misrepresentation of facts is also condoned should an application be thereby obtained, and on receipt of complaints from the subsequent consumer, apologies are offered from headquarters, pointing out that the man is "only a canvasser." This state of affairs must be remedied with the advent of the broader policy, and serious consideration given to the proper training of the canvasser.

Demonstration.—The value of efficient demonstration should, by this time, be universally admitted and recognised by the electricity supply industry, and should be conducted either by means of periodical exhibitions or permanent showrooms. The course to be adopted would be governed, to a great extent, by local circumstances; but if possible to establish it, the showroom is more valuable. In either case, efficient attendants should be engaged, and the duplication of exhibits should be avoided. It should also be distinctly understood that pyramids of distribution boards, switches, lampholders, &c., are uninteresting, and that only useful apparatus should be shown, and that in actual operation.

In the case of a periodical exhibition, attention should be carefully given to the inclusion of all details calculated to enhance the comfort and interest of visitors. Cookery demonstrations and lectures are always an attraction, and lectures on other operations might also be included, possibly illustrated with lantern slides or moving pictures. Press announcements and advertisements should appear well in advance, and during the exhibition a great amount of information should be collected for following-up purposes.

The establishment of the permanent showroom requires even more careful consideration. The furnishing and equipment should be carried out, if possible, on distinctive lines. The interior should be of inviting appearance, and examples of the latest type of apparatus should be obtained for demonstration purposes as soon as available. The staff should be selected with care and fully qualified to deal thoroughly with the various types of humanity which will favour the showrooms with visits. Well-chosen announcements and a selection of apparatus may be shown in the window front if this exists, but the wisdom of window demonstrations is uncertain, as they often result in the attraction of street urchins, who may crowd round for hours at a time and obstruct the view of the potential consumer. The showroom should preferably be located at the headquarters of the Publicity Department and thus render the organisation as efficient as possible.

The remarks under the foregoing headings do no more than treat the subject superficially, as it is quite impossible to deal with the matter exhaustively within the scope of a short article. It is, however, probable that the case has been sufficiently stated to cause those responsible for the destinies of electricity departments to consider seriously the question of publicity organisation.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Official Balance.

Referring to "Representative's" letter *re* the abovenamed article, the writer feels that a few remarks in reply will not be amiss.

The airy way in which "Representative" refers to the article as likely to afford amusing reading, conclusively proves that he fails to realise what the job in question entailed. Just a damp motor requiring drying out. How very simple! Had this been as simple as it sounds the article would never have been written.

The writer cannot quite see what leads "Representative" to think that it was the writer's first experience of ship work. The writer has had 16 years of it, three of mercantile and 13 of Admiralty work, during which time he has had through his hands electric gear for 45 of H.M. ships—not a bad experience. "Representative's" suggestions *re* packing, receiving, and getting gear under cover, &c., are, no doubt, well meant, but the writer is quite alive to the need and duly takes all the precautions.

"Representative's" remark that it is not his experience that compartments are regularly water-tested with motors in place is somewhat beside the mark. The writer never suggested that it was a regular custom. The case the writer had in mind was not due to anyone's negligence, but to a misunderstanding. The writer's reference to this and the possible damage due to exposure, reckless workmen, &c., did not necessarily mean that his troubles were due to any of these causes, but were rather illustrative of the treatment which electrical gear is liable to be subjected to.

"Representative's" suggestion *re* wrapping vital parts of motors in watertight cloth would be useless to prevent damp getting into the windings. The writer's experience carries him back to when all motors and controllers were fitted in absolutely watertight cases, but the damp got in all the same.

What made the test in question unique in its difficulty was a combination of circumstances and adverse conditions never before met with, by the writer, all together on one ship.

The writer hesitates to believe that "Representative" is one of that type of critic who can always surmount other people's difficulties so easily—after they are all over.

A.M.I.E.E.
(The writer of the article.)

Patents and Inventions.

I have only just noticed the letter of your contributor on this subject: and I agree that, if the statement which he quotes is taken away from its context, it does become rather "startling." But the clause in my address which follows the sentence that he quotes makes it, I think, clear that what was in my mind was that legislation was required which would give the employé the right to take out the patent in his own name, subject to its not falling under any of the three disqualifications alluded to; and that it should be unlawful for the employer to use his position to compel the employé to give up his invention without any regard to its subject matter, or how he arrived at the idea.

I have not, at the moment of writing, a copy of your paper by me; I do not know whether the paragraph to which I allude appeared in it, and, therefore, enclose herewith a copy of my address, in case your contributor was writing under a misapprehension.

A. M. Taylor.

King's Heath, *November 26th*, 1912.

[The explanatory paragraph to which Mr. Taylor refers reads as follows:—

> The question as to whether the employé got the idea from his employer, or whether he obtained the knowledge necessary for him to make the invention while in his employer's service, or whether his daily work was such as to necessarily provide him with the materials for the invention—all these should be left to an independent arbitrator (say, for instance, the President of the Institution of Electrical Engineers), before it is even conceded that his employer has any right to the first refusal of the employé's invention.

This paragraph did not appear in our abstract.—Eds. E.R.]

Electricity Supply Publicity.

Much dipping of the pen has been indulged in during the last year by people anxious to show how electric supply undertakings ought to be run, betraying at the same time, much ignorance of essential conditions. The writer of the article in yours of the 22nd inst., sheep like, trots out a little cheap sarcasm at the Joint Publicity Committee. This Committee, established under the able chairmanship of Mr. H. B. Renwick, drew up a complete scheme of organisation, but difficulties prevented more than one or two sections being started. The production of pamphlets, however, has been on a large scale, and from my actual experience of the use of such, has brought considerable increase of business.

The other sections of the scheme require liberal subscriptions, not only from supply authorities, but from manufacturers. The manufacturers have not yet realised their responsibilities.

The municipal electric supply authorities in London are prevented from assisting by Government auditors, leaving only London companies and provincial municipal authorities to provide the money.

As in any general scheme of advertising the London authorities would benefit without sharing in the expense, a little consideration should show that the efforts of the Joint Publicity Committee to formulate and get in working the complete scheme is not easy.

It will be time enough to criticise the Committee when, having first provided them with sufficient funds, they fail to give value for the money subscribed. At the present time, the Committee are expected to spend large sums on advertising, and to do many things that can only be carried out when a proper technical staff is at command, but every critic coolly ignores the question of how this is to be done without money.

The gas interests have been driven to combine by realisation that they are fighting for existence, but the electrical supply people, with business increasing all the time, have not the same incentive to combination.

Alex. C. Cramb,
Manager.

Electricity Works, Croydon.
November 26th, 1912.

The Institution of Electrical Engineers.

I have been reading in your "Correspondence" columns lately about the wages paid to submen. We know that some of the richest companies in the United Kingdom pay their submen something scandalous. For instance, in a sub-station belonging to a certain traction company I know some "engineers-in-charge" (save the mark!) who are paid the stupendous salary of five shillings a week, yet all the responsibility of the station is on their shoulders.

Your correspondent, "Booster," in his article, November 29th, says: "I do not say that we should be paid large salaries, but what I do say is, that we should at least get a tradesman's wages. . . ." I do not agree with "Booster" there; I say that a sub-station attendant should get a decent salary. Remember his education, training and apprenticeship. Is the electrical business not a profession of its own? If so, why not keep it above the level of the ordinary tradesman? Yet we have submen who are expected to live, clothe, study and keep themselves respectable on 5s. per week. I suppose in a few more years the yard men or the general labourers about the stations will be expected to "take charge" in their spare time.

Why not form an association at once, and put this sweating down for good? Practically every business has an organisation or society, except the electrical business. No doubt we have an Institution of Electrical Engineers, but what good is that to the sub-station attendant?

For goodness' sake, let an Association be started at once. I, personally, would be only too glad to act in any way that would help to form one.

Motor-Generator.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The G.E.C. "Just-for-Two" Cooker.

The latest type of cooker placed on the market by the General Electric Co., Ltd., is appropriately named the "Just-for-Two." This appliance boils, broils, fries and toasts: it cooks above and below the heating element, and will make two slices of toast above and two slices below at the same time. Should more heat be required above, a shallow dish, which is provided for the purpose, can be inserted into the grooves underneath, its polished surface reflecting the heat upwards. Similarly, the heat can be thrown downwards. A deep pan is provided for frying, grilling, &c. The heating wires are protected by a guard. The dimensions of the cooker are $8\frac{1}{4} \times 4\frac{1}{2} \times 3\frac{1}{2}$ in.; it consumes only 600 watts. The parts are nickel-plated, and are supplied complete with flexible and adapter.

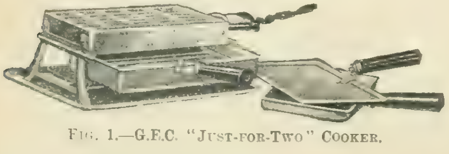

Fig. 1.—G.E.C. "Just-for-Two" Cooker.

Feed Regulator for Coal-Cutter.

The Diamond Coal-Cutter Co., of Stannard Works, Wakefield, have applied to their machines the "Crossland" patent automatic feed regulator, which controls the forward travel of the cutter. The arrangement is shown in fig. 2, where A is a solenoid in series with the armature of the motor, which, when a predetermined current is exceeded, draws in the plunger C against the weight B and auxiliary spring D; this action lifts the pawl attached to E, and prevents the feed from taking place until the current falls below the limiting value, when the pawl is released. Overloads often occur through extra hard material being met with, the picks becoming blunt, or the machine being fed too rapidly, and the use of the automatic device prevents damage to the machine on such occasions, while allowing the cutter to advance the moment the difficulty is overcome. The device is applicable to both D.C. and A.C. machines, and is said to have given very satisfactory results in practice, the gate-end fuses, which formerly blew frequently during every shift, requiring renewal only at intervals of weeks, and armature breakdowns being reduced 70 per cent.

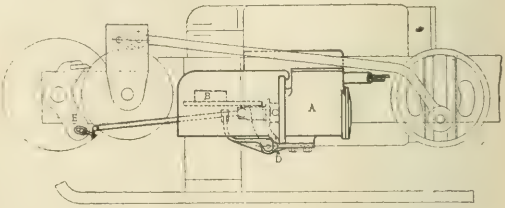

Fig. 2.—Crossland Regulator on Diamond Coal-Cutter.

The "Magnet" Iron in a Xmas Box.

In order to make the "Magnet" electric iron appeal more definitely to those who wish to give a Christmas or New Year gift, the General Electric Co., Ltd., have prepared a compact electric ironing set packed in a dainty coloured box. The set includes a "Magnet" iron, length of flexible wire, electric lampholder, adapter plug and a special cleaner and polisher by the use of which the high polish of nickel plate may be kept unimpaired. These are packed in a triangular-shaped box, the apex of which is flattened. The box opens diagonally, and the cover is secured by a nickel-plated snap clasp. It is a box worth keeping, the kind that might serve a variety of purposes in a household if not required to hold the iron: and it would look well in a Christmas window and draw inquiries.

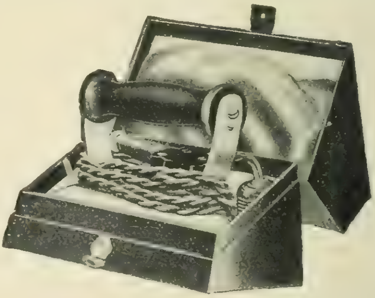

Fig. 3.—The "Magnet" Iron in Box.

Electric Tea.

The Afternoon Tea Cabinet Co., of Birkbeck Chambers, High Holborn, have devised a neat cabinet, fitted with a kettle on an electric heater, six cups and saucers, spoons, and all other necessaries, which is lent by the company to subscribers, and is kept supplied by them with tea, sugar, milk, and biscuits at a moderate charge. In the bottom of the cabinet is a receptacle containing a clothes brush, hair brush and comb, nail brush, hat brush, a set of boot brushes, polish, and polishing cloth.

B.T.H. Table Grill.

The British Thomson-Houston Co., Ltd., Rugby, have recently placed on the market a neat nickelled table stove, under the name of the B.T.H. Radiant Electric Table Grill, which can be used to grill, broil, toast, stew, or fry, and is especially suitable for the breakfast table. The cost of operation is about 2½d. an hour, with energy at 4d. per unit, the consumption being 600 watts.

The heating element is contained in the upper portion of the stove, which is attached to the stand by a divisible hinge, and can be lifted to place the food underneath it on the grid. The heater consists of a spiral of calorite wire, supported on heat-resisting insulators and protected by a nickel-plated screen of expanded metal. The calorite wire, we understand, melts at 2,800° F., and resists oxidation up to a very high temperature. There are two pans with the grill, for frying and boiling, the former serving also as a lid for the latter. The heater can be immersed in water for cleansing without injury.

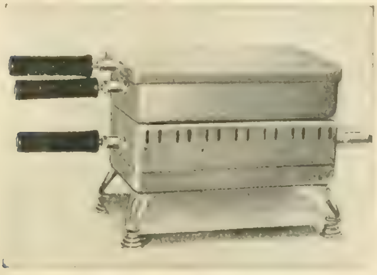

Fig. 4. B.T.H. Radiant Electric Grill.

B.T.H. Luminous Radiators.

In addition to the wide range of non-luminous heaters made by the British Thomson-Houston Co., Ltd., the company are now supplying from Mazda House, 77, Upper Thames Street, lamp radiators in a number of patterns. In all these radiators the framework is of hand-beaten art metal, with, in some cases, the additional embellishment of pottery and enamel ornaments. The radiators are supplied completely wired, with B.T.H.-Edison radiator lamps, holders and flexible cord. The company have issued a folder which illustrates and gives prices of six patterns of luminous radiators and lamps.

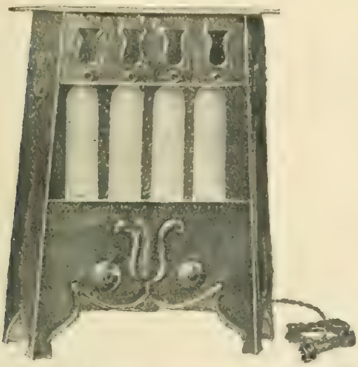

Fig. 5.—B.T.H. Luminous Radiator.

New Microscopical Lamp.

Prof. E. E. Roberts, of Cardiff, recently designed a lamp especially adapted to microscopic examinations, of which the General Electric Co., Ltd., has undertaken the manufacture. The brass foot is heavily weighted and covered with baize underneath; the upright portion is brass tubing, bent to accommodate the lamp itself, and at the top is a knuckle joint by which the lamp can be adjusted to any required angle. The parabolic shade is of nickel-plated metal. The source of light is an Osram lamp, frosted below. The appearance of the lamp is shown in the accompanying illustration, Fig. 6.

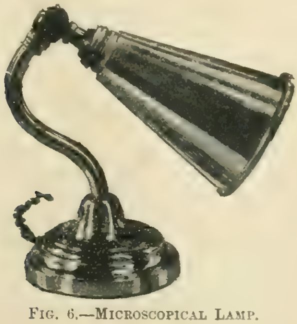

Fig. 6.—Microscopical Lamp.

The B.T.H. Tungstolier.

Following on the lines of the "Mazdalier," which we recently illustrated, the British Thomson-Houston Co., Ltd., has brought out a fitting styled the "Tungstolier," which is similarly supplied packed in a carton, and is ready wired with holders and galleries attached, so that it can be quickly built up into a complete fitting; it may have two, three, four or six arms, and there are five designs of bottom shell, with canopies to suit, and two bodies. With these parts a great variety of fittings can be built up, while the stock comprises only 18 different parts, all of which are standardised. The "Tungstolier" is a more handsome and substantial type than the "Mazdalier," which is intended to cover the purely utilitarian field.

LEGAL.

Hull Corporation v. Stickney.

On November 28th a case, in which great public interest was centered, was heard at Hull, where Mr. Walter Herbert Stickney, surveyor and valuer, was charged with contravening the by-laws of the Corporation by alighting from the driver's end of a tramcar at a terminus. Mr. Platts prosecuted on behalf of the Corporation, and Mr. H. S. Cantley, M.P., barrister, defended.

It was alleged that the defendant had contravened the by-law stipulating that "every passenger shall enter or mount upon, or depart from, or get off a car by the hindermost, or conductor's platform, and not otherwise." Against this it was urged that the by-law was contrary to the Board of Trade Regulations, which states that "the entrance to, and exit from, the carriage shall be from the hindermost—or conductor's platform—except at a terminus, when the carriages are stationary." The defendant was fined 15s. (in absence) at the Court in July last, and, being convinced that the by-law could not be legally upheld, he resolved to have a test case.

Mr. McCombe, the tramway manager, replying to the Stipendiary, said the hindermost end for passengers getting on was the end nearest Beverley, and the hindermost end for getting off was the end nearest Hull. He confessed that it depended on the interpretation of the passenger.

Several drivers and conductors gave evidence to the effect that Mr. Stickney committed the alleged offence of getting off at the wrong end of the car nine times. On one occasion the driver prevented him by running the car into the depôt.

Mr. Carthey held that the Board of Trade regulations superseded the Corporation by-laws, and that if there was any conflict between them the Board of Trade regulations must prevail.

Mr. Platts pointed out that the Corporation by-laws were in existence before those of the Board of Trade, and he argued that the Board of Trade by-law referred to the cars in transit, while the Corporation by-law regulated the entering and exit of passengers at the termini.

The Stipendiary (Mr. J. G. Hay Halkett) said he had decided to dismiss the summonses. He was of opinion that the Corporation by-law was in conflict with the Board of Trade by-law which ought to prevail. It should be clearly understood that this was an entirely new point, and was not raised in that Court when the defendant was last before him. On the arguments he had heard he was of opinion that the by-law was not good. The uncertainty arose the moment a car drew up at the terminus, for who could decide the psychological moment at which a driver's platform became a conductor's platform? After some discussion, he allowed the defendant 10 guineas costs.

Price v. Sylverlyte (1909), Ltd.

In the King's Bench Division on November 27th, an action was heard before Mr. Justice Avery and a common jury, brought by Mr. Sidney Leopold Price, trading as the Electric Battery Co., of High Holborn, against Sylverlyte (1909), Ltd., of Sise Lane, Queen Victoria Street, E.C. Plaintiff claimed for the price of goods sold by him to the defendant company, or, in the alternative, for damages for breach of five contracts to purchase from the plaintiff some 600 electrical accumulators. Of that quantity, something less than half were accepted and paid for by the defendants, who had refused to accept delivery of the balance. Defendants denied that they made any of the contracts, and said that it was a term of the contract that they should only accept delivery of the goods when they required them. Further, in regard to the second contract, that was made in substitution for the first contract.

Mr. T. Hollis Walker, K.C., and Mr. Woodgate appeared for the plaintiff, and Mr. R. J. Willis for the defendant.

Mr. Walker, opening the case, said Mr. Price, the plaintiff, was a maker of electrical accumulators and other similar motor accessories. The defendant company was formed in 1909, and were successors, he believed, to a company of the same name, who carried on the same kind of business. They were motor-lamp makers and carried on their business in Great Portland Street, but had a registered office in Sise Lane, Queen Victoria Street. The action arose out of several orders to supply electric accumulators of various sizes. In all, 600 accumulators were ordered by the defendant company; 285 of them had been taken, but 315 defendants had not taken. The action, as originally framed, had a two-fold purpose — first, to recover the balance of the purchase price of the 285 accumulators that had been taken, but not wholly paid for; and, secondly, to recover damages in respect of the fact that the remaining 315 had not been taken at all. But as regards the 285, the jury would not be troubled with them, because the claim in respect of them was admitted, and all issues on that point were cleared out of the action. In regard to the 315 accumulators, there were five orders relating to them. Although, explained Counsel, in the first instance each of the orders were verbally negotiated between plaintiff or his manager, Mr. Gregory, and the defendant company, it was not necessary to go into that, because in every instance the order was reduced into writing. The first order was on October 28th, 1909, for 250 accumulators at 13s. 6d. each, of which only 61 had been taken; the second order was on November 2nd, 1909, for 200 accumulators at £3 7s. each, of which 116 had been taken; the third order was on May 3rd, 1910, for 50 accumulators at £4 10s., of which 46 were taken; the fourth order was on September, 1910, for 50 at £1 17s. each, of which 39 were taken; the fifth order was on December, 1910, for 50 accummulators at £2 16s. 6d. each, of which 23 only were taken. Plaintiff's case was that delivery should have been taken within a reasonable time, but the precise dates of delivery and quantities, of course, depended on one's requirements. What was said here, was that long periods had elapsed, and that defendants had exceeded the bounds of all reason, and had allowed more than a reasonable time to elapse before taking delivery. In the manufacture of these accumulators, there were certain electric battery cells which required a particular amount of adjustment. What the plaintiff did as soon as he got the order was to at once set about obtaining the materials with which these accumulators would ultimately be made He had the cells prepared, and the only thing he did not do was to have the various parts assembled, so as to make the complete accumulator. The reason he did not do that was because it was harmful to set up an accumulator, and then leave it for months before it was going to be used. There was also the question of the position of the terminals which the defendant company was in the habit of giving instructions about. These materials were not for ordinary accumulators, except in the case of one contract. They were all of a special kind, and required teak boxes of a special size and make. A special kind of cell was also required, with the result that if they were not taken by the defendant company, they were practically lying useless in the plaintiff's hands.

On November 28th, when the case was called on, Mr. Walker said he had to ask his Lordship to give judgment for the plaintiff by consent for £200 and costs. The undelivered goods would remain the property of the plaintiff, that was to the exclusion of the balance of goods sold. In regard to the outstanding balance of the goods actually delivered, there was £30 due which had been paid into Court. He asked that that amount might be paid out. This was agreed to, the verdict of the jury being taken by consent, in accordance with the above terms.

The Telephone Arbitration.

(*Continued from page* 868.)

Sir A. Cripps, during the course of further arguments, said that no doubt the Postmaster-General had discovered some defects in the armour of the company. The hearing of the case had extended over 63 days and involved a claim of 20 millions, so that it would have been extraordinary if some defects had not been found. At the proper time, however, he would be prepared to admit the extent of the defects and remedy them. Continuing, he said the balance-sheet of the company taken at the time of its being taken over showed a capital cost of £15,677,810. From that he agreed that there should be deducted £1,816,988 expended on patents and good-will, and therefore not attributable to the cost of the plant. That deduction left £13,860,822 as the capital cost in the balance-sheet, leaving out of account the large sums which had been spent out of revenue and which were properly attributable to capital expenditure. The Solicitor-General had contended that the charges for depreciation, amounting to somewhere about five millions, ought to be deducted from that amount, but he thought that was a fallacious argument. There could be no proper deduction from that capital cost shown on the balance-sheet, on account of depreciation, because there really was no depreciation. During every year of the existence of the plant, money was spent on renewals and repairs sufficient to keep the value of the plant up to its original cost. That was, he said, a system of accounting which prevailed in practically every railway in the country. It was a system which was criticised by Americans as not showing the true value of the assets. Unquestionably, however, it was the practice in this country. To the 13 millions odd shown in the balance-sheet of the company as capital cost there should be added over £2,300,000, which had actually been spent out of revenue and ought to have been, but was not charged to capital. That figure shown in the balance-sheet the Solicitor-General had chosen as a check upon the claim of the company. It could not be properly employed as a check, because the cost that did happen and the cost that would happen were not alike. In the balance-sheet there was shown only expenditure necessary to keep the value of the plant alone up to its original cost. The claim of the company, exclusive of land and buildings, amounted roughly to 18½ millions, and the Solicitor-General sought to compare the £13,000,000 odd of the balance with it, but it was obvious that there were included many things that could not be included in a balance-sheet. The claim of 18½ millions was made upon the basis of the cost of reconstruction of the system on the usual tramway terms. In that, of course, there were included interest on capital during construction, contractors' profits, and other items, which in the aggregate amounted to about three millions, so that even the check proposed by the Solicitor-General went to strengthen the case of the company.

When the Court resumed, after the adjournment, Sir A. Cripps said that the parties had been able to agree on several very important items of the claim. It had been agreed that the materials, less wastage, should stand at £6,963,383. With regard to freight, cartage, &c., they had also arrived at an agreed figure, and these with the sums for materials, less wastage, now amounted to a total of £10,239,345, as against £10,313,000 originally claimed. Continuing, the learned counsel suggested that if the Court would allow the Attorney-General and himself to discuss privately with the Commissioners certain matters, the length of the subsequent proceedings would in all probability be curtailed.

Mr. Justice A. T. Lawrence said the Court would endeavour to make the arrangement suggested.

Sir Alfred Cripps, in continuing his argument on behalf of the company, dealt with the cost to the company for supervision, which he submitted they were entitled to claim for.

Sir James Woodhouse observed that the cost of supervision estimated by the company from their own experience, included a sum for supervision on maintenance as well as supervision during construction, and that the contention of the Post Office was that the cost of supervision of maintenance and repairs was much higher than of construction.

Sir Alfred pointed out that the company based their claim upon charges accruing in a composite year, arrived at by averaging the expenditure of a number of years over their own system. The Post Office, on the other hand, based their valuation upon an estimate for reconstruction of the whole system in a given time.

Sir James Woodhouse said the contention of the Post Office was that the cost of supervision during maintenance and repairs was three times as great relatively to the cost of labour during construction.

Sir Alfred Cripps said if the inference drawn from the fact that the cost of supervision to labour in some particular case of maintenance was greater than in construction, it was a nonsequetor. His information was that taken over all, one thing equalled another, and that therefore the company were justified in including maintenance as well as construction in making up the expenditure in the composite year on which their claim was based.

(*To be continued.*)

Gery *v.* Day Motor Co.

In the High Courts, on Monday, the Official Referee, Mr. Muir Mackenzie, gave judgment in the action of Gery *v.* Day, in which Mr. A. R. Orton Gery, of Royston Court, Ferryside, Carmarthen, sued the Day Motor Co., of Putney, for damages for an alleged breach of contract for supplying him with an electrical generating plant for the purpose of lighting his house with electricity. It was contended by the plaintiff that the plant in question was not up to specification, and was not in accordance with the contract. He submitted that he was therefore entitled to reject it, and he claimed a sum of £52 8s., the amount paid on the plant, and a further sum of £47 6s., moneys, he said, he had spent in consequence of the defective condition of the plant. Defendants, on the other hand, denied that the plant was defective and counterclaimed for a balance due on the contract price.

In giving judgment, the Official Referee outlined the facts of the case and said that among the defences put in was one that the plant was not sold to the plaintiff but to a Mr. Brown, an electrical engineer, and that plaintiff could not maintain an action. On this point he found that as between Mr. Brown and plaintiff there were relations of principal and agent, and that plaintiff was the buyer through Mr. Brown. Continuing, the Referee said he was of opinion that the plaintiff had failed to prove that the generating plant was defective, or that it did not comply with the specification. It was supplied for lighting the house through the batteries. Defendants would, therefore, be entitled to judgment on the claim and on the counterclaim. In respect to the latter he awarded them a sum of £32 5s. 2d. The costs would be defendants' except as to one or two small issues on which they had failed. He gave liberty to either party to apply.

The Bradford Strike Prosecution.

At the Bradford City Police Court, on Thursday last week, the Stipendiary Magistrate (Mr. H. W. W. Wilberforce) delivered judgment in the case brought by Arthur Arrowsmith, of Leeds, against Lionel Barker and Atkinson Pinder, of Bradford, for persistently following him from place to place without legal authority in connnection with the electricians' dispute at Bradford.

Mr. Alex. Neill, who appeared to prosecute, said that since the case was last before the Bench, electric cables had been cut at places where men who were not on strike were working. They could not find out who did the damage, but it had been done, and there could be nobody else capable of doing it except workmen employed in the same trade. He might say that the cables had been cut in a very expert and skilful manner.

The Stipendiary Magistrate said he could not take any action on that matter. He reviewed the evidence which had been adduced at the previous hearing (see Electrical Review, page 830, November 22nd), and said that one factor which had to be borne in mind was that the witness Horsfall, who had been working with Arrowsmith previous to November 25th, on which day the persistent following took place, appeared to be so frightened with his experience that evening that he had left work the following day. That seemed to him to prove that the persistent following and argument was not done in an innocent manner. There was no evidence that the defendants only took a silent part in the discussions on the tramcar. The handbills which had been distributed, though couched in rather unhappy terms, did not contain anything of a bad character. During the hearing it had been suggested that the action was an act of revenge on the part of the police for some complaint which had been made against a constable. There was not the slightest foundation for that suggestion, and he was sorry that the defendants' solicitor had brought such a foolish insinuation into the case. The defendants' solicitor contended that his clients were protected by a section of the Trades Disputes Act, but he (the Stipendiary Magistrate) would direct attention to another statute—the Conspiracy and Protection of Property Act, 1875, a sub-Section of which dealt with the persistent following of a person from place to place. To his mind it was perfectly clear that the section in the Trades Disputes Act which had previously been quoted, did not apply in this case. The words which had been used were innocent in their way, but the surroundings in which they were made—the booing and hooting of the crowd, the rush to the tramcar and so on—gave to them a meaning which otherwise they would have lacked. He was further strengthened in the conclusion which he had come to by the action which had been taken by the witness Horsfall. In his judgment the prosecution had proved the charge, and he would bind the defendants over to keep the peace for six months in the sum of £10 each and each would be ordered to pay three guineas costs or 14 days' imprisonment

Kelly v. A.E.G Electrical Co., Ltd.

Last week, at the Green Street Sessions, Dublin, before the Recorder, Edward Kelly, of 16, Amiens Street, sued the A.E.G. Electrical Co., Manchester, for £15 11s., for work and labour done at the request of the defendants.

It appeared from the evidence that the plaintiff, who was acting as Dublin agent for the defendants, in respect of this transaction, ordered an engine for a customer, and was to be paid by commission. The engine was sent forward, but the plaintiff alleged that the pulley was not as ordered. At his own expense, the plaintiff had the pulley altered at a cost of £15 11s. The defendant when applied to for payment, said they supplied the machine as ordered.

The Recorder, in giving judgment, said the defendant company put forward a defence which was denied, and proved to be false by their own letter. He had no doubt the machine had to be refitted in Dublin, and he would give a decree for £8.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Doubtful" writes:—"The writer is not quite clear as to the correct interpretation of Sec. 10 of Electric Lighting Act, 1909. Please be good enough to state:—(1) Whether the maximum revision referred to applies to a private lighting company supplying for public consumption. (2) (*a*) Whether the limit of five years refers to the length of time between any revision in prices when once given, or (*b*) whether five years' notice of an increase in price is necessary. Thanking you in anticipation."

*** There is no reason to be surprised at "Doubtful" being confused by Sec. 10 of the Act of 1909, because it is one of those provisions which involve legislation by reference.

As to (1), if "Doubtful" means by a "private company" a company which is supplying electricity otherwise than in accordance with a provisional order or special Act, such a body is under no control whatever in the matter of charges. Nor does it matter that the supply is given to a public body. Assuming that it (the private company) is supplying in accordance with a provisional order, it is clear that the provisions of the section apply to "supply to a corporation" as well as to "supply to an individual."

As to question (2), it is fairly plain, having regard to the words of the Act, that no notice of revision need be given.

South Africa.—At a recent meeting of the Stellenbosch (Cape Province) Council, it was decided to give notice that it was the intention of the Council to borrow £10,000 for the purpose of establishing an electric lighting and power scheme, and that the plans and specifications as prepared by Prof. Bohle be submitted to the Administrator for consideration in terms of the Electric Power Ordinance, 1911.

A special meeting of the Maitland Municipal Council has been called to discuss the question of electric lighting. The energy may be obtained from the Cape Town Council.

REVIEWS.

The Mathematical Theory of Electricity and Magnetism. By J. H. Jones, M.A., F.R.S. Second Edition. London: Cambridge University Press. Price 15s. net.

This book is for the mathematical physicist. It gives the mathematical theory of a well-defined range of electromagnetism, together with the mathematical analysis required for its treatment. The range covered is approximately that of Maxwell's original treatise, but the author claims—and justly—that while Maxwell's treatise was written for the fully-equipped mathematician, the present work is more useful to the student and to the physicist of limited mathematical attainments.

In the present edition the chapter on the electromagnetic theory of light has been largely rewritten and considerably amplified, and two new chapters appear on the Motion of Electrons and on the General Equations of the Electromagnetic Field. These last chapters—in which the author does not aim at completeness of treatment—are for the purpose of giving an introduction to the more recent developments of the subject.

A number of examples, taken mainly from the usual Cambridge examination papers, are inserted. These provide problems for the mathematical student, and they also form a sort of compendium of results for the physicist, showing what types of problem admit of exact mathematical solution.

The work opens with an introduction on the three divisions of electromagnetism, and is thereafter divided into three main sections:—(*a*) Electrostatics and current electricity; (*b*) magnetism; and (*c*) electromagnetism. It is splendidly printed and bound, and will form a valuable addition to the library of the mathematically-inclined engineer.

Fuel Economy. By Wm. H. Booth. London: S. Rentell and Co., Ltd. Price 1s. net.

An idea of how "Fuel Economy" came into being, and of what one is likely to find therein, can be obtained from the Dedication—in itself a novelty in a technical work—which Mr. Booth has placed on his title page, this being to the effect that "this small book is dedicated to my 1909-10 class of stokers at the Borough Road Polytechnic, in recognition of the attention and patience with which they supported my efforts as a lecturer." The work is certainly highly practical, and is likely to be found of value by central station engineers and electricians in charge of steam-raising plant. The lectures were given under the auspices of the London Coal Smoke Abatement Society, and, as reproduced in the present volume, should certainly further the excellent objects of that society, in that there can be no real economy of fuel where excessive smoke is produced as a result of its imperfect combustion. The volume is arranged with a view to affording an insight into the elementary chemistry of the combustion of fuels, and the means whereby the principles of chemistry can be, or are, applied to secure that combustion shall be carried on smokelessly and economically.

The author begins his task by describing the various scientific methods now used for ascertaining the calorific value of fuels, methods which have replaced the crude old way of taking a known quantity of coal and burning it under a boiler in order to show how much water it would evaporate. Two well-known types in common use—the Berthelot-Mahler calorimeter and Thompson's calorimeter—are described. The latter is probably the simpler, consisting of a metallic bell, in which the fuel is burnt in a measured quantity of water, the rise in temperature of which gives a measure of the heat value of the fuel. Natural draught and forced draught are dealt with, as well as the leakage of air through brickwork, a matter of considerable importance where perfect combustion is aimed at. Mr. Booth describes many of the various types of boilers on the market, and the best methods of working these, dealing particularly with forced draught. Somewhat out of its correct genealogical order is a section devoted to "How to light a fire." Surely it would have been better to have commenced a work on fuel economy with this, rather than to insert it one-third of the way through the book.

The use of the steam jet as an aid to fuel economy is touched upon, but in view of recent experiments in this direction, one can hardly agree with the statement that "the steam jet requires a lot of steam, so that where possible we like to avoid it." The recently introduced Caley-Robinson furnace is probably too new to have been included by Mr. Booth, but this is an example of the economical use of the steam jet, and for the rest it is quite in accordance with the author's statement that "the steam jet properly applied to a fire draught will often help to avoid smoke, and, further, it will often prove economical by enabling very inferior fuel to be used that would otherwise be useless." The author has a good opinion of the Lancashire boiler, holding that this, with a good draught, careful firing, and sufficient air admission, can be made to burn its fuel without smoke, but only so long as it has no cross tubes in the furnace, and has the customary air admission. Judging by the smoke in manufacturing places where Lancashire boilers are used, we must conclude that the author's cross-tube *bête noir* is in full vigour, assuming, of course, that the draught is requisite.

The use of the pyrometer is certainly helpful with a view to getting the best out of a furnace, hence Mr. Booth is wise in including a reference to these instruments, describing particularly the Féry electrical radiation instrument, which is very suitable for furnace work. He rightly holds that "in a few years' time we shall see more of these instruments used." The development of mechanical stokers is interestingly traced by the author, who then passes on to a consideration of fuel economisers and the question of superheat. The latter, he considers, is connected with the smoke question, because when superheaters are added to boilers, they may assist or prevent smoke by reducing the load on overworked boilers, or again, they may produce smoke if the load on the boilers, being reduced, compels such closing of the chimney damper as to spoil the draught over the fire.

The final portion of the book is devoted to a simple consideration of the physical units and chemistry necessary for a clear understanding of the subject of fuel economy, though here again this portion seems out of its correct order in the scheme of the book.—G. S. S.

BUSINESS NOTES.

Philippine Islands.—An American official publication states that "the contract for construction of an electric light and ice plant for Lucena, Tayabas, Philippine Islands, has been awarded by the Lucena Electric Light, Ice and Water Co. to E. C. McCullough and Co. at $30,000, the plant to be built upon latest improved methods, the first to be used in the Philippines in that class of construction. Besides furnishing electric lights and ice for the city, the Lucena Co. will supply the municipality with distilled water. The plant will use crude oil instead of coal, and Crocker-Wheeler generators will be installed. The construction of the electric light plant will begin at an early date, concrete poles will be used, the cross-arms will be of steel, as well as the pins, this being a new invention that will be used for the first time in the Philippine Islands. The line will include approximately 40 miles of wire to be strung throughout the town of Lucena, and 100 Philips 60-watt lamps will be installed to light the streets. The company has contracts for 3,000 incandescent lights to be installed in private houses and Government buildings, which will be increased from time to time.

Book Notices.—*The "Mechanical World" Pocket Diary* and *Electrical Pocket Diary for* 1913. Manchester: Emmott and Co., Ltd. Price 6d. each.—These old friends, growing more corpulent year by year, have been put through the usual revision; in the former, the sections on gas and oil engines and suction-gas producers have been rewritten, and a variety of alterations made, including the addition of a number of new sections; in the latter, the sections on dynamos and motors and measuring instruments have been rewritten, and new sections have been introduced dealing with magnetism, load and power factors, motor applications and control, &c. They are wonderful productions at the price.

The Indicator Handbook, Part II. By C. N. Pickworth. Manchester: Emmott & Co. Price 3s. net.—This well-known treatise is now in its fifth edition, and has been reset, besides undergoing extensive revision and enlargement. It has long occupied a place in the foremost rank of specialist handbooks, and needs no commendation at our hands.

Beginner's Guide to the Microscope. By C. E. Heath, F.R.M.S. London: Percival Marshall & Co. Price 1s. net.—The microscope is so extensively used in engineering nowadays, and is becoming so valuable an instrument in many applications, that no apology is needed for drawing attention to this admirable little introduction to one of the most fascinating pursuits imaginable. A reader who masters the instructions here given, with practice will readily acquire the skill that will enable him to use the microscope to good purpose in technical investigations.

We have received from the P. & O. Steam Navigation Co. a copy of a very interesting and useful pocket diary and almanac for 1913. Full information relating to the company's agents abroad, pleasure cruises and other services, mail dates to India, China and Australia, &c., is given in handy form, and a number of maps indicating lines of communication are published, followed by daily diary and memoranda space for 1913.

"Common Battery Telephony Simplified." By Walter Atkins. Price 3s. net. "Electrical Engineering for Mechanical and Mining Engineers." By H. J. S. Heather. Price 9s. net. London: *Electrician* Printing and Publishing Co., Ltd.

"Radioactive Substances and their Radiations." By E. Rutherford. Cambridge: University Press.

"*Journal* of the Institution of Electrical Engineers." No. 216. Vol. 49. Index to Vol. 49. London: E. & F. N. Spon, Ltd.—The issue for November, 1912, contains the following: Report of the Council for 1911-12; Annual Accounts; Condensers for Metal-Filament Lamps, by A. W. Ashton; Tariffs for Electrical Energy, by W. W. Lackie; Yellow Flame Arcs, by M. Solomon; Power Generation and Distribution in the Clyde Valley Co.'s Area, by D. A. Starr; Homopolar Generators, by E. W. Moss and J. Mould; Overhead Line Conductors, by E. V. Pannell; Auxiliary Machinery on Steamships, by E. T. Caparn; High-Voltage Testing Transformers, by R. G. Parrott; Wireless Telegraphy Transmitters, by P. R. Coursey and G. G. Dawson; The Transmission of Electrical Energy by Direct Current on the Series System, by J. S. Highfield.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 1. November, 1912. Newcastle-on-Tyne: The Institution. Price 5s.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 8. October, 1912. Chicago: The Society. Price 50 cents.

"Tait's Electrical Directory of Australia and New Zealand." 1912-13. Melbourne: *The Mining and Engineering Review.*

"Physikalische Grundlagen der Elektrotechnik." By Dr. F. F. Martens. Brunswick: Vieweg & Sohn. Price M. 8.

"Text-Book of Applied Mechanics." Vol. I. By Andrew Jamieson. 1912. London: Charles Griffin & Co., Ltd. Price 6s. net.

"*Journal* of the South African Institution of Engineers." Vol. XI, No. 4. November, 1912. Johannesburg: The Institution. Price 2s.

"Wireless Telegraphy Simply Explained." By H. T. Davidge. London: Percival Marshall & Co. Price 6d. net.

"*Journal* of the Franklin Institute." Vol. CLXXIV, No. 5. November, 1912. Philadelphia: The Institute. Price 50 cents.

"Osrams" on the Jungfrau. — Jungfraujoch, Switzerland, the highest railway station in the world (3,475 metres) has recently been equipped with Osram drawn-wire lamps. The authorities of the Jungfrau Railway, in Eigergletscher, Switzerland, have also equipped several trains (Nos. 8-10) with Osram lamps, as well as their station Eismeer.

Write-Ups.—The following editorial notes have just appeared in our American contemporary *Power*:—

"For the benefit of the reader and advertiser alike we take this occasion to declare our position with regard to publicity matter. By the latter is meant anything emanating from manufacturers, whether news, descriptive matter, test data, or what not, issued for the purpose of keeping themselves before the public.

"An editor must judge of the availability of matter from the standpoint of the subscriber. Is it the kind of matter that the readers pay for, the printing of which will satisfy them and cause them to continue their respect for and use of the paper?

"Nobody has a more up-to-date knowledge of power-plant problems than the makers of power-plant apparatus. Each is, or should be, a specialist in his own line. Access to this knowledge would be a godsend to an editor. Much of it might be printed to the advantage of the manufacturer. Most manufacturers are either so busy that they cannot stop to tell or write what they know, or are afraid it might be of some use to their competitors, and so hide their talents and those of their designers and engineers, under a 'talk-and-be-bounced' order, instead of writing themselves and letting their people write themselves, and the firm to the front as experts and specialists in their lines."

Trade Announcements.—The "Karlsbader Kaolin Industrie Gesellschaft" has changed its title to "Zettlitzer Kaolinwerke A.G.," Porzellan Fabrik, Merkelsgrun, near Karlsbad. The firm, which manufactures all kinds of porcelain insulators, is represented in the United Kingdom by Messrs. W. F. Dennis & Co., as sole agents.

Messrs. Krupka & Jacoby, Ltd., announce that from to-morrow, Saturday, all communications should be addressed to them at 26-30, Chapter Street, Westminster, S.W., where they have taken more commodious premises, and will hold a larger stock of Graetzin lamps and other electrical goods.

Messrs. Simplex Conduits, Ltd., announce that their telephone number for the sales department, publicity and purchasing departments, and general manager's office, at 113-7, Charing Cross Road, W.C., has been changed to "4327 Gerrard," three lines.

The Stereophagus Pump and Engineering Co., Ltd., of 39, Victoria Street, Westminster, S.W., have acquired from the Hon. R. C. Parsons, a right for the sale. in this country and abroad, of the Stereophagus pump patented by him. A leaflet has been received describing the Stereophagus pump as installed at the Leeds Corporation sewage purification works.

Messrs. Mavor & Coulson, Ltd., electrical engineers, Glasgow, are making an addition to their works at Broad Street, Mile End.

Consular Notes.—Palestine.—The Austrian Consul at Jerusalem reports that the importation of petroleum motors in 1911 was active, chiefly from Germany. This German trade is due chiefly to the fact that a German machine works recently established in Jerusalem represents a German motor firm, and is in a position to undertake the installation and repairs necessary. The importation of British motors has fallen off owing to the fact that a similar British machine works, which represented a British motor firm, got into difficulties and ceased operations.

Italy.—The Austrian Counsul at Milan, reporting on the condition of the Italian electrical industry, points out that the reason for the improvement witnessed in this industry is to be traced to the establishment of new central stations for the production of electrical energy from the water power available in the country in such vast quantities. The erection of these stations has resulted in the utilisation during the last 15 years of 800,000 H.P. from the various water powers. New markets for the electric current produced have been rapidly forthcoming, largely on the part of new industries, which became possible when cheap power was available. The companies supplying current have, therefore, been very favourably situated, and they have excellent prospects. There is some fear of the possibility of over-production of articles for the electrical industry, as prices have already been pressed down as far as possible. The electric lamp industry has recently been in an unfavourable position, partly owing to the difficult credit conditions, and partly to reduced export trade. The new law, which came into force in January, 1911, lowering the duty on petroleum from 24 lire to 16 lire per 100 kg., has done the electric lamp industry some harm by increasing the use of cheap petroleum lamps in the small towns, and the demand for petroleum cooking and heating apparatus. Nevertheless, electric lighting has made greater strides in Italy than in any other European country, on account of the utilisation of water power and the consequent cheapness of the electric current as supplied by the central stations, which, combined with the introduction of metal-filament lamps, has made electricity the most popular form of lighting. The 12 to 15 million lamps used in Italy annually are for the most part imported from abroad, and chiefly from Austria, Germany, Holland, France, and Switzerland; nevertheless, there are some lamp works in Italy, but they secure only about 20 per cent. of the total consumption, and that chiefly in metal-filament lamps. The ever-increasing competition and consequent price-cutting, the big outlay necessary for advertising, breakages, &c., have made profits from this branch of the industry very doubtful. The Italian demand for electric lighting materials of brass and bronze is almost wholly satisfied by the home production, the imports from abroad being for the most part confined to specialities and novelties chiefly for show purposes. Better class glassware for electric lighting is mostly supplied by Austria, and cheaper classes by Germany. Gas lighting has suffered very much by the increasing competition of electricity, but in the towns and larger villages where electricity and gas are both available, the dwellings are fitted throughout with gas, particularly for cooking purposes. Works which are engaged in the construction of steam engines and boilers, are finding the ground cut from under their feet more and more by the competition of gas and oil motors, which are frequently used as reserve force for electrical works running on water power, and which are now being supplied in increasing quantities both by firms in Italy and abroad. The leading firms engaged in steam engine construction have, therefore, taken up the construction of gas and oil motors, so that a very keen competition has now been brought about. One field which few firms have worked which is capable of development, particularly by firms abroad, is that of the supply of small motors for benzene, petroleum, &c., which has been used for some time by the agricultural industry without any wholly satisfactory type having been put on the market. The demand for pumps continues favourable, being supplied partly by the home industry and partly from abroad. It should be noted that centrifugal pumps are increasing in popularity, as they can be directly coupled to electric motors—a very important factor. Owing to decreased competition, the electric machinery and apparatus industry has enjoyed better prices, the three important groups having come to an understanding. A relatively new field has been opened up by these firms in the supply of electric locomotives, which as a result of the successful experiments made by the State Railways with electric traction on some of their lines, have had a good reception. These experiments have been taken up to pave the way for the electrification of more important lines. The installation of new electric tramways and local railways, and the electrification of existing tramways, have proceeded apace, and have kept the electrical firms well occupied. In view of the endeavours of the Italian Government to protect home industries, the large electrical companies have more and more shown a tendency to establish subcompanies in Italy for their Italian business.

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—Folder containing particulars of their combination cooking outfit. It is written in such a style as to appeal to the consumer, and is illustrated and priced. Supplies may be obtained by central station engineers and by contractors, overprinted, on application.

Messrs. Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden.—We suppose there are few subjects upon which the electrical publicity illustrator has brought his ingenuity to bear more than upon metallic-filament lamps. It used to be the great merit of economical consumption that had to be driven into the public mind. Nowadays it is the quality of strength of filament and the ability thereof to stand emergency strains. Of course, we cannot spare space to illustrate all the show-cards that reach us—there is always a great deal of matter of technical and news interest which the reader wants, waiting to be used, and copies of show-cards and catalogue covers would be more appropriate in our advertisement pages than in those set apart for literary matter. In many of the show-cards that have come before us the designer has effectively got his point home, and this remark applies to a new one just issued by Messrs. Pope's company, whereon two little imps in green are doing their best to break the filament of an "Elasta" wire lamp; but it is "British made," and *will* not give way. Trade readers who have not received copies can have them on application. also a new folder giving prices of the lamps.

The London Electrical Trading Co., Ltd., Palmerston House. Old Broad Street, London, E.C.—We have received a sample showcard illustrating the Bastian F Type heaters. These cards will be supplied to the trade or any other of the wholesale agents dealing in Bastian heating apparatus, on application.

The British Thomson-Houston Co., Ltd., Rugby. Descriptive list, No. 382, the letterpress containing a number of diagrams, concerning the B.T.-H. system of transformer protection, which system has been in satisfactory service for some years on both large and small power distribution installations; also price list, No. 386 (16 pages), containing notes on the advantage of the electric drive for printing presses, and describing (with illustrations and tabular prices and dimensional information) their printing press controllers, their construction and operation.

The Union Electric Co., Ltd., Park Street, Southwark, London, S.E.—Advance copy of their new season's list of "Excello" flame arc lamps. The list contains chiefly prices and data, and particulars of accessories, for use in conjunction with previously issued pamphlets and booklets on the same subject.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New priced leaflets, showing their "Magnet" domestic electric irons and electric kettles and the "Pygmy" food warmer. Also a Christmas leaflet, giving particulars and prices of Robertson miniature electric lamps, in assorted colours, for Christmas and New Year decorations.

The Westinghouse Cooper-Hewitt Co., Ltd, 80, York Road, King's Cross, London, N.—Interesting booklet of 16 pages, entitled "A Bar—not a point—of Light," giving information respecting their mercury-vapour lamps for photographic work—in the studio and for photo-printing, photo-engraving and cinema work. A copy of this publication is being sent, together with list No. 27, containing a brief description of the lamp and prices, to professional photographers. The company is now settled in its new premises, as above.

Economisers, Ltd., 60, Queen Victoria Street, E.C.—A well illustrated art paper pamphlet has been issued by the company dealing with its economisers (which are made at Alfreton Ironworks, Derbyshire). A complete specification, together with tabular matter relating to dimensions, heating surfaces, economies derived, &c., notes on the installation, working and inspection of the plant, and four drawings of typical economiser arrangements, are included.

Mr. Robt. W. Paul, New Southgate, London, N.—Illustrated leaflet describing the "Omega" (G. W. Harris's patent), their improved direct-reading ohmmeter combined with a hand generator of high voltage, for measuring insulation.

Messrs. Feld Bros. & Co., Ltd., 25, Budge Row, London, E.C.—Leaflet No. G1, relating to "Colonia" direct-current motors, shunt wound open protected type, of ½ to 20 H.P., giving prices, weights, dimensions and other tabulated particulars.

Dissolutions and Liquidations.—W. Watson & Sons, opticians and dealers in electrical and other apparatus, 2, Easy Row, Birmingham.—Messrs. W. Watson and A. K. Glover have dissolved partnership. Mr. Glover will attend to debts and carry on the business.

The Black Sea Telegraph Co., Ltd.—A meeting will be held at Electra House, E.C., on January 9th, 1913, to hear an account of the winding up from the liquidators (Messrs. A. R. Hardie and W. Hibberdine).

Dutch Shipping Exhibition.—In the first Dutch Shipping Exhibition, which is to be held at Amsterdam, from June to September next year, there will be an important British Section. The Exhibition will not be run for the purpose of making profits and the officials are honorary. The Prince of the Netherlands and all the Dutch Ministers of the Crown are patrons of the movement. The Exhibition grounds are on the north side of the Y Canal, opposite to the Amsterdam Railway station on the south side and, for the convenience of visitors there will be a constant service of steam and motor ferry boats between the two banks. For the British Section, a special pavilion is to be erected in a most favourable spot. H.S.H. Prince Alexander of Teck is the principal patron. Mr. W. R. Bisschop, LL.D., is the chairman of the British Executive Council. The manager of the British Section is Mr. J. Vandersteen, whose offices are in Sardinia House, Kingsway, W.C.

Bankruptcy Proceedings.—A. F. Mander (Mander Bros.), electrical engineer and cycle dealer, Birmingham.—December 14th is the last day for receipt of proofs for dividend. Mr. A. S. Culley, trustee, 191, Corporation Street, Birmingham.

Lighting Outfits for Italian Villas.—American Consul L. J. Keena, at Florence, has reported home on the opportunity for the sale of independent lighting plants. This, he says, should be much greater in the surrounding districts than in the city of Florence. "The small farmers would be little interested in any form of lighting plant, but throughout the mountains in this district are located numerous private villas, summer homes, pensions and hotels. Many of these are served by small local electric lighting companies. The ordinary charge for an electric light in a villa, as made by these local companies, is $1.60 per lamp for the season (June, July, August and September). Many of these companies use water-power from small streams, and in dry weather this source of power is apt to fail, with the result that the lighting service is interrupted. Many villas, pensions, &c., which are out of range of any electric lighting company, are lighted by private acetylene gas plants. The lighting systems and apparatus used here are of Italian manufacture. There is no local manufactory of such appliances. Those on sale in Florence came from Milan and Turin. The claim made by a Milan manufacturer is that his apparatus will operate 20-C.P. lights at a cost of 1 cent United States currency per hour for each hour"

Long-Lived Electric Kettles.—A customer recently took to the office of the Manchester branch of the General Electric Co., Ltd., a kettle for repairs, stating that this particular kettle had been purchased by him in London from a G.E.C. representative 22 years ago last March, and was used continuously for 14 years in London on a 100-volt circuit, without a breakdown. Afterwards, the owner removed to Manchester and had the kettle altered to suit the Manchester voltage of 200. It has been in daily use on Manchester circuits for the past eight years, and only now for the first time has it been necessary to have it actually repaired, *i.e.*, provided with a new element. A G.E.C. electric iron and a G.E.C. fry-pan were also purchased at the same time as the kettle above referred to, and both of these are still in use.

The British Prometheus Co., of Salop Street Works, Birmingham, have received for repair an electric kettle, which has been used for about nine years without repairs, on the circuit of the North of Scotland Electric Light and Power Co., Ltd.

These incidents—which, we understand, are by no means exceptions—speak well for the durability of this class of apparatus.

Canada.—According to the Census of Canadian Manufactures, which has lately been issued, the output of electrical appliances and supplies in the Dominion during 1910, attained a value of £3,004,368.

Backward Pernambuco.—We have already familiarised our readers with the lack of public electrical facilities in Pernambuco. Of interest in connection with the question is a recently-issued American Consular Report from that city, in which the Consul states that out of 125 automobiles in use in the city, about 40 are owned by private individuals, and the rest by the five different garages of the city. He says that, when one considers the condition of the streets, which are paved throughout with cobble stones, it is strange that there are so many!

"There are also a few automobile trucks of German manufacture, but they do not seem to endure the intense strain very well. . . . A set of tires on one of the public cars lasts about 22 days. . . .

"The greatest demand, in this city at least, is for a medium-priced car very strongly built, and provided with a serviceable hood for protection against the heavy rains as well as the sun. No public motor service outside of the city would pay at present, on account of the condition of the roads, nor will the demand be materially increased in the city until the streets are paved, which will probably be done as soon as the tracks for the new electric car system are laid. The duty on automobiles amounts to about 16 per cent. *ad valorem.*"

LIGHTING and POWER NOTES.

Accrington.—The Electricity Committee has decided that services shall be laid to the premises of Messrs. Lupton Bros. and Peel, Tootal & Co., for an estimated consumption of 20,000 and 60,000 units per annum respectively. A sub-Committee has been empowered to deal with an application from the Accrington Brick and Tile Co. for a three years' contract for the supply of 200,000 to 250,000 units per annum.

The supply of electricity by the Corporation is increasing. For the last quarter the units sold were 1,122,063, compared with 719,841 last year, showing an increase of 402,222. The units for power have gone up from 656,471 to 1,030,633; and for lighting from 63,370 to 75,062.

Argentina.—H.M. Consul at Buenos Ayres, states that a syndicate of British, French, Belgian and American bankers is reported in the Press to have formulated a scheme for the building of an electric power station at Buenos Ayres for the supply of electricity for motive power and lighting purposes at prices considerably below those at present prevailing. A concession has been applied for, which would, if granted, bring the German monopoly of the supply of electricity to an end. The proposed contract stipulates that the plant shall become the property of the Government at the end of 1957. Italian financiers are also said to be endeavouring to obtain a similar concession.

The German company, having its mains extended to every part of the capital, is naturally firmly established in the city.—*Board of Trade Journal*.

Messrs. Lambert Brothers, in Rojas, have acquired the Industrial del Oeste Electric Co. for $90,000. The new concessionaires mean to improve the system of public and private lighting.

Atherton.—The U.D.C. has decided to apply to the B. of T. for an order authorising it to supply electricity to certain property in the area of the West Houghton U.D.C.

Ayrshire.—The two-cell refuse destructor, erected for the burgh of Largs by Messrs. Heenan & Froude, was inaugurated last week by Col. C. C. Scott, of Halkshill. The company present inspected the installation under the guidance of Mr. J. A. Robertson, Greenock, who was consulting engineer in connection with the destructor. At a luncheon which followed, the contractors and engineer were congratulated on the efficiency with which they had done their work.

Bedford.—The T.C. has applied to the L.G.B. for a loan of £9,790 for additional plant at the electricity works.

Bentley-w-Arksey.—A difficulty has arisen respecting the supply of current to the district by Doncaster T.C. The U.D.C. had expressed the opinion that the proposals of Doncaster should not debar other persons from supplying current in the district, but the Doncaster town clerk has replied that if all comers are to be allowed to supply electricity in the district, it would make it hardly worth while for the Corporation to spend several thousand pounds in the extension. The U.D.C. has referred the question to the General Purposes Committee.

Bexhill.—The Chairman of the Electric Light Committee announced on Monday that since the commencement of the year applications for supply had exceeded the average of the last few years by 50 per cent.

Bispham (near Blackpool).—On the Electricity and Public Lighting Committee's recommendation, the U.D.C. has decided to apply to the L.G.B., for sanction to borrow £2,500, for the provision of additional lighting.

Blackpool.—The Corporation is to make application to the L.G.B. for sanction to borrow £6,300 for the purpose of extending the electricity mains. It was stated at a meeting of the Finance Committee on November 27th that there had never before been so many new customers applying for electric current as at present. The temporary set back caused by the general adoption of metallic-filament lamps has been overcome, and new customers are being connected at the rate of between 30 and 40 a month.

Bridlington.—The T.C. has applied to the B. of T. for permission to supply electricity outside the borough to the Golf Club, and residences on three estates close to the town.

Canada.—The city of Hamilton is to place its wires underground, notwithstanding the objections, legal and otherwise, of the companies interested. The Ontario Hydro-Electric Commission has ordered all electric, telegraph and telephone wires on certain of the streets, which include the principal streets of the city, to be placed in underground conduits, and that the unsightly wooden poles be forthwith taken down. Ottawa will soon follow suit, as she is negotiating with the Hydro and Railway Commissions for an order to bury her wires at least in the principal streets.

The Municipalities of Paris, Brantford, Port Dalhousie, Brockville and Prescott have signed contracts with the Hydro-Electric Commission, and other applications are now being considered.

It is proposed to spend $100,000 on a permanent means of illuminating the Niagara Falls by electricity during the evening hours, half the cost to be borne by Canada and other half by the United States. A bill was presented at Washington for $50,000, the share of the U.S.A.

There is a persistent movement on foot to get permission from the Canadian Government to dam the St. Lawrence River below the Thousand Isles, and thus obtain about a million horse-power. The promoters say that instead of this doing injury to navigation, it will aid the latter by doing away with the necessity for locks. As it involves international law, legislation from Washington would need to be obtained concurrently with that at Ottawa. The Conservation Commission is opposed to damming the St. Lawrence, and while there is some objection on the American side, yet a strong and influential body of New Yorkers is working for the scheme.

Cardiff.—Various reductions are proposed in the price of electricity in the city. For heating, cooking, &c., the rate is to be 1d. per unit instead of 1½d., and the E.L. Committee also proposes an alternative rate for power supply, viz., 1½d per unit for the first 250 units per quarter per KW. installed, and ½d. per unit afterwards.

Colne Valley (Herts).—The Colne Valley Electric Supply Co., Ltd., of 50, Queen Anne's Gate, Westminster, is applying for a prov. order for electric light in the parishes of Pinner, Bushey, Chorley Wood and Rickmansworth.

Continental Notes.—Austria.—The Austrian Imperial and Royal Central Water Board received during the month of September applications in respect of 32 schemes and 10 concessions; 12 of the former were for installations in the Tyrol, and seven in the Province of Steiermark, the largest relating to the second dam of the Etschwerk at Meran, 16,780-H.P. capacity, and the Unz River work in the Province of Carniola, 17,000-H.P. capacity. The largest installations for which concessions were granted were that in the Martell Valley, 6,500 H.P., and the Murdorf installation, near Judenburg, 1,000 H.P.—*Elek. u. Masch.*

Belgium.—The electric production of steel has given such satisfactory results during the past year at the important Belgian works of John Cockerill, as to lead to the increased use of electric furnaces, and many new installations are projected both here and elsewhere. Electric driving is now in increasing use in rolling mills and iron and steel works, in the collieries and in the shipyards, and according to our contemporary, the *Zeitschrift für Elektrotechnik und Maschinenbau*, a large and steady future demand for electrical and other machinery may be confidently anticipated.

RUSSIA.—The new harbour works at Libau, for which 4½ million roubles have been voted, include the provision and erection on the quays of a number of electric cranes.—*Zeit. für Elek. und Masc.*

DENMARK.—Arrangements are in hand for a considerable extension of the electric lighting undertaking at Esbjerg.

SPAIN.—Three tenders only have been sent in for the public lighting of Madrid, in answer to the recent invitation, namely, those of the Spanish Electric Constructions Co., the "Electra" Co-operative Society, of Madrid, and the Union Electrique Modrilène. The Special Commission of Light and Water is charged to consider the tenders.—*La Lumière Electrique.*

The Alicante Gas Co. having warned the municipality that it would cut off the gas supply unless the sum owing to it were paid, the Council has retorted by deciding to break its contract with the company and to open negotiations with electric supply companies, with a view to an electricity supply. It is intended, so soon as the Civil Governor grants his sanction, to begin the work of installation.

TURKEY.—A concession is being sought for an electric light and power plant and tramway system at the town of Samsun, on the Black Sea.

Dewsbury.—The Corporation has received the sanction of the L.G.B. to borrow £3,370, repayable in 17 years, for a turbine set; £3,130 for two new boilers, repayable in 15 years; £415 for a cooling tower, repayable in 10 years; £250 for mains and services, repayable in 15 years; and £250 for meters, to be repaid in five years.

Dublin.—In accordance with the approval given by the Municipal Council to the proposals of the Electricity Supply Committee to install an additional 3,000-KW. set at the Pigeon House during the next year, the Committee reports that it has received tenders for a turbo-generator, condensing plant and accessories, and recommends the acceptance of the tender of the Oerlikon Co.

Dudley.—The sale of the Corporation's electricity works was again referred to at the meeting of the Chamber of Commerce last week, when the secretary read a letter from the B. of T. stating—in reply to a resolution passed at an open meeting of the Chamber—that the T.C. had power, subject to the approval of the department, to sell the undertaking, that the request for a public inquiry would receive attention when the deed of sale came to hand. The Lighting Committee of the Corporation has appointed a sub-Committee to carry out matters of detail with regard to the working of the power station and the supply of electricity in the borough.

Eastbourne.—The E.L. Committee has recommended the purchase of a 1,000-KW. turbo-alternator at a cost of £4,100, to be advanced out of the reserve fund.

The consideration of the report recommending the purchase of a 270-KW. Diesel engine in addition to the above for economical running, and thus reducing the cost of generating during the hours of load off the peak, was deferred.

East Ham.—A scheme has been adopted whereby the Council will supply, fix and maintain on a three years' agreement, 1,000-C.P. arc lamps (including electricity), at a charge, for two lamps, of 9s. per lamp per quarter, plus 1¼d. per lamp per hour used, and for one lamp only, of 10s. 6d. per quarter, plus 1⅜d. per hour used.

Edinburgh.—The Electric Lighting Committee of the Corporation has had under consideration a motion as to the desirability of incorporating in the prov. order about to be promoted, powers for giving a supply of electricity to Barnton and other districts. A letter was submitted on behalf of proprietors in Barnton district of Cramond Parish, as to supplying a district, including Blackhall, Barnton Park, and Cramond Bridge. There were besides inquiries with regard to the supply of electricity in connection with the Colinton Barracks and tramways. It was decided to leave the matter in the hands of a small Sub-Committee.

Ellesmere Port.—The U.D.C. has resolved unanimously that application be made to the B. of T. for a prov. order authorising the Council to supply electricity within the urban district of Ellesmere Port and Whitby.

Epsom.—The U.D.C. has decided to promote a Bill in the next session of Parliament to enable it, among other things, to deal in electrical fittings, to lay down cables in private streets, and construct electrical sub-stations and other works under streets, and to empower it to make by-laws with respect to premises supplied with power from the municipal works.

Felixstowe and Walton.—A L.G.B. inquiry was held on November 26th into the application of the U.D.C. for loans of £4,052 for electricity purposes, and £1,000 for street lighting. The latter was, on the advice of the Inspector, Mr. H. L. Hooper, deferred, in order that the Council might obtain better terms for current, which is now charged at 3½d. per unit by the Electrical Supply Co. The other loan was altered to £3,930, £500 for battery extension buildings, £1,200 for battery extension, £1,730 for mains, services, switchgear, &c., and £500 for meters.

Hebden Bridge.—Owing to the steady development of the electricity undertaking since its inception nine years ago, which has made increased plant necessary, the U.D.C. has decided on the recommendation of the Electricity Committee, to purchase an additional Diesel oil engine set of 240 KW., at an estimated cost of £3,253, subject to the sanction of the L.G.B. being obtained for a loan to cover the cost.

Highland Village Plant.—An electric light installation by Edmondson's Electricity Corporation has been inaugurated in the Highland village of Beauly, the opening ceremony being performed by Mr. D. McGrath, chairman of the local company which has been formed, in the absence of Lady Lovat. Street lighting is to be supplied by 25 lamps. The current is supplied by a 40-H.P. suction gas plant, the pressure being 240 volts. Already the consumers number 150. The price charged to private consumers is 8d. per unit.

Isleworth.—The Isleworth Brewery Co. has made application to the U.D.C. for additional current to run two 250-H.P. motors; the estimated revenue is £400 per annum.

Leeds.—The system of high-pressure gas lighting installed in New Market Street, Duncan Street, and Calverley Street by the Corporation Gas Committee for demonstration purposes, has been considered by the Street Lighting Committee, who feel that the system is too costly. It has consequently requested the Gas Committee to remove the lamps within a month.

The Corporation has now given notice of its intention to obtain Parliamentary powers for the acquisition of land at South Accommodation Road, for the erection of a new generating station.

The Holbeck B. of G. has decided to install electric light in the Workhouse at an estimated cost of about £500.

Llandudno.—Consideration of the question of lighting by electricity Conway Road and Queen's Road, at an estimated cost of £398, has been deferred, and a proposal to improve the lighting of the Promenade has been referred to the chairman of the Committee and Mr. H. Morton, the electrical engineer.

The U.D.C. has referred to the electrical engineer for report an inquiry from the Ship Canal Portland Cement Manufacturers, Ltd., asking whether the Council would be prepared to supply electric current for power for an all-day demand for the Little Orme quarries.

London.—According to the *Times*, the Port Authority has decided to remove to Tilbury Dock the modern electric plant at the Victoria Dock, for which a supply of current has been obtained from the West Ham Corporation. "At Tilbury, where the Authority generates the electricity required at the Docks, the demand is growing with the increasing business, and the transferred plant will enable the Authority to provide for this demand at comparatively small expense."

MARYLEBONE.—Four converters are to be installed at the premises of Peter Robinson, Ltd. Mr. Snell has been engaged as consulting expert in connection with an additional supply, which is to be obtained for the winter of 1913-14. In consequence of reports from the general manager that the undertaking will be "very tightly placed" this winter with regard to plant capacity to meet the load, he has been authorised to negotiate with the Metropolitan Electric Supply Co. for a small emergency supply to be taken at the Aybrook Street station on the following lines:—The Council to pay for current taken at the rate of £1 per KW., and for units at a rate per unit to be agreed; the Council also to defray the cost of moving and fixing the necessary converting plant (roughly estimated at £250); also to endeavour to obtain a continuing yearly option (subject to three months' notice) on these terms. It is not anticipated that more than 500 KW. will be required.

Loughborough.—At a meeting of the T.C., the electrical engineer reported that it would be necessary next winter to put down additional plant for the general supply, in addition to the proposed extensions to meet the requirements of the Brush Co., but before making a recommendation, he asked for authority to visit Manchester. Last month the units generated showed an increase of 43·8 per cent. over the figures for last year.

Northwood and Ruislip.—The Northwood Electric Light and Power Co., Ltd., has applied to the B. of T. for an order extending the area of supply so as to include portions of the parishes of Watford Rural and Rickmansworth Rural.

Orsett.—The B. of G. has referred to the Buildings Committee the question of lighting the workhouse by electricity or gas. The Board was informed that the capital cost of an electric light plant would be £1,500, and the annual cost of maintenance, with repayment of loan, principal and interest, £172. For gas the capital cost is placed at £375, and the supply from the Stanford-le-Hope Co. would be at the rate of 3s. 6d. per 1,000 cb. ft.

Pateley Bridge.—The B. of T. has revoked the 1911 E.L. order.

Rochdale.—The Gas and Electricity Committee has decided that application be made to the L.G.B. for sanction to borrow a further £30,000 for extensions to the electricity works and plant.

Romford.—The London Electric Supply Co., Ltd., which is applying for a prov. order for electric light, has informed the R.D.C. that it is willing to extend the compulsory area in the parishes of Chadwell Heath, Hornchurch and Upminster. The Council, before coming to any decision, has decided to ask the company to deposit plans, &c.

Rosyth, Fife.—The Government, it is believed, is about to issue schedules to contractors for the erection of a power station and experimental laboratory at Crombie, in connection with the Rosyth Naval base.

Southend-on-Sea.—A L.G.B. inquiry was held on November 27th into the application of the T.C. for a loan of £3,900 for electric light purposes. There was no opposition.

Stoke-on-Trent.—The T.C. has applied to the L.G.B. for a loan of £12,000, £2,000 for boosters, balancers, automatic regulators, auxiliary steam plant and switch gear, and £10,000 for mains, transformers, and services.

Stroud (Glos.).—Messrs. Seymour, Williams & Co. have asked the U.D.C. to waive any objection it may have to their application for a prov. order for electric supply. The Council has decided to ask for further particulars of the scheme before taking any action in the matter.

Sunderland.—An interesting electrification scheme is shortly to be commenced at the Ryhope Colliery of the Ryhope Coal Co., Sunderland. The contract includes the conversion of the North Pit haulage from steam to electrical drive, and the supply and fixing of a three-throw pump and motor. The power will be three-phase at a pressure of 2,750 volts and 40 cycles. The British Westinghouse Co has the whole contract, but the pump will be supplied by the Ukside Engineering Co. In addition to the foregoing, an order has just recently been placed for the West Pit haulage, which is an exact duplicate of that of the North Pit, and both these installations are to be completed by Easter. The North Pit haulage will be provided with a 250-H.P. continuously-rated motor working up to 400 H.P. on the gradients. The pump will be capable of delivering 300 gallons per minute against a head of 1,870 ft. A motor-generator of 75 KW. will supply energy to drive D.C. screen motors and lighting. The current will be taken from the County of Durham Electrical Power Distribution Co., at 2,750 volts, and used at that pressure. This installation will be one of the first in the Durham and Northumberland coalfields to be carried out under the new Home Office rules. The haulage at the South Pit at Ryhope is also to be converted at Whitsuntide, and tenders for this work are now being considered, and the order is expected to be very shortly placed. This haulage will be of 350 H.P., and worked up to 600 H.P. on the gradients. All of the haulages at Ryhope are at present being worked by steam from underground boilers, for which it has been necessary to take coke down the shaft, and considerable economies in working costs are expected to result from the electrification. The scheme is being carried out to the designs, and under the direction, of Messrs. Hodgkin & Young, of Darlington, acting as the consulting electrical engineers to the Rhyope Coal Co.

In connection with a scheme of dock improvements estimated to cost £24,250, the River Wear Commissioners have approved plans in which provision is made for two new electric belt conveyors at the north end of Hudson Dock North, and an electric belt conveyor at No. 13 Staith. The conveyors will consist of endless belts driven by electric power, and will carry coal at the rate of 600 tons an hour.

Tilbury.—The U.D.C. has decided to conditionally support the application of the County of London Electric Supply Co., Ltd., for a prov. order for electric supply.

Truro.—An abortive conference over the E.L. question has been held by representatives of the T.C. and the gas company, both of whom are applying for prov. orders. The point discussed was the withdrawal of one of the applications, but no agreement was arrived at.

Uruguay.—An American Consular report states that some time ago the Government caused technical studies to be made on the possibility of utilising the Rio Negro, an important river crossing a large portion of the Republic, to produce power for an electric station capable of supplying all the requirements of Monte Video, the resulting reports being entirely favourable. It is intended to erect the power station on the river by constructing a dam nearly 3 miles long and a transmission line for energy 162 miles in length. The cost of the works is estimated to be $8,500,000, not counting the value of expropriations which, added to the cost of deepening the river to 5·9 ft. (now in progress), will bring it to $11,500,000. The power house will be able to supply 120,000 000 units annually—four times the present consumption—and would be able to furnish power to tramway and manufacturing companies. When in full operation there would be a saving of £1,200,000 each year in coal, besides bringing about many advantages in the economy of light and the establishment of various industries outside of the capital, which to-day cannot exist owing to the high price of coal. A Bill will be presented to the Chambers asking for authority to complete the project, which is at present in charge of an American engineer.

Whitstable.—A prov. order for electric light is to be applied for by a local company, which has received promises of considerable support, both in the town and at Tankerton, a residential suburb.

Worthing.—The Electricity Committee of the T.C. has decided that in future service lines are to be laid free of charge to the extent of 100 ft. instead of 60 ft., and to allow consumers of up to 1,000 units per annum a discount of 5 per cent., and those taking over 5,000 units per annum, 10 per cent.

York.—The Corporation has decided to insert in the Corporation Gas Bill to be introduced in the next session of Parliament, clauses which will empower it to purchase land from the Foss Navigation Committee for the purpose of constructing a reservoir for condensing purposes at the electricity works, it being stated that the Navigation Committee is unable to guarantee such a supply.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Town Clerk has reported to the Electricity Committee that he has written to the Rawtenstall Corporation, inquiring how many of the Corporation's cars running to Accrington had been converted from the regenerative control system as required by the B. of T. He read the following resolution from Rawtenstall Council in reply:—"That seeing the arrangements with respect to through running are no more satisfactory to this Corporation than to Accrington, this Corporation hereby expresses its willingness to terminate the agreement with respect thereto." A Committee was deputed to confer with Haslingden Corporation on the subject. Later the Town Clerk reported that he had written to Rawtenstall, reminding the Council of its resolution passed last February, giving instructions for the conversion of cars as soon as practicable.

Argentina.—Mr. F. Robetti has applied to the Government of the province of Buenos Ayres for permission to construct an electric tramway from Ostende station in the district of General Madariaga, to the Atlantic.

The Statutes of the Compania de Tramways Eléctricos Buenos Ayres have been approved. The company has been formed to work the concession for lines in Vicente Lopez and San Martin, and also to engage generally in concessions for omnibuses, tramways, and railways in any part of the Republic.—*Review of the River Plate.*

Asiatic Turkey.—A concession has been granted for an electric tramway from Scutari to Kadikeuy on the Asiatic side of the Bosphorus, to a French syndicate.

Australia.—The report of Mr. Hay, the engineer engaged by the New South Wales Government to report upon the traffic problem of Sydney, was laid upon the table of the Legislative Assembly recently. Briefly, the report recommends the following:—(1) A bridge to North Sydney from Dawe's Point to Milson's Point; (2) an underground city railway, with three-minute service; (3) a partly underground railway for the eastern suburbs; (4) a western underground railway through Balmain and Leichhardt; (5) the undergrounding of the King Street tramways; and (6) a goods tunnel from Woolloomooloo to Circular Quay, or Darling Harbour. The city railway and the King Street undergrounding are regarded as the most urgent works, and it is estimated that these could be completed within two to two and a half years. The estimated cost of these is (excluding the harbour bridge, and also excluding throughout electrical equipment, signals, rails and land resumption), £4,516,070, made up as follows:—City railway, £1,175,273; eastern railway, £995,058; western railway, £2,134,510; King Street tunnel, £112,420; Woolloomooloo tunnel, £98,809. The Minister for Public Works thoroughly agrees with Mr. Hay's recommendation that the city underground railway should be first constructed, and sums have been placed on the loan estimates for the current year so as to be in a position to start the preliminary work immediately the approval of Parliament has been obtained.—*Tenders (Mining and Engineering Review).*

Belfast.—At a meeting of the Tramways and Electrical Committee the manager of the tramways presented a statement with reference to proposed extensions of the electrical department, and submitted a scheme for generating electricity for tramways purposes only by installing Diesel engines in the present tramway depôts. Mr. Nance's suggested scheme was as follows:—(1) The electrical undertaking is to be placed in possession of the generating station, switchboards, engines, coal conveyor and all other properties paid for by, and belonging to, the tramway department within the limits of the present electric generating station in East Bridge Street, and to pay to the tramway department for them, "the present value" of the amount spent thereupon—namely, £96,155—to be settled by the city accountant with an assessor, if thought desirable; (2) the electrical undertaking to provide a new station for the transforming plant now in the Antrim Road tramway depôt, and the cost of such transfer and new station to be paid by the tramway undertaking; (3) the tramway undertaking to establish Diesel oil-engine generators, amount in all to 6,000 KW., in 500-KW. sets, in the various depôts around the city, with buildings and other requirements; to make necessary alterations in feeders, and to hereafter, under the authority of the general manager of the tramways and under the direct supervision of the chief engineer, supply all the electrical energy required for tramway purposes, and maintain all electrical equipment. The estimated cost of this installation, with the necessary changes in feeders and buildings, will amount to £101,500 (estimated). Mr. Nance claims for his scheme simplicity, economy, abolition of dual control, relief of the electrical undertaking from its present embarrassment and provision against rise of prices. This report was submitted to Mr Bloxam, the city electrical engineer, for his comments thereon to the Committee, and at a special meeting last week Mr. Bloxam analysed it in detail, and pronounced the first part to be unworkable; he pointed out that the present electric station output is limited by its boiler capacity, that any advantages which the development of the Diesel engine and oil fuel may make possible will be availed of by the whole undertaking, and not reserved exclusively for the tramway service, and so forth. The Committee by 9 votes to 3 decided not to take any action on Mr. Nance's report.

Blackpool.—A Daimler 'bus of the petrol-electric type was tested by members of the Corporation on Saturday. This type of 'bus is intended to run in suburban districts in which there is no tramway service. At a meeting of the Council on November 28th, Alderman Brodie said the Tramways Committee had under consideration the advisability of providing vehicular accommodation for one or two districts in Blackpool to meet the public convenience. There was no hope of any tramway service paying its way off the tram-track already laid. Councillor Tillotson inquired why private enterprise should not be allowed to provide the service, and recalled the time when former 'bus proprietors in the town were deprived of licences and defeated when they took the case to London. He failed to see why the Corporation should embark upon such an undertaking, and yet private owners had been refused the power.

Bradford.—The profits on the tramways for the half-year ended September 30th show a serious decrease on the corresponding half of last year, this being chiefly accounted for by the increased expenditure on repairs to permanent way, cars and rolling stock, power and wages, and the introduction of ½d. fares up to 9 a.m. The half-yearly statement shows a profit of £25,997, against £35,867 last year, being a decrease of £9,870. The traffic income has been £143,358, being £993 less than last year, in spite of increased car-mileage of 127,000. If the same rate of earning per car-mile had been maintained as last year (11·913d.), the income would have been £6,000 more. Repairs of the permanent way show an increase of £2,109, and cars and other rolling stock an increase of £2,008. Power expenses have increased to £992; traffic expenses, including wages of motormen, conductors, &c., have been £36,624, against £34,480 last year. The railless route undertaking shows a loss for the half-year of £181; the expenses being £798, against a revenue of £617. Income from the carriage of parcels was £4,242; expenses, £3,926; profit, £316.

Continental Notes.—Holland.—A concession has been granted to the Municipality of Arnhem for the construction of an electric tramway from Arnhem to Velp, and from Arnhem to Oosterbeek, a total distance of about 10 km. The Municipality must submit to the Minister of Commerce detailed plans of the line and of the electric power station within a year from the date of the concession, viz., November 2nd, 1912.

Belgium.—La Société des Tramways Electriques de Gand has just applied for a concession to construct and work a new line of electric tramway in the town of Ghent—between the Gand-Sud Railway station and the Boulevard de Roygem.

France.—Plans are being prepared in respect of a projected electric railway between Castres and La Salvetat (Herault).

Germany.—In connection with the electrification of the mountain railways in Silesia, the Prussian State Railway authorities have lately placed a contract with the Siemens-Schuckert Werke for 20 electric locomotives for goods trains, and with the A.E.G. for five trains for the same system of railways.

The first trials of the railways in the Wiesen Valley in the Lorrach district of Baden, which have just been electrified, were recently made. It is not expected, however, that the lines will be opened for traffic until next year.

Coventry.—The City Council decided this week to apply to Parliament for power to run motor-omnibuses within the city, and also along the route of the Corporation tramways.

Glasgow.—Some remarkable figures are given in the half-year's report in connection with the working of the Corporation tramways. For the six months ending November 30th, the total number of passengers carried reached the total of 150,016,653, as compared with 128,801,034 for the corresponding period of 1911—an increase of nearly 24¼ million passengers. During the year, the halfpenny stage was doubled in length, and the detailed figures show that this fare accounts for 60·69 per cent. of the entire traffic, the figures being 91,040,168 against 35,777,328 for the corresponding six months a year ago. While, however, the total carried has gone up, the revenue has fallen £9,485, caused by a big diminution of travellers on the penny stages and longer distances. The number of people who took penny tickets has fallen from 46·27 last year to 28·58 this year—the figures being 59,596,464 in 1911 and 42,876,350 this year. There was also a decrease in the 1½d. and 2d. stages, the figures being 10,055,008 and 3,170,896 respectively this year, as against 10,360,902 and 3,236,202 in 1911. The 2½d. stages were patronised by 1,477,822, as compared with 1,424,569; while those travelling 3d. stages and longer distances represented 1,396,410, against 1,361,631. The total decline in receipts is, as stated, £9,485, the six months' income from fares being £492,054, against £501,539. The halfpenny stage yielded £189,667, as compared with £74,536: but the money taken for penny stages was only £178,651, against £248,318 in 1911. A striking point in the report is that while the halfpenny stage passengers represented 60 per cent. of the total traffic, the receipts from the same class of patrons were less than 39 per cent. of the total revenue.

There appears every prospect of the T.C.'s new Committee on tramways pressing forward for the further extension of the system both within and without the city. Powers were obtained in certain omnibus Bills and prov. orders to lay tracks, which have not yet been taken advantage of, and the expectation is that those privileges will within a comparatively short time be put into active operation. Nothing definite has yet been decided on, but it is significant that the Committee in charge of extensions is making tours at present to several of the outlying districts. Among the districts scheduled and to be inspected are those of North Kelvinside, Canniesburn, Milngavie, Scotstounhill, Govan, Netherlie, Clarkston, Whitecraigs, Provanmill, Coatbridge and Cothkin. If the scheme is gone on with in its entirety, it will mean the addition of from 10 to 15 miles to the system.

Greetland.—The U.D.C. has formally approved of the Huddersfield Corporation's proposal to construct a single line of tramways along Saddleworth Road, to the Halifax Corporation's tramways in Halifax Road, subject to the Council being satisfied as regards the terminus of the tramways in Halifax Road.

Huddersfield.—The Corporation has formally resolved to promote in the ensuing session of Parliament a Bill authorising the construction of tramways in the borough, in the borough of Brighouse, and in the urban districts of Elland, Greetland, Slaithwaite, Linthwaite and Marsden, and in the parish of Fixby; and the provision and running of omnibuses and motor-cars on the railless trolley system within and without the borough.

India.—The formal sanction of the Government of India has just been received by the Mysore Government for the commencement of electrical tramways for Bangalore City and station. Orders will now be placed in Europe and America for plant and material, and the project is expected to be accomplished in 13 months.

Leeds.—The recent dismissals of motormen and conductors on the Leeds tramway system have occasioned some resentment, and it has been decided by the members of the Tramway and Vehicle Workers' Society to hold a meeting of all sections of the men. Mr. J. B. Hamilton, tramways manager, in the course of an interview with a Press representative, said that it seemed to him that a clique of the Union officials would like to control the tramways in their own interest, and to the disadvantage of the non-Union men.

The Corporation has given notice of its application for Parliamentary powers to make various tramway and railless traction extensions, referred to previously in our columns.

Liverpool.—The electric tramway system is being linked up in one of the suburban districts by motor-omnibuses under the control of the Corporation, and already a passenger service between the Menlove Avenue tramways terminus at Calderstones and the town of Woolton is in operation. So far only one new vehicle is in use in addition to three of a more or less obsolete type. The omnibus, which has cost between £750 and £800, is of 40 H.P., and is of the petrol-electric type. The Corporation has ordered a second 'bus of similar power, which is almost ready for delivery.

The additional electrified track on the L. and Y. Railway between the Exchange Station, Liverpool, and Sandhills, was brought into use on Monday.

Llandudno.—The U.D.C. has received from the Llandudno and Colwyn Bay Electric Railway, Ltd., notice of the latter's intention to apply to the B. of T. for sanction (*inter alia*) to abandon so much of Railway No. 6, authorised by the company's Order of 1898, as lies between Deganwy and West Parade, Llandudno.

London.—South-Western Railway Electrification.—It is reported that the scheme for the electric working of the Kingston and Hounslow loop lines, and the Shepperton and Hampton Court lines of, the South-Western Railway has been drawn up, and will shortly be submitted to the directors. A power house is said to be part of the scheme on which work is expected to commence next spring, and to continue for two years.

A complete electrical ambulance service has just been installed by the Port of London Authority. It is estimated that the service will cost £4,000 per annum to maintain.

Lewisham.—Objection is to be raised to the proposal of the L.C.C. to run railless trolley vehicles from Catford to Sydenham, as the local Council has consistently objected to the erection of overhead wires in any form.

Newcastle-on-Tyne.—For the past half-year's working of the Newcastle tramways, the gross receipts were £115,359, an increase on the corresponding period of last year of £2,163. The total working expenditure showed an increase of £3,837, and there is a gross surplus for appropriation on the half-year of £18,658, being a decrease of £443. After paying £12,000 in relief of the rates, there is a net profit of £6,658. The increased expense is due to more traffic, needing more men; greater expenditure on up-keep; and concessions to the men.

Ripley.—A conference was held on Friday last between Mr. Williams, representing the Notts. and Derbyshire Tramways Co., and the U.D.C. with reference to the proposed tramway service between Nottingham and Ripley. Mr. Williams stated that the capital for the scheme which the company was promoting was now fully subscribed, but it could not at present extend the scheme to Belper, as the cost of road widenings would be prohibitive. The company would enter into a written guarantee that the road widenings along the line of route throughout the Ripley Council's district, with one stipulated exception, should be 24 ft. wide. The Council decided to accept this guarantee and pass the plans.

York.—At the City Council on Monday, a resolution was brought forward on the recommendation of the Tramways and Electricity Committee that the Council purchase the old Liberal Club in Clifford Street for offices at a cost of £4,000. The matter was referred back for further consideration. The tender of Mr. Wm. Dobson, of Edinburgh, of £15,147 for the construction of the track for the Bishopsthorpe Road tramway extension was accepted.

TELEGRAPH and TELEPHONE NOTES.

Canada.—In Canada, on December 1st, the new combined land rates for wireless messages, which were fixed during the International Conference last June, came into force. Messages to ships on the high seas can be handed in at any telegraph office in the Dominion.—*Financier.*

Congo.—A wireless installation has been set up at the station at Kabelend, in Loango, in the Belgian Congo, which is in connection with 11 others in this territory. The equipments are on the Telefunken principle, and have a power of 1½ KW., with a range of 500 km. with the larger and 200 to 300 km. with the smaller installations. The network embraces a primeval forest region 4,500 km. in extent.—*Elek. und Masch.*

France.—A Government Bill has been laid before the Chamber of Deputies for the establishment of a system of wireless telegraphy between France and the French Colonies, consisting of two chains of wireless stations, viz., the Eastern line, with stations in the South of France, in Tunis, Jibuti, Pondicherry, and Cochin China, with a branch to Madagascar; and the South American and African line, starting from the same station in the South of France, connecting with stations in Morocco, Colomb-Béchar, Senegal, Timbuctoo, Bangui, and Martinique. These systems will be followed by a connection across the Pacific, with stations at Noumea and Tahiti. Finally, it is proposed to erect a station in the West of France for communication with North America. It is estimated that the total cost of the complete system suggested will be over £800,000.

Imperial Wireless System.—On Wednesday last week the Select Committee resumed the inquiry regarding the Marconi agreement. Mr. Beech Thompson, of the American Poulsen Co., read communications which he had received from the secretary of the Federal Telegraph Co., at San Francisco, between November 16th and 22nd, stating that communication had been established throughout the day. A letter from Mr. Godfrey Isaacs, of the Marconi Co., to the Committee was also read, communicating a telegram received from the Marconi Co. in America, in which the working of the Poulsen system between San Francisco and Honolulu was criticised. Mr. Thompson stated that the manager of the United Wireless Co. had telegraphed to him at San Francisco asking the lowest price for the assets of his company and the Poulsen patents. His company could not take a contract with the British Government, but the English company had arranged to acquire the use of the American improvements. He would not say how much of the nominal capital of his company (£5,000,000) had been subscribed.

Mr. Madge was further examined, and stated that in his opinion the system ought to be carried out by the Marconi Co. or the Poulsen Co.; they would make a better job of it than the Admiralty.

Regarding the production of documents, Capt. Charlton stated that the Admiralty would produce the conclusions, but not the data on which they were based, and Lord Robt. Cecil expressed dissatisfaction.

On Thursday Mr. Madge was again examined, and said that the Marconi designs were on sound engineering lines; the company possessed most valuable experience and an expert staff. He thought the duplex working could be accomplished. The Poulsen system would be cheaper to install and to maintain, but was in its infancy, and the staff was not experienced. The Marconi system was the better at present, though the Poulsen was more likely to develop. He had no doubt that the Poulsen system had effected communication between San Francisco and Honolulu in the daytime. In his opinion, the Admiralty could build long-distance stations without using the Marconi patents. He had no interest in any system of wireless telegraphy. Lieut. Fitzmaurice was examined, and corroborated Mr. Madge's evidence.

On Monday a letter from the Admiralty was read, quoting the rule governing the production of evidence before a Select Committee, and stating that officers giving evidence would have full permission to produce documents to the Committee, except in the case of papers relating to war arrangements. Captain Charlton outlined the events which led up to the agreement, and stated that the existing contract between the Admiralty and the Marconi Co. had been very hard on the former, the company having kept them strictly to its terms. The Admiralty being unable to communicate any information in wireless telegraphy to another department, the army had to carry out experimental work which had been covered years before by the Admiralty, so that the country paid twice over for the same work. Further, the new Australian warships could not be equipped with the same wireless apparatus as the ships of the Royal Navy. He approved of the final agreement. The company would not make any profit on the erection of the stations, but would make a big profit on the receipts if the system was a commercial success. The Admiralty had four long-distance stations—at Gibraltar, Malta, and two in England. They had no doubt they could work over 2,000 miles. The Admiralty attached very great importance to secrecy regarding their wireless service, which, together with their special methods, enabled them to obtain greater reliability of service and made interference by jamming more difficult. It would be most undesirable that any inspection of their apparatus should take place. Naval stations ought to be erected by the Admiralty, for the sake of secrecy. The Admiralty preferred simplex to duplex working, for military purposes, as a single station was more easily defended. If they had commenced work in 1911, they could have completed the stations by the end of 1914. The matter was most urgent a year ago, but several other nations now had long-distance chains in hand, and unless one could be first in the field, so as to be able to choose one's own wave length, there was not much to be gained by haste. If they had to start afresh, there would be at least four systems to consider, and if they waited longer there would be more. If they were starting now, stringent terms should be made to enable them to change the system if necessary. The Admiralty had made progress in the science during the past nine months, which would not have been possible if the Admiralty staff had been occupied in building the Imperial chain of stations. They were indebted to information derived from the Marconi Co. for the progress they had made. The Admiralty very much regretted the delay in carrying out the scheme. To have invited tenders would have taken a long time.

Large Pension Fund.—The American Telephone and Telegraph Co. and associated companies (Bell system), the Western Union Telegraph Co., and the Western Electric Co. have set aside a sum of two million pounds for pensions, sick benefits and life insurance for their employés, who number 175,000. The latter do not contribute to the fund, which will be used for the benefit of employés of all ranks. The aggregate wages paid by the companies amount to about £23,000,000 per annum.

Submarine Telephone Cable. — A large submarine cable has been laid by the Pacific Telephone and Telegraph Co. across the bay between San Francisco and Oakland. The cable, says *Telephony*, contained 154 pairs of No. 19 conductor, paper-insulated and lead-sheathed, with steel armour; it was 23,000 ft. long, weighed 16 lb. per ft., and was provided with loading coils. It was laid in two sections, landing at Goat Island, where the loading coils were inserted. The cable was made at Chicago, and was laid by a cable-carrying lighter, which has been specially built for the purpose by the company, on account of the increasing number of submarine cables employed in the coastal towns.

Telephone Employés' Grievances.—To protest against the application of an "unjust classification" to the ex-National Telephone Co.'s staff, a largely attended meeting of the Bradford branch of the Amalgamated Society of Telephone Employés was held last week. A similar meeting was held at Edinburgh, and it was unanimously agreed to draw the attention of the Postmaster-General to the classification, and ask that the terms of the Telephone Transfer Act, 1911, and the promises given by him in the House of Commons be carried out.

Telephone Numbers as Telegraphic Addresses.—The Postmaster-General has issued a notice reminding telephone subscribers of the existing facilities for securing, by the use of the addressee's telephonic address, the expeditious delivery by telephone of telegrams to telephone subscribers. This address consists of the subscriber's name, the name of his exchange, the number of his line and the name of the town in which the exchange is situated. When the name of the exchange is also the name of the town, or of a well-known locality, the name of the town may be omitted. The name of the town is not required when a telegram is addressed to an exchange number in the same town. Subscribers are recommended to print their telephonic addresses on their notepaper as their addresses for telegrams. Confirmatory copies of telegrams delivered by telephone will be sent by post without charge to the address in the Telephone Directory in daily batches, and, if the attention of subscribers cannot be obtained by telephone, telegrams will be delivered in the ordinary way by messenger.

The Telephone Service.—In a letter addressed to the Liverpool Chamber of Commerce, the Postmaster-General proposes that local advisory Committees be formed, to assist him in the administration of the telephone and telegraph services. These Committees will take the place of the general advisory Committee suggested by the Chamber last year.

Wireless Telephony.—Experiments have been carried out at Rome by the Minister of War with new types of transmitter and water microphone, the inventions of Profs. Moretti and Vanni respectively, with a view to opening telephonic communication with Tripoli. The wireless stations at Penzano, Madelena, Palermo and Trepane were telephoned to, and communication was successfully established. The results of the experiments have decided the War Department to appropriate the inventions for exclusive military use, a present of them to the Italian Government having been made by the inventors.—*Zeit. für Schwachstromtechnik.*

The World's Wireless Stations.—According to the statistics of the International Wireless Bureau, the wireless stations established in the different countries of the world, up to July 15th last, numbered 1,188 on warships, 1,262 on merchant ships, 371 on land for public service, and 114 on land for military purposes. Of these, Great Britain had 455 stations on merchant vessels, and 43 public land stations; Germany, 206 and 22; United States, 253 and 142. To these must be added 58 stations in various Colonial possessions.—*L'Industrie Electrique.*

CONTRACTS OPEN and CLOSED.

OPEN.

Abertillery.—December 16th. 100-KW. Diesel engine and dynamo, water-cooling apparatus, pipework, overhead crane and switchboard panels and connections, for the U.D.C. See "Official Notices" November 29th.

Australia. — SOUTH AUSTRALIA. — December 18th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" November 8th.

December 17th. — Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

VICTORIA.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" November 22nd.

January 10th, 1913.—Prahran and Malvern Tramways Trust (V.) invites tenders for trucks, wheels, axles, motor equipment and brakes. —*Australian Mining Standard.*

January 24th, 1913. Two 4,000-KW. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" November 22nd.

January 28th. — Thirty-three miles of paper-insulated lead-covered cable for P.M.G., Melbourne. High Commissioner's Office in London, 72, Victoria Street, S.W.

NEW SOUTH WALES.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" November 1st.

SYDNEY.—January 20th, 1913. Storage batteries, motor-generators and switchgear. City Electrical Engineer, Town Hall.

January 8th and 22nd. — Fifty induction motors (Specification No. 386); two turbine-driven centrifugal pumps (Specification No. 390). Chief Commissioner, New South Wales Government Railways, Sydney.

TASMANIA (HOBART).—January 13th. P.M.G.'s department:— Paper insulated, lead-covered cables. See "Official Notices" to-day.

QUEENSLAND.—January 29th, 1913. Detectors (Schedule 242), for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—February 21st, 1913. Four 1,500-KW. rotary converters, for the Melbourne City Council. See "Official Notices" to-day.

Austria.—VIENNA.—December 11th. The Minister of Trade is prepared to receive tenders for the supply, during the period January 1st, 1913, to December 31st, 1915, of safety apparatus for low-pressure current services, of the kind and quantity usually prescribed, subject to 30 per cent. increases. Particulars from the K.k. Postokonomieverwaltung, Postgasse 17, Vienna I.

Balderton (Notts.).—December 14th. The Parish Council invites tenders for an electrical installation for street lighting. For further particulars see this column for November 22nd.

Beckenham.—December 9th. Electricity meters, for the U.D.C. See "Official Notices" November 29th.

Brussels.—January. Tenders are invited for the supply of (1) two cables and their accessories to unite the Brussels telephone exchange (Rue de la Paille) with the exchange at Antwerp (Rue des Frères Cellites); (2) a cable to connect the exchange at Schaerbeck (Rue Jan Blockx) with Dieghem (Special Conditions No. 3,601). Particulars, Salle de la Madeleine, Brussels.

LIEGE.—December 16th. Tenders are required for the supply and erection of the cables and accessories for the electric installation to work the guns of position at the forts of Antwerp, in four lots. The first comprises the whole of the cable material requisite for the glow-lamp lighting service, and for the electric projectors and motors in 13 new forts and 12 redoubts; the second lot, similar material for the four existing forts in the first line of defence; the third lot comprises the supply of switchboards to the 13 new forts and 12 redoubts; and the fourth lot the supply of switchboards to the four existing forts. Further particulars from the Fonderie de Canon, 80 Quai St. Léonard, Liége. Tenders should be sent in 48 hours before 10 o'clock on the date of adjudication above mentioned.

December 16th.—Tenders are invited for the supply of 46 continuous-current dynamos for the previously-named forts and redoubts as per Cahier de Charges Spécial No. 7. Also, on the same date, for similar destinations and purposes, 46 semi-stationary steam engines, as per Cahier de Charges Spécial No. 6. Further particulars from, and tenders to, Fonderie de Canons, 80, Quai St. Léonard, Liége.

Colchester.—Electric light installation, West Ward School, for the T.C.; Borough Electrical Engineer.

Dewsbury.—December 17th. Two water-tube boilers, superheaters, mechanical stokers, &c., for the Corporation electricity works. See "Official Notices" November 29th.

Dundee.—December 20th. 5,000-KW. steam turbine and alternator, condensing plant, and one 500-KW. rotary converter with transformer, for the Corporation. See "Official Notices" to-day.

Eastbourne.—December 16th. 99 long-burning flame arc lamps for street lighting, and sale of 99 open-type double-carbon lamps to be displaced, for the Corporation. See "Official Notices" November 22nd.

France.—January 15th. Concessions for six railway schemes in the Department of Calvados, France, are offered for public competition. The lines are to be of 1 metre gauge, and the service to be either electric or steam. For further particulars see this column last week.

London.—HACKNEY.—December 12th. Open type and flame arc lamp carbons, for the B.C. See "Official Notices" November 22nd.

LAMBETH.—December 10th. The Guardians want tenders for three electric lifts, including removal of existing lifts, at Renfrew Road Workhouse and Brook Street Infirmary. Specification (deposit £2, returnable) from the Clerk to the Guardians, Brook Street, Kennington Road, S.E.

FULHAM.—January 9th. Steam dynamo, switchboard and connections for the Workhouse, Fulham Palace Road, W., for the Guardians. See "Official Notices" to-day.

Manchester.—December 17th. (a) Portland cement (b) Steel bolts and nuts for fish plates; (c) Self-acting sliding lathe; (d) Cleaning and dyeing of car curtains. Mr. J. M. McElroy, Corporation tramways general manager.

New Zealand.—January 6th, 1913. Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Pembroke.—The time for sending in tenders for a refuse destructor at the electricity works has been extended to December 10th.

Santa Fé.—The municipality of Reconquista will shortly call for tenders for an electric light and power station.—*Review of the River Plate.*

Spain.—MADRID.—The T.C. is open to receive offers for the supply of electric material and other necessary articles of municipal requirement for the financial year 1913-14.

December 23rd.—The authorities of the Fabrica de Artilleria de Trubia, at Trubia, are inviting tenders for five 20-H.P. electro-motors, four of 30 H.P. and four of 50 H.P.

December 28th.—The municipal authorities of Carballo (province of Coruna) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years.

Tenders have just been invited by the municipal authorities of Huesca for the concession for the electric lighting of the town during a period of 10 years.

South Africa.—December 31st. 107,580 yards of insulated wire, 6,336 yards of flexible wire, and 25 cwt. of bare copper wire, for delivery during February next. Tenders to Secretary to Tender Board, S.A. Railways Headquarter Offices, Johannesburg. Further particulars at the B. of T. Commercial Intelligence Department in London, and in the current *Board of Trade Journal.*

Trimdon Grange (Co. Durham).—December 7th. Electric fittings for a year, for the Trimdon Grange Colliery. The Storekeeper.

Warrington.—The Tramways Manager has been authorised to advertise for tenders for three motor-omnibuses.

CLOSED.

Accrington.—The Electricity Committee has accepted the tender of Messrs. T. Blackburn & Sons, Preston, at £249, for a steel roof over the boilers, &c., at the electricity works.

Atherton.—The Electricity Committee has accepted the tender of Messrs. Hanchett, Barratt & Co., Pendleton, for the supply of two 20-K.V.A. transformers.

Australia. — The *Mining and Engineering Review* (*Tenders*) reports the placing of the following contracts:—

VICTORIA.—P.M.G.:—

50 miles of copper wire.—Lawrence & Hanson Electrical Co., Ltd.
1,150 common-battery telephones and 1,000 condensers.—Western Electric Co. (Australia), Ltd.
240,000 porcelain insulators.—British and Foreign Indent Co.

Prahran and Malvern Tramway Trust:—

Duncan & Fraser, Adelaide.—Construction of 11 bogie cars, at £775 each. The other tenders were:—A. Pengelly, Adelaide, £1,150; J. McBride, Melbourne, £925; and Noyes Bros., Melbourne, £964.

According to the *Australian Mining Standard*, the following contracts were placed in October:—

SYDNEY.—P.M.G.:—

Purchase of wireless telegraph material, £7,890.—Maritime Wireless Co. (Shaw System), Ltd., Sydney.

MELBOURNE.—P.M.G.:—

Battery material, £390.—I.-R., G.-P. and T. Works Co., Ltd.
Bolts and nuts, £1,135.—Mephan Ferguson Pty., Ltd.
Paper-insulated lead-covered cable, £2,930.—W. T. Henley's Telegraph Works Co., Ltd.
Wireless telegraph gear, £150.—Maritime Wireless Co.

Bacup.—The contract for the installation of electric light at the baths has been secured by Mr. G. L. Adamson, of Rochdale.

Bedford.—The T.C. has accepted the tender of Messrs. W. H. Allen, Son & Co., Ltd., for a 400-KW. Diesel oil engine-driven alternator, at £8,980.

Barrow.—The T.C., on December 2nd, accepted the following tenders in connection with the extension of the electricity works :—

Steam turbine and three-phase alternator.—James Howden & Co., Ltd., £3,237.
Rotary converters with exciters and transformers.—British Westinghouse Co., Ltd., £2,818.
High and low-tension switchboards.—British Thomson-Houston Co., Ltd., £3,322.
Condenser and pumps.—Willans & Robinson, £1,142.
Steam and exhaust pipes, valves, &c., weigh tank and recorder.—E. Le Bas and Co., £1,239.
Water tube boiler.—Babcock & Wilcox, Ltd., £1,027.
Coal conveyor, weighing machine.—E. Bennis & Co., Ltd., £744.

The acceptance of a tender for mechanical stoker was deferred pending further inquiries.

Bolton.—The Tramways Committee has accepted the following tenders :—

Dick, Kerr & Co.—Six sets of bogie car equipments, and ten sets of single truck equipments.
United Electric Car Co.—Six bogie car bodies.
Milnes, Voss & Co.—Ten top covers for single-truck cars.

The Electricity Committee has accepted the tender of Messrs. E. Bennis & Co. for an ash elevating plant for the electricity works.

Bridlington.—The T.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for electric fire alarms, at £107.

Brighton.—The Corporation has placed a renewal order for the supply of Wotan pure drawn tungsten lamps, for the whole of the street lighting during the next 12 months, with Messrs. Siemens Bros. Dynamo Works, Ltd.

Cardiff.—Correction.—We are asked to state that the notice published in our last issue respecting a contract being placed with Messrs. Bennis for coking stokers and self-cleaning compressed-air furnaces for Roath power station, Cardiff, is quite incorrect. No such contract has been placed, nor, indeed, was such a tender received. Furthermore, the Cardiff Committee is not contemplating placing such a contract at the present time. Vicars's stokers are fitted to all boilers at the station, and they have been in operation for 12 years.

Christchurch.—The B. of G. has accepted the tender of Messrs. Andrews, of Boscombe, for the electric light installation at the workhouse, at £643, the costs of lamps (£84) having been deleted from the contract at the instance of the L.G.B., who intimated that the Guardians must purchase lamps as they require them.

Doncaster.—The Corporation Tramway Department has placed an order with the Albion Motor Car Co., Ltd., of Glasgow, for a 32-H.P. motor tower wagon, for overhead conductor maintenance work.

Dublin.—The Electricity Supply Committee of the Corporation, in a report on tenders for a new 3,000-KW. turbo-generator plant, considered at Monday's meeting of the Council, states (according to the *Dublin Daily Express*) that, in reply to advertisements, only three complete tenders were received, as follows :—

A.E.G. Electrical Co.	£11,200
Maschinenfabrik Oerlikon	11,351
C. A. Parsons & Co.	13,226

Dealing with these, the Committee says :—The specified date for completion is September 30th, 1913. Both the A.E.G. Electrical Co. and the Maschinenfabrik Oerlikon guaranteed completion by the date mentioned, but Messrs. Parsons could not guarantee delivery under 12 months from the receipt of the order. As the set will be required for regular use to meet the winter load next year, the Committee could not consider Messrs. Parsons & Co.'s tender apart from the question of price. The deputy city electrical engineer submitted an analysis of the two remaining competing tenders. Differences in spares, foundation work, &c., had to be considered, and, taking these on a comparative basis, the full tenders worked out as follows :—A.E.G. Co., £12,180 ; Maschinenfabrik Oerlikon, £12,629 ; a difference of £449 in favour of the A.E.G. As against this, the Commintee had to consider the following points on the tenders set out in the engineer's report :—

1. That the specified speed of the Oerlikon turbine is 1,545 R.P.M., as against 3,090 R.P.M. of the A.E.G. machine, a very distinct advantage in favour of the Oerlikon Co.'s plant, and one that would mean a substantial difference in the price if the A.E.G. set were speeded at the same rate as that of the Oerlikon Co., which latter was the speed set down in the Committee's specification.
2. The steam consumption guaranteed shows a very distinct difference in favour of the Oerlikon Co., and the deputy city electrical engineer having worked out the difference taking it at an equivalent of 1,500 hours' annual full-load running, reported that it meant a saving by the Oerlikon set of not less than £70 per annum.
3. The Committee also considers that it is an important advantage, representing a substantial value in money, that they should have the two 3,000-KW. sets of exactly the same type, as, apart from the advantage to the staff, an important saving would be effected by the requirement of only one stock of spare parts instead of two.

These three considerations, in the opinion of the Committee, work out at far greater money value than the difference of £449 between the two tenders, and having regard to the extremely satisfactory manner in which the set of plant installed by the Oerlikon Co. last year has worked, the Committee recommends their tender for acceptance as giving the best value.

Italy.—La Societa Ferrovie Elettriche di Catane, of Catania, has placed a contract with the Societé des Ateliers de Constructions Electriques de Charleroi (Belgium) for the supply of 25 railway carriage underframes with motors of 32 H.P., 37 H.P. and 40 H.P. and three 200-KW. dynamos, a battery of accumulators and a switchboard.

London.—L.C.C.—The contract for electric lighting in connection with the rebuilding of the Ricardo Street School is being given to Messrs. Tilley Bros., at £378.

The following tenders were received for the electric lighting of the Strand School, now erecting at Norwood :—

Tilley Bros. (recommended)	£620	Pinching & Walton	£671
G. Weston & Sons, Ltd.	650	E. Lawrance & Sons, Ltd.	680
Tredegar & Co.	667	Templin & Makovski	975

Engineer's estimate £695

Tenders were recently invited from six selected firms for the repair of a 500-KW. D.C. armature at Clapham sub-station. Only two complete tenders were received, and both were unsatisfactory. The Committee now proposes that the machine be repaired by the makers, Messrs. Dick, Kerr & Co., Ltd.

The Electric and Ordnance Accessories Co., Ltd., have received an order from the Westminster Electric Supply Corporation, Ltd., for 50 "Eclipse" cookers of a new pattern, these cookers being intended for hiring-out purposes. We understand that designs were submitted by a number of other cooker manufacturers, and that the contract was placed after severe tests.

The Metropolitan Asylums Board has accepted the tender of Messrs. Chesher, Toy & Winslow, at £42, for electric lighting works at the Fountain Temporary Asylum.

Marylebone.—The tender of Messrs. Blackmore & Co., for 4,000 tons of coal, at 15s. per ton, and 8,000 tons, at 14s. 1½d. per ton, f.a.s., has been accepted by the B.C. Electricity Committee.

New Zealand.—The following list of accepted tenders for material in connection with the Lake Coleridge Power Scheme appears in the *Australian Mining Standard* :—

Pipe line and accessories, £17,624 ; valves and accessories, £837.—Dunedin Engineering and Steel Co.
Water-wheels and accessories, £4,195.—Australian Metal Co.
Generators and accessories, £5,972.—Grey Thorne George, Auckland.
Transformers, £9,673 ; lightning arresters, £2,588 ; transmission insulators, £3,795.—National Electrical and Engineering Co., Dunedin.
Bare conductors, £13,101.—Richardson, Blair & McCabe, Wellington.
Insulated cables, £3,765.—P. R. Baillie & Co., Wellington.
Distributing insulators, £668.—Samuel Brown, Ltd., Wellington.
Testing transformers, £525.—Turnbull & Jones, Ltd.
Meters, £292.—A. & T. Burt.
Travelling crane, £646.—F. S. Greenshields & Co., Wellington.
Batteries and accessories, £840.—Turnbull & Jones, Ltd.
Bitumen, £1,087.—Neuchatel Asphalte Co.
Motor lorries, £1,106.—Grapes & Riley.
Motor-cars, £962.—Dalgety & Co., Ltd.
Gates for tunnel and penstock, £1,336.—Richardson, Blair & McCabe.

South Africa.—The *South African Mining Journal* states that an order has been placed for two variable-speed electric winders of the "Cascade" type, for the underground workings of the Van Ryn Deep, Ltd. The order has been placed with the Sandycroft Foundry Co., Ltd., of Chester. Their normal output will be 700 B.H.P. each, and their two efficient speeds are in the ratio of 2 : 3. These winders will be the first of the variable-speed "Cascade" type installed on the Rand.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION)

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, December 9th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, December 10th.—"B" Company. Recruit training, 7 to 10 p.m. ; company training, 7 to 10 p.m.

Thursday, December 12th.—"C" Company. Company training, 7 to 10 p.m.

Friday, December 13th.—"D" Company. Recruit training, 7 to 10 p.m. ; company training, 7 to 10 p.m.

Saturday, December 14th.—"C" Company. Run at Fort Coalhouse. Parade at Fenchurch Street Station at 8 p.m. Dress : Service dress, putties and greatcoat. Headquarters will bé open from 10 a.m. till 12 noon for regimental business only.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

Gifts to Liverpool University.—The Vice-Chancellor's report, presented at the annual meeting of the Court and Senate of the Liverpool University, on Saturday, November 30th, acknowledged the following gifts to the Department of Applied Electricity :—Sandycroft Foundry Co., Ltd., 10-H.P. cascade induction motor ; Dr. G. G. Stopford Taylor, 8-plate Wimshurst machine ; British Insulated and Helsby Cables, Ltd., a number of signalling instruments and telephone apparatus ; Campbell & Isherwood, Ltd., specimen resistance grids and stampings ; Crompton & Co., Ltd., set of working drawings and a four-machine set ; John Gibbs & Son, Liverpool, electrically-driven high-pressure fan.

ELECTRICITY AT THE SHELTON IRON CO.'S WORKS.

The properties of the Shelton Iron, Steel and Coal Co., Ltd., of Stoke-on-Trent, are of considerable extent, and include mines, collieries, coke ovens, blast furnaces and rolling mills. The main works are situated at Etruria, and the auxiliary works, including a forge, at Shelton. Some idea of the size of the company's premises may be gathered from the fact that the view, fig. 8, shows but a corner of the Etruria Works, the complete electrification of which is being gradually carried out. The most recent development in the progress of the electrification of the plant will be reviewed in the present article.

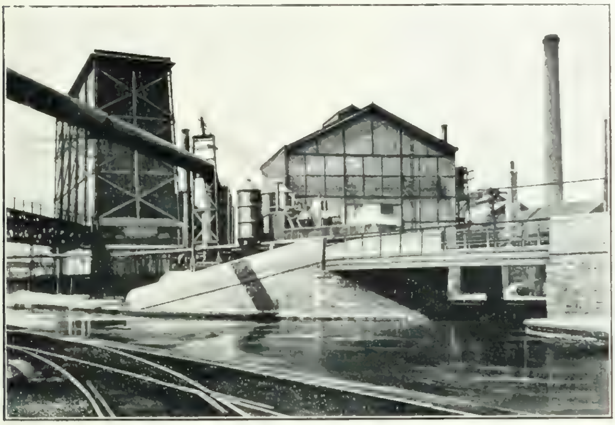

Fig. 1.—Turbine Power House, Shelton Co.'s Etruria Works.

The Shelton works contain a forge and four mills, namely, a sheet mill, and 16-in., 12-in. and 10-in. mills. These, together with much of the auxiliary machinery used in connection with them—such as saws, shears, and the like, were, until recently, steam-driven, the steam being generated by 14 Lancashire boilers. Nine of these boilers used waste heat from the heating furnaces, but the remaining five were hand-fired. By dispensing with these boilers and substituting electric drives for two of the smaller mills and the auxiliary machinery, it was estimated that a considerable financial benefit would result, provided that the electricity could be generated by a prime mover deriving its motive power from some other source of waste heat. This was available in the exhaust steam from the reversing rolling-mill engines at Etruria, the use of which presented the following favourable conditions:—(*a*) Ample supply of otherwise wasted heat; (*b*) Demand for current, justifying the installation of a good-sized unit; (*c*) Good load factor; (*d*) Displacement of inefficient rolling mill engines; (*e*) Displacement of extremely wasteful steam drives on auxiliary machinery; (*f*) Displacement of hand-fired boilers with their attendant labour and occupancy of valuable ground space.

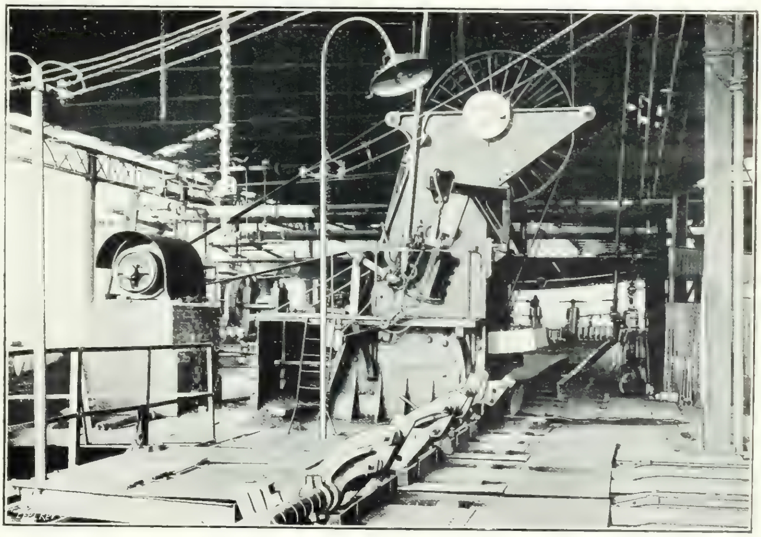

Fig. 2.—Motor-driven Hot Saw, &c., Shelton Iron Works.

Natural corollaries to conditions (*b*) and (*c*) were that the capital cost per kilowatt, and the cost per kilowatt generated, were both reduced to a minimum.

The reversing engines driving the 32-in. mill at Etruria are twin cylinder simple non-condensing machines, the cogging engine having 42 in. × 60 in., and the finishing engine, 50 in. × 60 in. cylinders. These engines are supplied with steam at about 120 lb. per sq. in. pressure, and 120 superheat, by nine Lancashire boilers, seven of which are hand fired, the other two using the waste heat from the heating furnaces. These engines exhaust into a riveted steel main, which also receives the exhaust from four small auxiliary engines. The whole of the exhaust steam is passed through a grease separator, and is thence conveyed to the power station by a 36-in. riveted steel pipe, carried over the stock banks and canal, as shown in fig. 1, which is an exterior view of the power station.

The exhaust steam pipe leads to an accumulator constructed to the design of Mr. P. J. Mitchell, one end of it being visible in fig. 1. This accumulator is capable of supplying steam to the turbine when running at full load, for periods of one minute, during which there is a cessation in the supply of exhaust steam from the mill engines. Steam from the accumulator is supplied to a Wright's heater-softener through a control valve which maintains a very slight pressure in the heater. Part of the boiler feed water is taken from the circulating water system through the heater softener, the remainder being discharged from the surface condenser as distilled water.

Since the supply of exhaust steam from the mill engines is very erratic, it often happens that the full demand of the turbine and the capacity of the accumulator are exceeded, when the steam would blow to waste. As much use as possible has been made of this excess in the plant under review, some of the surplus steam being utilised to heat the feed water. Two tanks (shown in fig. 1 with conical tops) are provided, each with a capacity of 650 gallons. The water for the boilers is taken from the condenser circulating water, and passed through these tanks in series on its way to the heater softener. Into each of these tanks is taken a pipe from the accumulator, perforations being drilled in these pipes at such a level below the water in the tanks that the pressure due to the head of water above the perforations is just exceeded by that at which the relief valve on the accumulator itself is raised. Thus, the water in the tanks is thoroughly heated at each peak in the exhaust steam supply, whilst, at the same time, the call for live steam for heating purposes is much reduced. The actual temperature of the water at the feed pumps, maintained by these means, varies between 190 and 200° F., the boilers and pumps being situated across the canal at some distance from the heater.

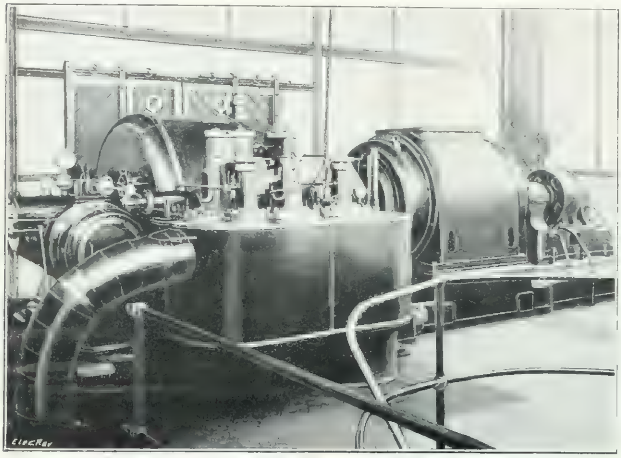

Fig. 3.—Westinghouse Turbine Plant in the Power Station.

Fig. 3 shows the inside of the power house and the 1,000-kw. (3,000 r.p.m.) mixed-pressure Westinghouse impulse-type turbine, driving a three-phase 50-cycle 5,500-volt pipe-ventilated alternator, with a direct-connected exciter having a radial commutator. The alternator is fitted with muslin air filters, arranged so that one can be cleaned whilst the other remains in use. The generator supplies current to the 8-panel black enamelled slate switchboard through a three-core, paper-insulated double-armoured cable. The voltage is kept steady by a Tirrill regulator. The high-tension switchgear is contained in cubicles located in the basement, and is mechanically operated from the switchboard in the turbine room.

The various 500-volt d.c. motors in the Etruria works are supplied with current from a 610-kw. 5,500/500-550-volt transformer, and a 500-kw., 750-r.p.m., 500-volt rotary converter, both of which are illustrated in fig. 9. The rotary is provided with an exciter and a.c. booster mounted on the same shaft. The current from the rotary is controlled from the low-tension panels of the main switchboard, whence it is distributed to the various motors in the Etruria works by overhead transmission lines.

The high-tension alternating current is transmitted to a sub-station at the Shelton works, over a three-phase transmission line composed of bare stranded aluminium conductors of ·2 sq. in. area, supported by creosoted timber poles; the terminals poles are steel structures, and the wires are prevented from falling to the ground by galvanised steel-wire cradling. Multiple gap lightning arresters are provided at each end of the line.

The condenser is of the Leblanc surface type, and has a cooling surface of 5,500 sq. ft. An Allen centrifugal pump is driven by a 72-b.h.p. Westinghouse motor at 600 r.p.m., and circulates the condensing water through the condenser and over the Zylba natural draught cooling tower, shown to the left in fig. 1. The condenser dry-vacuum pump is of the Leblanc rotary valveless type, and is driven by a 24-h.p. motor at 720 r.p.m. These pumps with their motors are illustrated in fig. 10, the condenser being situated through the wall at the right. The pump motors are controlled by Westinghouse Admiralty type control pillars.

The Westinghouse motors installed at the Etruria works are of various types and sizes, and perform many arduous duties, including the driving of the feed rolls, skids, and raising gear appertaining to the 32-in. mill, the main engines of which supply the steam for the mixed pressure turbine. Other motors are applied to the driving of saws, cranes, drills, shears, pumps, &c. Fig. 2 is a view looking towards the finishing rolls of this mill, the rolls being visible in the background. The finished stock is fed from the rolls through the channel way on to the rollers in the foreground, driven by 30-b.h.p. railway type motors, whence it is transferred by skids along the rails away to the right to cool. The motors employed on the mill feed rolls are 60-b.h.p. railway type machines and are located beneath the mill floor. This location is hot and dusty, so that totally enclosed machines had of necessity to be used, whilst the duty is extremely rough. The screwing down gear for the cogging rolls is driven by a 55-b.h.p. motor, and that for the intermediate rolls, by a railway type motor of 31 b.h.p. situated on a gallery between these stands of rolls. The skids for transferring the material from the cogging to the inter-

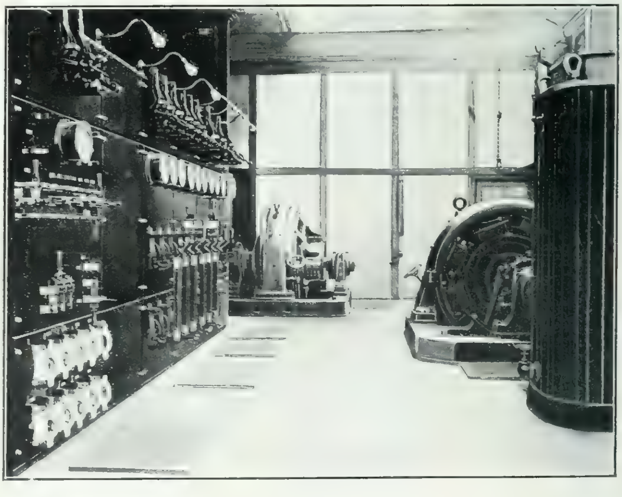

Fig. 4.—Converter Plant, Switchgear, and Mill Motor in the Shelton Works Sub-station.

mediate, and from the intermediate to the finishing rolls, are also motor-driven.

As the finished stock is fed from the channel way shown in fig. 2, it is cut off to the desired lengths by the Bowling saw illustrated. This saw is driven by a 55-H.P. Westinghouse motor shown on the left. The saw was originally a steam-driven machine, the cylinders, crank, disk, steam pipes and driver's platform being clearly visible. The displacement of this gear naturally results in great savings since apart from the steam leaks which always occur in pipe work of this description the efficiency of such an engine is extremely poor.

Fig. 7 illustrates a girder-straightening press, driven by a 24-H.P. motor. This machine is situated at the stock bank, and any finished stock which deviates from the straight after passing through the finishing rolls, is brought to it to be corrected. It will be seen that the motor drives on to the flywheel shaft of the press by means of a belt, and it will be recognised that the duty must often impose very heavy momentary overloads on the motor. In the background, to the right, will be seen the power station, cooling tower, high-pressure steam pipe and the feed-water pipe beneath it.

In fig. 5 a 13-B.H.P. motor running at 1,470 R.P.M. is is shown driving a Craven three-spindle girder drill press through a belt reduction. The motor control gear is mounted on the pillar at the left of the view.

The coal for the coking plant is brought to a washing house from the pits and is washed and screened, the dirt being carried away on an aerial ropeway. This is about ¼ mile long, and carries 10 skips, which are automatically emptied on to a tip at the point required. The motive power for this conveying equipment is an 8-H.P. motor, which is situated in the cabin on the loading platform at the washing house. The washing house is capable of handling 500 tons of coal per working day of 10 hours, and supplies the coke ovens shown in fig. 8. Here the coking process is carried on, the coke-oven gas being used to advantage in a gas engine-driven electric power plant, the jacket water-cooling tower and gas-holders of which are to be seen beyond the near end of the coking plant. The gas is washed, and forced through coolers, tar extractors and purifiers by two Bryan-Donkin rotary blowers, driven at 95 R.P.M., through double reduction gearing made by the Power Plant Co. These blowers are driven by two 20-H.P. Westinghouse motors running at 600 R.P.M.

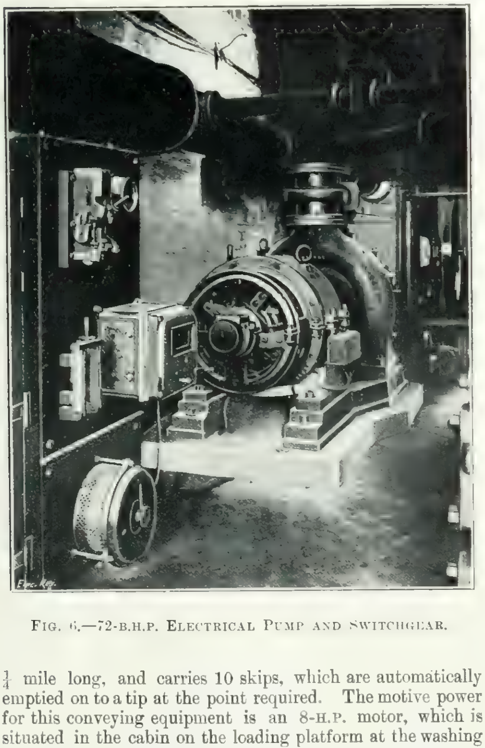
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Fig. 6.—72-B.H.P. Electrical Pump and Switchgear.

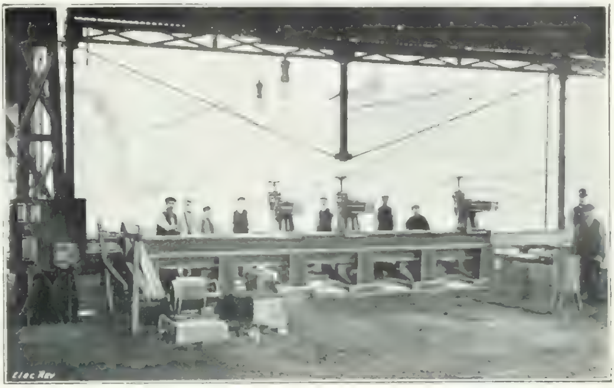
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Fig. 5.—Girder Drill Press, with Westinghouse Motor Drive.

Some of the blast furnaces may be seen in the background of fig. 8, a boiler plant being located close by them, and using the furnace gas for fuel.

The hydraulic plant at the blast furnaces is a mixed equipment embodying steam pumps of all types, sizes and ages, and there is also a turbine-driven centrifugal blower. The latest addition to the hydraulic plant equipment is a Mather & Platt centrifugal pump driven by a 72-B.H.P. compound-wound motor, running at between 600 and 1,000 R.P.M. This pumping set is illustrated in fig. 6, in which view the motor control panel can also be seen. The refuse from an old forge tip which is being worked, is discharged at the Etruria end of the property, the tip wagons being hauled by an endless cable receiving its motion from a 20-H.P. motor. This motor drives through reduction gear to a drum, around which the haulage cable is taken. The slack in the cable is taken up by a weighted bogie carrying a sheave and running on inclined rails.

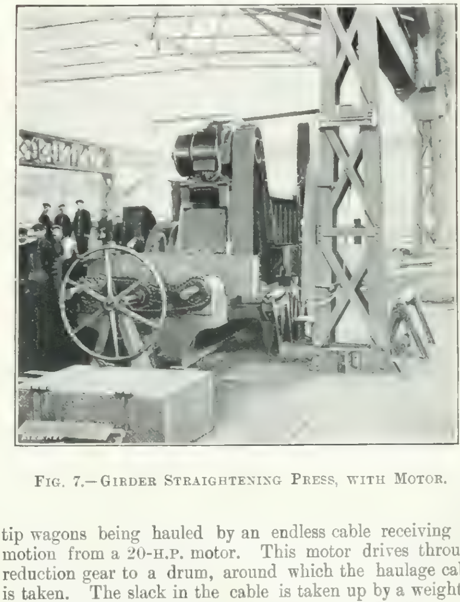

Fig. 7.—Girder Straightening Press, with Motor.

At the Shelton works a sub-station receives the incoming three-phase, 50-cycle, 5,500-volt lines from the power house, fig. 4 being an interior view of the sub-station. The feeder cables are taken to a seven-panel switchboard, from which connections are made through a 500-KW. 5,500/550-500-volt step-down transformer to a 500-KW. 500-volt compound-wound rotary converter running at 750 R.P.M., the rotary being provided with a liquid starter for starting up from the D.C. side. The shaft of the rotary is similar to that of the machine at the power station, but the booster and exciter mounted on the shaft of the latter are omitted in the case of the sub-station rotary, the rotor of this machine being designed so that the rotor of the power house converter can be put in its place in case of a breakdown. This rotary is capable of carrying a 25 per cent. overload for two hours, and usually runs from Monday morning to Saturday afternoon without a stop.

Fig. 8.—Part of the Shelton Co.'s Etruria Works, showing Coal Washery, Aerial Ropeway, &c.

At the far end of the sub-station is a 350-B.H.P. 500-volt, 450 to 720 R.P.M. compound-wound variable speed D.C. motor which drives the 10-in. mill. The motor shaft is provided with three bearings, a 3 ft. 6 in. rope pulley being mounted on it to carry 12 1⅜-in. cotton ropes. A liquid starter is provided for the motor, the starting handle being visible on the wall between the motor and the rotary, and the speed is variable by a shunt field rheostat. The starter itself is located outside the building. The motor will take an overload of 25 per cent. for one hour, and of 100 per cent. momentarily.

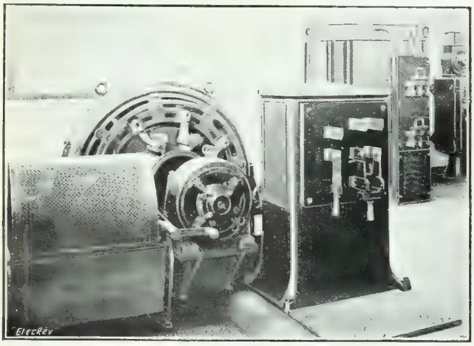

Fig. 9.—Converter Plant in Power Station.

The rope fly-wheel of the 10-in mill is 10 ft. 6 in. in diameter and weighs 10 tons, the speed varying from 150 to 240 R.P.M. The mill has two stands of three high, and two stands of two high rolls, and produces chiefly light stock and notched steel bars, such as are used in ferro-concrete work. The rope drive is completely shut off from the interior of the sub-station by steel plate guards, so that none of the fluffy matter from the cotton ropes can get into the motor windings. The power required to run the 10-in. mill light is 50 to 90 KW.

The motor driving the 12-in. mill is similar in every respect to the above machine, except that it is fitted with a 36-in. pulley. This drives the crankshaft of the displaced engine by 12 ropes, the rope pulley on the engine crankshaft being 14 ft. 6 in. in diameter, and weighing 7 tons. The engine fly-wheel is left in place and weighs 15 tons, all that is disconnected being the connecting rod big end and the eccentric strap. The engine shaft is driven at 90 to 150 R.P.M., and operates one stand of three high bolting rolls, and one stand of finishing rolls which may be worked either two or three high.

The power required to run the 12-in. mill light is 43 to 80 KW.

The adoption of the rope drive, more particularly in the case of the 10-in. mill, may appear to be open to criticism. It should, however, be noted that the high speed of the motor keeps down the cost of the equipment, whilst the two motors are exactly interchangeable, except for the pulleys, and the previous arrangement of both mills was extremely favourable for the rope drives. The motors, whilst they are in no way too large for the work, have proved of ample power and have operated satisfactorily in every respect.

There are a number of small Westinghouse motors scattered about the Shelton works, operating on the 500-volt D.C. circuit. These motors replace steam drives in the majority of cases in which they are applied to such machines as saws, shears, hoists and pumps.

The cost figures per unit of electricity generated, over a period of six months working, are as follows :—Wages, ·0331d. ; stores, ·0137d. ; fuel, ·0638d. ; repairs, nil ; total, ·1106d. These figures are exclusive of interest on capital charges and depreciation. The cost for fuel is based on the average time which the turbine ran on live steam alone. The total number of units generated in this period was 2,090,000, so that the operating costs for the 1,000-KW. set may be taken at being approximately £1,926·66 per annum.

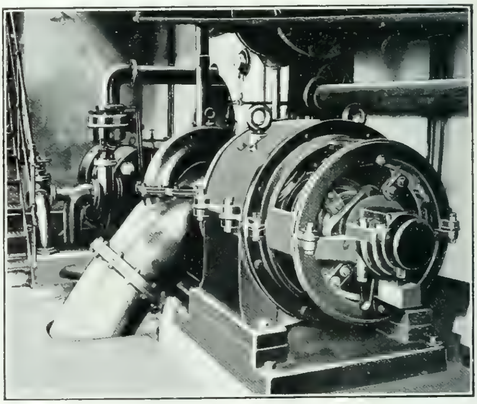

Fig. 10.—Westinghouse Condenser Pumps in Power House.

FORTHCOMING EVENTS.

Northampton Polytechnic Institute, St. John Street, E.C.—Friday, December 6th. At 7.30 p.m. Distribution of prizes and certificates by the Marquess of Northampton.

Saturday, December 7th. From 6.30 p.m. to 11 p.m. Members' and Students' annual conversazione.

Royal Society of Arts.—Monday, December 9th. At 8 p.m. Cantor lecture on "Methods of Economising Heat," by Mr. C. R. Darling. Lecture II.

Wednesday, December 11th. At 8 p.m. Paper on "Natural and Synthetic Rubber," by Dr. F. W. Mollwo Perkin.

Institution of Mechanical Engineers (Graduates' Association).—Monday, December 9th. At 8 p.m. Paper on "The New Generating Plant for the Port of Calcutta," by Mr. C. F. Robertson.

Institution of Electrical Engineers (Newcastle Section).—Monday, December 9th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Earthed v. Unearthed Neutrals in A.C. Systems," by Mr. J. S. Peck.

Wednesday, December 11th. At 7 p.m. At the Lit. and Phil. Society's Rooms, Middlesbrough. Paper as above.

Institution of Electrical Engineers (Western Section).—Monday, December 9th. At the Merchant Venturers' Hall, Bristol. Meeting.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—Monday, December 9th. At 6 p.m. At the I.E.E., Embankment, W.C. Paper on "Wireless," by Mr. F. Addey.

Faraday Society.—Tuesday, December 10th. At 6.30 p.m. Dinner at the Holborn Restaurant. At 8 p.m., at the I.E.E. Lecture on "The Electro-Motive Forces of Concentration Cells," by Principal A. P. Laurie.

Institution of Civil Engineers.—Tuesday, December 10th. At 8 p.m. Paper on "The Distribution of Producer Gas in South Staffordshire," by Mr. H. A. Humphrey.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, December 10th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Electric Theatre Installations," by Mr. S. Burns.

Institution of Electrical Engineers (Scottish Section).—Tuesday, December 10th. At 8 p.m. Meeting at the Princes Street Station Hotel, Edinburgh.

Association of Engineers-in-Charge.—Wednesday, December 11th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "Modern Methods of Electric Wiring," by Mr. F. Broadbent.

Junior Institution of Engineers.—Wednesday, December 11th. At 8 p.m. Presidential address, "Staff Officers in Industrial Works: Their Scientific and Practical Training and Duties," by Sir A. Trevor Dawson, R.N.

Saturday, December 14th.—At 7 p.m. At Caxton Hall, Westminster, S.W. Reception, dance and whist drive.

The Dynamicables.—Wednesday, December 11th. At the Hotel Cecil. Dinner.

Institution of Electrical Engineers (London).—Thursday, December 12th. At 8 p.m. Paper on "A Single-phase Motor with Pole-changing Windings," by Mr. B. P. Haigh.

Institution of Electrical Engineers (Dublin Section).—Thursday, December 12th. At 8 p.m. Meeting at the Royal College of Science, Dublin.

Electro-Harmonic Society.—Friday, December 13th. At 8 p.m. At the Holborn Restaurant. Smoking concert.

Institution of Electrical Engineers (Students' Section).—Saturday, December 14th. At 7, for 7.30 p.m. At the Trocadero Restaurant, Piccadilly Circus, W. Annual dinner.

NOTES.

Institution and Lecture Notes.—Institution of Electrical Engineers (Dublin Local Section).—At the meeting on November 14th, Prof. W. Brown gave an account of the equipment of the electrotechnological laboratories of the Royal College of Science, Dublin. The switchboard consists of marble panels, and is 40 ft. in length. There are 18 machines, by various British makers, the largest being a 30-kw. dynamo and a 46-h.p. induction motor; six smaller machines are also provided, as well as transformers and a storage battery. The testing apparatus includes an oscillograph, potentiometer, &c., and provision is made for experiments on electric furnaces and high-pressure work.

Institution of Electrical Engineers (Newcastle Local Students' Section).—On November 25th Mr. P. Grice read a paper on "The Heating and Cooling of Electrical Machinery," outlining the theory and illustrating the use of the heating time constant in deducing information as to the behaviour of a machine under various conditions. The inefficiency of radial ducts in armature cores was pointed out, and the bad effect of air pockets in field coils. The use of artificial methods of cooling with air and water was also discussed.

Institution of Electrical Engineers (Western Section).—A neat pamphlet has been issued containing the names of the officers and Committee of the Section, extracts from the articles of association and the rules of the Local Sections, and a list of members.

Institution of Electrical Engineers (Manchester Section).—A meeting was held on Tuesday, December 3rd, when a paper was read by Messrs. J. G. and R. G. Cunliffe on "Some Problems in Traction Development—Tramway Feeding Networks." A long and interesting discussion followed, which was replied to by the authors.

Institution of Electrical Engineers (Manchester Students' Section).—At a meeting on Tuesday last week Mr. S. N. C. K. Whitehead read a paper on "The Individual Electric Drive in a Modern Weaving Shed."

Physical Society of London.—The eighth annual exhibition of apparatus will be held by the Physical Society on Tuesday, December 17th, at the Imperial College of Science and Technology, South Kensington, from 3 to 6 p.m., and from 7 to 10 p.m.

Society of Engineers (Inc.).—On December 2nd Mr. P. J. Waldram read a paper on "Test Deflections in Reinforced Concrete."

Royal Scottish Society of Arts.—At a meeting in Edinburgh last week, Mr. G. A. Dickie, Birkenhead, gave a description of "A Miner's Electric Safety Lamp," the invention of the author.

Institute of Metals.—The annual general meeting of the Institute will take place on March 11th and 12th, 1913, at Storey's Gate, Westminster. Amongst the papers that will be presented will be Dr. G. D. Bengough's Second Report to the Corrosion Committee, in which he will deal with the results obtained from the experimental condenser which has been running continuously at Liverpool since the beginning of April. A ballot for the election of new members will take place this month: applicants for membership should send in their forms to the secretary on or before December 16th. As a result of a suggestion contained in a paper on "The Nomenclature of Alloys," read by Dr. W. Rosenhain before the Institute in January last, a Committee consisting of representatives of the Institute of Metals and Allied Societies has been appointed under the name of the Nomenclature Committee, and will shortly hold its first meeting.

Royal Institution.—The following are among the lecture arrangements before Easter:—Prof. Sir James Dewar, Fullerian Professor of Chemistry, a course of six experimentally illustrated lectures, adapted to a juvenile auditory, on Christmas lecture epilogues: Alchemy, December 28th; Atoms, December 31st; Light, January 2nd; Clouds, January 4th; Meteorites, January 7th; Frozen Worlds, January 9th. Prof. B. Hopkinson, two lectures on Recent Research on the Gas Engine. Prof. Sir J. J. Thomson, Professor of Natural Philosophy, six lectures on the Properties and Constitution of the Atom. The Friday evening meetings will commence on January 17th, when Prof. Sir J. J. Thomson will deliver a Discourse on Further Applications of the Method of Positive Rays.

Birmingham Association of Mechanical Engineers.—On November 2nd a paper on "Electric Lighting Systems and Dynamos for Motor-Cars" was read by Messrs. J. T. Walton and A. E. Brewerton, who recommended the use of a battery in conjunction with a dynamo driven from the main engine, and described the principal systems in use. An extra meeting was held on November 21st, when Mr. R. Berry read a paper on the "Transmission of Power by Belting."

Association of Mining Electrical Engineers.—At a meeting last Saturday at Nottingham, Mr. E. E. Beadsmoore, of Tibshelf, submitted a paper on "A Distance Indicator for Underground Haulage Signals.

Association of Mining Electrical Engineers (East of Scotland Branch).—The following are the dates and places of meeting for the remainder of the 1912-13 session:—December 20th, Kirkcaldy; January 24th, 1913, Dunfermline; February 22nd, Edinburgh; March 28th, Dunfermline; April 25th, Kirkcaldy; May 16th, Dunfermline.

At a recent meeting of the Croydon and District Launderers' Association, Mr. A. C. Bostel, of the Croydon Corporation Electricity Works, gave a lecture on "The Uses of Electricity in the Laundry."

Horizontal Aerials.—The possibility of using horizontal in place of vertical antennæ is of special interest, in that the construction of the former is simpler and cheaper. Provided account is taken of the special properties of horizontal aerials, the latter are at least as satisfactory as the vertical type as regards both reception and transmission.

M. Turpain has recently conducted experiments on a large scale at St. Benoit (Morocco), and communicated his results to the Assocn. pour l'Avancement des Sciences, at the Nimes Congress. Three horizontal wires, each 400 m. in length, were arranged parallel to each other at a distance of 25 cm., and arrangements were made for their interconnection in various manners. The lowest wire was 10 m. from the ground, and thorough earth connection was effected by two square zinc plates (40 cm. side) immersed in a pond.

When using only one of the horizontal aerials, signals from Rochefort, Brest, and Bizerta, were received, as well as those from two more distant, unidentified stations—one of which was believed to be Poldhu. Using a crystal detector, the Eiffel Tower time signals could be distinctly heard when the telephone was 26 cm. from the ear. Using three aerials in parallel, the latter distance could be increased to 33 cm. before the signals became inaudible. Very satisfactory results were obtained with wires 200, 300 and 400 m. in length, stretched along dry ground, but reception was not nearly so good as with the former elevated aerials.

A 400-m. aerial suspended 10 m. above ground level was compared with a vertical aerial carried from a 22-m. mast, and presenting a total length of 148·5 m. In observing time signals on the same day and with the same detector, the signals ceased to be audible when the telephone was 12 cm. from the ear using the vertical aerial (the circuit being tuned in each case to give maximum sensitivity). It was also found that the effects of parasitic waves and atmospheric disturbances were less serious when the horizontal aerial was employed. The cost of the latter was about half that of the vertical aerial with which it was compared.

Electrical Locomotives at the Sydvaranger Mines in Norway.—For the transport of "slig" or fine iron ore and briquettes, the Sydvaranger Co. has built an electrical railway, which is the most northerly railway of its kind in the world. Two electrical locomotives have been constructed for this line, which are shown in the illustration. At the time when these locomotives were ordered there was some question that the regular supply of current would be affected by the heavy falls of snow which sometime occur in these latitudes, but these anticipations have happily not been verified during the two winter seasons that the line has been at work, and there has, as a matter of fact, only been a stoppage of two hours on account of snow. The compartment for the driver is as shown in the illustration, completely closed, and all the controlling apparatus is arranged in such a way that the driver shall not be obliged to move from his place, even if the direction of running is reversed. The weight of each locomotive amounts to 11,000 kg., apart from which it also carries ballast of 6,000 kg., so as to obtain the necessary adhesion. Current is supplied to the locomotive by means of a third rail, and sliding shoes carried by the bearings of the engine.

The working of the line is arranged in the following order:—Every 45th minute there is run a train-load of 185 tons gross and about 100 tons net, distributed on four wagons. As every train has to be weighed and shunted under the loading bridge, these must be started every three-quarters of an hour as follows: Seven times with a loaded train; twice with an empty train; four times with the locomotive only.

Parliamentary Notes.—Oil and Electric Lamps (Testing).—Sir Arthur Markham asked the Home Secretary how the charge of £20 which he proposed to charge safety lamp manufacturers for testing oil and electric lamps, was made up. Mr. McKenna replied that the amount of the fee had been fixed so as to cover as nearly as possible the expenditure incurred by the Government in connection with the test, which includes the charges in respect of the establishment and equipment of the station, the working and maintenance expenses, and a proportionate part of the salaries of the officials employed on the work. It was not possible, in a matter of this kind, to make any close estimate, as the number of lamps likely to be submitted after the first year was uncertain, but he had no reason at present for thinking that the average annual amount received in fees was likely to show any surplus over expenditure.

Electrical Work on Battleships.—In the Parliamentary Papers last week, Mr. Barnes asked the First Lord of the Admiralty whether he was aware of a dispute in progress between Messrs. Beardmore, the Fairfield Shipbuilding Co., and Messrs. John Brown and Co., and the electricians in their employment; whether he was aware that the electrical work on H.M.S. *Conqueror*, H.M.S. *New Zealand*, H.M.S. *Southampton* and H.M.S. *Agasta* was being either inefficiently done by apprentices or neglected altogether: was the Admiralty passing the electrical work that had been or was being done on these ships, or what action was it taking; and whether he would inquire as to whether the employers were observing the fair-wages clause in their methods of dealing with the dispute. Dr. Macnamara replied that the Admiralty was aware of the existence of the dispute referred to, but, except in one case, no definite complaint in regard to the fair wages clause had been received at the Admiralty. Inquiries were being made into the circumstances of that case. Mr. Barnes could rest assured that none but satisfactory work would be accepted for H.M. ships.

Copper.—The returns for the end of November, as shown by Messrs. H. R. Merton's circular, do not indicate quite so brisk a market as would be expected. The difference in European visible supply (including Rotterdam and Hamburg stocks) is 3,060 tons. Withdrawals from English and French stocks are more in accordance with the recovery in trade now taking place, the English ports having transferred or sold 1,559 tons, and French 2,050, an unusually large decrease for the latter. Against this, the quantities afloat from Chile and Australia are rather heavier. Stocks in Rotterdam are entered as 350 tons only.

Turning to supplies, we find that North America is about average, Spain and Portugal considerably above, with 1,806 tons, Chile shipments below average, Australia shipments above. Total deliveries, at 41,828 tons, are good, but, as before remarked, not so high as might be expected.

The American Copper Producers' Association figures for American stocks (end of October) are 34,261 tons, an increase of 6,106 tons over the quantity for the end of September. The total visible supply for the end of October was 80,602 tons, an increase of 4,502 tons on the return for September 30th.

Manchester Electro-Harmonic Society.—The second concert of the above Society was held on Friday evening last, when a goodly number of members and visitors were present. The programme arranged was of a high-class nature, and nothing but praise can be given to the instrumentalists for the brilliant manner in which they rendered their selections. There was no question but that the items were very greatly enjoyed by those present. The singing of Mr. Bridge Peters was excellent, though his voice would have been heard to greater advantage in a larger room. The humorous selections given by Mr. Wilfred Ludlow were much appreciated. Mr. W. J. Smith, hon. musical director of the Society, is to be congratulated on arranging such a high-class programme, and it is to be hoped that he will be equally successful on the next occasion.

A correspondent writes:—"I was in Manchester last Friday and decided to stay for the Electro-Harmonic concert that evening. I found it so good that I feel impelled to tell my fellow members of *The* Electro-Harmonic Society (as our Manchester *confrères* ungrudgingly call it) all about it.

"The fear that I should feel an 'outsider' among so many people I did not know, was at once dispelled by the very hearty reception I had when it was known I was a member of *The* E.H. Society. The concert was timed for 7.15, though it did not actually start till 7.30—a still early hour for a Londoner—and left off at about 10.45, one or two curtailments having to be made in order to get through in time. The first thing I noticed on entering the room was the very splendid get up of the programmes, which are far more elaborate than our London ones. (This is not meant for an odious comparison, as I think we are all well satisfied with what we get.) The next striking feature, and one which struck me as worthy of emulation, was that the chairman, Mr. Cramp, announced that the waiters would take orders before the beginning of the first item and would execute them at the end of it. The absence of waiters, with their accompanying noise during the turns, was a very pleasing feature throughout the evening.

"But the best deviation of all from our practice in London was the number of intervals that were allowed between the turns. It has always seemed to me that there are not enough allowances for hob-nobbing at our London concerts, with the result that when one moves at half-time it is difficult to get back till the second half is nearly finished owing to the many acquaintances one meets. In Manchester, several five and 10-minute intervals are allowed and are much appreciated. Do our much larger audiences in London preclude this arrangement?

"The concert itself was tip-top. Too classical I am afraid for our London people, but much appreciated in Manchester, as was evidenced by the reception given to some remarks made by Mr. Smith, of Leigh and Bedford, in proposing a vote of thanks to the musical director. It was, to me, a novel sight to see the score of the music on the chairman's table, and to see with what relish it was followed by those around. Not that the comic element was not well received. In fact, as usual, the funny man elicited the most applause and got most encores. A very excellent baritone singer was the only other to get encored, encores not being a feature of the Manchester concerts, as they are in London. Of course, it is this self-restraint that allows time for the many intervals I have written of.

"Altogether it was a very pleasant evening, and reflects great credit on Mr. Hill, the secretary, and Mr. Smith, the musical director; my best thanks to them both for their kind welcome.

"In conclusion, I have to repeat the message that appeared in a former issue of this paper, viz., that all members of *The* Electro-Harmonic are cordially invited to 'show-up' at any of the Manchester Electro-Harmonics."

The Electro-Harmonic Society.—The next Smoking Concert will be held at the Holborn Restaurant (King's Hall) on Friday evening, December 13th, at 8 o'clock. The artistes are as follows: Vocalists—Mr. Edward Davies (tenor), Mr. Humphrey Bishop (baritone), Mr. Charles James (bass); Siffleur and humorist, Mr. Arthur Melrose; Irish comedian, Mr. Alfred Hurley; Humorist, Mr. Will Edwards; Banjo, Mr. Joseph Bull; Entertainer at the piano, Mr. Selwyn Driver. Solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

Canada.—According to H.M. Imperial Trade Correspondent at Toronto, a company has been formed in Ontario, with a capital of $1,000,000 (about £205,500), for the purpose of manufacturing and dealing in electrical and other machinery, generators, motors, dynamos, lamps and electrical devices and supplies of all kinds. The name can be obtained from the Board of Trade Commercial Intelligence Department in London.

The Sleeping Passenger.—A builder's labourer went to sleep in a tramcar on the night of August 26th, and he awoke to find himself in the car depôt. Picking his way out through the rails he fell into a pit and was injured. While holding that the servants of the Metropolitan Electric Tramways, Ltd., were negligent for not searching the car, the Marylebone County Court judge held that the plaintiff was equally to blame, and he gave judgment for the company.

The Electrical Trades Benevolent Institution.—The performance of "The Second Mrs. Tanqueray," given on October 16th by the Garrick Dramatic Society in aid of the funds of the Electrical Trades Benevolent Institution, was a success in every way. Not only did it provide, for those who were able to avail themselves of it, an opportunity for spending an enjoyable evening in the presence of a large company of kindred electrical spirits listening to an excellent rendering of the piece by talented members of the Society, but—and this is really the main consideration—it has brought from the Society out of the proceeds of the performance a donation of £50 for the Benevolent Fund. Thanks are due to the Garrick Society, to the members of the Benevolent Fund Committee and others who pushed the sale of the tickets, to electrical firms and individuals who bought them, and, of course, to Mr. Hawes, the secretary of the fund, for working so arduously to make a success of the event.

The Bradford Strike.—Our correspondent writes:—"The electricans' dispute at Bradford remains unsettled. The Lord Mayor's offer of arbitration has been refused by the employers, whilst the men did not greatly favour that course, and at a meeting of the Bradford Trades and Labour Council on Thursday last, it was stated that the men thought it desirable that a meeting of the workers engaged in the building and furnishing trades in Bradford should be convened to discuss the matter. It appeared that a large number of the electricians on strike were obtaining good employment outside Bradford, and if the period of waiting was prolonged the objects of the men might be defeated, for their strength locally was being seriously depleted owing to strikers getting fresh employment elsewhere. It was decided that the suggestion of the electricians should be carried out and a meeting of the builders and furnishers convened."

The B.E.A.M.A.—We are notified that the annual general meeting of the British Electrical and Allied Manufacturers' Association (Inc.) will be held in the Lecture Theatre of the Institution of Electrical Engineers, Victoria Embankment, W.C., on Friday, January 24th, 1913, at 2.30 p.m. The business will include the reading of the annual report and balance-sheet, and the election of five members of Council to fill retirements under the articles of association. The annual dinner of the Association will be held on the same day, the Right Hon. Lord Ampthill, G.C.I.E., &c., President of the Association, presiding. Details of arrangements for the annual dinner will be forthcoming shortly.

L.C.C. Coal Bill.—The annual maintenance votes for 1912-13 include a provision of £92,350 in respect of coal for use at the Greenwich generating station, but it is pointed out that owing to the high price of coal consequent on the coal strike, and to the necessity for burning a larger quantity than was estimated by reason of the breakdown of one of the larger turbine units, the vote will be exceeded by an estimated sum of £40,700.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the invitation of Ald. Joseph Clifton, chairman of the Peterborough Town Council Electricity Committee, the whole staff of the works sat down to dinner together last week. Interesting speeches were made by Mr. J. C. Gill, the city engineer, and other members of the party. In the course of the evening, Mr. T. Rowlands, works engineer, on behalf of the staff, presented Ald. Clifton with a large framed picture representing the exterior and interior of the works, various parts of the plant, the members of the staff and other details.

Mr. C. Mittelhausen, electrical engineer and tramway manager to the Bexley U.D.C., has resigned his position.

The marriage has taken place at St. Margaret's Church, Lowestoft, of Mr. Ralph Hardy, assistant engineer at the Lowestoft Electricity Works, and Miss Margaret S. Dance, daughter of Mr. C. W. Dance, of Lowestoft. The presents included a large tantalus from the electrical staff.

The Ilford U.D.C. has appointed Mr. George Edward Williams, of Finchley, as second charge engineer at the electricity works.

In consequence of the resignation of the second engineer-in-charge, Mr. G. Ingram, the Bermondsey Electricity Committee has decided to promote the third engineer-in-charge, Mr. P. G. Campling, to the vacant post, at £120 per annum, rising to £140. Mr. C. J. Oake, junior engineer-in-charge and switchboard attendant, is to be promoted to the position of third engineer-in-charge, at £110, rising to £130.

The staff at Colne electricity works has been re-arranged owing to resignations. Mr. George Chadwick has been promoted to the position of senior charge engineer.

Mr. B. D'Rane has resigned his position as assistant mains engineer to the St. Marylebone electric supply, having obtained an appointment with the Para Electric Railways and Lighting Co., Brazil.

The Dudley Corporation Lighting Committee has passed a resolution recommending that Mr. C. E. Savage, electrical engineer, who has tendered his resignation, receive the thanks of the Council for the able manner in which he has conducted the working of the electric power station during his engagement.

Mr. H. C. Appleby has resigned his position as senior shift engineer with the Kidderminster and District Electric Lighting and Traction Co., in order to take up the duties of shift engineer at the Rawtenstall Corporation Electricity Works.

General.—Upon his resignation as chief electrician at the Bentley Colliery, Doncaster, Mr. Barber has been the recipient of a handsome gold watch from the officials and employés of the colliery. Mr. Barber has obtained a post in India in connection with the construction of a railway there.

Mr. T. J. McKavanagh has resigned his position as chief electrician of the cs. *Minia*, and on December 1st he took up the duties of Lecturer and Demonstrator in Electrical Engineering at the Technical Institute, Shawinigan Falls, Quebec. He is equipping the electrical engineering laboratory, and will be glad to have lists from makers of laboratory supplies.

Mr. Charles F. Bennett has resigned the chairmanship of the Sheffield Corporation Electric Light Committee.

Four members of the Blackpool Tower electricity staff—Messrs. John Bamber, Sid Quick, Cyril Davies and George Nelson—have left Blackpool for Sydney, New South Wales, to join Mr. C. Grundy and other old Tower employés who left Blackpool some weeks ago. Each of the "emigrants" received a memento from the Tower staff.

Mr. J. D. Taylor, assistant superintending engineer of the engineering department of the Post Office, has been appointed superintending engineer, East District, Scotland.

Mr. T. H. Matthewman, M.Eng., who graduated with honours in the Liverpool University, has been appointed Lecturer in Electrical Engineering at the University of Hong Kong. Mr. Matthewman had a distinguished career in Liverpool, holding a Senior City Scholarship as well as the David Rew Memorial Scholarship.

Councillor D. B. Foster, of Leeds, by trade an electrician, has just conducted a debate with Tom Mann, in the Leeds Albert Hall, on "Syndicalism."

NEW COMPANIES REGISTERED.

Farringdon Electric Light and Power Co., Ltd. (125,573). This company was registered on November 27th, with a capital of £2,500 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with the Rural Districts Electric Undertaking, Ltd. The subscribers (with one share each) are:—H. T. Harrison, 11, Victoria Street, S.W., engineer; W. Riggs, 23, Davies Street, W., engineer; L. E. Jones, 29, Woodstock Avenue, Hendon, N.W., gentleman; H. U. Andrews, 54, New Broad Street, E.C., A.C.A.; H. I'Anson Jones, 62, London Wall, E.C., solicitor; W. G. C. Masham, 54, New Broad Street, E.C., secretary; Miss M. Eates, 77, Broadway, Bexley Heath. Minimum cash subscription, 100 shares. The first directors are H. T. Harrison, W. Riggs, O. H. Valpy, and J. Jacobs, J.P.; qualification, £50. Registered by T. J. Jones, 54, New Broad Street, E.C.

Metamica Syndicate, Ltd. (125,602).—This company was registered on November 28th, with a capital of £2,000 in £1 shares, to acquire from W. McLoughlin an invention relating to improvements in mica and the like insulators and screens, and to carry on the business of insulating material and electrical instrument manufacturers, &c. The subscribers (with one share each) are:—A. Round, 21, Waterloo Street, Birmingham, solicitor; O. F. Gloster, 21, Waterloo Street, Birmingham, solicitor. Private company. The number of directors is not to be more than five; the subscribers are to appoint the first; remuneration as fixed by the company. Registered office, 21, Waterloo Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Keighley Electrical Engineering Co., Ltd. (44,893).—Capital £10,000 in £1 shares (3,000 pref.). Return dated September 24th, 1912 (filed November 5th), 4,200 ord. and 1,800 pref. shares taken up; £1 per share called up on 2,588 ord. and 1,400 pref.; £3,988 paid; £2,012 considered as paid on 1,612 ord. and 400 pref. shares. Mortgages and charges: £5,000.

Cape Electric Tramways, Ltd. (54,636).—Capital £500,000 in £1 shares. Return dated November 13th, 1912, 491,002 shares taken up; £91,222 paid; £400,000 considered as paid. Mortgages and charges £463,000.

Concordia Electric Wire Co., Ltd. (74,416).—Capital £2,000 in £1 shares. Return dated October 14th, 1912. All shares taken up. 10s. per share called up on 1,993, and £1 per share on 7. £1,003 10s. paid. Mortgages and charges: Nil.

Falvey's Turbine Syndicate, Ltd.—Two debentures dated November 14th, 1912, to secure £25, each charged on company's property, present and future, including uncalled capital. Holders: C. A. F. Green, 53, Peak Hill, Sydenham, and H. F. Crick, Pennington Vicarage, Lymington.

Singapore Electric Tramways, Ltd. (84,088).—A memorandum of satisfaction to the further extent of £3,900 of debentures, dated November 30th, 1906, securing £350,000, has been filed.

Samuel Harford & Co., Ltd.—Second mortgage debenture dated November 29th, 1912, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: N. Woollright, Holly Bank, 15, Hargreaves Road, Liverpool.

Newton & Pycroft, Ltd.—Mortgage on Alfred Street Mills, Ashforth Street, Nottingham, dated November 16th, 1912, to secure all moneys due or to become due from the company to London City and Midland Bank, Ltd., 5, Threadneedle Street, E.C.

J. Kirby & Co. (Leeds), Ltd.—Debenture dated November 5th, 1912, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Scott, "Dunelin," Roundhay, Leeds.

CITY NOTES.

River Plate Electricity Co., Ltd.

An extraordinary general meeting of the shareholders of the above company was held on Wednesday, at the offices, 62, New Broad Street, E.C., Mr. M. W. Mattison presiding.

The Chairman proposed the following resolution :—"That the arrangement entered into between the River Plate Electricity Co., Ltd., and the Argentine Co. called 'La Electrica del Norte,' for the joint working of the stations and businesses of the separate companies in the city of Tucuman, and in the city of Santiago del Estero, Argentine Republic, be, and the same is hereby, approved and confirmed." He said that the arrangement was a very important one as far as their Tucuman undertaking was concerned. Its immediate effect provided for a working agreement with the La Electrica del Norte Co., including a complete pooling of the earnings of the two undertakings, and ultimately it contemplated a complete fusion between the two companies as far as Tucuman was concerned. It had nothing whatever to do with their La Plata or Ensenada undertakings, which formed the principal part of the business of the company. As they were aware, for many years they had supplied electric light and power to private consumers in Tucuman, and until recently their only competitor was the del Norte Co.—an Argentine company. That company, besides supplying private consumers, held the public lighting contract, and owned the only tramway system in the city. In addition, it owned an electric light station at Santiago, and altogether the interests of that company in the city were considerably larger than theirs. The geographical position of the city precluded the possibility of its ever being a great industrial centre, and it was obviously not a place which could support two competing power stations. Therefore, as the directors of both company's were business men, it was clear that sooner or later they would come together and combine their interests. It was possible that the arrangement now under consideration had been somewhat accelerated in the matter of time by the advent of a company called the Hydro-Electric Co. of Tucuman. That was an Argentine company which held a concession to develop water power at a point on the River Lules, some 15 or 16 miles from Tucuman. The board had known a good deal about the scheme from its inception. The original idea was to develop power on the river and convey it on overhead wires to Tucuman and sell it in bulk to companies like themselves. That was a proposition to which they neither could, nor did, take objection. They, however, never thought the project was commercially sound, and therefore they declined to risk their money in it, but they always expressed their readiness to purchase in bulk at a fair price. But the company had refused to deal with them on those lines—they were not content to be wholesale sellers of power, which was the *rôle* adopted by nineteen-twentieths of all successful hydro-electric companies in existence in the United States and elsewhere; they resolved to be retail sellers as well—in other words, instead of being content with one profit, they desired to get two, with the result, he ventured to say, that they would get neither. The competition at Tucuman had started; the installation of the Hydro-Electric Co. was completed to the extent that they were able to deliver light and power in the city, and from about the middle of November they had been supplying. They had issued a tariff which, as they (the directors) expected, was a highly competitive one. They were advised that even if the Hydro Co. could get the whole of the private lighting, which was done now by both companies—a most absurd and ridiculous supposition—the rates they were charging would not produce a net revenue which would equal depreciation and interest on debentures. As far as that company and the del Norte were concerned, they had met the rates by corresponding reductions, and if the Hydro Co. cut the rates still further, they would follow. The board deplored that ridiculous waste of money, but they were on the defensive, and they could do nothing else. He supposed the idea of the Hydro Co. was that, if the competition was made severe enough, the existing companies would be tired out, and though, in the meantime, the competitor might make losses, he would get them back when the other competitors were frozen out. The pooling arrangement between themselves and La Electrica del Norte they considered a most important step, for a combination of the interests of the two companies meant that if the Hydro-Electric Co. elected to continue the fight, they would have to fight a united, instead of a divided interest. There was the further consideration that the union of the two stations and the two staffs would mean a substantial reduction in working expenses. Another point which had to be weighed with them was that this arrangement would enable them to keep the finances of the fight in Tucuman largely apart from their undertakings in Ensenada and La Plata. As to how long the fight was likely to go on, he could only say it would last so long as was necessary to secure to La Electrica del Norte and themselves that full share of the business of lighting and power and traction to which they were entitled. It might take time, but however long the time they were prepared to wait, as they had no fixed charges to look to in Tucuman or for interest, and they had ample resources in other directions. Sooner or later, those who controlled the Hydro Co., if they ever desired a return upon the capital, would have to face the facts and revise their whole programme in accordance therewith. In the meantime they would do what every self-respecting company would do in like circumstances—maintain at all costs the bulk of their business in the city. He might take that opportunity of telling them that in La Plata and Ensenada, things had continued to develop favourably on the lines he had indicated at the last meeting, and unless something untoward happened in the next few weeks they would be able to present them with a satisfactory report next April. There was, of course, no probability of the board recommending any increase at present on the dividend of 10 per cent which had been paid for some time, but he thought they might confidently anticipate that the profits would admit of the payment of such a dividend with a handsome surplus. If the present situation continued in Tucuman until the spring, he thought it not unlikely that the board would decide to put the surplus to a special account applicable to the maintenance of their position there. For some time they had had the position in Tucuman in their mind, and had been making provision against it, and that, with the surplus they would have this year would, he believed, provide them with the sinews of war to carry on the fight for a longer period than, in his opinion, it was likely to last.

Mr. Robert Miller seconded the resolution, which, after a short discussion, was carried.

London Electrical Trading Co., Ltd.—Dr. Charlton Bastian, F.R.S. (chairman), presided on Tuesday last at the offices, 21, Broad Street House, E.C., over the second ordinary general meeting of the above company. We have received the following report of the proceedings: In moving the adoption of the report and balance-sheet, the chairman said that although only a small profit had been earned during the initial period of 18 months covered by the accounts, nevertheless, the prospects for the current period were very satisfactory, and only that day the company had booked an order for 1,150 heaters of a gross value of over £3,000. Bastian heaters were now being supplied to many foreign markets from London, Paris and Berlin, and a satisfactory increase in the demand was shown by the fact that the sales since the date of the balance-sheet showed an increase of nearly 40 per cent., as compared with the sales during the corresponding period the previous year. Business had already been opened up, not only in the home market but also in Germany, France, Spain, Scandinavia, Russia and several other Continental countries, but there were many markets in which the company had yet to create a demand for their products, and as further working capital could be profitably employed in this direction it had been decided to offer the unissued balance for subscription amongst the shareholders. Mr. A. R. Newman seconded the motion, and it was carried unanimously.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The directors' report for the year ended Sept. 30th shows a profit of £19,769, compared with £21,785 in the previous year. The exceptionally wet and stormy weather during the season caused the traffic receipts to show a decrease of £2,683. The sale of electricity increased by £1,685, or nearly 24 per cent. The amount of undivided revenue at the disposal of the company, including £2,282 brought forward, is £13,831, and the directors recommend a dividend of 2½ per cent. on the preference shares, leaving £10,081, out of which it is proposed to place £1,500 to reserve account, to appropriate £5,000 towards future maintenance of permanent way, to add to third-party insurance reserve £1,000, and to carry forward £2,581.

United Electric Trams of Monte Video, Ltd.—The directors have declared an interim dividend at the rate of 6 per cent. per annum on the ordinary shares, for the half-year ended September 30th.

Capital Reduction.—A petition for confirmation of reduction of capital of the Metropolitan Electric Tramways, Ltd., from £1,500,000 to £1,078,504, is to be heard in the Courts on December 10th.

Lima Light. Power and Tramways Co.—The directors of the Empensas Electricas Asociadas have declared a dividend of 1½ per cent. on the shares for the quarter ended September 30th.—*Financier.*

Electrical and General Investment Co., Ltd.—Interim dividend on ordinary shares of 1s. per share, being the maximum rate of 10 per cent. per annum for the six months ended November 30th.

Metropolitan Electric Tramways. Ltd.—On Wednesday, in London, a special meeting of the Metropolitan Electric Tramways, Ltd., was held with reference to the consolidation scheme.

Allgemeine Electricitats Gesellschaft. — According to the *Financial News*, this company held its meeting at Berlin on 2nd inst., at which the proposed increase of capital 25,000,000 m. to 155,000,000 m. was sanctioned.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—It is announced in some of the daily papers that the directors have declared the usual half-yearly dividend on the preference shares, and one of 7½ per cent. on the ordinary shares.

Power Gas Corporation, Ltd.—A dividend of 4 per cent. on the ordinary shares is announced.

Siemens and Schuckert Companies.

The *Rheinische Schuckert Ges. für Elektrischen Industrie, of Mannheim*, realised gross profits of £84,000 from new undertakings, investments, &c., in 1911-12, as compared with £55,000 in the previous year, and the net profits were £19,000 and £28,000 in the two years respectively. The provision made for depreciation and reserve funds is £31,000, as against £15,600 in 1910-11 and the dividend is at the rate of 7½ per cent. on £275,000, as contrasted with a similar rate on £200,000 in the previous year. The loan capital amounts to £175,000, and a fresh increase in share capital is in contemplation in the near future.

The financial statement of the *Siemens-Schuckert Werke* indicates net profits of £673,000 for the year ended with July 31st, 1912, as compared with £671,000 in the previous year. It is proposed to pay to the two proprietary companies—Siemens & Halske and the Schuckert Co., of Nuremberg—a dividend of 10 per cent., this rate being the same as in 1910-11. The sum of £125,000 has been allocated to the reserve fund, as in the preceding year, and £17,500 to the disposition fund as in 1910-11. Bonuses to officials and workmen absorb £65,000, as compared with the same amount in the previous year, and the balance carried forward is £15,000, as against £14,000 in 1910-11.

The *Elektrizitats A.G. vorm. Schuckert & Co., of Nuremberg*, whose heavy electrical engineering works were transferred to the Siemens-Schuckert works several years ago, reports gross profits of £428,000 for 1911-12, as compared with £362,000 in the previous year, the balance forward increasing the amount to £490,000, as against £423,000 in 1910-11. Administrative expenses, interest charges, taxes, and the customary provision for depreciation, absorb £130,000, as contrasted with £123,000, and the sum of £7,500 has been placed to the coupon tax reserve fund, leaving net profits of £352,000, as against £293,000 in 1910-11. The sum of £15,000, as in the preceding year, has been transferred to the special reserve fund, and after deducting "shares" in the profits there remains a balance of £322,000, as compared with £268,000. It is proposed to pay a dividend of 8 per cent. on the old shares of £3,000,000, and 4 per cent. on the new shares of £500,000, the former comparing with 7½ per cent. in 1910-11. The balance of £62,000 has been carried forward, as contrasted with a similar sum in 1910-11.

The accounts of *Siemens & Halske A.G., of Berlin*, shows net profits of £620,000 for 1911-12, as contrasted with £616,000 in the preceding year. It is intended to distribute 12 per cent. on the ordinary capital, being the same rate as in 1910-11. The sum of £100,000 has been transferred to the special reserve fund, as against £110,000 in 1910-11, and £17,500 to the disposition fund as in the previous year. The bonuses to workmen and officials amount to £45,000, as compared with £40,000, and the amount carried forward is £63,000, as contrasted with £54,000 in 1910-11. The financial development in the course of years has been as follows:—

	Net profits.	Percentage dividend.	Share capital.
1903-4	£276,000	7	£2,725,000
1904-5	349,000	9	2,725,000
1905-6	398,000	10	2,725,000
1906-7	435,000	11	2,725,000
1907-8	484,000	11	2,725,000
1908-9	571,000	12	3,150,000
1909-10	575,000	12	3,150,000
1910-11	616,000	12	3,150,000
1911-12	620,000	12	3,150,000

It will be observed that the net profits realised both in the case of the Siemens & Halske Co. and the Siemens-Schuckert Works in 1911-12 were not substantially different from those which were obtained in the preceding 12 months, whereas the Schuckert Co. secured an advance of £66,000, and the A.E.G. one of £102,000, as compared with 1910-11.

London United Tramways Co., Ltd.

Mr. W. M. Acworth presided on Wednesday at Winchester House, E.C., over a special meeting of the shareholders of the above company.

The Chairman said there was no resolution to submit, as the meeting had only been called in order to explain the scheme which had been put forward by the Metropolitan Electric Tramways, Ltd., and the Tramways (M.E.T.) Omnibus Co. for consolidating their various interests. In the circular which had been issued they were invited to exchange their present holdings for holdings in the new London and Suburban Traction Co., Ltd., on certain terms. The directors advised the shareholders without any hesitation to accept those terms, and already a very large number of shareholders had acted upon that advice. According to the last figures available, 81,000 odd out of 125,000 preference shares had been lodged in favour of the scheme, and 91,000 odd out of 100,000 ordinary shares. With regard to the position of the London United Co., a dividend of 3 per cent. was paid on the ordinary shares for the year 1906; for 1907 1 per cent., and since then the ordinary shares had received nothing. The preference shares in 1908 were paid 3¾ per cent. for the year, but in subsequent years no dividend had been paid. The accumulated back dividends amounted to £203,000 at the end of the company's financial year, and there was another half-year's interim dividend which had also not been paid. As to future prospects, the net profits were not likely to be as good in 1912 as they were in 1911; in fact, the published figures showed that the gross receipts were £13,000 down. He had been looking through the speeches of his predecessors in that chair, and he found that in March, 1907, the ominous word "motor-'bus" first appeared; and the result of its appearance was shown in the dividend records since. None of them doubted that the motor-'bus had come to stay, and he did not think that they could reasonably expect, as time went on, that the efficiency of the motor-'bus would get less or its economy get worse. There was an old adage of administering to the patient a hair of the dog that bit him, and that in plain English was what they were suggesting by the present scheme. They were invited to exchange their shares into shares of the new company, which itself would own 350 motor-'buses, and they would be worked under conditions which would result in a substantial profit. The M.E.T. Co. decided some time ago to purchase and work a fleet of motor-'buses, and they formed a subsidiary company for that purpose, and being desirous to work in harmony with the L.G.O. Co., they entered into negotiations with that company, whose shares, as they knew, were owned now by the Underground Co. That company was also a very large holder in the London United Tramways, and so not unnaturally the sphere of the negotiations was widened, and the proposal now was to fuse the interests of the shareholders of the London United, with those of the Metropolitan Electric Tramways and the Tramways (M.E.T.) Co. It was proposed to work the two systems of tramways as one undertaking, and to secure that the 350 motor-'buses should be worked by the L.G.O. Co. for the joint profit of the two companies. The unification of the management of this large tramway undertaking with over 100 miles of track, and carrying over 150 million passengers per annum, would, he had no doubt, secure considerable economies. The shares in the Metropolitan Electric Tramways carried with them a valuable asset in the company's holding of the ordinary shares of the North Metropolitan Electric Power Supply Co., which had four generating stations in important centres in the north of London, and which was doing a growing and a profitable business. Under the scheme the 350 'buses would be the property of the Metropolitan Electric Traction Omnibus Co., and the whole of the shares of that company would be made over to the new company, and the new company would receive the whole of the profit therefrom. The plan by which those 'buses would be treated for all purposes, except in respect of profits, as part of the L.G.O. Co.'s fleet would, he thought, commend itself to them all. The stipulation was that the net profit on each of their 'buses should be the average of the earnings of the 'buses worked by the L.G.O. Co. in the London area, which, he thought, secured them a fair share of all the profit that was to be had. With regard to the financial aspect of the scheme, the debentures would remain untouched. The preference shareholders, for each £10 share with all its rights, were offered £5 in cumulative preference shares and £4 12s. in ordinary shares of the new company. They had told them in the circular that they anticipated that the new company would enjoy a revenue sufficient to secure a fair return on its ordinary share capital. They had been asked what they meant by a "fair" return. Personally, he had no hesitation in saying that he looked for a substantial return, but the factors in the problem were so numerous, and conditions changed so rapidly, that nobody in a responsible position in the company could attempt to translate the word "fair" into any precise figure. He might say that the Underground Co. had shown their confidence in the new company by consenting to a large reduction in their nominal capital. If any preference shareholders preferred to remain out of the scheme, they would retain all their present rights; and it was for them to consider what those rights were worth in the altered condition of affairs.

Mr. A. J. Wood criticised the action of the directors in regard to the way in which the preference shareholders were to be treated, as compared with the debenture-holders.

Major Skinner said he thought the directors had done the very best they could under the circumstances. The fact was they had gone on in the belief that the tramcar was to be the locomotion of the future, but it was not, and that was an end of the matter.

The Chairman, in reply, remarked that when the London United Tramways was formed, the present position was not on the horizon, and no blame rested either on the shareholders or directors. It was impossible to deal with the debenture-holders in any other way than was proposed under the scheme, because their interests were protected by a deed.

The meeting then terminated.

Shropshire, Staffordshire and Worcestershire Electric Power Co.—The directors report that the accounts for the half-year to June 30th, including £84 brought forward, show an available balance of £4,118, which the directors recommend should be carried forward.—*Financier.*

West Kootenay Power and Light Co., Ltd.—The directors have declared a dividend on the Common stock, at the rate of 4 per cent. per annum, payable 1 per cent. quarterly, commencing December 1st next.

Continental.—France.—The report of the Compagnie d'Electricité de Marseille, of Marseilles, for the last financial year shows a net profit of £27,996, as compared with £24,300 in the preceding 12 months. No dividend is being declared, the bulk of the profits being applied to depreciation and reserve.

Meldrum Bros., Ltd.—According to the *Times*, the liquidator announces that the works and assets of the company at Timperley, together with the goodwill and book debts, have been transferred to a new company, which will continue the business under the style of Meldrums, Ltd. Mr. J. W. Meldrum, manager during the liquidation, will be the managing director.

Tramways (M.E.T.) Omnibus Co., Ltd.

The holding of an ordinary general meeting of this company at the Electrical Federation Offices, Kingsway, W.C., on November 28th, is reported in the Press. Mr. James Devonshire (the chairman) said that their financial year ended on September 30th, and they were unable before that date to place any of their omnibuses in public service, so that there was no profit and loss account. They had increased their order for chassis from 300 to 350 in number. All these chassis were being supplied by the Daimler Co., and the bodies were being manufactured by the Brush Electrical Engineering Co. and by Messrs. Dodson. Some of the omnibuses supplied to companies other than their own were already on the streets of London. Deliveries of their completed omnibuses had already begun, and in the course of the next few weeks the first batch should be placed in public service. The formation of this company resulted in negotiations between the Metropolitan Electric Tramways Co. and the London General Omnibus Co. These negotiations had now culminated in several agreements, to one of which this company and the L.G.O. were parties. The agreement provided that their fleet of omnibuses, which was to be limited to 350, was to be worked and maintained for them by the L.G.O. Co., as part of that company's fleet. Generally, the effect of the agreement was that, instead of their omnibuses suffering from severe competition from the omnibus fleet of the L.G.O., they would be worked by that company as part of their fleet, so as to avoid unnecessary duplication of existing services. The earnings of this company's omnibuses would be paid over to them, less the expenses of working, and it was agreed that their gross earnings were not to be less than the average gross earnings of the combined fleets of this company and the London General Omnibus working in the metropolitan area. They were thus assured of a fair average return from each omnibus working.

The report was adopted.

Cordoba Light, Power and Traction Co., Ltd.

The directors' report to September 30th, 1912, states that the balance of profit to that date, after meeting all charges, is £33,410, plus £9,220 brought forward, making £42,631. Out of this the directors recommend that a dividend at the rate of 5 per cent. (less income-tax) be paid, and that the balance of £12,631 be carried forward. Since the date of the last report the company has acquired further shares of the Cordoba Light and Power Co., and now owns 99·49 per cent. of that company's share capital, together with the whole share capital of the Cordoba (Argentine) Electric Tramways Construction Co., Ltd. Delivery of the remaining small balance of shares of the Power Co. has been promised. The new hydraulic station of the power company has been working most satisfactorily since its opening for public service at the end of February, so that for some months past the company has been relieved of the heavy expenses of operating the steam plant. The whole of the system covered by the concession of the tramways company has been converted to electric traction, the company now having 25¼ miles of track in operation, and, in addition, nearly 4 miles constructed, but not in operation. The results of the operation of the two subsidiary companies for the last few months, during which the above-mentioned improved conditions have prevailed, fully come up to the directors' anticipations. The power company has outstanding £100,000 5 per cent. bonds forming a first charge upon its property, and, therefore, ranking in priority to the debenture stock of this company. These bonds fall due on January 1st, 1913, and it is intended to remove the priority referred to by repaying them out of the funds to be provided by this company. To provide for the growth in the immediate future of the business of the subsidiary companies, extensions of the distribution system of the power company and of the lines of the tramways company are in progress as well as sundry minor works. For these purposes it is proposed to issue £300,000 of the balance of the company's unissued share capital in the form of 6 per cent. preference shares, entitled to a premium of 20 per cent. in event of liquidation or return of capital. The necessary resolution will be submitted to the general meeting. The directors refer with regret to the death of Sir J. Irving Courtenay, who acted as chairman of the company since its inception. Mr. T. Frame Thomson has been elected to the position of chairman.

Mr. T. Frame Thomson presided on Wednesday at the offices, 62, London Wall, E.C., over the fourth annual general meeting of the company. In moving the adoption of the above report, he said that they were meeting under circumstances of peculiar sadness, as Sir Irving Courtenay, who had been chairman of the company since its inception, died only a few weeks ago. It was particularly sad that just as they were getting to the point they had been aiming at for four years, he should be taken away. The letter which he had addressed to the shareholders would have given them full information as to the history of the company and its present position, and consequently it was not necessary for him to say much on that occasion. The company was formed for the purpose of giving considerable development to the business of the Cordoba Light and Power Co., and of protecting the position of that company by adding a tramways system to the electric light and power system. These objects had now been accomplished, and in the last few months they had been entering on the stage of reaping the benefit of the exchanges which had been made, and they might quite reasonably expect that the benefit would be very considerable. The few months during which they had been working had shown a very remarkable increase in the business, and he thought there was every reason to expect that in a very short time they would make up the leeway lost during the period of construction, and at the time when they were suffering from shortage of water.

Mr. H. A. Trotter seconded the motion, which was adopted without discussion.

In moving the re-election of Messrs. H. A. Trotter and A. D'Abbadie D'Arrast as directors, the Chairman said the latter gentleman was, until last year, the manager in Cordoba, and was thoroughly familiar with the situation there. He had now decided to reside in Europe, and the board were very glad to have the assistance of his practical knowledge.

Mr. C. M. Rose seconded the motion, and it was carried.

An extraordinary general meeting followed, when, on the motion of the Chairman, seconded by Mr. G. Kitchin, the following resolution was agreed to :—

> Of the 400,000 unissued shares of the company 300,000 shall be called preference shares and such preference shares shall confer the right to a fixed cumulative preferential dividend at the rate of 6 per cent. per annum on the capital for the time being paid up thereon and the right, in the event of a winding up or return of capital, to a bonus of 20 per cent. on their nominal value, and shall rank as regards return of capital, and the said bonus in priority to the ordinary shares, but shall not confer the right to any further participation in profits or assets. The remaining 100,000 shares of the existing capital of the company may be issued either as preference shares ranking *pari passu* for all purposes with the said 300,000 preference shares or as ordinary shares, as may from time to time be determined by the directors.

Adelaide Electric Supply Co., Ltd.—In their report for the year ended August 31st, 1912, the directors state that they have continued their policy of energetic development during the year, and have expended a further £102,645 on capital account in the provision of additional land, buildings, plant and mains. For the purpose of providing the necessary additional capital to carry out such development and to keep pace with the continued growth of the company's undertaking, a further £50,000 5 per cent. debenture stock has been issued during the year at a premium. For the same purpose a further 10,000 ordinary shares were offered to the ordinary shareholders in July last at a premium of £3 per share, ranking for dividend as from September 1st, 1912; the whole of these shares have been allotted and paid for in full. The profit and loss account shows a credit balance of £27,622. After paying the dividend on the preference shares for the half-year, and an interim dividend of 5 per cent. on the ordinary shares, there remains an available balance of £20,007, out of which the directors recommend a final dividend of 5 per cent. on the 30,000 ordinary shares, making 10 per cent. for the year, and a bonus of 2 per cent., free of tax, the balance carried forward being £5,007. The premiums received on the issues of debenture stock and ordinary shares, amounting to £31,049, are being added to general reserve, and certain special items in the capital account, amounting to £3,720, have been written off out of such reserve. The *Times* states that: "In view of the termination of the company's contract for the temporary supply of power to the Adelaide Municipal Tramways Trust, and the consequent shrinkage of revenue resulting therefrom, the board had set aside out of the profits of previous years a dividend equalisation fund amounting to £25,000."

Official Announcements *re* Companies.—The following companies will, unless cause is shown to the contrary, be struck off the Register within three months, and will accordingly be dissolved :—

Acme Conveyor and Machine Co., Ltd.
Dynamo Electric Car Transmission Syndicate, Ltd.
Electrical Fittings Co., Ltd.
Electrocab Development Co., Ltd.
Foxcroft and Duncan Engineering Co., Ltd.
London Electrocab Co., Ltd.
Nitrogen Power Syndicate, Ltd.
Norfolk Electrical Co., Ltd.
Orient Electric Power Syndicate, Ltd.

Imperial Tramways Co., Ltd.—The directors have issued to the preference and ordinary shareholders a statement regarding the proposal of the London United Tramways Co. (in which the Imperial Co. has a large preference holding) to consolidate its interests with those of the Metropolitan Electric Tramways Co. The scheme proposes to give in exchange for each existing £10 5 per cent. preference share of the London United Co., the following :—£5 in 5 per cent. cumulative preference shares, and £4 12s. in ordinary shares of the new company—the London and Suburban Traction Co., Ltd. The directors say that they have resolved to approve the scheme, inasmuch as, when it is carried through, the payment of dividends on both the preference and ordinary share capital of the Imperial Co. will be resumed at an early date.

Douglas Southern Electric Tramways, Ltd.—At the annual meeting, held in Manchester on the 3rd inst., Mr. T. J. Hutchinson presiding, it was stated that the total traffic receipts showed a decrease of £441, which was attributed to the cold and wet weather experienced throughout the season. A dividend of 6 per cent. upon the preference shares, absorbing £1,558, was agreed to, and the balance of £326 was carried forward.

The Paris Popp Co.—The accounts of the Compagnie Parisienne de l'Air Comprimé (Popp) for the year ended with June 30th, 1912, shows gross profits of £208,000, as contrasted with £194,000 in the preceding 12 months. After providing for depreciation, the net profits are returned at £137,000, as against £101,000 in 1910-11. The dividend amounts to £1 16s. per £20 share, as compared with £1 12s. per share in the previous year.

Ruston, Proctor & Co., Ltd.—An interim dividend of 5 per cent. per annum on the ordinary shares is announced.

British Columbia Electric Railway Co., Ltd.

THE fifteenth annual report shows that the business has continued to grow very rapidly. For the 12 months to June 30th 1912 the gross receipts show an increase of $1,601,994, or over 36 per cent., and the net earnings, including income from investments and subsidiary companies, and after charging renewals, show an increase of $401,837, or 27 per cent., over the preceding year. From June 30th, the close of the period under review, up to September 30th last, there has been a still further increase in gross earnings of $352,233, or 27 per cent., and in net earnings $138,204, or 31 per cent. The increase in business is well distributed over every department and over all branches of the railway system, but it is especially noticeable in the city of Victoria. During the whole of the 12 months under review, very large sums of money have been involved in various works and extensions under construction, and have consequently remained unremunerative. The following charges have boen made against the revenue account of the year, viz., provision for renewals maintenance (from which £22,110 has been deducted for adjustments and expenditure on renewals during the year) £95,232; amount added to capital amortization fund, £2 270 – £97,502. The net profit for the year, after making these deductions, amounts to £359,131, plus £6,590 brought forward, making £365,721, from which there are deducted the following: Interest on debentures and debenture stock to June 30th, 1912, £101,460; dividends already paid—on 5 per cent. cumulative perpetual preference stock for the year ended June 30th, 1912, £50,000; on preferred ordinary stock for the year ended June 30th, 1912, £60,000; and on deferred ordinary stock for the six months to December 31st, 1911, £40,000, leaving available for further distribution and reserve, £114,260. From this the directors recommend a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months to June 30th, 1912, making 8 per cent. for the year, £40,000, transferring to reserve fund £66,528, and carrying forward £7,732. There has been added to the reserve fund £55,471, representing the premium, less expenses, on £600,000 new capital, issued in July, 1911. After the transfer now recommended by the directors as above, the reserve fund will amount to £459,000. The growth of the company's business is indicated by the following figures:—

MILES OF TRACK IN OPERATION.		TOTAL CARS OF ALL CLASSES.	
1909 ..	97·74	1909 ..	218
1910 ..	141·65	1910 ..	427
1911 ..	233·65	1911 ..	647
1912 ..	285·75	1912 ..	725

Passengers carried during the year were 62,154,166, an increase of 15,612,718. Number of lamps in use, 735,426, an increase of 171,884.

In accordance with the established custom of the board for some of the directors to visit British Columbia annually, Mr. Blundell Brown went there in May last, and during his stay thoroughly discussed and investigated existing conditions and future prospects with the management and with many leading British Columbians. He reports much prosperity throughout the country, and is well satisfied with the great expansion of the company's enterprise since his last visit four years ago. He is entirely convinced that the progressive policy adopted by the company is wise and justifiable. Very important works have been carried out during the year, and are still under construction.

The extension of the hydroelectric power plant at Lake Coquitlam and Lake Buntzen has been successsfully carried on, and will be completed during next summer. Already the work has provided the company with largely increased water storage. The magnitude of the undertaking may be gathered from the following particulars: A new dam is being built at Lake Coquitlam—maximum height, 98 ft.; width at base, 600 ft.; length at crest, 850 ft.; width at crest, 40 ft.; storage capacity, 7,404,000,000 cb. ft., giving an available reserve during a dry season of 53,700,000 KW.-hours of electrical energy: 1,055,000 cb. yards of material will have been handled on completion of the works. The number of men employed on the work during the last six months has varied from 1,289 to 1,514.

An additional and separate power house of a massive character, with foundations on the solid rock, is being built at Lake Buntzen. Three hydroelectric units will be installed therein, having a combined capacity of 40,500 H.P. These, added to the units already in operation in the old power house, will give a total available supply of 82,500 electrical H.P. The directors had hoped that these new units would have been ready for operation in November, but, owing to labour troubles experienced in Great Britain, considerable delay occurred in the manufacture of the generators, and it was found impossible to ship the first generator from Birkenhead before October 12th. It is expected that the first unit will be in service during the month of February. The completion of the works above referred to will place the company, so far as power is concerned, in a very satisfactory position, and after February next, in return for the heavy capital expenditure of the past three years, it will have a very large power development at an economical figure, and one in which maintenance and operating expenses will be reduced to a minimum. In every detail the most modern practice in hydro-electric power plant design has been adopted, the best features of European and American design having been combined to produce a plant which will, undoubtedly, be one of the finest in the world. On Vancouver Island the company is also largely increasing its hydro-electric power installation to meet the rapidly increasing business in the city of Victoria and surrounding districts. The first Jordan River installation was put into operation in February, and consisted of one 6,000-H.P. impulse wheel on the shaft of a 4,000-KW. alternator, with all the necessary complementary equipment. A second unit of equal capacity has been completed within the last few weeks, and is now delivering power in Victoria. The dam connected with this installation was completed by May, 1912, and has a capacity of 327,900,000 cb. ft., which is equivalent to the storage of 5,960,000 KW.-hours of electrical energy. The company is also constructing, near Victoria, with a separate transmission line, an auxiliary steam plant having an initial capacity of two 2,000-KW. units. The design has been laid out so that, in the future, new units can be added very economically and quickly.

The railway from Victoria through the Saanich Peninsula, about 20 miles in length, referred to in the last directors' report, is now nearing completion, and the board hope that the line will be in operation during the month of December. [illegible] lines radiating from New Westminster have either been completed during the year or are approaching completion. The company is also building several extensions in North Vancouver, South Vancouver, Point Grey and Victoria, aggregating over 15 miles.

Large purchases of rolling stock have been made, in addition to which the company's own car shops at New Westminster have been kept working to their fullest capacity, and have turned out a large number of excellent cars.

The terminal station and central offices of the company in Vancouver have been completed, and constitute one of the most conspicuous and important structures in the city. The offices are now occupied by the staff, and the excellent accommodation which they provide should greatly facilitate the administration of the company's business.

During the year the company was compelled to suspend traffic in the municipality of Point Grey, owing to legal proceedings having been instituted which challenged the validity of its franchises. This question has been satisfactorily terminated by a vote of the people of Point Grey, who, by a very large majority, passed a by-law confirming our franchises for the unexpired 7 years.

Resolutions will be submitted to the stockholders at the annual meeting altering the articles of association. Under the articles of association it is provided that no more of the company's cumulative preference stock shall be issued than the amount already paid up on the preferred ordinary stock, and that no more of the preferred ordinary stock may be issued than the amount already paid up on the deferred ordinary stock. The new resolutions will have the effect of making certain that the directors have power to issue equal amounts of the three stocks simultaneously, notwithstanding that all the calls on the junior stocks may not have been actually paid up at the time that the senior stocks may be issued.

H.R.H. the Duke of Connaught visited Vancouver and Victoria in September. A special train was placed at the disposal of His Royal Highness, who expressed his appreciation of the importance and value of the undertaking in the kindest terms. The directors again have pleasure in expressing their appreciation of the loyal and satisfactory services rendered by the management and staff in British Columbia.

Year ended June 30th.	Gross earnings.	Net rev. inc. investments income.	Passengers.	Lamps in use.	Balance available for dividend.	Pref. ord. stock, div. per annum.	Def. ord. stock, div. per annum.	Amount to reserves.
1910 ..	£628,763	£226,803	34,476,804	439,815	£149,391	6 %	8	£108,265
1911 ..	961,[illegible]	[illegible]	46,541,448	563,542	[illegible]	6	5	158,571
1912 ..	1,231,[illegible]	[illegible]	62,154,166	735,426	257,679	6	8	197,391

The annual meeting is called for Tuesday, December 10th, at Liverpool Street Hotel, E.C.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

General Electric Co., U.S.A.—Scrip, fully and partly paid, for $4,000,000 5 per cent. gold debenture bonds (London issue).

Sao Paulo Electric Co., Ltd.—Scrip, fully and partly paid, for £1,880,000 5 per cent. 50-year first mortgage bonds.

And to allow the following securities to be quoted in the Official List:—

British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock; and £200,000 5 per cent. cumulative perpetual preference stock.

Montreal Tramways Co.—$10,445,000 first and refunding mortgage 5 per cent. 30-year gold bonds.

The Committee has appointed a settling day as under:—

Thursday, December 19th.—Sherbrooke Railway and Power Co.—$300,000 5 per cent. 30-year consolidated first mortgage sinking fund gold bonds of $500 each (Nos. 1,301 to 1,900).

And ordered the undermentioned to be quoted in the Official List:—

Melbourne Electric Supply Co., Ltd.—Further issue of £125,830 consolidated ordinary stock.

Puebla Tramway, Light and Power Co.—65,000 shares of $100 each, and $4,349,900 first mortgage 30 year 5 per cent. gold bonds (Nos. A 1 to 600 of $1,000, B 1,001 to 6,000 and 25,001 to 25,399 of $500, and C 6,001 to 16,504 of $100 each).

Sao Paulo Tramway, Light and Power Co., Ltd.—Further issue of £221,917 5 per cent. perpetual consolidated debenture stock.

Amalgamation.—According to reports published in several of the financial papers early this week, a merger scheme of considerable importance, embracing the supply of electricity for power and lighting purposes and the operation of tramways, is on the point of completion and will shortly be carried into effect. "The sphere of operations will include four of the most important Midland counties of England, representing an area of over 2,500 square miles. The undertaking has been financed by the Balfour group."

Richard Hornsby & Sons, Ltd.—The directors' report for the year ended September 30th shows a profit of £45,392, after writing off depreciation and paying directors' remuneration. After paying debenture interest and preference dividend, dividends at the rate of 6½ per cent. are paid on the ordinary and the new shares, and £10,000 is placed in reserve, leaving to carry forward £3,877.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, December 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£26	..
a Lead, Nitrate	„	£29	£1 dec.
a „ White Sugar	„	£25 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3⅛d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	72/6	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£90	..
b „ Wire, in ton lots ..	„	£112	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	..
c „ Tube (brazed)	„	11¼d.	..
c „ „ (solid drawn) ..	„	9¾d.	..
c „ Wire, basis	„	9⅛d.	..
c Copper Tubes (brazed)	„	1/0⅝d.	..
c „ „ (solid drawn) ..	„	11¾d.	..
g „ Bars (best selected) ..	per ton	£93	.
g „ Sheet	„	£98	..
g „ Rod	„	£93	
d „ (Electrolytic) Bars ..	„	£82	..
d „ „ Sheets ..	„	£99	..
d „ „ Rods ..	„	£87	..
d „ „ H.C. Wire	per lb.	$10\frac{9}{16}$d.	..
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	..	..
h India-rubber, Para fine	„	4/6½	¼d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	67/1	11d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£18 7 6 to £18 12 6	5/- dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 12 6	..
e Mica (in original cases) small ..	per lb.	6d. to 3s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
p Phosphor Bronze, plain castings	„	1/2 to 1/4	inc.
p „ „ rolled bars & rods	„	1/2	..
p „ „ rolled strip & sheet	„	1/2½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11⅓d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£228 to £229	£1 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/9	1d. inc.
p White Anti-friction Metals ..	per ton	£45 to £230	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£31 12 6	..

Quotations supplied by—

G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

Markets round the Stock Exchange cannot be accused of weakness, although they might have some difficulty in defending themselves from the charge of lacking business. It is customary for December to be a fairly strong month for prices, except perhaps just in the last few days, when an occasional bolt from the blue has been known to fall. Speaking electrically, the main theme of interest in the financial world continues to be the transport fusion—or fusions; although, so far as prices are concerned, they have not had much further effect.

The Home Railway market is strong as a whole, nor do the hints of labour trouble in connection with the Midland and North-Eastern Railways depress the general sentiment, which is buoyed by the expectation of the coming dividends and supplemented by the remarkable strength of Consols. Central Londons are, however, a dull spot, the Ordinary and Deferred stock both falling a point; while City and South London Ordinary lost ½, though this company's four Preference stocks all moved up 1. The shrinkages in the Tube Ordinary stocks will not occasion surprise to those who are accustomed to the Stock Exchange habit of discounting favourable events in advance. Evidently it was known to some people that the Central London and the City Companies were to be included in the Speyer group; the information must have been in their possession a week or two before its publication, and they sold as soon as the details were announced. Metropolitan Consolidated has fallen 1 upon the declaration that the Company will remain independent of the Underground group, but Districts spurted at one time to 42½, this leaving the substantial rise of 2¼ on the week. Underground Electric Railway issues are strong. There is persistent buying of the shares, and the Income Debentures gained 3 points, rising to 92, while the 1s. shares are steady at 13s. 9d.

London United Tramways shares fell back 10s., and Metropolitan Electric Trams Ordinary are ⅛ lower, while the Deferred and the Preference are also down. The fall in London United Preference is due to realisations by those who consider that the recent rise afforded them an excellent opportunity for getting out of their shares, in which course they were, perhaps, perfectly correct. The Company's 4 per cent. Debenture stock continues to creep up, and shows a further small gain on the week. In the traction group, Potteries hardened to 7s. 6d., and a few rises occurred in British Electric Traction issues, the 7 per cent. Preferred at 39½ being 2 up.

In the Foreign division, a report of considerable interest is that of the British Columbia Electric Railway Company, which tells of steady progress, necessitating further increase of capital. The Company's stocks are unchanged on the week. A private letter received from a young artisan in Vancouver tells of the way in which that country is going ahead by leaps and bounds, and throws an interesting sidelight on the necessity for additional rolling stock on the British Columbia Electric Railway system. The lad writes that from January 1st the Company will not be allowed to carry anyone who cannot find a seat on their cars; and he adds, as an illustration of the way in which the traffic increases, that he thinks nothing of having to ride home on the cowcatcher, accompanied by 10 or 12 others, and then, remarks our correspondent, "they have the sauce to come and collect the fare!"

The quotations for Rio Trams shares and Sao Paulo Trams shares have been taken out of the Stock Exchange Official List, there being hardly any market now for these, although the Company's bonds are, of course, readily marketable. The Common shares, however, have been largely exchanged for Brazilian Traction, Light and Power shares, and we have, accordingly, added the latter to our list of prices overleaf.

Supply and Power issues of Colonial and Foreign countries are mostly steady. Mexico Tramways are a strong market with a rise of 2. Shawinigan Water has given way, but Canadian Generals are very firm. Cordoba 5 per cent. Debentures are a shade harder, and there are not many other quotable changes in the list, except for a few *ex*-dividend markings.

English Electricity Supply shares are very firm as a whole, notwithstanding rumours to the effect that there has been a hitch in the reported negotiations which are said to have been going on between the Supply Companies and the local authorities with a view to closer working agreements. These reports, it may be observed, have been treated with reserve here since they first came into circulation. Big names have been mentioned in connection with the scheme, but those closely in touch with the industry know well how extremely difficult it is to harmonise the many conflicting interests that are found to exist when the subject is tackled at close grips.

Charing Cross Ordinary are ⅛ easier at £5 middle, but Counties rose ⅛ to 11½, at which, at the time of writing, there are buyers. The Company's new Ordinary shares were marked up 7s. 6d. to 11⅛ middle. Chelseas rose to 4⅞. City Lights are unaltered. The price of Edmundsons was put down $\frac{1}{16}$ to 10s. London Electric Ordinary are ⅛ easier. The market is in a state of suspended animation, although for a few shares there is still a fair demand. Nobody outside the inner ring knows what is going to happen, and the whole position is one of as much interest as uncertainty.

The Telegraph market continues strong, and the recent rises in the Eastern group are well held. Western Telegraphs have come into request this week, and Eastern Extensions are again ⅛ higher. Eastern Ordinary shows a rise of 1. On the other hand, Indo-Europeans and Cuba Telegraphs are 10s. lower. Telephones are quiet, with small rises in United River Plates and Orientals. There has been a spurt in National Telephone Deferred, and some sort of information with respect to what the company may expect to receive from the arbitrators will be out, it is thought, pretty soon. It is announced that an agreement has already been reached in respect of 10 million pounds out of the total claim of 20 millions. The Marconi market is quiet, and the shares show very little alteration, business in them having fallen away to retail proportions.

Willans & Robinson shares, both Ordinary and Preference, are still flatter, having fallen to 2s. 6d. and 10s. respectively—the quotations are somewhat nominal in each case. In the rubber market, the leading shares were hardened by Mr. Arthur Lampard's speech at the United Serdang meeting on Monday afternoon, in which he spoke optimistically of the prospects for consumption of the raw stuff. But it cannot be said that there is much increase in public demand for rubber shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 3rd	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9¾— 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾— 9¼	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord...	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½— 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98 xd	..	4 1 8
Charing Cross, West End & City	5	5	5†	4¾— 5¼	⅛	4 15 8
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾— 4⅞	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 8 4
Chelsea, Ord.	5	5	4†	4⅞— 5⅛	+ ⅛	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12½— 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103	..	4 7 5
County of London, Ord... ..	10	6	4†	11¼— 11¾	+ ⅛	5 2 2
Do. 6 % Pref.	10	6	6	11¾— 12¼	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 8 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 8 8
Edmundson's, Ord.	5	Nil		⅝— ⅞	1/16	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	8 — 8½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝— 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅝— 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½— 8	..	5 12 6

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 3rd	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½— 8½	..	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½	..	1½— 2	½	3 15 0
Do. 6 % Pref.	5	6	6	4¾— 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	5	4†	3¾— 4¼	..	5 3 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¼— 4⅝	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 — 101	+ 1	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅝— 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 — 101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6¼— 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9¾— 10¼	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜— 1⅞	..	..
South London, Ord.	4	5	..	2⅞— 3⅛	..	6 18 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅜— 1½	..	5 9 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord...	£3	Nil		½— ¾	..	..
Do. 5 % Cum. Pref.	5	2		2⅝— 3⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½— 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾— 9¼	..	5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾— 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛— 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅞— 7⅛ x	..	5 19 4
Do. 5 % Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	94 — 96	+ ½	5 4 2
Canadian Gen. El. Com. ..	$100	7	7	118 —122	..	5 14 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	⅞— 1	..	8 0 0
Do. 5 % Deb.	100	5	5	95 — 98	+1	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95 — 97	..	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	85 — 88	..	5 13 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16— 3/16	..	Nil
Do. 6 % Pref.	1	6	6	9/16— 11/16	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½— 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 8
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 13 8
Mexican Lt. & Power, Common	$100	4	4†	84 — 88	..	4 11 0
Do. 7 % Cum. Pref.	$100	7	7	103 —106	..	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 8 1

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	84 — 87	..	5 15 0
Montreal, Lt., H. and Power ..	$100	8	9†	234 —239	..	3 15 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	84 — 88	..	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106 —111	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	137 —141	3	3 10 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100½—102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½— 96½	..	5 3 8
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅝d.	15/16— 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½—106½	..	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7⅜— 7⅞ xd	..	5 14 3
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	145 —147	..	5 8 10
Do. Collat. Trust	$1000	4	4	93½— 95½	..	4 3 9
Anglo-American Telegraph ..	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110¼—111¼	..	5 7 8
Do. Def...	Do.	30/-	..	25⅝— 26	..	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½— 7¾	..	5 3 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½— 82½	— ½	4 17 0
Cuba Telegraph	10	6	6†	8½— 9½	— ½	6 6 4
Do. 10 % Pref...	10	10	10	16 — 17 xd	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½— 4	..	5 0 0
Do. 10 % Cum. Pref... ..	5	10	10	6½— 7	..	7 2 10
Direct United States Cable ..	10	5	4	7 — 7½	— ⅛	6 13 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98½—100½	..	4 9 7
Eastern Telegraph, Ord. Stock	Stock	7	7†	132 —135	+1	5 3 8
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79	+ ½	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	95½— 97½	..	4 2 1
Eastern Extension	10	7	7†	13 — 13½	+ ⅛	5 8 8
Do. 4 % Deb.	Stock	4	4	96 — 98	—1	4 1 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	10¾— 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12⅝— 13⅛	..	4 11 4
Great Northern Telegraph ..	10	18	18	28½— 29½	..	6 2 0
Indo-European Telegraph ..	25	13	5†	55½— 57½	— ½	5 14 0
Mackay Companies Common ..	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 1/16— 5 3/16	— 1/16	3 17 2
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅜— 4⅝	— ⅛	3 13 7

Monte Video Telephone, Ord...	1	6	6†	15/16— 1 1/16	..	5 13 0
Do. 5 % Pref.	1	5	5	¾— ⅞	..	5 14 8
National Telephone Def. ..	Stock	6	..	154½—156½	+ 3	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98¼— 99¼	..	4 10 8
Oriental Telep. and Elec. ..	1	8	6†	1¼— 1⅜	+ ⅛	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1 1/16— 1 3/16	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10¾— 11¼	..	8 16 2
Submarine Cables Trust ..	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7 5/16— 7 9/16	+ 1/16	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5⅜— 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3 3/16— 3 7/16	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½— 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101½—103½	..	4 16 7
Western Telegraph, Ltd. ..	10	7	7†	13¼— 13¾	+ ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	95½— 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 —101	..	4 9 1

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 3rd.	Rise + or Fall	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16— 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16— 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½— 13½	+ ½	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	+1	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	+2	..
Do. 5 % Perp. Deb. ..	100	5	6	92 — 96	..	5 4 2
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	3	3†	80 — 82	—1	3 13 2
Do. Pref.	100	4	4	81 — 83	.	4 16 5
Do. Def...	100	2	..	80 — 82	1	2 8 9
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1½	1¼†	37½— 38½	— ½	3 11 5
Do. 5 % Pref., 1891	100	5	5	108 —110	+1	4 10 11
Do. Do. 1896	100	5	5	108 —110	+1	4 10 11
Do. Do. 1901	100	5	5	108 —110	+1	4 10 11
Do. Do. 1903	100	5	5	108 —110	+1	4 10 11
Do. 4 % Deb.	100	4	4	98 —100	+1	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½— 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32— 17/32	..	8 6 8
Do. 4½ % Deb...	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5½— 5¾	— ½	..
Do. 4 % Deb.	100	4	4	74 — 77	+1½	5 3 11

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 3rd.	Rise + or Fall	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	55¾— 56½	—1	2 17 9
Do. Surplus Lands	100	2⅝	2¾†	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref...	100	3½	3½	86 — 88	+1	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	42¼— 42¾	+2¼	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	98 —100	..	4 0 0
Do. 4½ % First Pref... ..	100	4½	4½	88 — 90	..	5 0 0
Do. 3½ % Gtd...	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅛— 1¼	⅛	4 16 0
Do. Def...	1	Nil	..	¼— 5/16	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	13/16— 15/16	— 1/32	5 6 8
Do. 4½ % Deb.	100	4½	4½	93 — 95	..	4 14 9
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	5/16— 7/16	+ 1/16	..
Do. 5 % Pref.	1	5	5	17/32— 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	4⅜— 4⅝	+ ¼	Nil
Do. "A"	1/-	..	..	21/32— 23/32	..	..
Do. 6% First Cum. Inc. Deb.	100	..	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	100 —102	+1	4 8 3
Do. 6 % Income	100	1½	£2	91 — 93	+3	..
Yorkshire (West Riding), Ord.	5	Nil	..	½— ¾	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	..	4 5 9
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16— 5 1/16	..	5 3 6
Do. 2nd Pref.	5	5½	5½	4 11/16— 4 15/16	..	5 17 4
Do. 4 % Deb.	100	4	4	93 — 95	.	4 4 8
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	97 — 99 xd	..	5 1 0
Auckland Trams, 5 % Deb. ..	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brazilian Traction Light and Power	$100	..	..	94½—95½	+ ¼	..
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16— 7 5/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4⅞— 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	144 —149	..	5 7 5
Do. Pref. Ord.	100	6	6	118 —122	..	4 18 4
Do. 5 % Pref.	100	5	5	107 —110	..	4 11 0
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	100 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	5⅞— 6⅜	..	5 9 10
Do. 5 % Pref.	5	5	5	4 13/16— 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 8
Cape Electric Trams	1	2½	..	⅜—	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16— 5 11/16	..	4 8 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	⅜— ½	..	..
Do. Pref.	1	6	..	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92	— 1	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	113 —118	+2	5 18 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	95½— 97½	..	5 2 7
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7½— 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	96½— 98½	..	5 1 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1 [illegible]/32— 1 11/32 xd	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½— 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101½—103½	..	4 16 7
Do. 5 % Mort. Bonds ..	100	5	5	97 — 99	+ ½	5 1 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 —104 xd	..	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅝— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	⅝— ⅞	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/16— 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	9/16— 13/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝— ⅞	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½— 8	..	6 5 0
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	103 —105	+ 1	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	3	Nil	Nil	½— ¾	..	Nil
Do. Deb...	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb...	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10¾— 11¼	..	6 13 4
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	20	3 11/16— 3 13/16 xd	..	5 4 11
Do. Deb...	100	4½	4½	105 —108	..	4 3 4

Crompton & Co.	3	Nil	..	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16— 13/16	..	..
Do. Pref.	1	6	6	13/16— 15/16	..	6 8 0
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	⅛— ¼	..	Nil
Do. fully paid	5	Nil	..	1½— 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	13/16— 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 6 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12¼— 13	..	6 10 9
Do. Pref.	5	4½	4½	4 13/16— 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	101 —102 xd	..	4 7 5
India-Rubber, G. & T.	10	..	..	8½— 9½	..	..
Do. Pref.	10	5	5	9½— 10½	..	4 17 7
Telegraph Construction.. ..	12	17½	5†	35½— 37½	..	5 10 0
Do. Deb...	100	4	4	97 —100	..	4 0 0
Willans & Robinson	1	Nil	..	1/16— 3/16	— 1/16	Nil
Do. Pref.	5	Nil	..	½ —	— ¼	Nil
Do. Deb...	100	4	4	57 — 59 xd	..	6 15 7

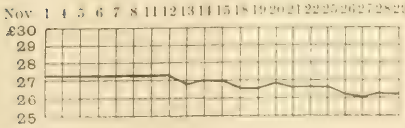
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

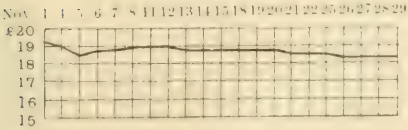
METAL MARKET.

Fluctuations in November.

SPELTER (G.O.B's.).



LEAD (ENGLISH).



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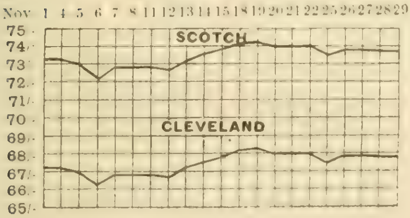

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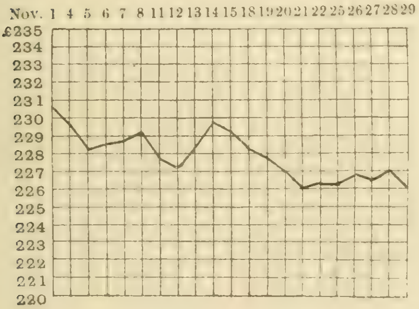
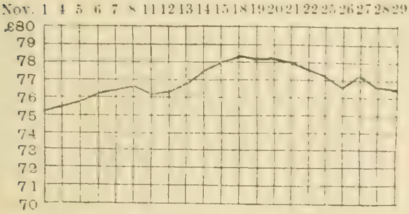


COPPER (G.M.B's.).



Dinner and Concert.—The employés of the London Branch of the Bosch Magneto Co., Ltd., opened their "Social" season on Friday last at the Horseshoe Hotel, Tottenham Court Road, W., where over 70 sat down to dinner. The dinner was followed by a concert. The chair was occupied by Mr. Chas. Gorick, and among those who rendered entertainment were Messrs. Hoffmann, Toomey, Povey, Richmond, Vinson-Monckley, Gorick, Revell, Beckitt, Deubelbeis, McAlpine, Parish, Partridge, and Herr Schmidt. Mr. H. F. Warren accompanied at the Piano. The toast of the evening, that of the "Management," was proposed by Mr. Chas. Godfree. Mr. A. Bennett responded. Mr. F. E. Barker acted as hon. sec. The ball and whist drive is to take place on January 3rd, at the Abercorn Rooms, and Mr. Gorick is now busy arranging for the event.

THE LOADING OF SUBMARINE TELEPHONE CABLES.

A Comparison between Coil-Loaded and Continuously-Loaded Cables.

By J. G. HILL.

(Continued from page 894.)

The following way of looking at the relative efficiency of cable circuits may be of interest. In the case of any circuit, loaded or unloaded, the following equation holds good—

$$\beta = \sqrt{\tfrac{1}{2}\sqrt{(R^2 + p^2 L^2)(s^2 + p^2 K^2)} + \tfrac{1}{2}(R s - p^2 K L)}, \quad (5)$$

where $p = 2\pi$ times the frequency n. The expression may be written

$$\beta = \sqrt{\tfrac{1}{2} p K R \left(\sqrt{(1 + p^2 L^2/R^2)(1 + s^2/p^2 K^2)} + s/p K - p L/R\right)}.$$

Now $s^2/p^2 K^2$ may be neglected, and the rearranged formula becomes—

$$\beta = \sqrt{\tfrac{1}{2} p K R \left(\frac{\sqrt{R^2 + p^2 L^2} - p L}{R} + s/p K\right)}. \quad (6)$$

If we write—

$$\sqrt{\tfrac{1}{2} p \left(\frac{\sqrt{R^2 + p^2 L^2} - p L}{R} + s/p K\right)} = \sqrt{A},$$

the complete formula for an unloaded circuit may be written

$$\beta = \sqrt{K R A}, \quad (7)$$

and the ratio of improvement obtained by loading a given circuit having this β before loading may be seen from the expression—

$$\sqrt{A/A_1} = \frac{\beta \text{ unloaded}}{\beta_1 \text{(same cable circuit loaded for minimum } \beta)}.$$

The value of L per km. may be calculated as explained further on, and it will not exceed 1 mh. per kilometre in an unloaded gutta-percha cable circuit. Also $p = 2\pi \times 1{,}000$, and therefore the above expression $\sqrt{A}$ in the case of modified gutta-percha may be reduced to—

$$\sqrt{A} = 56 \sqrt{\left(\frac{\sqrt{R^2 + 39{\cdot}5} - 6{\cdot}28}{R} + 0{\cdot}002\right)}.$$

If the case of a conductor having a loop resistance of 2 ω per km. be examined (weighing a little over 600 lb. per naut) the formula gives $\sqrt{A} = 22$, and

$$\sqrt{A/A_1} = 22/\sqrt{72} = 2{\cdot}6\,;$$

i.e., the speaking range brought about by coil-loading would be 2·6 times the original cable length.

If such a cable were loaded by the continuous loading method, we should have—

$$\sqrt{A/A_2} = 22/\sqrt{122} = 2 \text{ (nearly)}.$$

So that in this case the speaking range is doubled.

If the resistance R is very high, as in very small gauge cable, the expression—

$$A = 56 \sqrt{\frac{\sqrt{R^2 + 39{\cdot}5} - 6{\cdot}28}{R} + s/p K}$$

is modified. In that case—

$$\sqrt{\frac{\sqrt{R^2 + 39{\cdot}5} - 6{\cdot}28}{R}}$$

converges towards 1, and $s/p K$ becomes negligible. So that $\sqrt{A} = 56$, and $\sqrt{A/A_1} = 56/8{\cdot}5 = 6{\cdot}6$.

Theoretically, therefore, such a circuit could be increased in speaking range from 1 to 6·6 times the original length. The amount of inductance required, however, for this purpose would give too high an impedance, and the coils would require to be spaced too close together for practical purposes.

TABLE II.—Best Possible Inductance and Minimum "β" in Circuits with Different Resistances and Fixed Capacity = ·09 mf. per km. at 1,000 Cycles per Second.

Coil-Loaded Cables.—Modified G.P.

Per naut.								Per kilometre.					
Cond. R.	Coil R_1	S/K.	R_1/L.	K.	L.	β_m.†	$\sqrt{L/K}$.*	Cond. R.	Coil R_1.	K.	L.	β_m.†	$\sqrt{L/K}$.*
ohms.	ohms.			farads.	henrys.			ohms.	ohms.	farads.	henrys.		
3·71	3·12	12	60	1·67 × 10^{-7}	52 × 10^{-3}	6·68 × 10^{-3}	558	2	1·68	9 × 10^{-8}	28 × 10^{-3}	3·6 × 10^{-3}	558
7·42	6·18	12	60	1·67 ,,	103 ,,	9·46 ,,	784	4	3·36	9 ,,	56 ,,	5·1 ,,	784
11·13	9·3	12	60	1·67 ,,	155 ,,	11·55 ,,	963	6	4·98	9 ,,	83 ,,	6·23 ,,	963
14·84	12·36	12	60	1·67 ,,	206 ,,	13·34 ,,	1,111	8	6·60	9 ,,	110 ,,	7·20 ,,	1,111

Ordinary G.P.

3·71	1·26	120	60	1·67 × 10^{-7}	21 × 10^{-3}	10·55 × 10^{-3}	353	2	·66	9 × 10^{-8}	11 × 10^{-3}	5·69 × 10^{-3}	353
7·42	2·46	120	60	1·67 ,,	41 ,,	14·93 ,,	495	4	1·32	9 ,,	22 ,,	8·05 ,,	495
11·13	3·72	120	60	1·67 ,,	62 ,,	18·27 ,,	604	6	1·98	9 ,,	33 ,,	9·85 ,,	604
14·84	4·92	120	60	1·67 ,,	82 ,,	21·12 ,,	701	8	2·64	9 ,,	44 ,,	11·38 ,,	701

Continuously-Loaded Cables.—Modified G.P.

Per naut.								Per kilometre.					
Cond. R.	Added R_2.	S/K.	R_2/L.	K.	L.	β_m.†	$\sqrt{L/K}$.*	Cond. R.	Added R_2.	K.	L.	β_m.†	$\sqrt{L/K}$.*
ohms.	ohms.			farads.	henrys.			ohms.	ohms.	farads.	henrys.		
3·71	3·3	12	110	1·67 × 10^{-7}	30 × 10^{-3}	8·7 × 10^{-3}	424	2	1·76	9 × 10^{-8}	16 × 10^{-3}	4·69 × 10^{-3}	424
7·42	6·71	12	110	1·67 ,,	61 ,,	12·35 ,,	604	4	3·63	9 ,,	33 ,,	6·66 ,,	604
11·13	10·0	12	110	1·67 ,,	91 ,,	15·06 ,,	738	6	5·39	9 ,,	49 ,,	8·12 ,,	738
14·84	13·42	12	110	1·67 ,,	122 ,,	17·4 ,,	852	8	6·96	9 ,,	66 ,,	9·38 ,,	852

Ordinary G.P.

3·71	1·76	120	110	1·67 × 10^{-7}	16 × 10^{-3}	11·93 × 10^{-3}	310	2	·96	9 × 10^{-8}	8·7 × 10^{-3}	6·43 × 10^{-3}	310
7·42	3·55	120	110	1·67 ,,	32·3 ,,	16·88 ,,	440	4	1·91	9 ,,	17·4 ,,	9·10 ,,	440
11·13	5·32	120	110	1·67 ,,	48·4 ,,	20·59 ,,	538	6	2·87	9 ,,	26·1 ,,	11·1 ,,	538
14·84	7·1	120	110	1·67 ,,	64·5 ,,	23·89 ,,	622	8	3·82	9 ,,	34·8 ,,	12·88 ,,	622

* Characteristic impedance. † Minimum attenuation constant.

One further case of simplification may be of interest. The formula (1)—

$$\text{R} + \frac{(\text{R}_1/\text{L} + \text{S}/\text{K})\,\text{L}}{2}\sqrt{\text{K}/\text{L}} = \beta$$

is true for any loaded circuit with sufficient inductance, whereas the expression (4) $\beta_m = \sqrt{\text{K R A}_1}$ gives the β where the best inductance is used. Dividing (1) by (4), we get—

$$\beta/\beta_m = \frac{\sqrt{\text{R}/\text{L A}_1} + \sqrt{\text{L A}_1/\text{R}}}{2}. \qquad (8)$$

By substituting the value of L from (2), this becomes—

$$\beta/\beta_m = \frac{\sqrt{\text{L}/\text{L}_1} + \sqrt{\text{L}_1/\text{L}}}{2}, \qquad (9)$$

and if p_v is the percentage of variation from the minimum β, then—

$$p_v = 50\,[(\sqrt{\text{L}/\text{L}_1} + \sqrt{\text{L}_1/\text{L}}) - 2], \qquad (10)$$

where L is now the inductance required for a minimum β, and L_1 is any inductance selected for loading purposes. As an example, consider the β of the cable in Table II, having a resistance of 14·8 ω per naut. When fully loaded with 206 mh., the β is given as $13·34 \times 10^{-3}$. The same cable in Table III is loaded with only 103 mh., and the β is $14·17 \times 10^{-3}$. By inserting the above values of L in formula (10), we get—

$$p_v = 6·05,$$

i.e., by only taking half the best possible loading, the β obtained varies 6 per cent. from that obtained with the best possible loading (it is, of course, higher), and if 6 per cent. of 14·17 be added to 13·34, the two sets of figures agree very nearly. If, instead of taking only half the best inductance, the latter inductance be doubled, the equation gives the same result. In the same conditions (*i.e.*, with the same resistance, capacity and leakance), the β of the continuously-loaded cable is 57 per cent. higher than the minimum β when loaded with 0·087 mh. per kilometre.

By means of the various formulæ given, Tables II, III and V have been worked out. Tables II and III show the minimum β per naut and per kilometre for circuits of various resistances, and with the same fixed capacity in each case.

Table II assumes that the minimum β can in all cases be obtained. It is of theoretical interest, but in practice the best β cannot always be obtained. It will be seen that the ratio $\sqrt{\text{A}_1/\text{A}_2}$ holds good.

Table III differs from the preceding one, inasmuch as inductances which are known to be commercially practicable are adhered to, but in other respects the constants are the same as in Table II.

In M. Devaux Charbonnel's article similar, but not identical, tables are dealt with, and 0·087 mh. per kilometre is stated by that writer to be the best L which can be obtained without great difficulty and expense in continuously-loaded cables. This statement must not, of course, be taken too literally as a rigid limit, but it affords a convenient and accepted basis for comparison. As will be shown later, however, it is not economical to provide all cables of equal capacity, and therefore Table V has been prepared. This table gives electrical details of cables of both types, approximately made up on the basis of using the least amount of gutta-percha consistent with safety, to keep down expense. Details of continuously-loaded cables having the *same* capacity as the coil-loaded ones are added for interest.

Before applying the data in these tables to obtain the cost of the two types of cables, *i.e.*, the cost of obtaining a given β in each type, it will be necessary to examine the formulæ which permit of the inductance and added resistance of continuously-loaded cables being calculated, seeing that from these details the design of such cables must be determined.

The amount of inductance added to a cable by a given quantity of iron is given by the following formula, which is developed and proved in Prof. Breisig's "Theoretische Telegraphie," page 322 :—

$$\text{L} = 4\,l\left(\log 2\,d/r + \tfrac{1}{4} + \mu\,\frac{\pi\,t^2}{2\,(2\,r + t)\,(t + a)\,(1 + \alpha)}\right), \qquad (11)$$

where l is the length in cm., d is the distance between the centres of the conductors, r is the radius of the conductor, μ is the permeability of the iron, t is the thickness of the iron winding, and a and α are coefficients which account for energy losses.

If these losses be neglected the formula becomes—

$$\text{L} = 4\,l\left(\log 2\,d/r + \tfrac{1}{4} + \frac{\mu\,\pi\,t^2}{2\,(2\,r + t)\,t}\right),$$

and this formula was found in practice to hold approximately good by M. Devaux Charbonnel. The difference in the two formulæ may, however, amount to several per cent.

The first part of the expression, viz., 4 L (log 2 d/r + $\tfrac{1}{4}$) accounts for the natural inductance of the circuit apart from the iron, and the added inductance is therefore—

TABLE III.—Inductances Commercially Used (or Obtainable) and Corresponding "β" in Circuits with Different Resistances and Fixed Capacity = ·09 mf. per km. at 1,000 Cycles per Second.

Coil-loaded Cables.—Modified G.P.

Per naut.								Per kilometre.					
Cond. R.	Coil R₁	S/K.	R₁/L	K.	L.	β.†	√LK.*	Cond. R.	Coil. R₁.	K.	L.	β.†	√LK.*
ohms.	ohms.			farads.	henrys.			ohms.	ohms.	farads.	henrys.		
3·71	3·12	12	60	1·67 $\times 10^{-7}$	52 $\times 10^{-3}$	6·68 $\times 10^{-3}$	558	2	1·68	9 $\times 10^{-8}$	28 $\times 10^{-3}$	3·6 $\times 10^{-3}$	558
7·42	6·18	12	60	1·67 „	103 „	9·46 „	784	4	3·36	9 „	56 „	5·1 „	784
11·13	6·18	12	60	1·67 „	103 „	11·81 „	784	6	3·36	9 „	56 „	6·37 „	784
14·84	6·18	12	60	1·67 „	103 „	14·17 „	784	8	3·36	9 „	56 „	7·64 „	784
Ordinary G.P													
3·71	1·26	120	60	1·67 $\times 10^{-7}$	21 $\times 10^{-3}$	10·55 $\times 10^{-3}$	353	2	·66	9 $\times 10^{-8}$	11 $\times 10^{-3}$	5·69 $\times 10^{-3}$	353
7·42	2·46	120	60	1·67 „	41	14·93 „	495	4	1·32	9 „	22	8·05 „	495
11·13	3·72	120	60	1·67 „	62	18·27 „	604	6	1·98	9 „	33 „	9·85 „	604
14·84	4·92	120	60	1·67 „	82	21·12 „	701	8	2·64	9	44	11·38 „	701

Continuously-loaded Cables.—Modified G.P.

Per naut.								Per kilometre.					
Cond. R.	Added R₂.	S/K.	R₂/L.	K.	L.	β.†	√LK.*	Cond. R.	Added R₂.	K.	L.	β.†	√LK.*
ohms.	ohms.			farads.	henrys.			ohms.	ohms.	farads.	henrys.		
3·71	1·76	12	110	1·67 $\times 10^{-7}$	16 $\times 10^{-3}$	9·15 $\times 10^{-3}$	310	2	·96	9 $\times 10^{-8}$	8·7 $\times 10^{-3}$	4·93 $\times 10^{-3}$	310
7·42	1·76	12	110	1·67 „	16 „	15·1 „	310	4	·96	9 „	8·7 „	8·15 „	310
11·13	1·76	12	110	1·67 „	16 „	21·1 „	310	6	·96	9 „	8·7 „	11·37 „	310
14·84	1·76	12	110	1·67 „	16 „	27·1 „	310	8	·96	9 „	8·7 „	14·59 „	310
Ordinary G.P.													
3·71	1·76	120	110	1·67 $\times 10^{-7}$	16 $\times 10^{-3}$	11·93 $\times 10^{-3}$	310	2	·96	9 $\times 10^{-8}$	8·7 $\times 10^{-3}$	6·43 $\times 10^{-3}$	310
7·42	1·76	120	110	1·67 „	16 „	17·86 „	310	4	·96	9 „	8·7 „	9·63 „	310
11·13	1·76	120	110	1·67 „	16 „	23·82 „	310	6	·96	9 „	8·7 „	12·84 „	310
14·84	1·76	120	110	1·67 „	16 „	29·77 „	310	8	·96	9 „	8·7 „	16·05 „	310

* Characteristic impedance. † Attenuation constant.

$$\text{L} = 4\,l \left(\mu \frac{\pi\, t}{2\,(2\,r + t)} \right). \qquad (12)$$

Call $2\,r = d$ (the diameter of the wire), and we get—

$$\text{L} = \mu\, 2\, \pi\, l\; t\,/(d + t). \qquad (13)$$

If the thickness of iron be made up by p windings, each of thickness t, this becomes $\text{L} = 2\,\pi\,\mu\,l\,p\,t/(d + pt)$, but—

$$p\,t/(d + p\,t) = \frac{1}{d/pt + 1}, \qquad (14)$$

and from this it may be seen that if the ratio d/pt is kept constant, L will be unaltered (if the natural inductance of the circuit is unaltered). On that assumption, it is evident that, in order to obtain the same value of inductance in conductors of different diameters, the thickness of the iron winding ($p\,t$) must be increased in the same proportion as the diameter of the copper conductor is increased. The expression given is in absolute units, and to bring it to henrys per km. we have—

$$\text{L} = 10^{-4} \times 2\,\pi\,\mu \times p\,t\,(d + p\,t). \qquad (15)$$

The figure to be taken for permeability, μ, is a somewhat doubtful quantity. It is sometimes taken as 120, but M. Devaux Charbonnel finds 110 to be suitable with the shortened formula, whilst some other experimenters find a less value still. It depends largely upon the material used. The increase in resistance brought about by the insertion of inductance in continuously-loaded cables has been made the subject of exhaustive research by Prof. Larsen, and Prof. Breisig, on page 323 of "Theoretische Telegraphie," gives the following formula after consideration of Larsen's work—

$$\text{R}_2 = \frac{\text{S}_e\, \pi^2\, \mu^2\, \omega^2\, t^4}{4\,(2\,r + t)\,(t + a)\,(1 + \alpha)^2}, \qquad (16)$$

where S_e is the specific conductivity in C.G.S. units of the iron, t is the thickness of the iron winding, r is the radius of the wire on which it is wound, $\omega = 2\,\pi\,n$, μ is the permeability, and a and α are correcting factors, as in (11). Neglecting these losses, we get—

$$\text{R}_2 = \frac{\text{S}_e\, \pi^2\, \mu^2\, \omega^2\, t^3}{4\,(2\,r + t)}.$$

Converting the specific conductivity S_e to specific resistance, $1/\rho$, and rearranging the formula, we get—

$$\frac{4\,\pi^4\,\mu^2\,n^2\,t^3}{4\,\rho\,(d + t)},$$

where d = the diameter of the conductor, and all the dimensions are in centimetres. To convert to ohms per kilometre we have—

$$\text{R}_2 = 10^{-4}\,\frac{\pi^4\,\mu^2\,n^2\,t^2}{\rho}\cdot\frac{t}{d + t}. \qquad (17)$$

If millimetres are used in place of centimetres, and ρ is the resistance in ohms of a piece of iron 1 m. in length and 1 sq. mm. in cross-section, the formula becomes—

$$\text{R}_2 = 10^{-11}\,\frac{\pi^4\,\mu^2\,n^2\,t^2}{\rho}\cdot\frac{t}{d + t}. \qquad (18)$$

It is often convenient to use the formula in this form.

(To be concluded.)

IMPROVEMENTS IN STEAM TURBO-GENERATORS.

According to the report of the Committee of the Association of Edison Illuminating Companies on steam turbines, based on information supplied by the manufacturers, a number of developments and improvements have been made recently in Westinghouse steam turbo-generator practice. Speed limits have been materially raised within recent times in both 25-cycle and 60-cycle practice. In 60-cycle practice generators of 5,000 K.V.A. rating at 3,600 R.P.M. have been built, which is considerably larger than had been completed a year ago. For machines larger than 5,000 K.V.A. four poles are being used up to approximately 20,000 K.V.A., whereas a 10,000-K.V.A. generator was about the largest machine yet built with four poles up to a year ago.

In 25-cycle practice, two-pole 1,500-R.P.M. machines are being built in sizes up to 20,000 K.V.A., and it is probable that the ratings will be carried up to 25,000 K.V.A. or possibly 30,000 K.V.A., although at these ratings other factors than the design of the turbo-generator itself may control the speed conditions. It may be said, however, that the generator itself is practicable up to 30,000 K.V.A. at 1,500 R.P.M. At 750 R.P.M. it is hard to say what the upper limit will be.

Some of the most radical improvements in the later high-speed turbo-generators have been in the methods of ventilation. In the older Westinghouse practice practically all the ventilation of the machine was through the air-gap between the rotor and stator. On the more recent machines, especially where the speed limits have been raised, it is not practicable to force sufficient cooling air through the air-gap alone, and, therefore, additional ventilating channels are provided, and particular provision is made to prevent the currents of cooling air in the various paths from interfering with each other. In particular, the air passages are arranged with a view to cleaning them without dismantling the machine. Methods have also been devised for effectively cooling machines which have a great length compared with their diameter, and thus, it is claimed, a long machine of very high rating can be cooled as effectively as a short one, which has not usually been the case.

In the more recent machines of very large outputs, the rotor is made up of rolled-steel plates, which are rigidly and permanently clamped together, without a through shaft, to form the rotor body as a whole. This core is then suitably slotted for the rotor windings and for purposes of ventilation. The rotor windings consist of formed strap coils insulated with mica and asbestos, so that they can withstand an excessively high temperature under emergency conditions. Tests made with this type of insulation are said to have shown that it can successfully withstand temperatures higher than that of the melting point of tin solder.

As far as the records show, the manufacturer claims that there has never been a failure of the insulation with the Westinghouse mica-wound rotors due to deterioration by temperature, although a large number of such rotors have been employed in commercial service for a number of years.

On account of the higher speed limits with large machines, the methods of supplying cooling air have required more or less modification recently. For instance, a 60-cycle, four-pole machine of 20,000 K.V.A. rating will not have a materially larger diameter of rotor than a 10,000-K.V.A. machine of the same speed, although the amount of air required for cooling must be twice as great. In the 10,000-K.V.A. machine, a ventilating fan of the largest permissible dimensions may be installed directly on the rotor shaft, and the opening through such fan may be just sufficient to force in the required amount of ventilating air. Therefore, on the 20,000-K.V.A. machine it may be impracticable to obtain enough opening through a ventilating fan of the largest practical dimensions to allow the necessary air to be supplied to the machine, and hence some other method of ventilation becomes necessary or desirable. In consequence, on very large high-speed turbo-generators separate blowers are coming into use, these blowers being designed for any suitable speed and driven by electric motors. When a number of large turbo-generators are located in one station the ventilating fans can supply air to a large air chamber which opens to all the machines. This scheme is somewhat more economical than with blowers directly on the machines, as the fans can be operated at the most economical speed, and furthermore, if the fans are driven by motors with adjustable speed characteristics it is possible to vary the air pressure, depending upon the requirements of the load, so that further economy is thus obtained.

The Westinghouse Co. countenances the use of voltages up to 11,000 volts and 13,000 volts directly on the armature winding. Two principal difficulties incidental to the use of high voltage on the armature winding—namely, dangerous heating in that part of the copper buried in the core, and deterioration or "eating away" of the insulation by static discharges—have both been overcome by the use of mica insulation on the buried part of the coil, this insulation being put on individual turns as well as on the outside of the coil as a whole.

The end windings of Westinghouse machines, it is said, have been braced in a still more rigid manner than in the past, so that no danger is anticipated from dead short-circuits across the terminals of such machines without external reactance in series. The Westinghouse Co. designs its turbo-generators with a relatively large internal reactance, sufficient to prevent damage to the machine in case of a dead short-circuit across the terminals. This usually means from 12 to 18 times full-load current at the first instant of short-circuit. If for any reason outside the machine itself it is necessary or desirable to reduce still further the short-circuit current, it is recommended that this be done by means of external reactors. By this expedient a certain amount of adjustment is possible to meet external conditions, while the machine is able to protect itself regardless of the use of additional reactors.—*Electrical World.*

BRITISH TRADE IN RUSSIA.

By reason of past experience British firms are apt to look askance at the Russian market, fearing lest endeavours to extend their trade there may only result in loss to themselves. Such action in the past may have been warranted, but there is not, at the present time, the same reason for holding back from trade in Russia. Care is, of course, very necessary; "long" firms are by no means few, but if the trade is properly watched such firms can be avoided.

In a recent report, the British Consul at Moscow points out that Germany, France and the United States have made great advances in the market, while British trade has remained almost stationary. In extenuation of this unsatisfactory state of affairs it may be urged that figures are unreliable, and further, that certain branches of industry which once were practically British monopolies are now being exploited by foreign competitors. This is especially the case with spinning machinery, which at one time was almost entirely in the hands of British firms, partly because these firms led the way in this particular industry and partly because the managers of the numerous mills were nearly all Englishmen. Of late, however, other Continental firms have entered into the market. They supply cheaper machinery, and aided by their trade banks, can give longer credit than British firms are either able or willing to give. As, too, the number of British mill managers is decreasing, it is evident that, although British supremacy in this line is not likely to be threatened, British firms will no longer enjoy the monopoly which once was theirs. However, even allowing for the inaccuracy of figures and for the inevitable increase of competition, other reasons must be sought for the stagnation of British trade in the Russian market. First and foremost comes the question of credit. This has been a prominent feature in Consular reports for many years. It is quite true that it is impossible for British firms to grant the same credit as German and French firms which are supported by their local trade banks. In Moscow alone there are five German and two French trade banks. The Consul has long urged the necessity for creating a British trade bank in Moscow, which would assist British firms and help to supply information.

British firms, however, are at last beginning to realise the necessity of printing their catalogues in Russian and of sending young employés to learn the language, a policy which has also been advocated for years. It is quite a fallacy to suppose that British firms cannot do well in Russia or to state that the advantages which the Russian market affords are purely imaginary. Some trouble must be taken and concessions must be made to prevailing local customs, and British firms who have taken the trouble to study local conditions have invariably done well.

A factor which tells against British firms is the immense advantage which the foreign commercial traveller possesses over the British. English is hardly spoken at all in Russia, whereas German is widely known. The British traveller, as a rule, not only knows no Russian, but is also very often greatly handicapped by the fact that he is not generously treated by his firm as regards expenses as entertaining allowances, &c. In Russia most business is done "over the bar," and before a man can secure a big order he must, as the saying goes," show his money." The German traveller, in addition to knowing the language of the country is more liberally treated in this matter.

Yet another factor that tells against British firms is the fact that they are often very badly represented by their agents. In Moscow there are often foreigners who will take an agency for a British firm simply for the sake of blocking sales. And yet there is no denying that, generally speaking, Russians all admit the superiority of British goods.

Imports from the United Kingdom into Russia consist mainly of machinery and raw and semi-manufactured articles. As Germany sends the same class of goods, competition is naturally very keen. To meet this competition satisfactorily, it is necessary that firms should have a knowledge of local conditions, that commercial travellers with a knowledge of Russian should visit the country with catalogues in Russian and prices in Russian money, and that credit should be given. As regards the last named, the Moscow Consul writes:—

"The credit system, which is the crux of the whole situation, is a sore point with British commercial journals, who point out very rightly that in urging the giving of long credit Consular reports are advocating what is, under present conditions, impracticable and impossible. British firms cannot compete with foreign firms, which are backed by their own trade banks. And until the United Kingdom establishes local banks in Russia, and falls into line in this respect with other nations, British firms will always be at a serious disadvantage as far as the Russian market is concerned."

In this connection, too, the Vice-Consul at Kharkoff recently wrote that British manufacturers are generally far too conservative with respect to credit, mainly, no doubt, because they have not studied the principles on which their Continental rivals do business. It is fighting them with one arm tied to refuse to adopt their most powerful weapon. Provided, of course, that the giving of credit is in the hands of experienced sales managers and is kept under proper control, outstanding accounts are regarded on the Continent as a very excellent asset, little below fluid capital in value. Without trade the manufacturing plant becomes dead capital, whereas when business is done as above, the outstanding debts are returned within a reasonable time and carry 5 to 6 per cent. interest. And when the manufacturer has not sufficient capital to finance the trade, Continental banks, or their London branches, are very willing to advance the money to firms of good standing for the support of this credit. It is not unusual for such credit to be given on open account, as an overdraft. But more often customers' six months' promissory notes, with the manufacturer's endorsement, are taken as a guarantee, these notes being renewable at six monthly intervals up to the termination of the sales' credit, in, say, 18 to 30 months. Thus not only is the trade extended without extra capital, and higher prices taken than is possible with cash payment, but an additional profit is made on the difference between the interest charged to the customer and the bank rate. British manufacturers and British bankers will find themselves forced to adopt the Continental methods of giving credit for the support of the export trade. If they do not do so, the British manufacturer will find himself elbowed aside when his Continental competitor sets seriously to work, and the British banker will see profitable banking operations, and especially the discounting of foreign bills, monopolised by Continental banks. Banks which discount the manufacturer's notes naturally obtain his other banking business also; and where a bank is largely concerned in financing a manufacturing company, it will frequently have a voice on the board of that company and influence the company's purchasing operations and trade for the benefit of other businesses in which the bank has an interest. The above remarks apply more particularly to makers of machinery.

The British Vice-Consul at Kertch points out that, in his district

German and Austro-Hungarian manufactures are everywhere noticeable, and one naturally wonders why they could not have been equally well supplied by British makers. The reason undoubtedly is that the foreign goods were offered to the purchaser and the British were not. The relatively high quality of British manufactures is undisputed, and the local feeling would seem to be that, given equal facilities for payment and delivery, the British article would be preferred on account of its unique reputation for quality and durability. One well-arranged catalogue in the Russian language has recently been received at the Vice-Consulate. This is an important step in the right direction, but when the foreign competitor's goods are offered personally by a competent commercial traveller, such documents, unassisted, are apt to be laid aside. The question of allowing long credit to certain classes of desirable customers should be carefully studied; the practice is now generally accepted and seems fraught with no special danger, always provided the necessary discrimination is exercised.

PROCEEDINGS OF INSTITUTIONS.

Earthed v. Unearthed Neutrals on Alternating-Current Systems.

By J. S. Peck, M.I.M.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, November 19th, and London, November 28th*, 1912.)

It is intended in this paper to discuss the various questions involved, and to show why under some conditions of operation it is becoming general practice to earth the neutral, while under others it may be advisable to operate with the neutral unearthed.

While several advantages may be claimed for the earthed neutral, there are but two which are really of any great value. These are:—

(*a*) The limiting of the voltage between line wires and earth.

(*b*) The possibility of cutting off any wire or feeder in the event of an earth upon it.

The chief objection to earthing is the fact that the system cannot be operated with an earth on any line wire.

It is well known that in an unearthed three-phase system, where the impedance of each phase to earth is equal, each of the three conductors assumes a potential above earth equal to 58 per cent. of the voltage between wires while the neutral point is at earth potential, but any difference in the impedance causes the potential of the neutral point to shift, bringing the phase having least impedance nearer to earth potential and raising the others to a potential correspondingly higher above earth. When one phase is earthed, it assumes earth potential, and the other phases reach full line potential above earth. When the potential of each phase to earth is the same, the charging current to earth will be equal in all phases, but when one phase is earthed the charging current to earth is increased by 73 per cent. in both of the unearthed phases, and all of this current will return to the generator through the earthed phase and will pass into the faulty wire at the earthed point.

Earthing the neutral means that this point is fixed at earth potential, and the three line wires are fixed at a potential 58 per cent. above earth.

If the neutral point is earthed through a resistance, and one phase is earthed, current flows through the neutral resistance, and the drop across this resistance measures the voltage between the neutral point and earth, so that the neutral point is not fixed definitely but depends upon the amount of resistance and the current flowing through it.

With the earthed neutral very simple and reliable apparatus can be provided, which will cut out any feeder in case an earth occurs upon it. This apparatus may be of the Merz-Price balanced protective type, or it may be of that type which is based upon the principle that the resultant current in a three-phase circuit is zero. Fig. 1 shows a well-known arrangement of this kind. It is evident that under normal conditions the resultant current in the secondaries of the three transformers is zero, therefore no current can flow through the trip coil; but should an earth occur on one of the wires, the circuits will be unbalanced and current will flow through the trip coil. This apparatus may be adjusted to work on a very small earth current.

Still another possibility is to put a trip coil in series with the earth connection, but this arrangement is not so satisfactory as those previously mentioned, in that it does not discriminate as to the feeder to be cut off.

Where a large cable network is supplied from common bus-bars the arrangement shown in fig. 1 may work satisfactorily without the neutral point being earthed. The reason for this is as follows:—

In the event of an earth on any wire, the charging current to earth on all of the cables on the system will be returned to the bus-bars through the wire which is earthed. Therefore the current balance on the earthed feeder will be upset and the circuit-breaker operated. This arrangement is, however, limited in its application, and is not so positive as when there is a current flow between earth and generator neutral.

All modern three-phase generators are insulated to stand operation without the neutral being earthed, so that no consideration of reduced first cost due to limiting the voltage to earth by earthing the neutral need enter the problem. The question of risk of breakdown with earthed or unearthed neutrals may also be practically neglected. Three classes of service will be considered:—

(*a*) Generator supplying network of underground cables.

(*b*) Generator supplying overhead transmission circuits without transformers.

(*c*) Generator supplying overhead transmission line through step-up transformers.

In case (*a*) an earth on any phase of a cable is almost certain to develop into a short-circuit between phases, and on a large system the result of a short-circuit on a cable is usually to burn off a section of the cable, perhaps to damage adjacent cables, and sometimes to set up surges which may cause serious breakdowns elsewhere on the system. Since the majority of breakdowns on cables are to earth, it is therefore extremely desirable that a cable be cut off as soon as an earth develops, and as this can be done quickly and with certainty where the generator neutral is earthed, it is becoming general practice to do this in all stations of this class. Thus practically the only question to consider is whether the neutral shall be earthed solidly or through a resistance, and, where there are several generators in parallel, how many of them should be earthed. The only object in inserting resistance between generator neutral and earth is to limit the rush of current which occurs whenever there is an earth on the system. If balanced protective apparatus is used, similar to that shown in fig. 1, the resistance may be made so high as to keep down the current rush to a comparatively low value, because the protective apparatus may be set to operate with a very small unbalancing in current; but where plain overload protection is used—and this applies to the majority of cases—the resistance should be low enough to pass sufficient current to trip the breakers on the largest feeder, but high enough to prevent damage to generator windings, and, if possible, to prevent serious burning at the point of accidental earth.

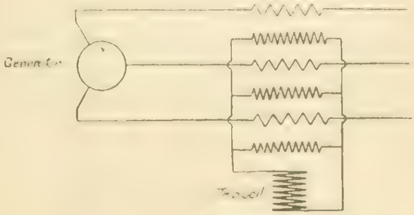


Fig. 1.—Balanced Protective Gear.

In general, earthing resistances are built up of cast-iron grids mounted on porcelain insulators, and should be located in a fireproof compartment. They are usually designed to have sufficient heat capacity so that full star voltage may be maintained across them for at least 15 seconds without a temperature rise of approximately 300° C. being exceeded. The ohmic value of the resistance is determined by the current required to trip the breakers on the largest feeder.

Where it is desired to earth through a resistance, and two or more generators are operated in parallel, the simplest and best method is to connect the neutrals of all the generators to a common bus-bar which is earthed through a suitable resistance. Then, regardless of the number of generators, the value of the earth resistance will always be the same. With this arrangement switches must always be provided between each generator and the neutral bus-bar, otherwise a generator disconnected from the main bus and shut down may be raised to a dangerous potential above earth, in case of an earth on any feeder. The objection to this method of connection is that in certain cases very heavy currents may circulate through the neutral connections and generator windings. It should be noted, however, that the neutral current divides equally among the three-phases of the generator. With 30 per cent. of full-load current in the neutral the resultant heating in the generator is increased by only 1 per cent. at full load and is quite negligible.

It would seem advisable, therefore, to try connecting the generator neutrals solidly together, especially in the case of turbo-generators, which there is no angular variation in speed, and therefore less chance of circulating currents. Should satisfactory operation be impossible, then only one generator should be connected to the neutral bus, or resistance may be inserted between each generator and the neutral bus.

(*b*) In this case there are usually a comparatively small number of transmission lines, and an earth on one wire is not likely to cause a short circuit between wires, so that with an unearthed neutral it is quite possible to run for a long period with one wire earthed. If there are not sufficient feeders to all distributing centres to make it possible to cut out a defective one and deliver full load over the others, the possibility of being able to operate with one wire earthed may be sufficient far to outweigh the only practical advantage gained by earthing the neutral, which is the ability quickly to cut off a feeder in the event of an earth upon one wire. In the majority of cases the weight of the argument is in favour of operating with the generator neutrals unearthed.

(*c*) In this case there are conditions involved which make it extremely desirable to earth the neutral or else to earth the low-tension side of the transformers.

If one terminal of the high-tension side of a single-phase transformer be connected to a high-tension line, and the low-tension be open-circuited, the high-tension winding assumes a potential above earth equal to that of the line to which it is connected. The high-tension winding then acts as one plate of a condenser, with the low-tension and core as the other plates. The low-tension winding also has static capacity to the iron, and it will therefore assume a potential above earth, the value of which will depend upon the relation between its capacity to the high-tension winding and its capacity to earth. In practice it may easily assume one-half the potential of the high-tension winding (see fig. 2).

If—K = capacity between high-tension and low-tension, K_1 = capacity between low-tension and core, V = voltage of high-tension line, V_1 = potential of low-tension winding above earth,

$$V_1 = V \times K/K_1.$$

If both terminals of the high-tension winding are connected to the high-tension lines, the resultant potential of this winding above earth will be zero, and the resultant potential of the low-tension winding above earth will also be zero. If, therefore, one terminal of a transformer be connected to or disconnected from a line before the other, the low-tension winding during this period may assume a very high potential above earth and its insulation be broken down to earth. When the low-tension winding is connected to a generator, the generator winding also has capacity to earth, so that the capacity of the low-tension winding to earth is increased by this amount, and its voltage correspondingly reduced. If the capacity of the generator winding to earth = K_2, then the voltage of the low-tension circuit above earth = $V \times K/(K_1 + K_2)$. Thus, while the voltage is reduced by connecting the transformer and generator windings together, it may still be dangerously high.

When both terminals of the high-tension winding are connected to the line, and one wire is earthed, the resultant voltage of the high-tension winding above earth will be $V/2$, and that of the low-tension winding will be one-half as great as before, but may still be dangerously high.

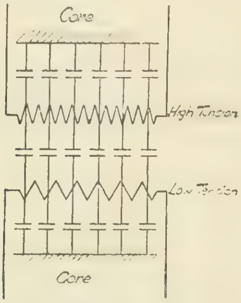


Fig. 2.—Electrostatic Capacity between Coils and between Coils and Core of a Transformer.

In the case of a three-phase transformer the conditions are much the same as described above for a single-phase transformer.

It is evident that when the neutral of the high-tension system is unearthed there are several possibilities of obtaining a high voltage on the generator windings, viz., in the case of an earth on one high-tension wire, or in the case of the switches in the three phases not operating simultaneously.

A case is on record where several generators in parallel were supplying a very high-voltage line through step-up transformers. The neutral point of the generators was unearthed. The lightning arresters on one high-tension phase broke down, and the generator windings were raised to a high potential. One generator broke down, and the attendant, seeing smoke, cut it off the bus-bars. A second machine immediately broke down, and was in turn cut off. This was repeated until nearly all the generators in the station were broken down. The attendant then cut off the excitation. Had the neutral point of the generators, or that of the high-tension side of the transformers been earthed, the trouble could not have occurred in the generator circuit. There is, however, a chance of similar trouble even when the high-tension neutral is earthed, provided the generator neutral is unearthed. This occurs when the insulation between the high and low-tension windings of the transformer breaks down at one point. The low-tension winding then assumes the potential of the high-tension winding at the point of connection, and a breakdown on the low-tension system is almost certain to follow.

Where it is considered undesirable to have a direct connection between low-tension windings and earth, a spark-gap may be placed in the circuit and set to break down at a pressure slightly above the normal voltage of the winding above earth.

The use of earth shields between primary and secondary windings is now scarcely ever called for.

Thus in the case of generators supplying a high-tension transmission line through transformers, it is highly desirable to earth the neutral point of the generators, and preferably through a rather low resistance. If it is not desired to connect permanently to earth, then a spark-gap should be used in the earth connection.

The arguments in favour of earthing the neutral in the case of high-voltage transmission circuits are :—

(*a*) The possibility of cutting off the circuit in the case of an accidental earth on any wire.

(*b*) Reduced cost of transformers and of line insulators due to limiting the voltage above earth to 58 per cent. of line voltage.

(*c*) Reduced cost and closer possible setting of lightning arresters.

(*d*) The possibility of using the earth as a conductor in the event of one line wire being disabled. This requires an earth at both ends of the line.

The argument against earthing the neutral is that an earth on one wire makes it impossible to transmit over the circuit.

(*a*) Whether there is any advantage in being able to cut off a circuit in the event of an earth on one wire depends upon the number of circuits available. In general, there are seldom more than two circuits to any sub-station, and often there is but one, so that cases may often arise where, to keep up the supply, it will be absolutely necessary to operate with one wire earthed. This method of operation would be impossible with an earthed neutral. Also an earth on one wire is not likely to develop into a short-circuit between phases, so that there is no particular need for cutting off the earthed circuit.

(*b*) The higher the voltage of the transmission the greater will be the saving in first cost made by insulating the transformer for 58 per cent. of the line voltage and by using line insulators for a corresponding voltage; but in general it is bad practice to adopt this expedient, for it may prove impossible to operate continuously with an earthed neutral, due to disturbances on adjacent telephone circuits which may occur under certain abnormal conditions, and in the event of an earth on one wire it may be essential to remove the neutral connection and operate with one wire earthed. In general it is poor economy to cut down insulation on either lines or transformers.

(*c*) If the system may sometimes be operated without earthed neutral the lightning arrester equipment must be suitable for this condition, so that there is no saving in first cost; but as long as the system is operating properly with earthed neutral the arresters may certainly be set for lower discharge values than when the system is unearthed.

(*d*) In the event of one wire on an earthed system going to earth, it would still be possible to transmit approximately two-thirds the full amount of power over the two remaining wires, provided the neutral points at both ends of the line were solidly earthed and one line with its corresponding transformers cut out of circuit. In this case the earth would carry full line current, and in very few places would this be allowed on account of disturbances to neighbouring circuits.

The neutral point of a high-tension system can be obtained only by connecting the high-tension windings of the transformers in star, or by the use of an auto-transformer, and this latter method is seldom, if ever, used. If the high-tension windings are connected in star, then damage to one transformer disables the whole group, while with the delta connection on both windings one transformer of the group may be cut out and approximately two-thirds the capacity supplied from the remaining transformers. (This does not hold in the case of three-phase core-type transformers, but is true for single-phase and three-phase shell-type transformers.)

The conclusions to be drawn from the above are that in the great majority of cases continuity of service will demand that the system be operated with an unearthed neutral, and that in general the transformers should be connected in delta on both high-tension and low-tension windings.

When it comes to a study of the question of low-tension distribution circuits, the majority of the arguments presented above will apply here also, but there enters one other consideration, *i.e.*, the danger to human life.

If the neutral point of, say, a 500-volt system is earthed, then the maximum potential above earth which any point of the system can reach is 290 volts. If the system is supplied from a 500-volt generator, the difference between a 500-volt and a 290-volt shock may mean the difference between life and death, or it may not, and there is certainly greater risk of shock from a system which is permanently earthed than from one which is earthed only occasionally. The higher the voltage of the generator the less will be the value of the earthed neutral in preventing danger to life due to reducing the voltage to earth.

When the distribution circuits are supplied through step-down transformers, there is always the possibility that the low-tension circuits may be raised to a very high potential, either through an earth on one wire of the high-tension system, or through a connection between high-tension and low-tension inside the transformer. In the former case there is great danger to low-tension insulation, and in the latter there is danger to life as well as to insulation.

Thus, where the distribution circuit is supplied direct from a generator, the advantages of the earthed neutral are the ability quickly to cut off a defective circuit and a possible reduction in risk to life, due to lower maximum voltage to earth; but where the circuit is supplied through step-down transformers from a high-voltage line there is danger to life and apparatus if the neutral is unearthed.

Where a single-phase circuit is supplied from a single-phase transformer, the low-tension winding should be earthed, preferably at the middle point of the winding, but it is better to earth one line wire than to leave the system unearthed.

Discussion in London.

This paper was discussed in London on November 28th, when **Mr. H. Brazil**, the first speaker, voiced his agreement with the greater part of the paper, particularly with the view that the neutral should be earthed. His company originally started with the neutral insulated, but had had eventually to revert to earthing, which in conjunction with lightning arresters—which were much more reliable with the earthed system—had been very satisfactory. While convinced of the necessity of earthing the neutral, he felt that this should be done through a resistance, otherwise it would give rise to excessive currents and would lead to surges. Iron had a positive heating coefficient and was not the best material for the resistance; its resistance increased enormously when heated, whereas a material such as carbon, with a negative coefficient, was much preferable. He described a resistance built up of 72 rectangular fireclay troughs containing carbon powder, arranged eight sets in parallel, each set consisting of nine in series, and giving 200 amperes with a fault. This has been installed at the Lancashire Power Co.'s station, and has avoided the trouble experienced with iron resistances. Further, a rearrangement of the troughs enabled the tripping current to be adjusted. With iron resistances as much as 750 amperes passed, and it was evident that under present conditions the effect on the system was much less severe.

Mr. W. A. Chamen said in the South Wales system they had earthed the neutral of one alternator only and were going to insert a resistance. The distribution system was both overhead and underground, and in the old days before the precaution of earthing had been adopted, one fault generally led to another. The South Wales sub-stations were equipped with three single-phase transformers coupled in delta, and as it made no difference in insulation, he thought it would be advantageous in colliery supply to earth one phase. For lighting supply three-phase transformers were employed with four-wire circuits, and the neutral was solidly earthed.

Mr. G. W. Partridge said it appeared to him that earthing one-phase would get over difficulties and would cheapen the switchgear required, as there would be only two phases to be equipped. He was doing this himself, and was surprised that the author had not mentioned it in his paper. He agreed that earth shields in transformers were undesirable, and that in the case of distribution circuits supplied through transformers it was very necessary to earth in view of the possibility of the secondary system getting charged up and people receiving shocks. He felt that in the case of a sub-station above a certain capacity there should be some direct path back to the generating station as well as the earthed neutral, as there might be such local resistance at the earth plate that the ground in the vicinity became dangerously charged. He suggested a connection from the earth wire through a spark gap to the earth shield of the H.T. cable on the primary side.

Mr. K. Edgcumbe referred to the advantages of having some means of telling how the insulation of the system was going on from day to day, which in the insulated system could be met by connecting an electrostatic voltmeter between each main and earth. With high pressures the voltmeter was connected through a condenser, and the arrangement was quite satisfactory; he knew of 200 electrostatic voltmeters in use on a 7,000-volt system in the Midlands which had given no trouble. On an earthed system similar means could be found; an ammeter could be connected across the poles of the transformers in the protective gear, and transformers would have to be provided in any case.

Mr. J. Shepherd considered that in very few cases would it be possible to connect solidly together all the machine neutrals. The difference in potential of the neutrals was as much as 500 volts in some cases. The earthing resistance installed at the Greenwich tramways generating station of the L.C.C. (and described by Mr. J. H. Rider in a paper before the Institution, in 1909), cost £120, and had a capacity of 500 amperes, while the automatic switch cost £45, and the arrangement had been perfectly satisfactory.

Mr. Brazil said the cost of the resistence referred to by him was about £40; it was designed for 1,200 KW. when cold and 2,000 KW. at the end of one minute.

Mr. C. P. Sparks said his experience was practically confined to earthed neutrals; they were essential in every case of overhead mains for the protection of the public. With unearthed neutrals, one breakdown caused another, through surging.

Mr. A. P. Trotter said that while earthed neutrals were commonly adopted here, yet a good many stations had been run with free neutrals until circumstances led them to earthing. With overhead lines the conditions were peculiar, and it might be worth while with a long line to have a free neutral and run on a fault. In this country, however, the distances were short, and this enabled one to effect repairs quickly, so that the conditions were different. In view of the necessity of securing safety in the case of overhead lines in populous districts, he would like to see some form of trip provided in the earthed neutral which would shut down the line with the minimum current flowing to earth.

Mr. S. L. Pearce said that at Manchester they started in 1901 with unearthed neutrals, and the arrangement continued to the present day. The problem had not been studied then as now, and it was, no doubt, considered that the insulated system was safer, and that it offered the possibility of running with one phase earthed; and this had been borne out in practice. Under present conditions, however, there was nothing to chose between one system and the other at Manchester, and it had been decided at an early date to earth the neutral in order to limit the current to earth. As there was 45,000 KW. at Stuart Street behind a fault, it was rough on the switch which interrupted the circuit. He proposed to combine earthing through a high resistance (giving about 100 amperes) with balanced protective gear, such as was shown in the paper. The resistance would be proportioned to allow sufficient current to trip the largest circuit-breaker.

Mr. J. S. Peck, in replying to the discussion, asked whether there was any change in the value of the carbon resistance referred to by Mr. Brazil, and was informed that there was not. In many cases, he said, manufacturers were able to make considerable reduction in cost of apparatus where earthing was adopted, owing to the limited voltage, but he did not favour this, because apparatus should be capable of working unearthed if necessary. In regard to overhead lines, if it was only a case of a pierced insulator, he saw no reason why the line should not be earthed at the station and run. In the case of a low-voltage system, it did not matter whether one phase or the neutral was earthed, but with step-down transformers, it was better to earth one phase than work unearthed. The tendency on very high-voltage systems seemed to be towards insulated neutrals, and the use of delta-connected transformers. He thought it was doubtful whether earthing should be adopted with the 200 or 400-volt supplies in large industrial works, as it was necessary to keep going and impossible to shut down for temporary earths which frequently occurred.

Discussion at Manchester.

Mr. A. P. Trotter said he had to look at the question from the point of view of safety of human life. The B. of T. regulations permitted the use of a free neutral, which practice he thought came from Germany. Originally, earthed neutral was specified, and after a lengthy experience of high-pressure distribution with free neutral, he was not convinced that the latter method was the best practice. Each case had to be treated on its merits. Personally, he did not wish to recommend that free neutral should be insisted upon at present for high pressure. Coming to low pressures, the case was different, and for distribution circuits at low or medium pressures there could hardly be any doubt except in mines, where conditions were again different. Much trouble was experienced from birds on the overhead lines, and he would like to see a time-limit device employed to meet such cases. There was still plenty of room for devices for leading current to earth. He did not think anyone was likely to repeat the London arrangement for connecting machines to earth, and the plan of putting one machine only to earth was not necessarily reliable. The bus-bars should be earthed rather than the machines. The author stated that it was quite possible to run for a long period with one wire earthed, but he (the speaker) would like to see a shut-down if anything in the way of a permanent earth was developed. There was something to be said on the question of running three-phase circuits with one phase earthed, and one point to be considered was that an interruption of the earth conductor would cause the transformer to become alive. In conclusion, he considered that the time had come when those engaged in overhead-wire construction should look out for some method which would ensure that if a wire fell to the ground it should be cut out at once.

Mr. W. B. Woodhouse thought that generators should be connected together at as few points as possible; if joining the neutral to any machine could be avoided, so much the better. Regarding overhead lines, it was difficult to carry out earthing satisfactorily; the resistance of earth between the point of leakage and the station was an unknown quantity. Earthing overhead systems involved other troubles, such as disturbance to telegraph systems. Even with perfectly balanced systems, the capacity currents caused trouble.

Mr. R. Blackmore cited an experience with three 2,000-KW. turbine sets and a few 500-KW. reciprocating sets which were coupled with the neutral point solid to earth. A feeder went to ground, and almost immediately the stator of one of the machines broke down to earth, due, as he thought, to surging. The feeder was cut out, and some days later, another machine, which had been in service during the feeder fault, also broke down to earth. After careful investigation, it was decided to retain the earth, but through a resistance instead of a solid connection. He felt confident that this was the correct thing to do. Incidentally, when the change-over was being made to insert the earthing resistance, the turbo sets were coupled correctly, but the reciprocating sets were overlooked. In consequence, when the sets were all running in parallel, the earth resistance, which was capable of carrying 300 amperes for 10 seconds, became red hot, showing that there was an enormous interchange of current between the machines.

Mr. A. E. McKenzie said that the Manchester high-pressure system had been running for 10½ years with the neutral insulated, although, on the occasion of a fault, they had undoubtedly run for a period of one hour with one phase earthed before being able to locate and isolate the faulty feeder. Such circumstances were not permissible at the present time, as, owing to the rapid growth of the system, if one phase was earthed, there would be an immediate breakdown adjacent to the first earth on some other part of the system. This state of affairs had been in existence for about a year, and they had been considering the advisability of earthing the neutral. They would not think of earthing the neutral without a resistance, and presuming it to be designed to carry the current of the largest circuit-breaker, it would have to be of enormous proportions, as the ·25-feeder circuit-breakers were set to operate at 600 amperes. He thought they would be better served by a resistance which would open with a small current instead of 600 amperes, and by having balance protection, not necessarily at the gear, as all the feeders had plain overload protection, but protective gear as shown in fig. 1 in the paper. In his opinion fig. 1 was somewhat misleading; it appeared that if the generators were protected as shown in the paper, and a fault occurred between any two phases, all the generators would be thrown off the bus-bars immediately. He could quite imagine this protection on a feeder, but not on a generator. The possibility of cutting off a wire or feeder in the event of an earth, as the author stated, was not confined to an earthed neutral; several years ago two of the Manchester feeders were fitted with Ferranti-Field protective devices similar in theory to that shown in fig. 1, except that a ring transformer was used.

So far there had been no trouble on the feeders referred to. In the early days, although three ammeters were employed, it was rather difficult to locate feeder faults, owing to the fault current being out of phase with the load current.

Mr. S. J. Watson thought that if the safety of the public was the sole study, earthing was desirable, but if the question of continuity of supply was the study, the less they earthed the better. Taking for example the universal practice under Board of Trade Regulations of earthing the neutral of a three-phase L.T. distribution scheme, and the middle wire of plain D.C. distribution, he did not think anybody would earth either neutral or middle wire, unless under compulsion. It was fairly well recognised that a fault on an earthed system meant discontinuing supply, and this, above all other things, was to be obviated. The speaker was at issue with Mr. Trotter in suggesting that some device should be got out which would entirely cut off a high-pressure line when a fault occurred on an overhead transmission. If a line could be kept in service until the supply could be diverted into another feeder, they should continue to supply people through it. He was assured that this view was accepted by supply engineers. He did not earth at all, and so far had not experienced any trouble. A great deal of past trouble in connection with H.T. earthing was due to defects in generator design. It was a simple matter to design an alternator which would not give more than its full-load output, and he thought that this principle might be embodied in the design of future machines.

Mr. W. Cramp asked the author whether it was not possible to use a choking coil of a particular design and so combine the features of dead earth and resistance to earth. The object of resistance was to limit the flow of current particularly at high frequency. A choke coil would do this, and could be so designed as to prevent any surging at all.

Mr. E. Wedmore said he had yet to find out why it was necessary to employ separate resistances for different machines. The reasons given in favour of earthing, particularly the possibility of cutting off any wire or feeder in the event of an earth upon it, were becoming more important every year. A point which fig. 1 did not bring out was that an instantaneous trip device could be put in where the trip coil was shown, which would cut off a set immediately with a small current, whilst time limits on the other feeders would hold out temporary overloads. Disturbances on the system always occurred when a fault in the nature of an arc to earth developed. It was his practice to specify two minutes loading for earth resistances, but in general it was a good deal more than two minutes. The average short-circuit current was capable of clearing itself inside two minutes. A time-limit loading of 10 to 15 seconds was not really safe, as an earth fault on a single generator might cut off the earth resistance just at the most critical moment. He agreed with the author's conclusions. The delta connection of transformers was to be advocated. The majority of faults at the present time appeared to be in apparatus and not in cable.

Mr. K. M. Faye Hansen said he had more prejudice for earthing than the author. It was very likely that proposals in the direction of balanced protective gear would become more important in time. The reasons given by the author for earthing generators applied equally to transformers for underground networks. Similarly the remarks concerning overhead transmission lines held good for underground lines. Earthing by means of auto-transformers was not very often adopted.

Mr. E. M. Hollingsworth said that, as an engineer running a system with free neutral, he felt rather lonely. He had had no trouble during three years' running, although in one case the spark gaps welded over, and he felt convinced that if he had employed an earthed neutral it would have meant a shut-down.

Mr. R. G. Cunliffe asked for more information on the question of where, when and how the neutral point should be earthed. He objected to the term "true earth," and suggested "normal earth" as more appropriate.

Mr. W. B. Shaw said the term "solidly connected" might be taken to imply that no protection should be employed between the neutral point of the generator and the neutral bus-bars; he thought some device should be used in this position, in order to control the fault current and not leave the generator open to damage. For systems of medium pressure it was a mistake to put resistance in at all. The resistance obtained in an ordinary earth was appreciable, and the current due to a short on a system of medium pressure would not be sufficient to do serious damage, and it was necessary to be certain that the circuit-breaker would act when relying upon an earthed neutral for protection. He agreed with Mr. Trotter regarding the danger of fallen overhead lines, using an earthed neutral.

Prof. Marchant said the diagram, fig. 1, seemed to indicate a good circuit for triple-frequency currents. Would these operate the trip coil?

The Author, in reply, said that he and Mr. Trotter appeared to be agreed in general. He did not mean to imply that a system would work with one wire earthed, because usually, especially on large circuits, as soon as they got an earth on one of the wires of a three-phase cable, numerous shorts occurred, and in the case of large systems might cause much damage to generator and apparatus. If Mr. Trotter's suggestion of shutting down whenever an earth occurred was followed, there would be many cases where such procedure would be fatal to the undertaking. In many transmission schemes it would be impossible to run a sufficient number of circuits to ensure continuity of service when one or more lines were broken down. A certain risk must be taken, and if necessary the system should be run with one wire earthed until the supply could conveniently be shut off for repair. Referring to fig. 1, a short between two wires of one phase would affect the trip coil. Life was not always protected by earthing; many cases had occurred where shocks were obtained with neutral earthed. Regarding the use of choke coils, he did not consider that any trouble would be experienced, but resistances had proved very satisfactory, and were probably quite as cheap if not cheaper than chokers. He had heard of several cases where trouble resulted from coupling generators together. Mr. Faye Hansen seemed to lean towards earthed neutrals in cases where he (Mr. Peck) would rather run on free neutral. He contended that when one phase broke down, it operated at normal voltage, and not at double voltage, and he thought that high-voltage apparatus should be built to operate successfully with one side earthed. Regarding Mr. Shaw's remarks on the circuit breaker in the neutral wire, as far as he was aware nothing had been done in this way. He could not say off-hand whether the triple-frequency currents referred to by Prof. Marchant would cancel themselves, or go through the trip coil.

The Effect of Recent Decisions upon the Arbitration Clause.

By W. Valentine Ball, M.A., Barrister-at-Law.

(*Abstract of paper read before the* Institution of Municipal Engineers, *on November 27th*, 1912.)

I propose to consider whether, and by what means, the parties to a contract can make sure that the disputes which may arise during or after the execution of the works shall be referred to an agreed arbitrator, whose decision shall be final.

A form of arbitration clause with which most municipal engineers are familiar is to be found in the form of contract approved by the Royal Institute of British Architects. The difficulty with which it is my object to deal in the present paper is not likely to arise if the R.I.B.A. form is adopted in its entirety, because the arbitration clause which is there used expressly provides that the "architect" and the "arbitrator" shall be two distinct persons.

The question between the employer and the contractor when the contract is being prepared will be: "Whose name is to be inserted as arbitrator?" In recent years the practice has grown up of appointing an engineer or surveyor who is actually in the employment of a municipal or other local authority to act as sole arbitrator under a contract to which that authority is a party. How far may the contractor be compelled to submit to his decisions?

A man cannot enter into a contract on the terms that neither he nor the person with whom he contracts shall have recourse to the legal tribunals of the land. As to arbitration, however, the Courts have long held that the decision of an arbitrator may be made a condition precedent to bringing an action. The jurisdiction of the Courts is not really ousted.

It is obvious that bias clearly proved would be sufficient to justify the Court in refusing to allow a particular man to sit as arbitrator. In order to succeed because of alleged bias a probability, not a mere possibility, of bias must be shown. The mere fact that the arbitrator is the servant of one of the parties is not sufficient to disqualify him; for this is a fact which must have been known when the contract was signed. The Court will be reluctant to revoke a submission to arbitration on the ground of interest. Where the matter in dispute is something in which the arbitrator is only indirectly interested, a reference to him would not be prevented.

It has been held that a mere expression of opinion in favour of one party is not sufficient reason to disqualify an arbitrator unless it appears that he has so made up his mind as not to be open to argument.

It seems that, in considering the question whether a person who is the servant of one of the parties can act as arbitrator in a dispute, the Court will consider the nature of the question which he has to decide. In a case where the company objected on the ground that the engineer did not allow them to have proper facilities for proceeding with the work, the Court of Appeal refused to stay the action, saying that it was not human nature to suppose that he could properly determine that he himself was an unreasonable person.

If the conduct or dealings of the engineer himself are in question, the matter will be taken from his hands.

To summarise the cases to which I have alluded: The contractor will not be compelled to submit to the decision of the employer's engineer as arbitrator (1) if the matter in issue is an unseemly personal dispute raising a vindictive feeling between the engineer and the contractor, and the engineer has so strongly expressed his view that it amounts to a prejudgment; (2) if the nature of the dispute is such that the cross-examination of the engineer is essential; (3) if the matter in issue is something outside the original agreement —*e.g.*, a dispute as to whether the engineer and contractor had agreed to vary the original agreement; (4) if the conduct of the engineer himself is practically the only point in dispute.

Deletion of the arbitration clause would involve recourse to legal proceedings for the settlement of all disputes; but a dispute arising under a building or engineering contract would not come before the Court and a jury, but before a special referee (*i.e.*, an engineer appointed by the Court), or before an official referee. In the result the proceedings would be very similar to those which would take place before the arbitrator named in the contract. It is a trial of this kind which takes place if litigation ensues owing to the failure of an arbitration clause. Save that a reference to an official referee is reference to a lawyer, it very much resembles a reference to arbitration.

Reference to an independent arbitrator appears to present almost if not quite as many objections as a reference to the Court. It is wise, if it is desired to have an independent arbitrator, to leave him to be selected by agreement when the dispute arises, or, failing agreement, to be nominated by some eminent engineer of known capacity.

I venture to make the following suggestion: Frame the arbitration clause so as to leave the decision of every question arising under the contract to the engineer, but subject to a proviso that, should it appear to the Court on an application to stay any action or proceeding brought in relation to the contract that the engineer is disqualified from acting as arbitrator, the matters in dispute will be referred to an engineer, to be agreed between the parties, or, failing agreement, to be nominated by the president of the Institution of Civil Engineers. Another alternative is suggested by Mr. E. J. Rimmer; it is that, while preserving the finality of the decision of the engineer upon certain special points, a proviso should be added to the arbitration clause, stating that if any action is brought the defendant may either (*a*) have the action stayed and remitted to the engineer, or (*b*) have the matter referred to an independent arbitrator appointed in one or other of the manners above suggested.

What the local authority, which is responsible to the ratepayer, desires in relation to a contract is certainty in the matter of price and time; certainty that work shall be done under trustworthy supervision; and reasonable certainty that disputes shall be settled economically and expeditiously by a man in whom it has confidence. The suggestions I have put forward may, if adopted, avoid a good many of the pitfalls laid bare by the cases which I have cited.

NEW ELECTRICAL PROPOSALS FOR PARLIAMENT TO CONSIDER.

We give below, in our usual form, brief particulars of new lighting, power, and traction proposals that have formed the subject of notices published in the last few issues of the *London Gazette*. These will, if they survive the usual preliminary stages, occupy the attention of Parliamentary Committees early in the new year:—

(*a*) Electric Light and Power.

Baildon.—Electric lighting powers are sought by the U.D.C.

Barnet.—North Metropolitan E.P.D. Co., Ltd., extension powers, parish of Arkley.

Barton-on-Humber.—Mr. F. Hopper, Elmtree House, Barton-on-Humber, seeks electric lighting powers.

Basingstoke.—Corporation seeks electric supply powers within the borough and certain parishes in the Rural District.

Beckenham.—Application by U.D.C. for prov. order extending area to include West Wickham.

Caerphilly.—Application by Mr. J. H. Edwards, 127, Victoria Street, Bristol, for prov. order.

Chipping Norton.—Mr. W. A. Schultz (C.N. Electric Supply Co., 50, Cannon Street, E.C.) is applying for a prov. order.

Cleveland and Durham County.—C. and D. County Electric Power Co. seeks powers for acquisition and working of generating stations of other companies, for supply to authorised distributors, for supply of electric apparatus, &c.

Colne.—Corporation seeks extension of electricity supply area, also powers to acquire the Colne and Trawdon Light Railways undertaking.

Colne Valley.—C.V.E.S. Co., Ltd., seeks powers for supply in Pinner, Bushey, Chorley Wood, Rickmansworth, &c.

Coventry.—Corporation, area of electricity supply. Motor-omnibus powers.

Crowborough.—C. District Gas Co. seeks electricity supply powers, to erect generating station, supply in bulk, &c.

Cwmamman.—U.D.C., electric supply powers.

Derby.—Corporation, extension of supply area to include various parishes in Shardlow, Belper and Repton Rural Districts.

Dartmouth.—Urban Electric Supply Co., Ltd., extension of area to U.D. Brixham, &c.

Doncaster.—Corporation is seeking electric supply powers for the Urban Districts of Bentley-with-Arksey and Balby-with-Hexthorpe.

Ellesmere Port and Whitby.—Application by U.D.C. for electric lighting powers.

Ely Valley.—New company seeks power to supply gas and electricity, construct generating station, purchase and supply in bulk.

Epsom.—U.D.C., provisions as to supply of electricity, electrical fittings, &c.

Feltham and District.—Application by Mr. F. H. Edwards, Mandeville, Platt's Lane, Hampstead, for power to supply in Feltham Urban District and adjoining places in Middlesex.

Grays and Tilbury.—G. and T. Gas Co. seeks power to apply for prov. orders for electricity supply.

Hazel Grove and Bramhall.—Powers are sought by the U.D.C. to purchase or produce electricity.

Herne Bay.—H.B. Gas and Coke Co., Ltd., seeks powers for transfer from U.D.C. of electric light order, 1909.

Hove.—Corporation, purchase of undertaking of H. Electric Lighting Co. Extension of supply area.

Itchen (Southampton).—Electric supply powers to U.D.C.

L.C.C.—Powers to Metropolitan Borough Councils to attach brackets to buildings for public lighting.

Leatherhead and District.—Extension of area of L. and D. Electricity Co. to include portions of Epsom and Dorking Rural Districts.

Marlborough.—Application for prov. order by M.E.S. Co., Ltd.

Menai Bridge.—M.B. Electricity Supply Co., Ltd., prov. order for Urban District of Menai Bridge and parish of Llandegfan.

Mid-Sussex.—The M.-S. E.L. and P. Co., Ltd., is applying for electric supply powers for the Urban Districts of Cuckfield and Haywards Heath, &c.

Morley.—Further powers are sought by the Corporation in respect of its electricity undertaking.

Neath Rural District.—Application by R.D.C. for extension of electric supply area.

Northern Counties E. Supply Co., Ltd.—Confirmation of agreements between the company and Hebburn and Felling U.D.C.'s, also County of Durham and Newcastle-upon-Tyne E.S. Companies.

Northwood and Ruislip.—Northwood E.L. and P. Co., Ltd. Extension of supply.

Porthcawl and District.—Porthcawl Gas Light and Coke Co., Ltd., various powers, including electric generating station and supply of electricity within gas limits. Supply of electricity in bulk. Application of capital for electrical purposes.

Rickmansworth, Chorley Wood and District.—Application by R. E. H. Fisher, solicitor, of Chorley Wood, for electric supply powers.

Romford.—Application by Mr. W. T. Pressland, 11, Tothill Street, Westminster, for prov. order to supply within the Urban District.

Romford and District.—County of London E.S. Co., Ltd., powers to supply Romford and Tilbury, &c. Supply in bulk in Urban Districts of Barking Town, Grays Thurrock, Ilford and Romford.

St. Annes-on-the-Sea.—Application by U.D.C. for extension of supply area so as to include Lytham U.D.

Sevenoaks and District.—S. and D. Electricity Co., Ltd., Salisbury House, E.C., is seeking supply powers within the Urban District and various parishes in the Rural Districts of Sevenoaks and Godstone.

Skelton and Brotton.—Electric supply powers to U.D.C.

Smethwick.—Birmingham District Power and Traction Co., Ltd., repeal or amendment of Smethwick 1898 order. Transfer of powers, supply of electricity in bulk.

Southborough.—U.D.C. seeks electric lighting powers.

South Staffs.—Mond Gas, Power and Heating Co., powers as to capital rearrangement. Co-partnership scheme and benefit fund for employés.

Stoke-on-Trent.—Corporation seeks powers extending area to include part of Wolstanton, not in 1899 order.

Stroud (Glos.).—Application by Mr. J. H. Edwards, 127, Victoria Street, Bristol, for a prov. order.

Tottenham and Edmonton.—T. and E. Gas Light and Coke Co. seeks powers to take over Wood Green E.L. Order and incidental powers.

Truro and District.—T. Gas Co. seeks powers to supply electricity.

Truro.—Corporation seeks electric lighting powers.

Watford.—U.D.C., extension of supply to several parishes in the Rural District.

Weaverham.—W. Electricity Supply Co., Ltd., is applying for prov. order for electricity supply to various parishes in the Rural District of Northwich.

Wellingborough.—W.E.S. Co., Ltd., power to purchase lands and erect generating stations.

Westgate and Birchington.—W. and B. Gas Co., electricity supply powers and extension of gas area.

Whitstable.—Application by Mr. C. Campbell, 37, Cromwell Road, Whitstable, for a prov. order.

Wolverhampton.—Corporation, extension of supply area to include Bushbury. Repeal of the Midland Electric Power, Distribution and Lighting and Extension Order of 1900.

Wood Green.—North Metropolitan E.P.D. Co., Ltd., electric supply powers.

York.—Corporation, further electrical powers. Lands for electricity undertaking.

(*b*) Electric Tramway and Railless Trolley Vehicles.

Baildon.—U.D.C. seeks tramways prov. order.

Birmingham.—Corporation, motor-omnibus powers; also use of coupled and trailer tramcars.

Bradford.—Corporation, new trolley vehicle routes.

Brighton.—Transfer to Corporation of undertaking authorised by Brighton, Hove and District Railless Traction Act, 1911. New trolley vehicle routes, motor-omnibus powers.

Chesterfield.—Corporation, trackless trolley powers within and without the borough. Motor-omnibus powers. Further powers for electricity supply.

Derby.—Corporation, tramway, motor-omnibus, trackless trolley vehicle powers.

East Ham.—Corporation, use of trailer cars on tramways. Various electric supply provisions, &c.

Folkestone, Sandgate and Hythe.—F.S. and H. Tramways Co. seeks power to abandon tramways, and release from liability. Release of company and National Electric Construction Co., Ltd., from certain obligations. Change of name of company, and power to run trolley vehicles in Folkestone, Hythe, Sandgate and Cheriton.

Lancaster.—L. and District Tramways Co., Ltd., reconstruction of tramways, &c.

Leeds.—Corporation, new tramways and trolley vehicle routes within and without the city. Electric generating station.

Leicester.—Corporation, new tramways, motor-omnibus powers, extension of electric supply area. Power to let out on hire electric motors, and cooking and heating apparatus, and arc lamps.

Halifax.—Corporation seeks powers for new tramways and tramroad in the boroughs of Halifax and Brighouse, and some Urban Districts in the West Riding.

Hastings.—H. Tramways Co., seeks power to work Tramway No. 1, authorised by 1903 Act. by overhead system. Repeal of provisions of 1903 Act.

Huddersfield.—Corporation, powers for tramways in Huddersfield, Brighouse, Elland and other places in the West Riding. Also trolley vehicle and motor-omnibus powers.

L.C.C.—Construction of new tramways and subway. Trackless trolley vehicles and other powers.

Metropolitan Electric Tramways, Ltd.—Trolley vehicle powers for Tottenham, Wood Green and Walthamstow. Transfer powers to local authorities, &c.

Mexborough and Swinton.—Powers to M. and S. Tramways Co. to work railless trolley vehicles in Mexborough, Swinton, Wath-upon-Dearne and other Urban Districts and Parishes.

Morley.—Corporation seeks authority to run railless electric traction system on defined routes.

Newcastle-on-Tyne.—Corporation, construction of new tramways.

Nottingham.—Corporation, tramway and motor-omnibus powers. Also trackless trolley vehicles within and without the city.

North Lindsey Light Railways Co.—Light railways amendment order.

Rhondda.—R. Tramways Co., Ltd., seeks power to work railless trolley vehicles in parish of Llantrisant, also power to B. of T. to sanction other routes. Electric supply agreements.

Southport.—Corporation, additional tramway powers, trolley vehicles, omnibuses.

West Bromwich.—Corporation, powers for running trolley vehicles and motor-omnibuses. Further provisions as to electricity undertaking.

Western Valleys, Monmouthshire.—New company to run trolley vehicles from Brynmawr to Newport, Mon. Construct generating stations, agreements with local authorities and others as to supply of current. Running powers over Newport Corporation Tramways.

(*c*) Railways.

Central London Railway.—New railways and works, agreements with L. and S.W.R. and other railway companies. Additional capital and other financial powers.

City and South London Railway Co.—Powers to enlarge tunnels, enter into agreements with other railway companies as to construction of works, power to re-equip railway out of capital, rearrangement of existing and authorising of additional capital.

London Electric Railway Co.—New railways and works, running powers over City and South London Railway, &c.

Metropolitan District Railway.—Powers to widen at Parson's Green, to enter into an agreement with Metropolitan Railway, confirmation of agreements with Wimbledon and Sutton Railway, emergency supply of electric power, &c.

Metropolitan Railway.—Transfer of G.N. and City Railway Co. Supply of current to other companies.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

26,396. "Electric motors." G. E. Thomas. November 18th. (Complete.)

26,412. "Arrangement of the running gear of electrically-driven or other self-propelled tramway cars or other vehicles or machines running on rails, and having their direction determined thereby." J. Murgatroyd. November 18th.

26,430. "Electric hauling plant." Akt. Ges. Brown, Boveri et Cie (Convention date, November 17th, 1911, Germany.) November 18th. (Complete.)

26,439. "Electric meters and meter systems and relays adapted to control the same and for other purposes." Siemens Schuckertwerke G.m.b.H. (Addition to 25,831/12. Convention date, November 17th, 1911, Germany.) November 18th. (Complete.)

26,443. "Means for setting the timing gear of electrical ignition systems." J. E. Sturgeon. November 18th. (Complete.)

26,457. "Devices for adjusting the length of the spark-gaps between electrodes." O. Imray. (Compagnie Générale Radiotélégraphique, France.) November 18th. (Complete.)

26,469. "Magnetic compasses for use on aeronautical machines." J. F. A. Trotter. November 18th.

26,474. "Spreaders for telephone-receiver casings." P. M. Cox. November 18th. (Complete.)

26,485. "Apparatus for electric sterilisation." K. Gasiorowski. November 18th. (Complete.)

26,499. "Automatic telephonic apparatus." B. Degenhardt. November 18th. (Addition to 3,978, 1912. Convention date, November 18th, 1911, Germany.) (Complete.)

26,502. "Electric alarm clocks." F. Goss. November 18th. (Complete.)

26,504. "Method of and means for cleaning electroplating and finishing surfaces, more particularly surfaces *in situ*." G. P. M. Lee and W. A. Brame. November 18th.

26,509. "Mechanical device for obtaining and timing the sparking in petrol and other engines to which it may be found applicable." C. Porter. November 19th.

26,517. "Electrical switches." A. Wynne. (Divided application on 13,195, 1912. June 5th.) November 19th.

26,548. "Incandescence filament lamps." J. R. Quain. November 19th.

26,579. "Telephones, phonographs, and such like apparatus." A. S. Bowley. November 19th.

26,597. "Automatic regulators for dynamo-electric machines." British Thomson-Houston Co., Ltd, and A. H. St. Croix Watson. November 19th.

26,611. "Safety starting device for petrol and petrol-electric cars." W. A. Stevens. November 20th.

26,639. "Method of testing electrical apparatus." C. Sarel. November 20th.

26,646. "Apparatus for starting internal combustion engines and for generating current for lighting and other purposes." C. A. Vandervell and A. H. Midgley. November 20th.

26,651. "Adapter-holder for use in electric lighting, power and heating." C. C. Smith. November 20th. (Complete.)

26,657. "Telephonic apparatus." G. A. Meyer-Henniger (Firm of). (Convention date, November 20th, 1911, Germany.) November 20th. (Complete.)

26,671. "Electrical switches." B. D. Horton. November 20th. (Complete.)

26,680. "Electric rotary converters." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 20th.

26,681. "Device for automatically stopping electric hoists." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) November 20th. (Complete.)

26,699. "Dry electric batteries." J. Bohle and "Volta" Commanditges. fur Elektrische Kleinbeleuchtung. November 20th. (Complete.)

26,716. "Electric lampholders and fittings." F. S. Miller. November 21st.

26,720. "Apparatus for the electro-deposition of metals on wire." W. Barron and C. A. Barron. November 21st.

26,732. "Alternating and direct current organ-blowers." F. C. Judges. November 21st.

26,752. "Methods of and apparatus for charging storage batteries." D. H. Wilson. (Convention date, November 21st, 1911, United States.) November 21st. (Complete.)

26,765. "Method of and means for holding tubes, rods, bars, and other articles in position to be electroplated." G. P. M. Lee and W. A. Brame. November 21st.

26,781. "Sound reproducing apparatus." W. H. Derriman. (Automatic Enunciator Co., United States.) November 21st. (Complete.)

26,782. "Telephone systems." W. H. Derriman. (Automatic Enunciator Co., United States.) November 21st. (Complete.)

26,809. "Means for the interruption of electric circuits." British Westinghouse Electric and Manufacturing Co., Ltd. (Westinghouse Electric and Manufacturing Co., United States.) November 21st. (Complete.)

26,823. "Dynamos." F. B. Lodge and A. M. Lodge, trading as Lodge Bros. & Co. November 22nd.

26,845. "X-ray attachments for automobiles." E. B. Hazleton. November 22nd.

26,846. "Magneto-electric machines." H. C. H. Smyth. November 22nd.

26,893. "Voltage regulators for dynamos." A. P. Froger. (Convention date, November 23rd, 1911, France.) November 22nd. (Complete.)

26,899. "Regulation of electric rotary converters." British Thomson-Houston Co., Ltd., and P. Whitaker. November 22nd.

26,900. "Moulded materials and process of making same." British Thomson-Houston Co., Ltd., (General Electric Co., United States.) November 22nd.

26,904. "Electrical-indicating, recording and like arrangements." E. A. Graham and W. J. Rickets. November 22nd.

26,912. "Starting switches for electric motors." V. G. Middleton, C. J. Baker and F. Farndon. November 22nd.

26,935. "Solenoids for alternating currents." C. G. Major and Smith, Major & Stevens, Ltd. November 23rd.

26,947. "Memorandum and like appliances for use in connection with telephones and for other purposes." E. F. M. Bransom and F. H. Bowden, trading as Bramson & Bowden. November 23rd.

26,948. "Apparatus for heating water by electricity." G. R. B. Middlecoat. November 23rd.

26,953. "Pipe unions and couplings for electric conduit junction boxes and other purposes." F. H. Terry, H. M. Bigwood and Brotherton Tubes and Conduits, Ltd. (Addition to 24,492, 1912.) November 23rd.

26,961. "Electrical instruments." F. G. Waters. November 23rd.

26,964. "Telephone transmitters." F. Gottschalk. November 23rd.

27,011. "Control of fly-wheel electric motor-generators." British Thomson-Houston Co., Ltd., and J. J. Ash. November 23rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

System and Apparatus for Preparing Perforated Tape for Telegraphic Transmission of Messages. C. E. Ingram. 10,973. May 6th. (November 6th, 1911.)

Electric Timing Devices. H. S. Hatfield. 24,141. October 31st.

Stand for Supporting and Facilitating the Manipulation of Photographic Electric Arc Lamps and the like. B. A. Quint. 24,300. November 2nd.

Miners' Electric Lamps. E. A. Hailwood. 24,305. November 2nd.

Hand-feed Arc Lamps. L. Kamm. 24,333. November 2nd.

Electric Distribution Systems. G. W. Partridge. 24,386. November 2nd.

Processes for Producing Directive Forces by Induction in Alternating-Current Apparatus. H. Abraham and J. Carpentier. 24,442. November 3rd. (February 25th, 1911.)

Dynamo-Electric Machines. British Thomson-Houston Co., Ltd., and F. P. Whittaker. 24,463. November 3rd.

Lanterns and Lamp Carriers, and Arrangements for Lighting Purposes. H. T. Harrison. 24,486. November 3rd. (Cognate application 9,166 of 1912.)

Apparatus for obtaining a Uniform Longitudinal Seam in Tubes Welded by Electricity. Ges. fur Elektrotechnische Industrie, m.b.H. 24,575. November 4th. (November 5th, 1910.)

Controlling Apparatus for Electrical Lifts. A. W. Penrose & Co., Ltd., and F. Barlow. 24,745. (Addition to No. 1,335, 1911.) November 7th.

Miners' Electric Safety Lamps. O. Oldham. 24,787. November 7th.

Electrical Measuring Instruments of the Induction Type. G. North. 25,086. November 10th.

Means for the Electric Heating of Ovens and other Appliances. C. W. Martin. 26,101. (Convention date not granted.) November 22nd.

Electric Switches. Siemens Bros. Dynamo Works and J. F. Crowley. 26,245. November 23rd.

Holders for Electric Lamps. Frankenburg & Sons, Ltd., and E. Fleming. 26,376. November 25th.

THE

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ELECTRICAL REVIEW.

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THE ELECTRIFICATION OF RAILWAYS.

THE recently-published report of Mr. C. H. Merz on the electrification of the Melbourne railways, together with the announcement of the extensive schemes of conversion to electrical operation of the L. & N.W. and the L. & S.W. Railways, may reasonably be regarded as evidence that at last the long-expected, but long-delayed, period of activity in this important department of electrical engineering is about to open. In saying this we do not ignore the fact that the great system of the London underground railways, and a large portion of the L.B. & S.C. Railway, as well as other lines, have already been converted to electrical working; but these operations were somewhat exceptional in character, the former having been effected practically under Parliamentary compulsion, and the latter under pressure of intense competition which had destroyed the profit-earning power of the sections concerned, so long as they were operated with steam locomotives. The three examples which are now before us stand on an entirely different footing; they embody the conviction of their respective directorates that the future of suburban railway traction depends upon the adoption of electricity as the motive power, and that no other agency can cope with the growing demands for transport facilities in and around our great centres of population.

That their example will be followed by other railway companies in London, Manchester and elsewhere, can hardly be doubted, and the extension of the principle to interurban traffic may be confidently expected to follow at no distant date; between London and Brighton, Manchester and Liverpool, Edinburgh and Glasgow, and various other neighbouring towns the need for rapid transit and convenience of operation, such as only electricity can supply, is little less urgent than in the areas immediately surrounding those centres. We anticipate, therefore, a period of great activity in the manufacture of the necessary plant and equipment, which, we hope, will bring to the electrical industry in this country that degree of prosperity which we believe it thoroughly deserves, but has never hitherto enjoyed.

The question inevitably arises here to what extent our manufacturers will participate in the important orders shortly to be placed. So far as the generating, transmitting and converting apparatus is concerned, we believe they are in a position to defy the competition of the world; but as regards the equipment of the rolling stock, the position is not so clear. The enormous importance of this part of the work is well exemplified by Mr. Merz's report, according to which the cost of equipping the 500 motor-coaches and 450 trailers on the D.C. system is nearly a million sterling, and on the A.C. system almost two millions. So long as the work is carried out on the D.C. system, whether at 1,500 volts as at Melbourne, or at 600 volts as in the other two schemes before us, our manufacturers can be relied upon to deal with the work without any difficulty; but if the A.C. system were adopted, as has been so largely the case on the Continent, our people might be at a disadvantage owing to their limited experience in this class of work. It is, therefore, a matter for congratulation from a commercial point of view that these three systems will all be carried out on the D.C. system.

We cannot here enter into the question of the respective merits of the D.C. and A.C. systems—the subject calls for an article to itself, and must be left to another occasion—but we may point out the importance of preparation for the execution of contracts on the A.C. system, which will almost certainly be employed in some cases; we trust that British manufacturers will take care to provide themselves with the information and experience necessary to enable them to undertake the equipment of motor cars on the single-phase system in any part of the world where they may be required.

Elsewhere in this issue we refer in some detail to the two London schemes of railway electrification, no less important in view of the magnitude of the interests involved than the Melbourne project, and undoubtedly of much closer interest to the majority of our readers. These are the London and North-Western and London and South-Western schemes, the former of which contemplates the equipment of 79 miles, and the latter of 73 miles (increased eventually to 173) of single track.

In both these cases it is reasonable to assume that inter-running facilities with existing electric railways influenced the decision in favour of the 600-volt third-rail system. To adopt any other system would mean voluntarily relinquishing the undoubted advantages of possible through services into the heart of the metropolis, and of utilising the existing termini—or, in the alternative, complicating the electrical equipment and running of the trains if both third-rail and overhead working were involved.

In both the North-Western and South-Western schemes a 25,000-KW. power station is proposed, and one begins to wonder how many more of these not really large, yet not small, railway power plants will be installed in London, which already suffers from a surfeit of comparatively insignificant generating stations. One independent 25,000-KW. power station could not very well contain less than five units (and judging from past experience, some engineers would prefer twenty-five), thus limiting the unit size to at most 5,000 KW., yet it seems passing strange in these days of 150,000-volt transmissions and 20,000-KW. turbine units, that some combined scheme for the production of railway power on a genuinely economical scale—a magnified Lot's Road station, for example, with 15,000 or 20,000-KW. turbines—has not been arranged.

If it is advantageous to do away with small scattered power units—in this case steam locomotives—and concentrate power production in one plant, it would seem only reasonable to carry that concentration to the fullest extent possible, and reap the huge monetary economy which the largest present-day unit is capable of showing. Moreover, as both the Lot's Road and Neasden plants are near and could render help in emergency in the case of a joint power scheme, an appreciable saving in spare plant and capital cost would result.

LABOUR RUN RIOT.

We have had occasion more than once in these columns to inveigh against the methods of the Neo-Trade Unionist. Not content with striking for higher wages and shorter hours, he has invented all kinds of other excuses for industrial warfare, whereby he hopes eventually to bring employers of every class under the heel of the proletariat. We are far from saying that a strike is always unjustifiable and illegal; but, to use a cant phrase, the claims of those who leave work without notice to their employers appear to have reached "the limit" in the strike on the North-Eastern Railway.

An experienced engine driver was convicted of being drunk while off duty. The company, in the faithful discharge of its duty to the travelling public, lowered his status to that of pilot engine driver. Immediately, and without any notice, some thousands of his friends leave work, with the result that traffic on an important railway is dislocated, and many thousand passengers and traders are condemned to suffer loss and inconvenience.

The justification of the railway managers is complete in the eyes of all ordinary men and women. Each engine driver is entrusted with the lives of hundreds of thousands in the course of the year. To allow them to be at the tender mercies of a man who is known to give way to drink were little short of criminal. Suppose, for instance, a frightful accident were to take place on the North-Eastern, or any other railway, and it was revealed at the inquest that, to the knowledge of the company, the driver had been convicted of drunkenness a few weeks before—what would be the defence of the directors before the Coroner's jury? What would they be able to say in mitigation of their crass neglect before that larger and more critical jury—the British Public? These two questions have only to be put in order to supply a complete vindication of the step taken by Mr. Butterworth, which has brought about the present strike.

That the example of striking against the ordinary rules of discipline which are observed in every well-conducted business should be set on the North-East coast is not surprising. For some reason which is hard to explain, workers in this corner of England have always seemed to be the advanced guard in the army of militant Trade Unionists. In 1909 a dispute was referred, by the consent of masters and men, to the arbitration of Sir James Woodhouse. The award was given in November of that year. The men did not get all they wanted. Then, without the usual notice of an industrial war, they struck to set aside an award by which, as one of the parties to the dispute, they had agreed to abide. But the mere breaking of agreements is apparently not enough to satisfy these men. They must needs lay it down that sobriety is not to be considered a qualification for the highest and most responsible post which falls to the lot of a railway servant.

It is difficult to say where this latest labour development will end if it is not checked at once by firm and resolute action on the part of the employers who are involved in this particular dispute.

Readers of this journal would not contemplate with equanimity the spread of this kind of interference to the electrical industry. The difficulties of the manager of an electrical undertaking, either public or industrial, would be increased tenfold if labour, organised or unorganised, were to be considered entitled to interfere in the smallest degree in any question of discipline. As a matter of fact, the men have come out without the authority of their Unions. As we go to press it is stated that the Home Secretary is considering the case of the driver in question, who declares that he was wrongfully convicted. We hope that the Government will not show any signs of weakness in this matter, but will limit itself to its legitimate duty of settling whether the conviction of drunkenness was or was not justified. Anything beyond that, merely in order to bring "peace at any price," would be an everlasting danger. Too often in the past have we experienced Government intervention. It has always been loudly proclaimed as impartial; but the events of the last few years hardly justify the claim to impartiality. Under one pretext or another, the employers have been compelled to give way; and it is not a large inference to assume that the prospect of official support has done much to strengthen the hands of the strikers.

Business-Getting in the States.

Unity of purpose has never been a strong point with British electrical interests; it is, however, otherwise in the States, where, although it is not suggested that entirely harmonious relations exist between the various partners engaged in the electrical business, yet local jealousies have been subordinated sufficiently to enable the various interests to make common cause for the good of the whole. Thus one notices that the by-laws approved recently by the Society for Electrical Development, Inc., at New York, include an article bearing on the financing of the Society, the funds of which will be subscribed on the following basis:—

Central station and manufacturing members, not less than one-fifteenth of 1 per cent. on the gross amount of their respective sales up to and including $20,000,000, and at the rate of not less than one-twentieth of 1 per cent. on the gross amount of such sales in excess of $20,000,000; the contracting, dealing and jobbing members, not less than one-twentieth of 1 per cent. on the gross amount of their respective sales.

The board of directors will be composed of five classes (the board having 20 members), four from the central station interests, four from the manufacturing interests, four from the jobbing interests, four from the contracting interests, and four at large. These directors will each be elected by the membership represented in the class in which they belong, with the exception of the members at large, who will be elected by the membership as a whole.

The doings of the Society have, of course, attracted attention in this country, but, so far, nothing definite has been accomplished here on similar lines.

Another instance of the wide-awake methods of our American electrical friends is the national co-operative advertising campaign of the Electrical Vehicle Association of America, which, with a view to pushing the electrical vehicle—an entirely neglected vehicle on this side of the Atlantic, although conditions are even more favourable to its use than in the States—called for subscriptions from its members for the purpose of an educational campaign, and secured over $40,000. In this case the subscribers included 81 central stations, seven battery and accessory manufacturers, and 13 vehicle makers; the advertising scheme was entrusted to a recognised agency, and the results are evidently considered satisfactory, as a $50,000 fund is to be formed to continue the campaign for a second year.

The report of the Publicity Committee of this Association discloses an enthusiasm which is infectious; it impresses one with the belief that American electrical men are convinced that judicious expenditure on organised lines is undoubtedly a paying investment; but their *confrères* in this country appear to regard expenditure of this kind as in the nature of a charitable contribution.

Exit the "Greenwich" Engines.

Six-and-a-half years ago the Greenwich tramways generating station of the London County Council was declared open with the usual flourish of trumpets. Some there were who felt that the flourish was not wholly appropriate to the occasion, which will be remembered as marking the introduction into this country of the large low-speed engine of the vertical-horizontal reciprocating type for electrical generating purposes, and that at a time when the steam turbine had already proved its commercial superiority in every way as a prime mover for large generators. At the time we drew attention to the retrograde character of the step which had been taken, and it is, therefore, not surprising to us to learn that these huge machines, excellent examples of engineering skill though they be—which, during their brief existence of 6½ years, have more often than not acted the part of understudy to the commercially more efficient turbine plant which was installed when the second portion of the Greenwich station was constructed—are to be replaced by turbine-driven plant.

Full justification for this step, which accords with our originally expressed opinion on the matter, is contained in the report of the Highways Committee, which shows that it is proposed to substitute in the first instance two 8,000-KW. turbines in the space occupied by two of the 3,500-KW. reciprocating plants, showing a clear gain of 9,000 KW. in generating capacity and an estimated annual saving of nearly £16,000 with coal at its present price, and with the present maximum output. At a later stage the remaining engines will be replaced by two similar turbine units, and the normal capacity of the Council's Greenwich plant will then be 52,000 KW., which, though it represents a limit imposed by the adjacent Observatory authorities, allows a big margin over the present plant capacity of 34,000 KW., and will enable the rapidly increasing load due to tramways extensions to be dealt with economically.

Although unsuited to their present environment even from the day when they commenced to turn round, these huge reciprocating sets, with their double H.P. and L.P. Corliss cylinders and speed of 94 R.P.M., must have many years of useful work before them in some situation where space and fuel cost are subsidiary factors, and an undoubtedly well-built prime mover at a second-hand price is regarded as a consideration.

Swiss Railway Conversion.

The fourth and concluding report has been issued by the Commission of Inquiry which was appointed by the General Administration of the Swiss Federal Railways, to undertake preliminary labours in connection with the suggested conversion of the Swiss railways to electric traction. It appears that the further investigation made has confirmed the opinion of the Commission that the single-phase system of about 15 periods, with a working conductor pressure of 15,000 volts, is the best for the conditions appertaining to State Railways, and also with special regard to the St. Gothard Railway. The scheme prepared for the latter shows that even on the basis of the present prices of coal, electrical working would be considerably cheaper than steam traction, notwithstanding the much higher speeds in the case of the former method, and apart from the advantages of smokelessness and the possibility of being able to utilise the railway to better advantage. The question of the power requirements for all the Swiss railways has also been examined by the Commission. It is calculated that the five networks of State railways and the private railways would annually require, with traffic of twice the volume of that which obtained in 1904, from 1,200,000,000 to 1,300,000,000 H.P.-hours at the turbines, and the hydro-electric works would have to be built for a maximum output of 500,000 H.P. According to expert estimates, the water powers reserved for the State railways could yield 1,800,000,000 H.P.-hours per annum, and the works could be erected so as to be able to produce 625,000 H.P., thus leaving a large amount of power available for industrial purposes.

THE MEASUREMENT OF MAGNETIC FIELDS.

By P. H. S. KEMPTON, B.Sc.

The strength of a magnetic field is defined fundamentally in terms of the force exerted on a hypothetical unit magnetic pole, but Faraday's conception of lines of force provides the unit in terms of which magnetic field strengths are stated in practice.

The statement that a unit pole placed at a point in a magnetic field experiences a force of x dynes is equivalent to the more practical statement that the field has a flux density of x lines per square centimetre or x gausses at that point.

The strength of a magnetic field is measured by the magnitude of its effects. These effects may be divided into three classes, viz., magnetic, electrical and optical, and the applications of these phenomena to the measurement of fields of various strengths and under various conditions will be dealt with in detail under these three headings.

1. *Magnetic Methods.*—The magnetic methods of estimating field strengths are chiefly applicable to fields of small intensity such as that due to the earth.

(*a*) The magnetometric experiments involving observations of deflections and oscillations of magnetic needles are familiar laboratory routine, but are not applicable to the measurement of fields such as are dealt with in electrical machinery and electro-magnets.

(*b*) A method which depends upon the variation of pressure at right angles to the lines of force with the permeability of the medium is, however, of value for fields of great intensity. The method was first used by Quinke to investigate the magnetic properties of liquids, but was modified by Du Bois to measure the strength of fields.

Fig. 1 is intended to illustrate the principle of the method, the actual apparatus being of a slightly more complicated nature. A is a V tube containing a liquid of known permeability (Du Bois used nickel sulphate and water). A magnetic field is applied to the narrower limb, so that the lines of force pass parallel to the liquid surface, some in the liquid and some above it. The pressure at right-angles to the lines of force, and hence at right-angles to the surface of the liquid, is μ $H^2/8\pi$ in the liquid and $H^2/8\pi$ in the air above. The difference of pressure $(\mu - 1)\ H^2/8\pi$ causes the liquid to rise in the narrow limb until equilibrium is established—*i.e.*, when $(\mu-1)\ H^2/8\pi = h\rho g$. By tilting the tube as shown in fig. 1 and reading the elevation of the column by means of a microscope, Du Bois rendered this apparatus more sensitive and capable of measuring fields of strengths from 500 to 10,000 gausses, with an error of less than half of 1 per cent.

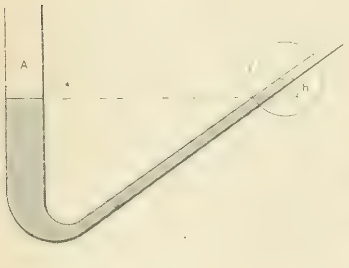

Fig. 1.

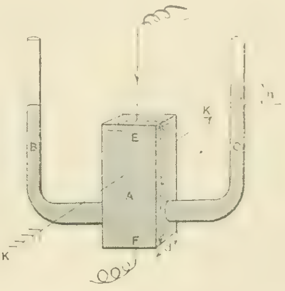

Fig. 2.

2. *Electrical Methods.*—There are three electromagnetic effects which have been used to measure magnetic fields.

(*a*) The induction of current in a conductor moving in a magnetic field. This is obviously the principle of the earth inductor, which, in conjunction with a ballistic galvanometer, provides the most common method for comparing fields such as V and H, and by calibrating the ballistic galvanometer this instrument is rendered capable of giving accurate values of field strengths of small magnitude.

In order to measure strong fields existing in small gaps in electrical machines, &c., the earth inductor is replaced by a small search coil of known effective area connected to a ballistic galvanometer, of which the constant is known, or, more conveniently, to a fluxmeter giving direct readings of flux linkages. The introduction or withdrawal of the search coil changes the linkages by $H \times A$, where H is the magnetic field strength and A the effective area of the coil.

The search-coil method is applicable to fields of all strengths, the sensitiveness being dependent on the effective area of the coil. The coil can be wound on a small flat bobbin in order to facilitate its introduction into narrow gaps, and if a fluxmeter is used there are no troublesome calculations. These advantages probably render this method the most convenient for general practical use.

(*b*) The motion of a conductor carrying a current in a magnetic field. The moving-coil galvanometer may be cited as a simple example of this general principle as applied to the measurement of a current, using a constant magnetic field. A similar apparatus could evidently be used to measure magnetic fields, using a constant current in the coil. The motion of the coil may be measured either by its deflection or by means of a torsion head. Such an instrument for use in small gaps has been devised by Stansfield and Edser. The motion of the coil is determined by the current passing and the intensity of the field. It is measured by means of a torsion head. The constant current (about $\frac{1}{100}$ ampere) is supplied by a portable cell, and a commutator is also provided in order to obtain readings on the torsion head on both sides of the zero.

The force exerted by a magnetic field of strength H on a conductor of length L carrying a current of C C.G.S. units is given by the product H C L. The application of this principle to the case of a liquid conductor provides a further method of accurately measuring large magnetic fields. The apparatus is known as Lippmann's galvanometer, and is shown diagrammatically in fig. 2. The central rectangular cistern A is connected to side tubes B and C; all contain mercury. Current is led in at the top of A by an electrode E, and passes out at F.

The magnetic field is applied across the cistern, as shown by the arrows K K. The resulting force on the conducting fluid (H L C) is transmitted to the side tubes, and the mercury rises in one of them until equilibrium is reached, *i.e.*, when $H L C = h \rho g \delta L$; ρ being the density of mercury, g the gravitational acceleration, and δL the section of the mercury perpendicular to the magnetic field.

(*c*) The variation of electrical resistance with magnetic field intensity. This phenomenon occurs to some slight extent in all conductors, and is probably allied to the Hall effect in which the equipotential stream lines are deflected. In bismuth the effect is very marked, the resistance rising rapidly and regularly with field strength.

If a coil of fine pure bismuth wire be used as a resistance it serves to measure fields after having once been calibrated. It is found that R_x/R_o and H are connected by an approximately linear law over a large range of H. The coil must be of pure bismuth, or this relation does not hold. It must also be wound non-inductively.

Unfortunately, the effects of temperature change are very large in the case of bismuth coils, and so the accuracy of the method often suffers on this account. There is also a time lag, although no trace of hysteresis has yet been discovered.

3. *Optical Method.*—Although magneto-optics provides a multitude of examples of magnetic effects on light phenomena, only one of these has been found of service in the measurement of magnetic field strengths, viz., the magnetic effect on the plane of polarisation. When plane polarised light passes along the direction of a magnetic field the plane of polarisation is rotated through an angle $\theta = C H$ where C, the constant multiplier of the field strength, is known as Verdet's constant. This fact has been used in special cases

to measure magnetic fields, but the application of such a method in practice is obviously limited.

Summing up, we find that the electromagnetic effects are the most fruitful of practical methods for measuring magnetic fields of all strengths, and that the search coil and bismuth coil are the most likely to serve practical purposes satisfactorily. The latter has numerous disadvantages compared with the former, and is incapable of high accuracy under ordinary workshop conditions. The magnetic effects provide general methods for the measurement and comparison of weak fields, and one method of importance for strong fields. The use of the optical method is limited to special investigations.

In the above discussion of the various methods we have considered their application to the measurement of steady fields only, that is, fields of which the intensity remains constant during a period of time sufficient for the taking of a normal set of observations. The measurement of fields of rapidly varying intensity, and of the rotating fields in modern A.C. machines, presents some features which deserve attention.

In the first place, methods which are subject to time lag or hysteresis are obviously unsuitable for such measurements. On this account the bismuth coil method, which would afford a direct record of the magnetic field variation on a recording galvanometer, has to be rejected. Du Bois's method and the Lippmann galvanometer suffer from a similar disability —the inertia of the fluid index and the difficulty of accurately recording the motion.

No such objections apply to the search-coil method, but, if this be adopted, the electrical arrangements and the capability of the fluxmeter of quickly following the flux variation become matters of primary importance. It should be possible to design an arrangement of this type with a recording mirror fluxmeter capable of investigating rapid changes of flux density.

Although the optical investigation of field intensity is unlikely to become of importance in workshop practice, the applications of optics to magnetic investigations in the laboratory bid fair to yield valuable results. The change of plane of polarisation with magnetic field intensity may be observed and measured in various ways, and affords a sensitive index devoid of time-lag, hysteresis or inertia defects.

THE JOHANNESBURG TURBINES.

Our readers will recall that on May 31st of this year we published an article* giving an account of the purchase of steam plant by the Municipality of Johannesburg since 1907, when the gas engines failed. We summed up the results of an inquiry held by Mr. John H. Rider and Mr. A. M. Tippett, into the circumstances attending the submission of, and reporting upon, tenders for a 3,000-KW. alternator during last year. These gentlemen, called the Board of Inquiry, presented their report, and the town clerk of Johannesburg (Mr. John Taylor) presented the board's report, together with criticisms of his own, to the Council.

We expressed very strong views on this course of action, and we did so because we felt, and still feel, that for a layman to criticise the report of a board of experts on a matter of this kind, where they were specially instructed, in a letter under the town clerk's hand, "to report to the Council as to which is the most advantageous tender for the Council to accept," was a highly unwise proceeding. They were not instructed to report to the town clerk, and the town clerk was not instructed to report to the Council. Yet he treated the board's report as matter for a report of his own. It is not material that it was the town clerk who did so. Had it been the Governor of the Union of South Africa, we should still have considered it objectionable.

Our readers will not need to be told that we had no personal feeling in the matter. We did not even know the name of the town clerk. In this matter, we considered that, as a public officer, he had committed a most serious error of judgment, and that, in effect, is what we said in our article.

The sequel to the events thus briefly summarised was a libel action on the part of the town clerk against the *Rand Daily Mail*. In opening the case, Dr. Krause, counsel for the plaintiff, stated that "very serious statements" had been made by members of the Town Council, and it had been suggested that the action of the Town Council was not above suspicion. On June 13th one of the Councillors "made very serious statements," and on June 14th those statements were published in defendant's paper, as well as with other statements, suggesting bribery and corruption. Afterwards the *Rand Daily Mail*, on June 21st, published our article, and considerable flutter in the dovecotes of Johannesburg was caused thereby. The town clerk sued the *Mail* for £1,000 damages, and the action was commenced on October 28th, before Mr. Justice Ward. Eminent counsel appeared on either side, and the case occupied three days. There was also an action in which the town clerk sued Mr. Rider for £1,000 damages on account of the fact that he was alleged to have published the libel by sending a copy of the Electrical Review for May 31st to Mr. H. J. Hofmeyr, a member of the Town Council.

The defendant newspaper denied that the plaintiff was asked to report upon the matter, but admitted the publication of the words. It was denied that the article was published falsely or maliciously, or that it was defamatory. Alternatively, it was pleaded that the allegations of fact were true, and were justified as expressions of opinion and fair comment made in good faith and without malice on matters of public interest.

Counsel for the plaintiff, in opening, admitted that the dates and general facts concerning the tenders, as stated in the article, were "more or less correct"; and after he (counsel) had read the article and had made sundry statements amplifying to some extent the information available, Mr. John Taylor went into the witness-box.

His examination-in-chief was directed towards proving the facts surrounding the various purchases of steam plant by the municipality. This, and his cross-examination, occupied the whole of the first day, and most of the morning of the second day. During cross-examination Mr. Taylor was on three occasions reduced to silence, failing to answer the questions put to him. Much use was made of the word "bumptious" (which is, with one exception, consistently spelt "bumptuous" in the reports which we have before us, from the *Rand Daily Mail*). The dictionary defines the meaning of the word as "offensively self-assertive," and we applied it to the report of the town clerk. Mr. Rider was certainly offended by that report, and Mr. Taylor, in reply to the question "You have first sat in judgment?" said, "I have had my say, certainly." Hence the word seems highly appropriate.

The next witness was Mr. L. E. Neame, acting editor of the *Rand Daily Mail*, whose evidence dealt with the publication of the article in question, together with a leader dealing with it.

He was followed by Mr. Rider, who gave evidence supporting his report; and the last witness was Mr. Tippett, who was only called for the purpose of speaking as to the circumstances under which he was appointed. The case for the defence was then closed.

Counsel for the plaintiff then began his argument, and went on the lines that because Messrs. Rider and Tippett's report was characterised in the article as "frank, fearless and reliable," the suggestion was that Mr. Taylor's report was none of these things. Of course it was not said or implied that this was the case. His report was frank. So far from being the reverse of fearless, we think it was very daring. It could not be reliable, because, as he admitted over and over again, he was not qualified to pronounce on technical subjects. There is nothing disrespectful in this statement, but the fact is that Mr. Taylor is a solicitor, and not an engineer. The reference to iniquitous conduct on the part of the representatives of the public interest does not involve the town clerk, who is a servant of those representatives.

Counsel for the defence began his argument on the third day. He pointed out that there was no imputation against the plaintiff, but that the main attack was directed against the tactics of the Council.

In the second case—that against Mr. Rider—Mr. Hofmeyr was called to prove that he had received from Mr. Rider a copy of the Electrical Review containing the article complained of. Mr. Rider also gave evidence, and argument followed. His counsel described the action as one of the most paltry ever heard in court; and the opposing argument was that, by sending the copy, Mr. Rider had made an attempt to discredit the town clerk in the eyes of one of his employers.

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* "In Darkest Africa," Vol. 70, page 881.

Judgment was reserved. On receipt of copies of the *Rand Daily Mail* recently, containing an exhaustive account of the proceedings, we cabled to Johannesburg to ascertain the results of the actions. Our information is that a verdict has been given against the paper for £150 damages, with High Court costs in addition, and against Mr. Rider for £5, with costs in the magistrates' court.

We have already given our opinion on the proceedings leading up to the action, and in what has been written above we have tried, as reasonably as possible, to discuss the action itself, and have given the result of it. The tender of Messrs. Reunert & Lenz was eventually accepted by the Town Council, and we are bound to say that, in view of the whole circumstances, we have nothing to add to, and nothing to withdraw from, our previous article. There is no doubt that our readers will agree, and the British public will hold the same view, that when a municipality invites expert opinion, expressly stating, through its executive officer, that that opinion will practically govern its decision, and then flies in the face of that opinion, adverse comment will be forthcoming, and will appear to be abundantly justified.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Cayley-Robinson Furnace.

A reference to the Cayley-Robinson furnace is made in the ELECTRICAL REVIEW, page 908, as an example of a furnace using steam economically. This remarkable little furnace uses a very slight jet of steam in order to keep in movement a column of furnace gas. The writer claims that steam jets for draught production are never really economical. They serve a good purpose in many cases, and help to effect certain commercial economies. Cheap, dusty and dirty coal is sold at much less per heat unit than good clean coal. Such dirty coal will raise so much more steam for a penny than can be raised by cleaner coal, that some of the extra steam produced can be used to blow the fire, and economy will still be shown. But this does not prove the steam jet to be economical. It is convenient; it serves to eliminate other systems of blowing the fires.

In the Cayley-Robinson furnace the steam jet is a very small affair in a small furnace, and to substitute an air jet, however produced, would involve such mechanical complication, that it would not be a commercial economy. Moreover, an air jet would introduce too much air into the furnace. It appears to be probable that the steam jet in the Cayley-Robinson furnace gives a gas-producer effect, the steam being split up and carbonic oxide and hydrogen formed. But the essence of the furnace is that the coal is distilled, and its gases are passed into a combustion chamber and whirled round in that chamber several times before being allowed to escape. Owing to this there is very complete mixture in a hot chamber of gas and air and ample time for complete combustion to take effect. Thus the essentials of complete combustion are secured, but this is no evidence of steam jet economy. The ingenuity of the furnace lies in the way in which the burned gases are allowed finally to depart from the partially consumed mass. And this shows how the furnace could be improved very considerably, though it's operation may already be allowed to be an excellent example of perfect combustion.

But the Cayley-Robinson furnace is after all not a boiler furnace of 500 H.P. It is in big furnaces that the convenient use of steam is so apt to prove both technically and commercially uneconomical. Further, it is not to steam, as steam, that the C.-R. furnace owes its smokelessness. It owes it to such things as are already indicated above, and to the absence of the cross-tubes referred to at p. 908. These cross-tubes are still in full vigour on the basis of "extra per water pipe," so much—it was 40s. at one time, and their surface is still called heating surface. It should be called flame-chilling surface, for no good has ever been shown to arise from them, and they are contrary to all the tenets of good combustion.

W. H. B.

The Institution of Electrical Engineers.

Having started this correspondence, I am much interested in the subsequent letters, mostly from unfortunate individuals who are in charge of large sub-stations at a "salary" of (apparently) 5s. to 20s. per week. The general cry seems to be—"The Institution is no good to us; let us have an Association." This has always been the cry, and nothing has been, or ever will be, done in this direction.

I should like to state that the Institution is the only salvation for these unfortunate and sweated engineers. Let them *all* join the Institution of Electrical Engineers, and the result, to their surprise, will be to find that owing to their number they will be able to push the Institution Council off its present too dignified perch, and make it look after the majority of not only its Members (who will be in the minority), but also its Associate Members. At present the argument is that it is to the advantage of the Members to keep down salaries. This is a very poor argument, and I advise engineers-in-charge to come into the Institution in a body and shout for themselves.

How can engineers-in-charge expect the Institution to benefit them when they will not join it?

A. J. Abraham,
Engineer and Manager.

Aberdare Electricity Works,
December 6th, 1912.

I have read with interest the recent correspondence on the subject of improving the status of station engineers, and it is to be hoped that at last a genuine effort will be made to check this ever-growing lust for cheap labour, which threatens to become an infectious disease amongst the engineers and officials of both municipal and company undertakings. Of course, we all know that the wages paid are largely dependent on the demand on the "market," and especially so when the workers are an unorganised body of men or have no Trade Union to support them. While Trade Unionism is excellent in many ways, its principles are hardly applicable to the trade, or rather profession, of station engineering, and no doubt the necessary standardisation or attainment of a certain definite status can best be accomplished by the institution of examinations on somewhat similar lines to those obtaining at present for marine engineers.

The fact that a man can pass a certain examination is, of course, no absolute criterion of his abilities, but if he can only sit for the examination after attaining a certain standard of competency in practical work, then the main object of testing his fitness is only really an additional safeguard, and is necessary for registration purposes. If it is considered necessary that the engineer-in-charge of only the boilers and machinery on a steamer should have attained to a definite standard of training and possess a "ticket," how much more important is it that the engineer in charge of the plant which, perhaps, supplies the electrical energy of an important industrial centre or town, or even a city, should have had a certain training or experience and be registered or the possessor of a certificate of competency. In the Colonies and many places abroad, engineers in charge of even comparatively unimportant plants must possess certificates, and it is surely just as necessary in our country, where we depend so largely on engineers to maintain our industrial position in the markets of the world. The examinations for charge engineers could, perhaps, be conducted either by the Board of Trade, or by representatives of the Home Office and the Institutions of Electrical and Mechanical Engineers, and both first-class and second-class certificates issued. The Association of Mining Electrical Engineers have set us a splendid example in this direction, and I believe the Association of Engineers-in-Charge are in favour of such examinations, while last and (let us hope) not least, our Institution of Electrical Engineers are beginning to open their eyes to the fact "that there is something rotten in the state of Denmark." Although many of us won't forget the days when it was possible for a marine engineer to drop straight into the position of charge engineer in a station, and at a salary, too, of about £3 10s. a week, yet we must remember that those "balmy" days are over, and unless we make an immediate and united effort to drag ourselves out of the mud, we may very soon see the present "balmy" (?) days of 35s. a week fading away, and our last cry will be—too late!

Flashover.

I agree with both "Booster" and "Motor Generator" *re* status and salary paid to sub-station engineers. With reference to "Motor Generator's" remark that "in a few years the yard men or general labourers about the station will be expected to take charge," I would like to point out that, on a certain system, there are men in charge of sub-stations who were at one time valets, milkmen and clerks. These men, who are without technical training, now receive something like £75 to £108 per annum. How does that compare with the man who has a technical college certificate, B.Sc. London, Hon., who willingly goes on the test bed for 15s. per week?

Of course, the members of the I.E.E. are business men, and, as such, must go to the cheapest market; hence the exceptionally low salaries for brains and the somewhat of a living wage for the lucky milkman.

Some years ago I suggested the formation of an association whose object was to refuse pocket money for men's work and demand a fair salary. For, surely, the 5s., 10s. and 15s. man must have private means, and while working for such a salary, he is taking the bread from another man's mouth.

Form an Association!

W. M. E.

The Official Balance.

The writer was interested to read the further remarks on the above subject by "A.M.I.E.E.," and to learn that his experience on ship work extends over 16 years, and is more than ever at a loss to understand the laboured methods adopted to overcome a commonly experienced difficulty.

We are now assured that the 140-H.P. motor was not immersed in water, and was only suffering from general dampness. The great difficulty with which the insulation was got up to standard, would point either to the poor quality of the insulation used in the motor, or to exceptional carelessness in allowing rain and water to damage it.

If "A.M.I.E.E." is so alive to the care needed in looking after electrical machinery on shipboard, how is it he found his motor in such a bad state? If he was not responsible, why did he not blame the dockyard authorities (to whom we may assume he was sub-contractor), and insist upon them helping to get the insulation up?

It is the writer's experience that when trouble arises, due rather to bad luck than negligence, both dockyards and shipyards will always give assistance to a sub-contractor, as they have all the necessary gear for tackling awkward jobs. It seems incredible that a responsible engineer should have burnt charcoal in a confined space. No wonder the men were knocked up!

Why was a coke fire quite out of the question? Has "A.M.I.E.E." during his long experience never seen a riveter's coke fire in a confined space? Then, again, a careful engineer would have measured his head room before attempting to move the armature and decided accordingly what was the best action to adopt.

Why was it necessary to work with only a tallow dip for light, when "A.M.I.E.E." tells us that current was available for lighting purposes? Surely temporary leads might have been fixed up as in other parts of the ship.

After baking the coils, would it not have been better to allow them to cool down before returning them to the ship? The writer is under the impression that coils when hot will absorb moisture much more readily than when cold. Could not some dry sacking and sailcloth have been found to protect the coils during their hazardous journey of one-third of a mile?

We are given fewer details with regard to the drying out of the controller, but the writer's experience is that by carefully drying such parts as micanite insulators between the resistance grids, very little difficulty is experienced in getting modern well-designed controllers through the insulation test.

The writer, having had too many troubles of his own on shipwork, is not given to belittling other people's misfortunes, but he strongly objects to futile methods being disguised as insurmountable and unique difficulties, and is still of opinion that the original article affords amusing reading.

Representative.

Arbitration: Recent Decisions.

I, for one, do not in the least follow Mr. Valentine Ball's line of reasoning. Will he be good enough to cite the "recent decisions," the effect of which on the Arbitration Clause (page 938, last issue) he is endeavouring to make clear?

His question is, shortly: How to secure an agreed arbitrator? And his first (and, presumably, his most favoured) answer is: Make the engineer the arbitrator subject to an action to unseat him.

This line of reasoning seems to me the mental equivalent for the cat chasing its tail. Mr. Ball has categorically stated in the earlier portion of his article four specific cases in which the engineer will be disqualified, and we have no assurance that others will not arise, the millennium not being here yet.

Why, then, choose him, when such a wide choice is open to you admitting of no doubt whatever as to qualification, namely, the presidents for the time being of any of the Institutions?

It may be answered: But the parties may not be able to agree him when signing indentures. That may be. Some people will disagree with the solar system. How very much less likely—human nature being what it is—are they to agree the paid officer of the purchaser, be he never so good a chap—which, of course, he always is.

Omikron.

[Our correspondent apparently has not consulted the full text of the paper, of which we gave only a brief abstract. He will find that in the original Mr. Ball quoted chapter and verse in support of his statements regarding recent decisions.—Eds. E.R.]

The Earthing of the Neutral.

In your leading article under the above title in the Electrical Review of December 6th, I notice a reference to my remarks in the discussion on the subject of electrostatic leakage indicators on extra-high-tension systems. I venture to think, however, that you have somewhat misunderstood my reference to these devices.

My point was not so much that the electrostatic voltmeter of 10 years ago was unsatisfactory. (A "box of tricks" was the unparliamentary expression of which I fear I was guilty, this being somewhat freely translated by you as "so unreliable as to be practically useless.") My point was rather that, at the present time, any mistrust of well-designed instruments of this nature was quite groundless, while I was forced to confess that such a statement could hardly have been made in connection with the earlier models.

If I may be allowed to transpose two of the sentences in your article, I venture to think that they put the whole matter in a nutshell. You say, "Twelve years ago we were familiar with many examples of such instruments in use on ordinary low-tension circuits and on circuits of 2,000 volts, and that was about as high as could readily be found in the United Kingdom at that time," but "of course, Mr. Peck considers pressures of all magnitudes, and it was a sign of the times to hear him speak of 2,000 and 5,000 volts as 'low voltage.'"

Now it is precisely because working pressures have so greatly increased of late years that porcelain insulation has replaced ebonite, and cast-iron cases connected to earth have superseded the once fashionable case of "insulating" material.

This being so, I trust you will agree that my remarks, far from being, as you suggest, "an animadversion on electrostatic voltmeters" were really a eulogy, in which I am more than pleased to find that you are prepared to join.

I should not trouble you with this letter, but that I am loth to let it be thought that I could, even for a moment, have proved faithless to so early a love of mine as the electrostatic voltmeter.

Kenelm Edgcumbe.

Hendon, *December 9th*, 1912.

In commenting on the discussion on Mr. Peck's paper in last week's issue, you make the statement that the carbon powder earthing resistance which I advocated was not new, as a similar resistance had been made by the B.T.H. Co. some years ago. As this statement is somewhat misleading, I should be glad if you would allow me to make a correction.

Although it is quite true that the B.T.H. carbon rod resistances possess a negative temperature coefficient, this property is of no value when the resistance is used in connection with spark gaps for minimising the effect of surges; whereas, on the other hand, the negative temperature coefficient is of great value in an earthing resistance, a use to which the carbon rods cannot be put.

During the discussion on Mr. Clayton's paper in April, 1910, I went to some trouble to explain the difference between the carbon resistances of the compressed form and those in which carbon powder was employed, the chief point being that as soon as a crack developed in the compressed carbon the whole resistance became useless, whereas with the carbon powder no such trouble could arise.

While not pretending that the use of a resistance having a negative temperature coefficient is new, I venture to suggest that its peculiar advantages, when used as an earthing resistance in the neutral point, have never been put forward by anyone else.

H. Brazil.

Beckenham, *December 10th*, 1912.

Patents and Inventions.

Admitting that the paragraph appended to Mr. A. M. Taylor's letter of the 26th ult. may modify the statement called in question, the fact still remains that he, in his official capacity as a member of the Council of the Institution of Electrical Engineers, has advocated legislation in favour of one class of the community without stating what are the needs for and possible results of the same.

The author of the address does not give the definitions asked for, but perhaps, at this stage, it is not of importance, as, in this letter, I prefer to confine myself to asking him for proof of the need for the said legislation.

Speaking with upwards of 25 years' experience of engineering factories, including electrical, no case occurs to my mind where an employé has been deprived of the benefits due to him. At the same time, it is only fair to say I cannot recollect an employé attaining affluence by the same means.

Doubtless, before writing his address, Mr. Taylor gave this matter much more careful study than has been possible for me and can readily quote cases of hardship such as he desires to redress.

Something Wrong.

Personal Liberty.

The North-Eastern Railway men have struck work because an engine driver has been reduced for being drunk in his own time. They argue that this is an interference with personal liberty, and may lead to further such interferences. Had they struck work on a demand for a further investigation into the doubtful question as to whether the man was, or was not, drunk, I should have had nothing to say, for magistrates are often so egregiously wrong in their decisions, that I confess to many doubts on many findings. But if the man was drunk I do not think that any rational being would regard his being put back in rank as an unwarranted interference in his private life. An engine driver on a railway, and an engine man on a coalpit head, working the winding engines on which miners' lives depend, have no private lives in the sense that other men have. They have private rights up to a point, as we all have, but their actions in certain directions are, and must be, limited. A shop walker, or a joiner, may drink to excess, and with less serious consequences to the public. An engine driver who gets drunk in private life endangers, it may be, a thousand members of the public in a mass. There must be limits to the private life of every man, and such limits are drawn at the point where private action involves public danger. Is it not illegal to lay poison in a man's own garden? To drive a motor-car to the public danger?

The railway men have surely made a grievous error in striking on such an excuse as this. Common-sense forbids all consideration of such a personal liberty as private drunkenness in any person on whose sobriety and nerve the safety of the public depends. A man cannot become drunk in private and remain a safe man in public, and though no general statement can be made as to what is, and what is not, justifiable interference, all men of sense would soon come to a decision on individual cases as they arose. The strikers evidently contend that it matters nothing that drivers should be drunk so long as they are not drunk on duty. They will not gain much support for this view among the general public, but they might secure considerable support for a demand for inquiry into the magistrate's decision.

B.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Ontario Power Co., at Niagara Falls, whence the Hydro-Electric Power Commission obtains its supply of current, intends to install a thirteenth unit of about 12,500 H.P. Nos. 11 and 12 are being erected now, but the demands on the station, due largely to the requirements of the Commission, are such that further extensions must be undertaken.

The Commission already referred to has recently exercised, for the first time, its power to order wires to be placed underground; this has been done in the case of the city of Hamilton, where, in the busiest sections, all wires (including telephone and telegraph wires) must go underground.

It is stated that the town of Galt is also applying for a similar ruling, so that the local companies may be compelled to do away with overhead wires in the centre of the town. It is probable that, in most instances of this kind, the municipality will lay the conduit system, and rent to the various companies such portions as are required by them.

The Dominion Government Department of Mines has for some time been experimenting with a 100-ton electric furnace for electric smelting; a report will shortly be issued on this subject tending to show that electric smelting of Canadian ores is commercially possible.

It is estimated that if a canal were built connecting Lakes Manitoba and Winnipegosis, a fall of 18 ft. would be secured near the town of Dauphin, Manitoba, from which some 40,000 H.P. could be generated. The Board of Trade of the Town of Dauphin, Manitoba, is taking the matter up with a view to a supply of power being obtained.

The Toronto Harbour Commissioners have recently presented to the City Council elaborate plans for improvement of the harbour. Aesthetic, as well as practical considerations have been taken into account, and vessels having a draught up to 24 ft. can be accommodated under the new scheme. There will be freight sheds, warehouses, factory buildings, &c., together with proper railway facilities. The factory buildings which it is proposed to erect on what is now waste ground, are estimated to yield a ground rent revenue of about £100,000 per annum.

There will be boulevard driveways on the water front, with bridle paths and walks, &c., for a distance of 11 miles.

For dredging purposes, electric lights and searchlights will be provided, so that work can be carried on at night as well as by day. Inside a breakwater, which it is proposed to build, a large space is to be filled in, 25,000,000 cb. yards of material being required for this work. The estimated cost of the whole scheme is nearly £4,000,000.

PROFIT-SHARING AND LABOUR CO-PARTNERSHIP.

By GEORGE JOHNSON.

Between Capital and Labour, two (though they should not necessarily be) antagonistic forces, there is a mighty unfilled space, which we may term the recognite and reconciliater of interests, awaiting the labours of social and industrial reformers. From a natural point of view, the attention that has been bestowed on the subject has not led to much practical application, excluding, of course, the Co-operative Society movement in the provinces; this movement relatively may be said not to exist in London.

Mere profit-sharing, which is quite different from co-partnership, has its limitations, and, so far as it has been applied, it may, generally speaking, be regarded as a temporary palliative for the ills that exist between the two opposing forces we have mentioned. In certain industries its application is comparatively easy and its advantages are obvious; but, in general, there are many difficulties to be encountered and surmounted, and not the least of them is the growth and power of Trade Union federations, whose interests, it is often asseverated, are diametrically opposed thereto.

The International Co-operative Congress in 1896 defined profit-sharing as the agreement freely entered into by which the employé receives a share, fixed in advance, of the profits. The profits are understood to be the actual net balance of gain realised by the financial operations of the undertaking in relation to which the scheme exists. It follows, therefore, that the payment of bonus on output, premiums proportionate to saving effected in production, commission on sales, and other systems under which the amount of the bonus depends upon the quality or amount of the output or volume of business, irrespective of the rate of profit earned, do not constitute profit-sharing.

It will thus be seen that co-partnership is practically an extension of profit-sharing.

Broadly, there are two modes of affording the worker an interest in the undertaking by which he is employed—viz., profit-sharing and co-partnership.

Mere profit-sharing, as at present practised, in the main consists of gratuitous or voluntary payments, with generally no legal right thereto, and an entire absence of the element of co-partnership.

Co-partnership exists only in those cases in which the worker receives, in addition to the standard wages, a share of the profit of the undertaking, that share, or a part of it, being accumulated in the business to enable him to obtain the rights and responsibilities of a shareholder or a partner, as the case may be.

The subject is one that is likely to come prominently before the public mind in the future.

To those who evince practical sympathy with the amelioration and uplifting of the lot of the worker, improved relations between employer and employed, industrial efficiency, the greater security and the extension or expansion of our industries, the recent report by the Labour Department of the Board of Trade on "Profit-sharing and Labour Co-partnership" will be found of great interest and assistance.

The Report furnishes, after the usual introduction, a general summary of profit-sharing and co-partnership in private firms and companies, a detailed account of schemes of various types, opinions of employers as to results obtained by profit-sharing and co-partnership, profit-sharing and partnership in co-operative societies, the conversion of ordinary business into co-operative societies, and other valuable matter, which it is impossible to discuss in detail in the limits of this brief article.

It would appear from the data in the chapter or section relating to the application of such schemes to private firms and companies, that 299 profit-sharing schemes have been born up to 1912, of which 166 are now defunct, leaving 133 with an employment of 106,189 workers. There seems to have been only one scheme prior to 1865. This number of 133 is obviously remarkably small for a nation of traders; but the report is hopeful, and it is gratifying to observe that out of the 299 schemes inaugurated, 104 have been started since 1900, and that 86 of the 104 were in existence in August, 1912.

The facts set forth in the report prove that the adoption on one or other of the numerous forms of the profit-sharing system is capable of affording to employés considerable advantages. These advantages include the opportunity of receiving an addition to their normal remuneration, the provision of special facilities for thrift, and in many cases, a certain measure of control over the management of the undertakings by which they are employed. At the same time, the opinions of employers quoted or summarised show that the methods of profit-sharing and co-partnership are, in numerous instances, considered by practical men, who base their judgment upon actual experience, to produce excellent results in the direction both of developing a higher degree of efficiency on the part of employés and of bringing about those harmonious relations between employers and employed.

DIGGING POLE HOLES WITH DYNAMITE.

Sometimes it is necessary to set a pole in very hard clay or frozen earth. Under these conditions, dynamite can be employed to advantage in digging the pole holes.

The illustration, fig. 1, from *Popular Electricity*, gives a very good idea of how this is accomplished. A chuck drill for sub-soiling, as shown in fig. 2, is used for making the hole. It is made of 1¼-in. wrought-iron pipe. The part A is 4 ft. long, with a full-threaded tee at one end. A steel, pin-shaped point, 6 in. long, is welded into the other end of the pipe. The handle is made up of two 12-in. pieces of 1¼-in. pipe screwed into the tee at H. A piece of 1¼-in. pipe, K, 4 ft. long, that is threaded at one end and provided with a coupling at the other end, is intended for use as an extension for the main part A.

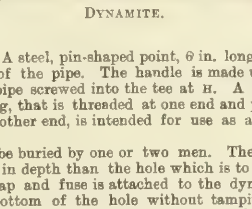

Fig. 1.—Method of Digging Pole Holes, Using Dynamite.

The drill can be buried by one or two men. The hole is made about 6 in. less in depth than the hole which is to be obtained by blasting. The cap and fuse is attached to the dynamite, and it is dropped to the bottom of the hole without tamping; that is, no earth is to be placed on top of the dynamite, so that there will be practically no resistance between the dynamite and the surface; then light the fuse and get out of the way.

The method is simplicity itself, as the chuck drill will almost go through solid rock. Of course, in solid rock, it is necessary to use a solid bar and sledge.

Regarding the amount of dynamite necessary, the use of a ½ lb. of 60 per cent. Atlas or Hercules dynamite is ample for a 5-ft. hole. Du Pont dynamite, 60 per cent., is recommended, as it is quick acting, and follows the line of least resistance (the untamped hole) in such quick time as to have practically no shattering effect on the ground, except within the immediate radius of the drilled hole.

The number of holes that can be prepared and shot in a day depends upon the men and the character of soils. Two men are able to punch, load and shoot in the neighbourhood of 200 holes per day. As an example of the work where the blasters must firmly tamp all holes, such as when sub-soiling in agricultural work, two men can shoot 194 holes on 15-ft. centres. Of course, the telephone pole holes are further apart, and the men must cover more distance.

A portable magazine should be used for carrying the dynamite, and the instructions which accompany the explosives as to capping, firing and handling, should be carefully read and followed.

As to the average cost per hole, 60 per cent. dynamite costs about .22 cents a lb. One cartridge, that is ½ lb., is enough for a hole. Allowing 1 cent for the cap, and about 2½ cents for the fuse, the total for material will be about 15 cents. The labour cost will be for about 100 holes per man per day.

Of course, for work of this class, the materials will almost invariably be purchased in quantities. The advantages of quantity prices can be obtained, thereby reducing the cost even below these figures.

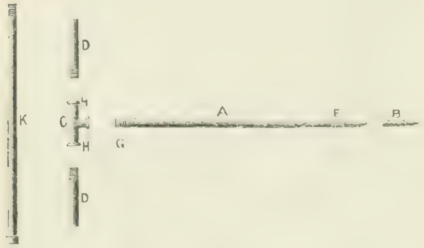

Fig. 2.—Details of the Chuck-Drill.

The instructions furnished by the makers for handling the dynamite are very complete. As it is really a very simple matter to handle it safely, this method of making holes should be extensively used. H. R. Van Deventer, in *Telephony*.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

An Avery Weighbridge at Sunderland.

The Sunderland Electricity Department has recently installed a new weighbridge, the manufacture of which, and the alterations to the gantry, were entrusted to Messrs. W. & T. Avery, Ltd., of Birmingham. The machine is entirely self-contained, the principle of construction being the three-lever type for which it is claimed all torsional stress is avoided, and the platform allowed to swing in the direction of the traffic, thus preventing undue shock and wear to the knife-edges and bearings.

The frame is fitted with joggle joints, machined and bolted together, which prevent any shifting under stress which would result in variation in weighings, and the platform, measuring 17 ft. × 6 ft., is fitted with steel rails fixed at the usual regulation gauge of 4 ft. 8½ in.

The wearing parts—in a machine of this character, of great importance—are made of special high grade steel, shaped, hardened and lapped, on the interchangeable system which ensures rapid replacement, and after the exchange the machine will continue to weigh accurately.

The pillar is of the arch pattern, and the steelyard is of the ticket printing type, which indelibly prints the weight on a ticket at the time of weighing, both gross and tare weights being printed on the same ticket, thus avoiding all disputes in accounts. There are no loose weights to be handled or mislaid, as the steelyard is graduated to its full capacity of 30 tons by divisions of 7 lb. The fixing of the weighbridge was quite exceptional, as all the coal for the station comes in from the colliery over a single track gantry running at a height varying from 10 to 25 ft.

In order to erect the weighbridge it was necessary to entirely pull down one section of the gantry and rebuild it with the weighbridge fixed with the rails on a level with those on the gantry. Owing to the necessity of non-interference with the coal supply, a short time could only be allowed, and the replacing the section of the gantry, and placing and adjusting the weighbridge in position, was completed in 27 hours.

The whole work was carried out by the local branch of Messrs. W. & T. Avery, Ltd.

Steam and Water Meters.

The British Thomson-Houston Co., Ltd., of Rugby, have developed and patented "flow meters" for steam, water and air based on the principles of the Pitot tube and the Venturi meter; the former is applicable to pipes of any diameter down to 2 in., while the latter is used only for pipes of 2 in. diameter or less. The meters for steam differ very little from those used for air or water. In the case of the Pitot tube type, a "nozzle plug" having suitable perforations, on opposite sides of an internal partition, is screwed into the pipe in which the flow is to be measured, and the respective sets of openings are connected to a mercury manometer on which the pressure difference is registered. In the other type an "orifice tube" is inserted in the main flow, having a tapered constriction at which the pressure of the fluid is reduced owing to the increased velocity, in accordance with the well-known principle; the loss of pressure—which is, of course, regained when the fluid has passed the constriction—is measured in the same way as in the former type. We illustrate in fig. 1 an "orifice tube" meter connected with an indicator, which is shown in detail in fig. 2.

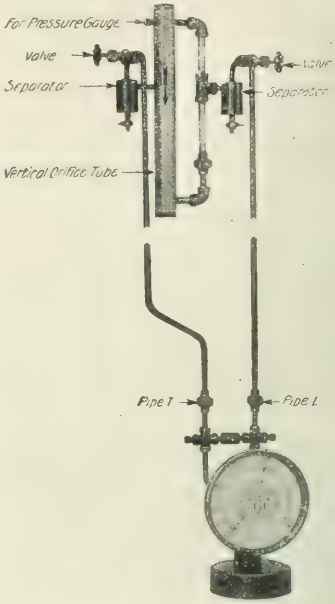

Fig. 1.—Arrangement of B.T.H. Flow Meter.

The body of the indicator consists of an iron casting cored out as shown to form a U-tube, the change of level of the mercury being communicated to the mechanism by a float and cord. As the tube must be closed, a magnet on the spindle of the pulley is used to control a magnet attached to the external pointer, a copper plug between the two magnets serving as a non-magnetic wall to the tube at this point, and as a damper to prevent oscillation. A "target" adjustable from the outside is provided, to indicate the normal rate of flow desired. The scale is calibrated according to the nature of the fluid to be measured and the units used, as, for example, lb. of steam per hour (at given pressure, superheat, &c.), gallons of water per minute, cubic feet of free air per minute, &c. A fresh calibration constant is necessary if a meter is to be used under changed conditions.

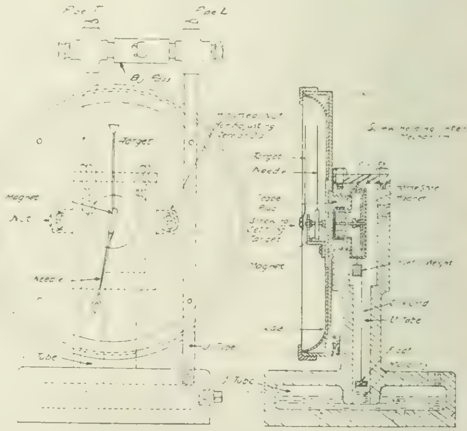

Fig. 2.—Cross-Section of Indicator.

The meter illustrated is of the stationary type; a portable instrument is also made, which, unlike the former, is capable of a great variety of applications without recalibration, the indications being given by a mercury manometer, which can be inclined so as to vary the sensitiveness over a very wide range. The readings are interpreted with the aid of a set of scales. Lastly, a recording instrument of more elaborate construction is made, which records the rate of flow on a moving chart; this is actuated by the unbalancing of a U-tube partially filled with mercury when there is a difference of pressures in the limbs of the tube. As the scale of the ordinates varies throughout, the ordinary planimeter cannot be used to integrate the records and determine the total amount of fluid that has passed the meter, but a special B.T.H. planimeter has been devised to overcome this difficulty. It will be seen that considerable ingenuity has been expended in devising this series of apparatus, which should prove of great utility to the station engineer in these days of minute analyses and voluminous records.

A Semi-Automatic Panel with "Inching" Features.

The Adams Manufacturing Co., Ltd., of Bedford, have recently introduced a semi-automatic panel, with "inching" features and wide speed control by shunt regulation.

These panels are made up in two separate parts or in one complete unit, as may be required, and are furnished with a main D.P. quick-break switch of robust construction.

The semi-automatic starting switch is so arranged that, by one single upward movement of the handle, the motor is started and automatically accelerated in a predetermined time, regardless of the operator, the time element being adjustable.

The working of the switchgear is made visible by means of a glass panel, which is fitted in the side, and a push button is provided by which the motor can be instantly stopped. When furnished with an overload trip, this is operative throughout the starting period. By means of the magnetic switch, the panel can be mounted in any suitable position.

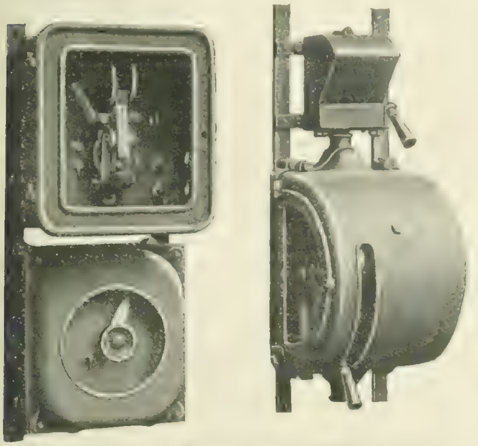

Fig. 3. "Igranic" Semi-automatic Starting Panel.

All circuit making and breaking is removed from the starting switch and is handled under the best possible conditions and under the influence of a very powerful magnetic blow-out. Mounted together with this switch is a shunt field regulator giving a wide speed range.

The panel consists of four independent units, making the equipment particularly flexible and applicable to almost any condition of service.

Prometheus Convector.

The British Prometheus Co., Ltd., of Salop Street Works, Highgate, Birmingham, have introduced a new design of convector, which has been extensively installed on board ship; the elements are made on the company's well-known system, and are guaranteed for five years. The company is adding many new designs to its series, and has showrooms in London, which are very fully equipped with cooking and heating apparatus, and are open for the use of contractors and their customers.

The Adnil "Autocom" Telephone.

The Adnil Electric Co., Ltd., of Adnil Buildings, Artillery Lane, E.C., have brought out a new type of intercommunication telephone under the above title, which we illustrate in fig. 4. The special features of this instrument, which is fitted with a hand-combination set, are that it may be fixed either on the wall or on the table, and that a five-line set can be increased to a 20-line set without removing it from its position. These points will appeal both to the contractor and to the user, the advantage of being able to start with a small system, and extend it as may be found desirable, being especially attractive. In this type of instrument calls may be recived and answered irrespective of the position of the line selector at the station called, and cross-talk is reduced to a minimum. It is normally arranged for common-battery working. The conversion from wall to table set is effected by the addition of a flexible cable and connecting-box.

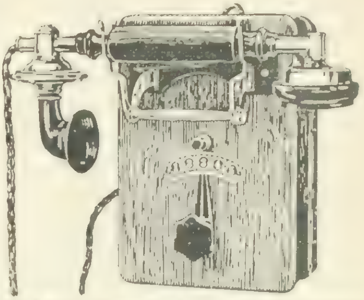

Fig. 4. Adnil Convertible "Autocom" Telephone as Wall Set.

LEGAL.

F. W. Potter & Co. v. Opera Omnia, Ltd.

In the Shoreditch County Court, before his Honour Judge Cluer on Tuesday, Messrs. F. W. Potter & Co., of Phipp Street, Shoreditch, sued Opera Omnia, Ltd., the proprietors of the National Vibro Massage Co., of Chapel Court, Borough High Street, to recover £76 17s. 4d. for goods supplied, being electric vibrators and hair dryers, to be used by hairdressers. There was a counter-claim of £35 9s. principally for the expense the defendants had been put to in making the vibrators and hair dryers interchangeable. Samples of the articles were produced in court, and were very carefully examined by his Honour.

Mr. Werthemier, barrister, appeared for the plaintiffs, and Mr. Blanco White for the defence.

Mr. H. F. Joel, M.I.E.E., manager of the electrical department of the plaintiffs, said he was a great friend of Mr. Ansell of the defendant firm, and together they agreed on the various changes that were made in the original model of the vibrator and drier. All of them were supplied as arranged. It was an impossibility to make the drier interchangeable with every vibrator. He had heard of Barker's electric vibrator, but did not know they were interchangeable. They had from time to time effected alterations in the fixings of some of them to please the defendants, but not that they were really called upon to do so through any defect in them.

Mr. Leach then went into the box and said his firm were the Adnil Electrical Co.

Counsel: "Adnil," your firm go in for a Latin name.

His Honour: Does it mean useless?

Witness: No, sir.

His Honour: He says it does not. It is bad Latin, anyway.

Witness: The wife of the proprietor of the firm is named Linda, and it is her name reversed; that is all the Latin there is in it.

Witness went on to say that these dryers and vibrators could not be made interchangeable to be a good job. He had never heard that Barker's were made interchangeable. Potters made motors for them, and their work was always of the very best. If the dryer, when fixed to the vibrator, was loose, he was quite willing to agree that it would be extremely bad for the unhappy person in the barber's chair, as they might very reasonably think their head was coming off.

For the defence, Mr. Ansell went into the box and said he, right from the start, was continually harping upon the necessity of the two being interchangeable. They were practically useless unless they were. If they were not, it meant that, if a customer purchased a vibrator and afterwards wanted a dryer, he would have to return the vibrator to allow of a dryer being specially fixed to it. That would not be a commercially sound arrangement. Witness told the plaintiffs that he sold a good many more vibrators than dryers, but that he wanted them to fit each other. They could be made to do so quite easily, and it should have been done by such a firm as the plaintiffs. Barker's dryers, which were fans, and not hot air, like theirs, could be interchanged; that he had been told by hairdressers, and, naturally, they would fly to the easiest one to fix. He had never expressed himself as satisfied, and if there was "O.K." on the invoice it did not refer to the quality only, nor to the quantity. Repairs and alterations were carried out on the goods supplied, and the accounts for these were sent on to the plaintiffs as they came in, showing that they always considered the plaintiffs liable for not supplying as required. There were defects in the vibrators because there were "shorts," and when he had had one in his hand, and there had been a "short," it had knocked him down. The "shorts" were caused by the two poles or wires touching the metal case. They were not told there might be "shorts" until half of the vibrators had been delivered. He certainly would never have ordered the dryers had he known they would not have been made interchangeable. He spoke of it almost daily, and, therefore, was not as careful as he might have been in putting it in the order.

His Honour: Your order simply says, "as per pattern with improved connection."

Witness: Yes, and that was never carried out.

His Honour: Has the pattern or the connection anything to do with the interchangeability?

Witness: Both have. Witness went on to say that the dryers supplied flew off from the vibrator, and he nearly had an accident with one. It would obviously be dangerous for a hairdresser to use them in that state.

Cross-examined: Witness said his contention was that he was not liable because of the failure to supply them interchangeable. They had tried to make them fit, but had failed to do so. The plaintiffs had offered to fit 36 dryers to vibrators, but he could not let them do that, as he had not got the vibrators now. He did not consider there should be more trouble in fitting a dryer to a vibrator than there would be in fitting any bayonet to any gun of the pattern for which it was made. He admitted he had not proceeded with the patent, that being because there was such a big supply from Germany, although not at the price he could produce at.

Other evidence was given as to the defects in the vibrators, and, finally, Judge Smyly found for the plaintiffs on their claim, less £9 1s., making £67 16s. 4d., and for the plaintiffs on the counterclaim, with costs.

Grevener v. Storey.

In the Shoreditch County Court before his Honour Judge Smyly, K.C., on December 4th, Julius Grevener, of 46, Southwark Street, S.E., electrical fitting manufacturer, sought to enforce payment from James Storey, of 290, Romford Road, Forest Gate, of a debt of £5 15s. 7d.

The Defendant said he did electrical work and traded in arc lamps, electrical fittings, and so on. The rent he was paying was £28 a year.

Mr. Robinson (for plaintiff): This debt is for electrical goods supplied, and he has paid nothing. He has had our goods, used them or sold them, and now calmly offers to pay us 4s. a month.

Defendant: I have every desire to pay, but I am driven to doing what I am doing by municipal competition. All I earned up to last Friday was 10s. for the week. I have a family of eight children, and only one of them helps me.

Judge Smyly: It doesn't sound flourishing.

Defendant: Then they are pressing me for the rates.

Mr. Robinson: You must expect that if you do not pay.

Judge Smyly made an order for payment at 4s. a month.

Tramway Accident Claim.

An elderly lady, named Wells, residing at Lewisham, was, in the King's Bench Division, on Wednesday, awarded £85 damages against the London County Council for injuries sustained by a fall from an electric tramcar in the Deptford Road on the evening of January 19th last. The plaintiff's case was that the car stopped at the corner of the Devonshire Road, and that as she was in the act of leaving it, the car started with a jerk, throwing her into the road, as a result of which she suffered injuries to the face and shoulder. She alleged that the place where the accident happened was marked as a compulsory stopping place up to the time of the accident, but that it had since been altered to "stop if required." The defendants denied negligence, and pleaded contributory negligence on the part of the plaintiff in endeavouring to leave the car while in motion.

National Telephone Co.

On the application of Mr. Danckwerts, K.C., with the assent of all parties, Mr. Justice Swinfen Eady fixed Monday, December 16th, for the hearing of a summons taken out to determine the rights of the shareholders in the surplus assets of the National Telephone Co., Ltd.

Counsel said the surplus to be dealt with was the surplus over liabilities and capital. They were now within measurable distance of a final award, and the matter would then be at once pressed on.

The Telephone Arbitration.

(*Continued from page* 906.)

On the resumption of the hearing on Monday, December 9th, the Attorney-General said that as the result of the protracted negotiations between Sir Alfred Cripps and himself, they had arrived at a settlement of all outstanding matters with which the Court had not dealt, and he was quite sure the Court would not be sorry to hear it when he informed them that one item involved 80 compensation claims. The first item settled was for plant constructed after the taking of the inventory. The claim was £658,599, and the sum agreed was £439,390. In giving these figures to the Court at this stage of the inquiry counsel said he had no desire to prejudice the view of the Commission in regard to other parts of the claim. The next item upon which they had come to an agreement was for the sum of £7,592 for certain plant and assets. The third item was for structural alterations and additions to the premises. The claim was for £6,539, and the sum agreed was £6,460. The fourth item included plant, property and assets of the company not subject to any special inventory. That would amount to £181,108. There was also included £1,250,000 for land and buildings, £243,247 for wayleaves transferred, £211,372 for licensed telephonic business at Portsmouth, Hull and Brighton; and £212,350 for the private wire business of the company, which the Postmaster-General had to take over on a three years' basis. The total claim in Item 4 amounted to £2,098,177, and the composite figure agreed on settlement was £1,225,000. The fifth item was for stores and tools not included in any other claim; the amount claimed was £434,747, and the agreed figure was £290,000. The sixth item referred to furniture, fixtures, &c., total claim £87,540, and the settlement was for £87,026. These items involved a total claim of £3,292,996, and the amount agreed in settlement was £2,055,468. Continuing, the Attorney-General said he was sure they could not have arrived at any compromise if it had not been for the reasonable spirit in which his learned friend had met him, due regard being paid by both sides to the interests of the respective parties. They were anxious to avoid protracted litigation, and to arrive at something which would represent a fair and reasonable figure.

Sir A. Cripps said he desired to confirm what the Attorney-General had said, and also to testify to the fair way in which the Attorney-General had met him, and the fair way in which the Solicitor-General had conducted the case. The figures in question had no bearing upon the matter before the Court, and would not affect it one way or the other.

His Lordship said that it was a great relief to the Court to feel that these items had been disposed of in a very businesslike way. It was self-evident that to dispose not only of 80 compensation claims, but also of other complicated matters, was to relieve the Court of sittings of almost indefinite duration, and thereby saved the parties from a large sum of money in costs. He was sure counsel had acted extremely wisely in the conclusion they had come to. He could not pretend to say that the amounts were necessarily accurate, because he had not gone into them, but he felt that counsel had gone into the matter with great care and with every desire to safeguard the interests of their clients. Counsel, in his opinion, had rendered great services to both the parties in the case and to the Court.

Sir A. Cripps, continuing his summing up for the National Telephone Co., dealt further with the question of plant valuation and the item for separate establishment. The Postmaster-General, he said, had raised the question of piecemeal construction, with the object of whittling down the claim of the company.

Mr. Justice Lawrence said there was some evidence that piecemeal construction was more expensive. The cost of ordering and estimating must be more in piecemeal construction. In the case of ordering and storing, the total sum under that head was £800,000, and his learned friend had attempted to whittle it away without putting before the Court any estimate. The figure for separate establishment differed from other figures in that it was based upon judgment, and not upon any list or experience.

Sir A. Cripps said that being an estimate it was more open to attack. The other side never came to close quarters with the company's figures, and he submitted that the company had substantiated this part of the claim.

Mr. Justice Lawrence asked what the learned counsel had to say with reference to the claim of the company in respect to contractors' profit.

Sir A. Cripps contended that the company were entited to 10 per cent., which they claimed. If employers saved that sum by undertaking the responsibility, trouble, wear and tear, they were entitled to recover it from the person to whom they were called upon to hand over the work. It would be unfair to penalise them.

Sir Jas. Woodhouse said he should not consider himself penalised if he could himself do certain work for £100,000 less than a contractor would charge for it.

Sir A. Gripps said everything depended on whether Sir James was able to get a profit on the work or whether he had to hand it over to another person.

(*To be continued.*)

Metropolitan Electric Tramways, Ltd.—Reduction of Capital.

A petition by the Metropolitan Electric Tramways, Ltd., for the sanction of the Court to a proposed reduction of its capital, came before Mr. Justice Neville in the Companies' Court on December 10th. The details are already familiar to our readers.

There was no opposition, and his Lordship sanctioned the reduction as proposed.

Prosecution under the Companies' Act.

On 4th inst. the Board of Trade prosecuted three directors of the Electric Safety Boiler Cleaner Co., Ltd., under Sec. 64 of the Companies' (Consolidated) Act, 1868, for not holding the annual meeting in 1912. The directors were Lord Louth, F. A. Mills, Kensington, and J. Brandon, Pall Mall.

Mr. Hamar Greenwood, M.P., who acted on behalf of the Board of Trade solicitor, said that the object of the prosecution was merely to see that the requirements of the Act were complied with. The last meeting of the company was held on September 10th, 1911. The company had not issued a prospectus nor done any business during the year, but shareholders had complained at the absence of the meeting. The promoter of the company was the secretary, Mr. Frank Hamilton, who had been summoned, but the charge had been withdrawn on account of his serious ill-health. Mr. Brandon said that he had resigned his seat and that everything was left to the secretary. Lord Louth also said that he looked to the secretary to do all that was necessary.

Sir John Baddeley said that the defendants had shown that they had not knowingly been party to the default, and he dismissed the summons, but on the application of Mr. Greenwood he agreed to state a case on a point of law.

IMPORTANT LONDON RAILWAY SCHEMES.

South-Western Electrification.

The directors of the London & South-Western Railway Co., as mentioned in a previous issue, have decided to commence the electrification of their suburban lines with the circular route from Waterloo *viâ* Wimbledon, Kingston, Twickenham and Richmond, back to Waterloo, and also the connecting link with the existing electric line between East Putney and Wimbledon. This portion involves the conversion of 73 miles of single track. The other portions of the scheme will follow in due course, involving the conversion of a further 173 miles of single track, but it will obviously be some little time before these further extensions can be put in hand.

The company has decided to adopt the direct-current third-rail system, using 600 volts on the third rail. The directors were largely influenced in this by the fact that this system is in use on the London electric lines, including the District, whose trains already run to Richmond and Wimbledon over the South-Western metals, the convenience of being able, if necessary, to run through trains over the different lines being regarded as important.

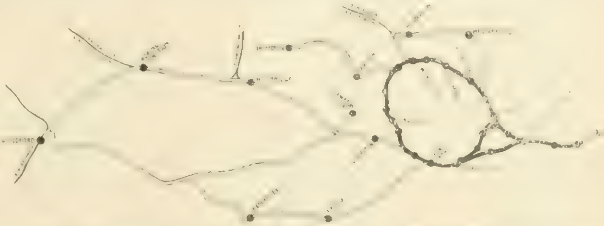

Fig. 1.—Showing the Extent of the Proposed South-Western Railway Electrification Scheme (First Section shown Black).

The South-Western Co. propose to provide a power house, with a capacity of 25,000 kw. Sub-stations will be provided on the first stage of the work at Clapham Junction, Raynes Park, Barnes, Twickenham and Kingston, and the existing generating station at Waterloo will form another. It has been decided to have two classes only on the electric trains—viz., 1st and 3rd—but, at the same time, to adhere to the compartment system, in preference to the open coach as used on the Metropolitan and District Railways.

The immediate proposals provide for six trains per hour in each direction on the more important routes, and there will be electric trains leaving Waterloo at an average interval of three minutes throughout the day.

The electrical work generally will be in charge of the company's electrical engineer, Mr. H. Jones, while Sir Alex. Kennedy and his partners are the company's consulting engineers.

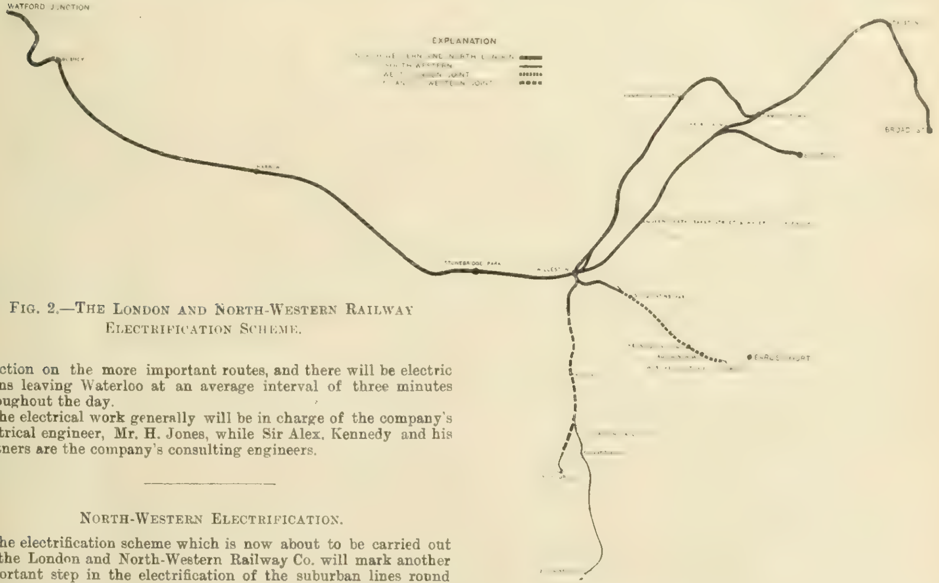

Fig. 2.—The London and North-Western Railway Electrification Scheme.

North-Western Electrification.

The electrification scheme which is now about to be carried out by the London and North-Western Railway Co. will mark another important step in the electrification of the suburban lines round London. Not only does the scheme provide for the electrification of 79 miles of track, hitherto operated by steam traction, but it will also enable electric trains to be worked by a main line company over one of London's "tube" railways, namely, the Baker Street and Waterloo. This is an innovation which will no doubt have considerable influence in inducing other main lines companies to undertake similar electrification work. The present scheme dates from the Act obtained by the London and North-Western Railway Co. in 1907, which authorised the construction of a new line from Euston to Watford running along side the main line, and is intended to relieve the latter of its suburban traffic. The scheme now includes not only the original proposal, from Euston to Watford, but also the electrification of the North London Railway from Broad Street to Chalk Farm, and the L. & N.W. Railway from Camden Town, *via* Hampstead to Willesden (H.L.), and thence over the West London and District Lines to Earl's Court, and also from Willesden over the N. & S.W. Junction and L. & S.W. lines to Kew Bridge and Richmond. The whole scheme is shown on the map reproduced in fig. 2. The extension of the Bakerloo Railway will join the L. & N.W. Railway Co.'s Euston to Watford Line at Queen's Park, where the "tube" will rise to the surface and a physical connection will be made with the L. & N.W. electric line. The scheme will, therefore, give facilities for the running of through trains from Watford to the Elephant and Castle in the South, and connection will be established with the whole system of London's underground railways, giving access to all parts of the metropolis.

The civil engineering work of the new line to Watford is being carried out by Mr. E. C. Trench, the company's engineer, and this section is making great progress; the first portion, between Willesden and Harrow, has already been opened for traffic in June last, and is now being operated by steam trains. This section will be opened to Watford in the beginning of February.

The equipment of this line for electrical working is now about to be undertaken, but the first section over which electric trains will operate will be from Willesden, over the West London Line to Earl's Court, and it is expected that these trains will be running very shortly. The system of electrification to be adopted for this important undertaking has received very careful consideration by the company under the advice of their chief electrical engineer, Mr. F. A. Cortez-Leigh, and it has been decided to adopt a direct-current system at 600 volts for the operation of the trains, using third and fourth rails in accordance with the system already adopted by the Metropolitan District and other London railways over which the company's trains will run, which system leaves the running rails free for the installation of electric track circuiting and automatic signalling.

The London and North-Western Railway Co. are already inviting tenders for some sections of the electrical equipment to the specifications of the chief electrical engineer, who has entire charge of this work, and is engaged in preparing all the necessary plans, and it is hoped that all the most important contracts for this work will be placed early in the new year. The general manager, Mr. Rees, is, of course, taking a very keen interest in this work, which is being carried out under his personal supervision.

The power station will be erected between Stonebridge Park and Wembley stations, on a site covering an area of 17 acres, adjacent to the electric line. The power station buildings are being so laid out that if necessary the power house can be considerably extended, and special consideration has been given to the important question of storing a large quantity of coal, space being available for many months' supply. Further, a good supply of water is obtainable on the site.

The very up-to-date and excellent coal handling arrangement which will be provided, enables no less than three months' supply to be handled, automatically utilising the old coal first, and after considering many proposals, Mr. Cortez-Leigh, in consultation with Sir Alexander Kennedy, decided to recommend this system. The necessary railway siding accommodation, which will be provided in the arrangements for dealing with the coal, is such that two trains can be discharged in a few minutes, and the system also lends itself readily to the convenient removal of the ashes from the power house to the trucks in the sidings. In addition to the reserve of coal outside the power house, storage bunkers will be provided, as usual, above the boilers, and will be filled by mechanical elevators and conveyors.

The power house will be a very substantial structure, and the initial plant will have a capacity of about 25,000 kw., which will consist of turbo-generators having a large overload capacity, and will be complete with the usual complement of boilers, mechanical stokers, condensing plant, &c. The whole of the generating plant will be of the most up-to-date and economical design; duplication and other provision for emergencies has been allowed for, as far as possible, to ensure continuity of supply. Similar provision will also be made in the main conductors to the sub-stations, and from the sub-stations to the conductor rails on the track.

The electrical energy will be generated as three-phase alternating-current at 11,000 volts pressure and 25 cycles per second, and will be transmitted by cables, carried on each side of the line, to sub-stations located from 3 to 4 miles apart. The cables will be entirely in duplicate, and so placed as to be well out of the way of interference from traffic operations, and where possible they will be carried above ground. At the sub-stations the current will be converted from the high-tension three-phase supply to direct current at 600 volts by means of static transformers and rotary converters, in the usual manner, and transmitted direct to the conductor rails. In addition to the transforming plant, the sub-stations will be equipped with large storage batteries and automatic boosters, which alone will be capable, if found necessary, of running a full service of trains for a considerable time. The batteries will also be of service in relieving the power house of heavy peak loads incidental to the operation of the electric trains.

The site obtained for the erection of the power station buildings will also provide ample accommodation for the shed for repairing and overhauling the electrical equipment, and as the position is approximately in the centre of the system it will tend to reduce dead mileage and also facilitate the handling of the trains generally. Further, this will enable the administrative work to be centralised, and thus obviate duplication of supervision.

The rolling stock will be of the most modern type, and will consist of motor-cars, trailers and driving trailers, and every consideration has been given to the seating accommodation, lighting, heating, &c., to ensure the maximum of comfort for passengers. The trains will be operated on the multiple unit system, so that they may be driven from either end and can be divided up in units of such number of coaches as may be required to suit the conditions of the traffic. The number of motor-cars required for the proposed service will be about 100, and during the busy hours it is proposed to run a service with five-minute intervals between trains on the Watford section of the line. The electrical equipment will be of the four-motor type, with motors of large capacity, and it is intended to operate at a high schedule speed and with an acceleration second to none in the country. The stock for working over the Bakerloo "tube" will be of special design, as it is necessary to bring it within the limits imposed by the diameter of the "tube," and also to allow for the difference in the heights of the platform levels.

The company in embarking on this undertaking have left no stone unturned to give to the public the most up-to-date system which engineering science can produce in every respect suitable to the local conditions, details having been most carefully considered with this object in view.

BUSINESS NOTES.

Trade Announcements.—The West India and Panama Telegraph Co., Ltd., has removed to Spencer House, South Place, Finsbury, E.C.

Messrs. Fredk. Hodgson & Co., of 24, Queen Victoria Street, E.C., have, owing to increased business, added to their telephone lines, which are now as follows:—City, 4674 (two lines); Hampstead, 5721 and 5565.

Consolidated Diesel Engine Manufacturers, Ltd., and Diesel Engine Co., Ltd., announce that their telephone number is now "2245 City" (three lines).

Mr. Alan Williams, late with Messrs. Crompton & Co., Ltd., has started business at 9, Queen Victoria Street, London, E.C., where he will deal principally in switchgear and switchboards made by Messrs. Eckstein, Heap & Co., Manchester, and in high-speed gas engines made by the Anderston Foundry Co., of Glasgow.

Catalogues and Lists.—From Mr. C. S. Northcote we have received a leaflet of his "Utopian" lavatory basin (Therol system) to give hot and cold water supply without pipes. It is a portable lavatory equipment provided with a cupboard containing a storage tank for water with space below for soap, towels, brushes, &c. Beneath the basin is the electric heater, which runs on the ordinary lighting circuit, and a waste water receptacle.

Mr. H. R. Witting, 41, Berners Street, London, W.—Eight-page list describing, and pointing out the advantages of, the Möller single pocket air filter.

Messrs. J. C. Fuller & Son, Ltd., Wick Lane, Old Ford Road, Bow, E.—Eight-page list containing illustrated particulars and tabulated sizes, dimensions and prices of their patent block accumulators for telegraph service, train lighting, house lighting, motor-car and motor-boat service.

The Electrical and Engineering Supplies Co., Harold Wood, Essex.—Leaflet showing, and giving prices of, decorative outfits for lighting Christmas trees, also for shop window and interior illumination and display. Copies will be sent on application.

Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.—Sixteen-page pamphlet containing an abridged description of their Dionic water tester, also its uses, method of testing, prices, and so on.

The British Thomson-Houston Co., Ltd., Rugby.—List No. 389 (20 pages), containing a full and well-illustrated account of their new steam, water, and air flow meters, which are shown in our "New Devices" section to-day.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Supplementary section ("O" 1644) of 12 pages containing illustrated particulars and prices of "Geeko" lamps and electrical novelties, including pocket lamps, torches, electric candles, hand lamps, model turbines and generators, electric clocks, massage vibrators, and so on.

British L.M. Ericsson Manufacturing Co., Ltd., 4, Chancery Lane, London, W.C.—Two illustrated leaflets giving brief information and prices relating to two types of their battery ringing wall telephones.

The Concordia Electric Wire Co., Ltd., Crown Parade, Cricklewood Lane, London, N.W.—20-page catalogue (No. 103) giving a large amount of tabulated, technical and commercial data regarding their "Concordin" high resistance wire for electric heating and cooking apparatus. Prices of these wires and ribbons are also given in tabular form.

Messrs. Simplex Conduits, Ltd., London and Birmingham.—Twelve-page illustrated and priced catalogue (revised), particularising their various electrical measuring instruments, moving iron and moving coil, in both switchboard and portable types, also galvanoscopes, Wheatstone bridges, and pocket measuring instruments.

The Economic Electric Co., Twickenham, London, S.W.—Very full catalogue of over a hundred pages giving illustrated particulars and prices of a host of small electrical apparatus and machines for young students, amateurs and others, including many lines suited for presentation purposes at this period of the year.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—Catalogue of all sorts of presents for Christmas, including electric table standards, flash lamps, and disk electric fires.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, E.C.—Pamphlet on the "Vulcan" soldering and branding irons, showing a great variety of patterns. We understand that these appliances are in considerable demand, owing to their freedom from the troubles which have been met with in the past, and which have created a certain amount of prejudice in some quarters against electric soldering.

Messrs. Ward & Goldstone, Springfield Lane, Salford, Manchester.—This firm is as usual laying itself out for the supply of fruit, flower, and figure lamps, for Christmas tree and bazaar lighting. A list giving prices and illustrations of their series strip, miniature batten holders, and fancy lamps, has been issued, and copies can be obtained on application.

For Sale.—Messrs. Wheatley Kirk, Price & Co., will, on January 14th and following days, sell by auction, at Gateshead, the freehold land and buildings, plant and machinery, goodwill, stock, stores, &c., of Messrs. Ernest Scott & Mountain, Ltd.

Messrs. P. Huddleston & Co., will, on December 17th, sell by auction, at Dalling Road, Hammersmith, a large quantity of electrical apparatus. See our advertisement pages to-day.

Cape Copper.—At the meeting of the Cape Copper Co. on 4th inst, says the *Times*, Mr. J. E. Champney stated that the profit for the year amounted to £80,494, as compared with £60,862 in the previous year. He hoped that the present prices of copper would be maintained for some time.

Bankruptcy Proceedings.—Wesley Sutton, 62, Dale Street, Liverpool, lately trading in partnership with Samuel Lord and John William Garsden, under the style of the Howe Electrical Engineering Co.—The first meeting of creditors in this matter was fixed for last week at Liverpool, but no creditors attended.

Crane Contracts.—Messrs. Royce, Ltd., of Trafford Park, Manchester, have received the following orders:—To construct and erect 25 electric gantry cranes for the Hull Joint Dock Committee; four similar cranes for the Alexandra Dock, Hull; 16 electrically actuated jib cranes for South Australia; two cantilever loading stages with two 15-ton cranes for South America. In addition they have orders for a number of capstans of both their ordinary and "Royce" patent free Bollard types.

Book Notices.—*Hazell's Annual*, 1913. London: Hazell, Watson & Viney, Ltd. 3s. 6d. net. This useful work has now reached its twenty-eighth year of issue. It is edited by Mr Hammond Hall, and its record of men and movements is revised down to as late as November 25th. As usual, there is a brief review of electrical affairs since the appearance of the last edition, and other articles deal with the cables of the world, British trade and British investments abroad, art and literature, politics and sport, national and other insurance; indeed, almost every topic under the sun receives attention somewhere. The book is one that we find it well to have always at hand.

Tait's Electrical Directory of Australia and New Zealand. Melbourne and Sydney The *Mining and Engineering Review* Office. 5s., post free outside Australia.—This a booklet of some 80 pages, containing the following sections:—(1) Alphabetical list of undertakings, with particulars of plant, output, &c.; (2) list of undertakings classified according to location in Australian States or New Zealand; (3) engineers in charge of plants and their addresses. In view of the growth of Australasian electrical undertakings, and the interest that English firms naturally take therein, this directory should be of considerable service.

The Central (the Journal of the Old Students of the City and Guilds (Engineering) College). Vol. IX, No. 29. December, 1912.—An interesting account is given of the Grand Central Terminal, New York, by W. A. Del Mar; the "Awakening of China" is described by W. C. C. Langdon, and the Compayne transmission gear, power plants in Canada, and the Bruce electrically-controlled steam whistle, are other subjects dealt with.

Poulsen Patent.—According to a notice in the *London Gazette*, Mr. Justice Warrington has directed that the petition of the Telegraphone Corporation, of New York, as assignees of patent No. 8,961 of 1899 (granted to Valdemar Poulsen, of Copenhagen, for a "Method of and apparatus for effecting the storing up of speech or signals by magnetically influencing magnetisable bodies") for an extension of term, is not to be heard before March 1st, 1913.

Christmas Holidays.—Messrs. Mawdsley's, Ltd., of Dursley, Glos., announce that their works will be closed from mid-day on Saturday, 21st inst., to the morning of Monday, the 30th.

The Walsall Electrical Co., Ltd., of Walsall, are closing down from Tuesday, December 24th, to 30th, for the holidays.

South Africa.—Our contemporary, the *British and South African Export Gazette*, states that so rapid is the growth of the demand for electric current at Lourenço Marques that the Delagoa Bay Development Corporation, Ltd., have been compelled to order further generating plant. There is also a corresponding development of the market for fittings and small motors.

The same journal also states:—"The proposal for electric light and telephones at Elizabethville, Katanga, still hangs fire pending local support. A trackless tram scheme has at last been adopted by the Boksburg Municipality, and contracts have been awarded. It is proposed to establish a water and electric light supply at Ermelo, Transvaal Province, at a total cost of about £22,500. An electric lighting scheme is being considered at Estcourt, Natal Province. A hydro-electric power scheme is being considered by the Harrismith (O.F.S. Province) Municipality, which will involve the purchase of a considerable quantity of machinery and plant.

"The Rand Water Board are in the market for an electrically-driven high-lift centrifugal pump for their End Street depôt."

Dissolutions and Liquidations.—Foreign Radial Axle Cars, Ltd.—A petition for winding up this company has been presented by Messrs. Milnes, Voss & Co., Ltd., of Birkenhead, creditors, and it is to be heard on January 14th in London.

Raworth's Traction Patents, Ltd.—A meeting is to be held at 126, Bishopsgate Street, E.C., on January 14th to hear an account of the winding up from the liquidator, Mr. F. J. Riches.

Simms Magneto Co., Ltd.—This company, of Kimberley Road, Kilburn, N.W., is now winding up voluntarily. A meeting of creditors is called for December 17th at the Institute of Chartered Accountants, Great Swan Alley, E.C.

Cowper-Coles Inventions Development Co., Ltd.—A meeting of creditors was called for 11th inst. at Westminster.

North-Western Electricity & Power Gas Syndicate, Ltd.—A meeting will be held at Hanley on January 7th to hear an account of the winding up from the liquidator, Mr. C. E. Bullock.

LIGHTING and POWER NOTES.

Algeria.—A concession has been granted to Mons. A. Grammont, of Pont de Cheray (Isère), to lay down four lines of electric tramways in the city of Constantine, Algeria.—*La Lumière Electrique.*

Batley.—The electrical engineer has been instructed to prepare and submit plans and estimates, with a view to an early application to the L.G.B. for sanction to the raising of a loan for an extension of the present generating and distributing plant, providing as alternatives (*a*) a steam, and (*b*) a gas generating plant.

Bedford.—The T.C. has decided to install a 400 KW. Diesel engine and alternator, to be constructed by Messrs. W. H. Allen, in the power station; the cost, £8,980, is covered by the loan application to the L.G.B. mentioned in our last issue.

Brazil.—A syndicate has been formed at Blumenan, in the province of Santa Caterina, to establish a large power station at falls on the River Itajahy in order to supply electricity for lighting and power purposes to the city and suburbs.

Brighton—Hove.—With reference to the electricity question at Hove, the Brighton T.C. has passed a resolution requesting the Lighting Committee to take into consideration the question of negotiating with the Hove T.C. as to the supply of electricity in bulk to Hove.

Burton-on-Trent.—Application is to be made to the L.G.B. for sanction to borrow £8,500 to provide for expenditure on mains, services and transformers during the next three years; 50 electric irons are to be purchased for distribution amongst consumers, and after one month's trial, such consumers are to be asked to purchase them through local contractors.

Canada.—The Calgary Power Co. is about to spend $1,000,000 (£200,000) on two additional units at its hydro-electric station, making the plant equivalent to 20,000 H.P. in all. Prices for power will be reduced. The city electrical department has put in 3,200 new lighting connections during 1912.

Subject to the approval of the necessary loan by the burgesses, estimates for the following additional electrical equipment have been authorised at Regina: 1,500-KW. set already ordered for delivery in August, 1913, £8,000; poles and wires, £15,000; street lighting extensions, £4,000; meters, £4,000. The demand for electricity has increased from 833,039 units in 1907, to 4,179,948 units in 1912. The estimated demand in 1913 is put at 7,000,000 units. The pumps for the city water supply are at present operated in connection with the power station, but in the new power house about to be put in hand the two services will be separated.

Chesham.—With reference to the street lighting question, the Bucks. C.C. has passed a resolution dispensing with the penalty imposed by the Local Government Act in the case of five members of the U.D.C. who are shareholders in the Gas Co., "So as to enable them to freely vote on the question at which tenders for the supply of gas or electricity for public lighting or power are considered and dealt with by the U.D.C."

Clacton-on-Sea.—The U.D.C. on December 4th decided to apply to the L.G.B. for a loan of £5,100 for the provision of a Diesel oil engine and generating set of 250-KW. capacity.

Continental Notes.—Austria.—According to a return lately issued by the Electrotechnische Verein, of Vienna, there are now close on 1,000 electric lighting undertakings in Austria, supplying current to nearly 2,000 towns and villages.

Denmark.—A municipal central electric lighting station is about to be established in the town of Struer, Jutland, the contract for the work having been secured by the Siemens-Schuckertwerke.

The Sydostsjalland Electricitäts Aktieselskab is the name of a company which is reported to be in course of formation at Kjöge, to establish a large generating station for the supply of electricity for lighting and power purposes in the southern portion of the Island of Zeeland.

Spain.—La Sociedad Energia Electrica de Cataluna, of Barcelona, is increasing its capital to £80,000, for the purpose of extending its operations in the province of Catalonia.

Norway.—The Ryfylke Electrical Works, which owns several waterfalls in the neighbourhood of Stavanger, has just completed the first power station at one of the falls. In the first instance only about 2,000 H.P. has been utilised, of which 1,500 H.P. has been contracted for by the Stavanger Electrical Steel Works, where the machines are now being installed. The plant of the Ryfylke Electrical Works was subjected to a trial run recently with very satisfactory results. The generators are two in number, of 1,000 H.P. each; one of them has been delivered by the Brown-Boveri Co. and the other by Messrs. Siemens-Schuckert.

The Norwegian Company Meraker Brug has recently applied to the Government for a concession for transmitting 15,000 H.P. from the waterfalls at Meraker to the seaside at the Trondhjemsfiord, where the company owns excellent sites suitable for industrial purposes, at Hommelviken as well as at Murviken. The energy to be transmitted is to be derived from the Gjössefos, which is now being harnessed. The utilisation of this fall is not an easy task, as the water will have to be conducted through a tunnel about 900 m. long, which will require considerable expenditure of capital.

The same company only a few months ago lost by fire one of its pulp mills at Meraker. Instead of rebuilding this mill, it has now been decided to utilise the surplus energy for the electrical smelting of ore, and the necessary steps have already been taken for the erection of smelting works on the site of the pulp mill.

The utilisation of the Trollhättan Waterfall for the generation of electrical energy has been of direct benefit to the City of Gothenburg, which is now illuminated by electricity at an extremely low cost. Last winter efforts were made, not only to utilise the current for industrial purposes, but to extend its adoption for the heating of public and private buildings. These efforts have proved a great success. In consequence, a dearth of heating apparatus has manifested itself, and manufacturers might find profit in directly catering for this opening.—*Elektrotechnik und Maschinenbau.*

Conway.—The town clerk submitted, at the meeting of the T.C. on December 4th, correspondence between himself and the B. of T. respecting an application by the Council for a further extension of time to carry out the obligations under the Electric Lighting Order. It was decided to inform the B. of T. that the question of electric lighting was receiving the Council's attention. The engineer was requested to submit at the next meeting a report as to a scheme for the electric lighting of the Conway Bridge Embankment.

Crewe.—The T.C. decided on Wednesday last to replace 30 to 40 oil lamps in the Coppenhall district with electric lights.

Doncaster.—The manager of the electricity works has been authorised to complete arrangements for the holding of an electrical exhibition in the Guild Hall. Admission will be by ticket, which may be obtained from the electricity works or from any of the electrical contractors in the town.

The T.C. decided on the 4th inst. to borrow £5,000 in respect of the proposed extension of electric cables to Balby and Hexthorpe and £3,000 in respect of the extension at Bentley, for which a provisional order is now being sought.

East Ham.—The engineer has been directed to prepare a report upon the question of giving a supply of electricity in bulk to Barking, and also as to whether a portion of that Council's tramways over which it is proposed to make through running arrangements from Aldgate should be leased.

Epsom.—The U.D.C. on the 3rd inst. decided, after hearing reports from the electrical engineer and waterworks consulting engineer, to accept the offer of the Electricity Supply Committee to undertake the whole of the pumping at the waterworks at a cost of 3¾d. per 1,000 gallons. The pumping is at present being done by suction gas. The cost of installing the necessary plant and laying the main will be £850.

Hastings.—The owners of machinery in Hastings and St. Leonards are up in arms at a decision of the Assessment Committee to assess machinery specially. In this matter, we understand, the Overseers and Assessment Committee are at variance, the former contending that it is unwise in a place where there is comparatively little machinery, thus to tax local industry.

Hazel Grove (near Stockport).—At a meeting of the U.D.C., it was reported that representatives of the Council had had an interview with Parliamentary agents in London respecting application to the B. of T. for an order to supply electricity within the district, and that the Electricity Sub-Committee had received and considered an up-to-date report from Mr. Crews (consulting engineer) upon a scheme of electricity supply together with an estimate of the cost. It was decided that application be made to the B. of T. for a prov. order for the purpose named, and that the seal of the Council be affixed to the memorial praying for such order.

Holmforth (Yorks.).—At the last meeting of the Council, it was stated that the application of the Council for a prov. order had received the assent of the Select Committee of the House of Commons. The Electricity Committee of the Council is now in communication with the Yorkshire Electric Power Co., in respect to arranging terms for the supply of electric power required by the Council.

Lisbellaw (Co. Fermanagh).—With the electric lighting of the houses in Lisbellaw, the village now has quite an up-to-date appearance. A movement is being set on foot to light the streets also with electricity. The sanction of the Rural Council to carry overhead wires and strike a rate for the village to cover the cost of the lighting will be sought.

Liverpool.—The men employed in the electrical department of the shore gangs of several of the leading steamship companies of Liverpool, came out on strike last week for an increase of wages to 39s. 9d. per week and shorter hours. At present the wages range from 36s. to 37s. 6d. per week.

Llanfair Caereinion.—An E.L. scheme for the parish has been prepared by Mr. B. Thomas, of Manchester, and as the canvass for consumers has exceeded all expectations, it will be carried out. The capital expenditure is placed at £1,000. Mr. David Davies, M.P., has offered to take £500 in shares in the company to be formed.

Leeds.—At the City Council on the 4th inst., Alderman Smithson moved that the section of the Parliamentary Bill, which empowers the Corporation to acquire lands in the city and to erect an electrical generating station and other works, be deleted. Thirty voted for, and 30 against the motion, and the town clerk said that the resolution to exclude the section having been defeated, the clauses remained in the Bill, but it was necessary that the Bill be approved by at least 35 votes of members of the Council, and as that number had not been forthcoming, that portion of the Bill automatically fell to the ground.

London.—WOOLWICH.—To enable consumers, who are supplied under contract and purchase more current than they are able to consume under the normal working of their business, to use the excess current by additional connections, it has been decided to allow these consumers whose premises are wholly lighted by electricity, to install additional arc or other lamps without increasing the normal maximum demand charge, provided that they agree to pay an additional sum over and above such charge at the rate of £5 per KW. installed, all current used being charged at 1d. per unit, with discount allowances as under principal contracts. To those consumers who are supplied at the flat rate charge, and who desire to make temporary additions to their installations for decorative or display purposes, a charge of £1 10s. per KW. is to be made. An agreement has been sealed with the West Ham Corporation consenting to its giving a supply of energy to Pearson & Son, Ltd.. for use under their contract for the construction of the South Albert Dock, upon payment by the West Ham Corporation of £30 per annum during the whole of the period of supply.

FULHAM.—The electrical engineer has been directed to prepare a scheme for lighting High Street, Hill Road, Broadway, and Merton Road, with 300-C.P. metallic-filament lamps in lieu of the present 50-C.P. size and existing arc lamps.

POPLAR.—The Electricity Committee states that it has received a report from the electrical engineer upon the policy and progress of the undertaking. This report shows that the revised system of charging, on the basis of a fixed charge per annum, and ½d. per unit on consumption, has resulted in a large increase of business. Until the present year the normal annual increase has averaged 1 million units since 1906, with an increase in demand of from 300 to 400 KW. per annum. The increase in output this year will be from 2½ to 3 million units, with an increased demand of 1,000 KW. The total rated capacity of the plant, before the present extensions were entered upon, was 4,200 KW.; the plant nearly ready for use, and in course of completion, in the new building, is rated at 6,000 KW., making a total of 10,200 KW. The showroom in East India Dock Road has proved self-supporting, and has been of considerable benefit to the undertaking in the rapid extension of business.

Mickleover.—The Repton R.D.C. has consented to Derby T.C. obtaining a prov. order for electric light at Mickleover.

Newport (Mon.).—The T.C., on the 10th inst., confirmed the recommendation of the Electricity and Tramways Committee to enter into supplemental agreements with the General Electric Co. in regard to their existing contracts. The Committee also placed on record its "appreciation of the able services rendered by Mr. Nichols Moore, the borough electrical engineer, in carrying through the negotiations with the General Electric Co."

North Bierley.—The Guardians are seeking information as to the cost of installing electric light at their workhouse at Clayton, in place of gas.

Pontefract.—At the meeting of the T.C. on Thursday last week it was reported that the transfer of the Council's powers, under its Electric Lighting Order, to the Yorkshire (West Riding) Electric Tramways Co., had been completed.

Portsmouth.—With reference to the tenders received for installing the electric light at the infirmary extensions, the B. of G. has decided to have the specifications amended, as required by Mr. Foale and the architect, Mr. Smith.

Reading.—The T.C. has invited the Electric Supply Co., Ltd., to tender for lighting the streets in the borough.

Rochdale.—With reference to our brief note of last week, stating that the Gas and Electricity Committee had decided that application be made to the L.G.B. for sanction to borrow £30,000 for extensions to electricity works and plant, the following are the detailed particulars:—Engine room and boiler house extensions, water settling tank, and strainer gear, £5,500; two three-phase steam turbo-alternators, with cable connections. Two condensers, with pumps, pipework, valves, and meters; suction, delivery, exhaust, and drain pipes; one 500-KW. three-phase motor alternator, with cable connections. Additional switchboard panels, £13,160: two water-tube boilers, and superheaters, and economisers. Two boiler feed pumps, with suction and feed pipes, hot well, cold water tank, and valves. Steam blow-down and drain pipes with valves. Coal and ash elevators, and storage bunkers, £9,260; induced draught plant for old chimney, £500; transformers, wiring, and contingencies, £1,580; total, £30,000.

The suggestion to light the Town Centre by electricity has been deferred owing to the pressing demand for current elsewhere.

St. Annes-on-Sea.—The U.D.C. has resolved that application be made to the L.G.B. for sanction to borrow £6,000 for mains, services, and meters.

St. Helens.—The T.C. has applied to the B. of T. for a loan of £6,800 for electricity purposes—viz., transformers, £1,000; sub-station building, £500; sub-station equipment, £600; overhead mains, £1.000; underground mains, £3,000; services, £700.

Sheffield.—For the years ending March 25th, 1913, and 1914, the Electric Light Committee estimates that it will have a surplus of £3,314 and £10,695 respectively. The total income is estimated at £107,688 and £121,130, as against an expenditure of £40,882 and £44,639. Regarding the tramway undertaking, it is estimated that the total receipts for the two years will amount to £355,233 and £363,019, while the estimated net balance is expected to amount to £27,740 and £26,058 respectively.

Southampton.—The T.C. has decided to hire out electric radiators at a rental of 2s. 6d. per quarter, with 25 per cent. per annum additional rent for radiators above the value of 50s.; 100 radiators are to be purchased forthwith.

Stoke-on-Trent.—The T.C. has applied to the L.G.B. for a loan of £12,000 for prospective and current work in connection with the electricity undertakings in the borough.

Stretford.—Application is to be made to the L.G.B. for sanction to borrow £5,500 for distributors and services and £2,000 for motors. At a recent meeting of the E.L. Committee, the chairman reported at some length upon the financial results of the working of the undertaking for the past year, and stated, with respect to the forthcoming year, that the increased cost of coal would add materially to the cost of production, but in all probability this would be largely compensated by the increased price obtainable from the Corporation for current supplied for traction purposes. The Committee has decided to reappoint Mr. Miller consulting engineer for the year ending October 31st next.

Swanscombe.—The Gravesend T.C. has applied to the Dartford R.D.C. for consent to mains being laid at Swanscombe for the supply of current to the Empire Cement Co. and other intending consumers. At a meeting of the R.D.C. on December 3rd, there was slight objection to the application, and the matter was deferred for fuller particulars to be obtained. Some 10 years ago the Council consented to a prov. order for electric light being obtained by a private company, but the scheme never matured.

Swindon.—The T.C. on December 3rd decided to rescind the acceptance of the tender of the Diesel Engine Co. for a Diesel generating set. A special meeting is to be called to further consider the matter.

Tonbridge.—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £2,560 for additional generating plant, and £1,000 for mains extensions. There was no opposition. The Council proposes to install a 100-KW. set.

Torquay.—To all consumers who use over 1,000 but not more than 2 000 units of electricity in any quarter for heating, cooking, and other domestic purposes except lighting, a reduced charge of ·9d. is to be made, while those who exceed 2,000 units are to pay at the rate of ·8d. per unit.

Walsall.—The T.C. is being asked by the Electricity Committee to sanction the laying of a cable at an estimated cost of £1,400, from the generating station, for the purpose of supplying the Caldmore district with alternating current, and also providing the means for augmenting in the immediate future the supply to the Highgate district.

West Africa.—A survey is now being made on parts of two rivers in the Congo, having an aggregate length of 450 miles, with the idea of exploiting their water-powers in the generation of electricity, also to improve the navigation. It is expected that the work will take about one and a-half years to complete.—*African Engineering.*

West Ham.—The Electric Light Committee has received a letter from the Barking U.D.C., stating that the Council has had under consideration the question of extending the generating plant, but before coming to a decision thereon it desired to know whether the West Ham authority would be prepared to give a supply of electricity in bulk, or, alternatively, whether West Ham would be prepared to consider the question of the transfer to it of the Barking Council's Electric Lighting Order, and the works executed thereunder, upon terms. Having fully considered these terms for a bulk supply, the Committee has decided not to entertain the application.

Wimbledon.—Application is to be made to the L.G.B. for sanction to borrow £5,650 made up as follows:—Mains and house services, £3,000; transformer sub-stations, £800; meters, £1,850. It has been decided to fix, at a cost not to exceed £105, two air filters on the two 1,000-KW. alternators at the electricity works, in order to minimise the risk of breakdowns, owing to the accumulation of dry dust.

Woodbridge.—The U.D.C. has approved of the electric light scheme, submitted by the Rural District Electricity Undertakings, Ltd., and given permission for the use of overhead and underground mains.

TRAMWAY and RAILWAY NOTES.

Accrington.—The borough electrical engineer, the town clerk and the chairman of the Electricity Committee have had a conference with representatives of the Haslingden Corporation, with a view to adjusting details in respect of the supply of energy for tramway purposes as given and metered at the Baxenden boundary, and it is understood they will be able to lay before the next meeting of the Committee terms for a more satisfactory adjustment of the matter.

Ayr.—The local tramway system is to be extended to the racecourse. The Western Meeting Club and the proprietors of Craigie and Auchincruive estates have agreed to give the necessary ground and road improvement alone costing £2,000.

Canada.—An electric railway, 29 miles in length, from Lacombe (Alberta) to Rimbey, *via* Gull Lake and Bentley, is projected. There will be four stations, each equipped with facilities for loading wheat.

During the first 10 months of 1912 over 1,500,000 passengers were carried on the Regina (Sask.) electric street cars, the fares paid being £15,030. The surplus on operation has amounted to £3,650, and, after paying interest charges, there is a net profit of over £1,600. The existing 14 miles of line will be extended in 1913, and the rolling stock triplicated. The city authorities propose to construct a spur line of the electric tramway to the proposed new garbage incinerator for the purpose of conveying street and house refuse

Brazil.—A contract has been signed between Dr. Carl Otto Jäckstein and the T.C. of Thomazina, province of Parana, for the installation of electric tramways between Mineira and the city, with branch lines to such points as are found necessary.—*Revue Pratique de l'Electricité.*

Continental Notes.—France.—On Saturday last traffic on the Paris Metropolitan Railway and tramways of the Eastern Co. was held up for two hours, owing to a short-circuit which occurred at the St. Denis generating station. This also affected the general lighting supply in the North of Paris, which was not restored to the normal until midnight. The situation has naturally provoked a good deal of criticism in the local Press.

The French Minister of Public Works has approved a scheme for the construction of an electric railway between Villefranche and Vernet-les-Bains (Pyrenees Orientales).

Russia.—The *Frankfort Gazette* states that the St. Petersburg Municipality has decided to issue a loan of seven million roubles for the construction of tramways.

Dundee.—A proposal to rescind a resolution whereby £1,500 is charged against the revenue of the tramway department and placed to common good, led to an animated discussion at the monthly meeting of the Corporation. It was argued that any surplus should go towards improving the service, and that £1,500 a year would go a long way to enable the Corporation to extend the railless trolley system. The convener of the Tramway Committee hoped the Tramway Committee would be in a position before very long to make improvements on the service and yet continue to pay the £1,500. He also hoped the Committee would be asked to consider the question of extending the railless trolley system to Lochee. It was agreed to continue the payment.

Durham.—The United Automobile Service Co., Ltd., is introducing a motor service between Durham and Spennymoor and Bishop Auckland.

Fife.—Colonel von Donop inspected, and described as highly satisfactory, the new tramway from Lochgelly to Glencraig and Lochore last Thursday. The line is a continuation of the Dunfermline and Lochgelly system opened two years ago.

Glasgow.—The general manager and the town clerk are to report to the T.C. as to the advisability of acquiring, in connection with the tramway service, a number of motor-'buses for the purpose of (*a*) tapping the districts in the neighbourhood of the various tramway termini, and (*b*) being utilised for the conveyance of passengers in the city at night or early morning after the service of tramway cars has ceased. The Sub-Committee remitted the matter to the town clerk and the general manager for consideration and report.

Hastings.—The Hastings Tramways Co. is promoting a Bill in Parliament to enable it to adopt the overhead system on the Front line in lieu of the existing Dolter system. The matter was discussed at Friday's meeting of the T.C. A petition from frontagers strongly protested against the Bill, and appealed to the Council to oppose it. In the course of the discussion several speakers contended that the present system could be improved by better attention to the track, and it was argued that before overhead wires were approved, the company should carry out certain suggestions recently made by Major Pringle, of the B. of T., who came down at the instance of the Corporation. Eventually, by 22 votes to 9, the town clerk was instructed to take all necessary steps under the direction of the Law and Parliamentary Committee to oppose the Bill.

Huddersfield.—The Corporation is giving a trial to an improved cover for its tramcars. It has been constructed by the United Electric Car Co. from the designs of the tramways manager (Mr. R. H. Wilkinson). The cover can be fixed to the present cars, and will provide increased seating accommodation, comfort and freedom from draught. It is claimed that the cover will be a great improvement upon those at present in use.

Luton.—The T.C. has notified Messrs. Balfour, Beatty and Co., Ltd., that it requires them to take a further 10 years' lease of the electric tramways from February 21st next.

Irlam.—On Tuesday, last week, a deputation from the District Council waited upon the Tramways Committee of the Salford Corporation in support of the application for the extension of the Salford electric tramways from Peel Green to Irlam and Cadishead, which are developing into important industrial localities. Alderman Linsley, chairman, pointed out that the Salford Corporation could not entertain any such proposal unless the local authority was prepared to indemnify it against all loss. It would, moreover, want some profit. The deputation, of course, could give no such undertaking.

Lancaster.—At the annual meeting of the Lancaster and District Tramways Co., on Saturday, Mr. A. Bell, the chairman, said they were £600 worse off than in the preceding year, on account of bad weather and the cost of provender. So long as they retained horse traction, he said, they had reached the high-water mark, but the directors had given notice of their intention to apply for power to introduce mechanical traction, and the lines had been inspected by the Board of Trade.

London.—The Highways Committee has decided to remove and sell the four 3,500-KW. vertical-horizontal engine sets at the Greenwich tramways generating station, and to replace them with, in each case, an 8,000-KW. turbine. When worked entirely by turbines, the plant capacity will amount to 52,000 KW., as against at present 34,000 KW., there being four 5,000-KW. turbines installed, in addition to the reciprocating plant. The first section of the work, including the installation of two units, will be taken in hand immediately, and will cost £128,000; the second section is estimated to cost £99,000. On the basis of the present price of coal, 16s. per ton, the first section of work will result in a saving of £16,000 per annum in fuel, as well as a gain in capacity of 9,000 KW.

The L.C.C. on Tuesday adopted a recommendation of the Finance Committee that the scheme for a tramway from the Marble Arch to Cricklewood should be dropped, in view of the opposition of the various road authorities. The Council approved the General Powers Bill which includes various other tramway extensions estimated to cost £800,000.

Marsden.—The seal of the Council has been affixed to the agreement between it and the Huddersfield Corporation in connection with the extension of the tramways to Marsden.

Mytholmroyd.—A special meeting of the Council was held on Wednesday last week, when the prov. agreement drawn up by the Halifax Corporation, respecting the running of cars and motor-'buses in the D.C.'s area, was considered. Under this agreement, the Council agrees to postpone its right to purchase the tramway to 31 years from the passing of the proposed Bill; the Corporation agrees to run a motor-'bus to Cragg Vale upon certain conditions: that Councillor C. W. Greenwood deposit £100 in the bank in the name of the chairman of the Mytholmroyd D.C., and that the Corporation have the right to draw upon this sum in order to recoup itself of any loss which might be entailed by the running of the motor-'bus.

Oldham.—At the T.C. on the 4th inst., the Committee's action in not allowing whiskey advertisements on the tramways, was endorsed by 20 votes to 14, and Councillor Low remarked that the Corporation was throwing away £150 a year, and he would have been prepared to let the decision stand if it would make one fewer drunkard in Oldham, but it would not have that effect. The Deputy Mayor said a wealthy Corporation like Oldham should not do anything to encourage the drinking habits of the people.

Siberia.—The old tramway system in the city of Vladivostock has now been converted to electric traction. It is described as being the first electric tramway in Siberia.

South Africa.—The *British and South African Export Gazette*, referring to the matter of railless traction, says that Bloemfontein has already adopted a comprehensive scheme covering 11½ miles of route; Boksburg has just awarded contracts for a similar undertaking; Germiston has decided to inaugurate a service over a 7½-mile route; Benoni ratepayers have just approved a comprehensive scheme already adopted by the Council; and Krugersdorp has a scheme under consideration. The Johannesburg Corporation, however, has decided to inaugurate a service of motor-omnibuses instead of a railless system.

York.—In connection with the Bishopthorpe Road tramway extension scheme, the City Council has deferred consideration of tenders for the electrification in order that the city electrical engineer might prepare a report upon the cost of his department undertaking the work.

TELEGRAPH and TELEPHONE NOTES.

Dundee.—The Corporation, along with other representative bodies, is making renewed efforts to persuade the Postmaster-General to extend the underground system of telegraphs from Edinburgh to Dundee and Aberdeen.

Hong Kong.—The *Indian and Eastern Engineer* says that for the proposed wireless telegraph installation a sum of $100,000 is set aside. This is to be a station for ship-to-shore communication, with a range of not less than 600 miles. The proposed Imperial station is quite distinct from this scheme.

Imperial Wireless System.—On Wednesday last week the Select Committee on the Marconi contract continued the inquiry, Capt. E. F. Charlton, Assistant Director of Torpedoes at the Admiralty, giving evidence. The witness said that apart from the Imperial system, the Admiralty stations that would be necessary would not be long-distance stations except in the case of the Mediterranean and home waters. He could not over-emphasise the absolute importance of wireless telegraphy to the Navy, especially to the ships. If the Admiralty had constructed the stations, their staff would have been depleted, and it was very difficult to obtain suitable men. Asked why the Admiralty stipulated that applicants should have a University degree, he stated that they wanted men who had had a good engineering training. Their staff of wireless experts was only sufficient for experimental and naval work. While they were talking and holding inquiries, other nations were getting on with the work. He maintained that the agreement was a good commercial agreement. Government messages would be entirely free. It was a deplorable thing that the agreement had not been ratified long ago. He had no financial interest whatever in the Marconi or any other company.

Mr. P. Minter, Assistant Director of Navy Contracts, said the great aim of the Admiralty had been to secure a modification of the restrictions of Clause 9 of the 1903 agreement. The Admiralty approved of the agreement in its final form. He was not certain that the Crown clause in the Patents Act would have given the Government the right to use the patents for public traffic. If the contract had gone to someone else, the Marconi Co. might have set up competing stations and so prejudiced the chances of commercial success. The Admiralty had obtained freedom to communicate with other departments subject to certain restrictions, due to distrust on the part of the company, lest the departments should use the information obtained from the Admiralty without paying for it. He would like to see the inspection clause altered.

On Thursday Mr. Minter's evidence was concluded. He thought the right to reject plant considered by the Postmaster-General to be unsuitable was a valuable one. There was nothing in the agreement which conferred a monopoly upon the company.

Capt. Fitzmaurice, the representative of the Admiralty on the Cable Landing Rights and the Imperial Wireless Telegraphy Committees, said he thought that cables would ultimately be superseded by wireless telegraphy. He preferred a State-owned system, and regretted that an Admiralty scheme which he laid before the Cable Landing Rights Committee had not been put forward. The matter was still extremely urgent. We had not lost strategically, because we had not had a war. The urgency was on strategic grounds, but it did not matter, strategically, whether the stations were operated by the Admiralty or by a company. He had no interest whatever in the Marconi or any other company.

Col. Macdonogh, of the General Staff, who represented the War Office on the Committees, expressed similar views; he said that sites had been considered, and the work could be begun almost immediately. The matter was even more urgent now than in 1910. After the decision in their favour in February, 1911, the Marconi Co. had asked the War Office for royalties amounting to £20,000 down and £5,000 a year. The War Office offered £180 per station, which the company refused, and the matter was referred to the Treasury. For strategical reasons the War Office preferred simplex working. They had decided to concentrate their defence on the transmitting station, of the two duplex stations. The agreement met their requirements, and should be carried out. They could not agree to the inspection of any military station. He had no financial interest in the Marconi Co.

Major R. H. Boys, of the Engineering Staff of the War Office, gave evidence as to the question of patent rights between the War Office and the Marconi Co.

On Monday last the examination of Mr. J. E. Taylor, one of the staff engineers of the Post Office, occupied the sitting. The witness stated that on November 8th he informed the engineer-in-chief to the Post Office that he purchased 30 £1 shares in the Marconi Co. on December 21st, 1911, not then having any connection with the Imperial scheme. Later he thought that, for the sake of appearances, it would be wiser to part with them, and on March 19th he sold the shares, as well as 100 shares of the Canadian Marconi Co., which he had purchased on February 1st. He still held 200 £1 shares in the latter company, with which the Government had no dealings. He was in no way influenced by his holding in the company, as might be gathered from the tenor of his reports. He made this statement in advance, in order that the Postmaster-General might not be prejudiced before the Select Committee by his action.

At an interview with the Postmaster-General, on November 26th, he explained that he bought the shares because he believed them to be a sound investment, having a considerable knowledge of the Marconi Co. The Postmaster-General pointed out that he, being in a responsible position in charge of the staff concerned with wireless telegraphy, ought not to have purchased the shares. In a further statement to the engineer-in-chief he said he was not aware of any precedent which should have deterred him, as a Post Office servant, from making investments in a company contracting with the Government.

A letter from the Postmaster-General, dated November 13th, was read, in which he expressed his "grave displeasure" with Mr. Taylor's transactions; on December 15th, 1911, Mr. Taylor was present at a meeting of the Committee which was advising in the negotiations, when the subject of the contract was fully discussed, and on December 21st he bought 30 shares. He sold them on March 19th, 1912, when the price had increased 50 per cent. The Postmaster-General could not regard Mr. Taylor's explanation as satisfactory; such action was contrary to the traditions of the Civil Service, and tended to impair public confidence in its integrity. Had Mr. Taylor used his position to support the claims of the company his retention in the public service would have been impossible; but he was satisfied that he had not at any time shown any disposition to favour the Marconi Co., and, in view of that fact, and his honourable and very efficient service of 24 years, the milder course of reducing him to the rank of assistant superintending engineer would be followed.

The witness stated that he did not buy the shares on the faith of the Government contract. He bought 200 Canadian Marconis on July 15th last, which he still held. After the tender was accepted, he thought he would probably be engaged in the supervision of the work, and that his name had better not appear on the list of shareholders. There was no rule in the Post Office that he knew of against such transactions, but he thought it was desirable that some such regulation should be made.

Regarding the relative merits of the Marconi and Poulsen systems.

he said the latter was less liable to atmospheric disturbances, and would probably be more easily worked at a higher speed than the former. Assuming that the Poulsen system was reliable and could be worked over 2,000 miles day and night, it would be considerably the cheaper both in first cost and running cost.

Improved Telegraphic Apparatus.—Mr. Herbert Samuel, the Postmaster-General, recently stated that his department was experimenting between London and Liverpool with new machines which would send telegrams both ways simultaneously at the rate of 150 words a minute and transmit 1,000 telegrams an hour. The Department was taking measures further to improve the telephonic communication, and early in the New Year four additional circuits would be brought into operation between London and Liverpool.

Mongolia and Thibet.—Arrangements are in hand for the establishment of a system of telegraphs in Mongolia and Thibet. As it is expected the work will occupy at least three years, it is proposed, in order to furnish prompt and reliable information on the development of current affairs in these countries, to install for present use wireless telegraph stations in Urga, Uliasutia, and Kobdo, in Mongolia, and in Chamdo, Batang, and Lhassa, in Thibet.

Portugal.—Marconi's Wireless Telegraph Co., Ltd., has received information from Lisbon to the effect that Parliament has ratified the contract entered into with the Government, amounting to 2,006,000 fr., for the erection of wireless stations at Lisbon, Oporto, Azores, Madeira and Cape Verde.

The Telephone Service.—Mr. Bridgeman recently asked the Postmaster-General if it could be arranged that at all post offices where telephones for service purposes were installed, those telephones should be made available for the use of the general public at the usual charge. Mr. Samuel replied that this was being done. Nearly 200 such call offices had been authorised in the provinces since January 1st.

CONTRACTS OPEN and CLOSED.

OPEN.

Abertillery.—December 16th. 100-KW. Diesel engine and dynamo, water-cooling apparatus, pipework, overhead crane and switchboard panels and connections, for the U.D.C. See "Official Notices" November 29th.

Australia.—VICTORIA.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" November 22nd.

January 10th, 1913.—Prahran and Malvern Tramways Trust (V.) invites tenders for trucks, wheels, axles, motor equipment and brakes. —*Australian Mining Standard.*

January 24th, 1913. Two 4,000-KW. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" November 22nd.

January 28th.—Thirty-three miles of paper-insulated lead-covered cable for P.M.G., Melbourne. High Commissioner's Office in London, 72, Victoria Street, S.W.

January 28th.—Paper-insulated lead-covered cable for the P.M.G.'s department. See "Official Notices" to-day.

SYDNEY.—January 20th. Storage batteries, motor-generators and switchgear. City Electrical Engineer, Town Hall.

January 8th and 22nd.—Fifty induction motors (Specification No. 386); two turbine-driven centrifugal pumps (Specification No. 390). Chief Commissioner, New South Wales Government Railways, Sydney.

TASMANIA (HOBART).—January 13th. P.M.G.'s department:—Paper-insulated lead-covered cables. See "Official Notices" December 6th.

QUEENSLAND.—January 29th. Detectors (Schedule 242), for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—February 21st. Four 1,500-KW. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

Balderton (Notts.).—December 14th. The Parish Council invites tenders for an electrical installation for street lighting. For further particulars see this column for November 22nd.

Barton-on-Humber.—Wiring for electric light at Bardney Hall. Particulars obtainable up to, and including, Friday, December 13th, from Mr. A. Stamp, architect and surveyor, Ferriby Road, Barton-on-Humber.

Belfast.—January 1st. The Harbour Commissioners are inviting tenders for a 120-ton electric derrick crane at Alexandra wharf. Specifications, &c., from Mr. W. R. Kelly, Harbour Engineer, Harbour Offices, Belfast.

Belgium.—March 1st, 1913. The municipal authorities of Molenbeek St. Jean, Brussels. Concession for the supply of electrical energy for public and private electric lighting and power purposes in the town. Tenders to La Maison Communale, whence particulars may be obtained.

Blackpool.—December 17th. The Tramways Department is inviting tenders for a motor tower wagon. Mr. Charles Furness, Tramways Manager, West Caroline Street.

Bournemouth.—December 20th. Tramway clothing and caps, for the T.C. Mr. I. Bulfin, General Manager, Tramway Offices, Lansdown Crescent.

Dewsbury.—December 17th. Two water-tube boilers, superheaters, mechanical stokers, &c., for the Corporation electricity works. See "Official Notices" November 29th.

Dundee.—December 20th. 5,000-KW. steam turbine and alternator, condensing plant, and one 500-KW. rotary converter with transformer, for the Corporation. See "Official Notices" December 6th.

Eastbourne.—December 16th. 99 long-burning flame arc lamps for street lighting, and sale of 99 open-type double-carbon lamps to be displaced, for the Corporation. See "Official Notices" November 22nd.

France.—January 15th. Concessions for six railway schemes in the Department of Calvados, France, are offered for public competition. The lines are to be of 1 metre gauge, and the service is to be either electric or steam. For further particulars see this column for November 29th.

The State Railways Department are inviting tenders for the supply of 197 passenger coaches of various types. Particulars from the Bureaux du Service du Matériel et de la Traction, 44, Rue de Rome, Paris.

December 23rd.—The French State Railway authorities (Bureau du Service Electrique), 43, Rue de Rome, Paris, are inviting tenders for two sets of transformers at the electricity generating station at the railway station at Le Mans.

RENNES.—January 2nd. Tenders will be received for the supply of two switchboards for the Rennes railway station. Particulars from Bureau du Service Electrique (1e division), 43, Rue de Rome, Paris.

Germany.—SLAWENTZITZ.—December 15th. Offers required for the supply and erection of lightning conductors on 34 rural public school buildings. Particulars (70 pfennigs) from, and tenders to, Der Schulverbandsvorsteher, Slawentzitz O.S., Germany.

Hebden Bridge.—December 31st. One 240-KW. Diesel engine and dynamo, for the U.D.C. See "Official Notices" to-day.

London.—FULHAM.—January 9th. Steam dynamo, switchboard and connections for the Workhouse, Fulham Palace Road, W., for the Guardians. See "Official Notices" December 6th.

Manchester.—December 24th. (*a*) Three motor-'bus engines and chassis; (*b*) one motor-car. Mr. J. M. McElroy, General Manager of the Corporation Tramways.

New Zealand.—January 6th, 1913. Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Ramsbottom.—The U.D.C. is inviting tenders for 3⅛ miles of overhead electrical work. Specification and forms of tender (£5 5s., returnable) from the Clerk, U.D.C.

Spain.—The municipal authorities of Villacanas (province of Toledo) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years.

South Africa.—December 31st. 107,580 yards of insulated wire, 6,336 yards of flexible wire, and 25 cwt. of bare copper wire, for delivery during February next. Tenders to Secretary to Tender Board, S.A. Railways Headquarter Offices, Johannesburg. Further particulars at the B. of T. Commercial Intelligence Department in London, and in the current *Board of Trade Journal.*

Switzerland.—BERNE.—The T.C. are about to spend 897,000 fr. on the purchase of additional rolling stock for the city tramways.

Warrington.—December 20th. Three motor-omnibuses for the Electricity and Tramways Committee. Tramways Manager, Car Sheds.

CLOSED.

Belgium.—Six German, two Belgian and one each French and British firms competed last week for two contracts for the supply of telegraph cable to the Belgian Telegraph Authorities. In one case the lowest offer was that of the Land und See Kabelwerke Gesellschaft, of Nippes, Cologne, and in the other the Rheydt Kabelwerke Gesellschaft, of Rheydt. Messrs. W. T. Henley's Telegraph Works, London, competed for both orders.

Bradford.—The Corporation has accepted the tender of Messrs. Ferranti, Ltd., for extra-high-tension switchgear for the 1,500-KW. rotary converter to be erected at Valley Road electricity works, at £166.

British Columbia.—The B.C. Electric Railway has ordered five electric locomotives from the Westinghouse Electric and Manufacturing Co.

Canterbury.—The T.C. has accepted the tender of Messrs. Chamberlain & Hookham for two battery meters.

Colchester.—The T.C. has accepted the tender of Messrs. H. G. Merry & Co. for 600 tons of Mansfield or Shirebrook nutty slack for the electricity works, at 13s. 10d. per ton, or, if the firm are unwilling to supply at that price, to accept the tender of Messrs. Cory & Sons, for Shirebrook nutty slack, at 15s. 2d. per ton

Dartford.—The U.D.C. has accepted the tender of the Western Electric Co., Ltd., for cables and boxes, at £372 ; and that of the Woodville Electric Co., for wiring work at the electricity Works, at £[illegible].

Doncaster.—In connection with the equipment for the Bentley tramways extension, the Tramways Committee has accepted the tender of the British Mannesmann Steel Tube Co. for light poles, at £5 11s. each, and for medium poles, at £7 11s. each.

Finchley.—Messrs. Francis Reade & Co. have received the order for the electric lighting work, bells and speaking tubes for block of flats and houses for the Brent Garden Village (Finchley), Ltd.

Glasgow.—The Works and Stores Committee of the T.C. has accepted the following offers —

Gas heating appliances for Partick Depôt.—Corporation Gas Department.
Chip dryers.—Municipal Appliances Co.
Lead-covered cables.—National Conduit and Cable Co., Ltd ; Western Electric Co., Ltd.
Nidged Setts.—M'Creath, Taylor & Co.

Gosport.—For installing electric light at the new Stone Lane Council Schools, the tender of Mr W. N. Walters, of High Street, Gosport, has been accepted.

Hull.—The City Council has accepted the tender of Mr. P. T. Kettlewell, of Trinity Street, Hull, at £5,095, for extensions and alterations at the power station.

Johannesburg.—The electrical equipment of the Johannesburg Town Hall is to cost £5,536, the local contractors being Messrs. W. Haine, Ltd.—*British and South African Export Gazette.*

London.—Woolwich.—The B.C. has accepted the tender of Messrs. F. Wells for 1,500 tons of coal for the Plumstead electricity works, at 13s. 11d. per ton.

Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained the contract for the supply of tantalum traction lamps for the Aberdeen Line of steamers for the year 1913.

L.C.C.—Messrs. Chamberlain & Hookham, Ltd., have received an order, *via* the British Westinghouse Co., for supplying car meters for the Woolwich section of the L.C.C. tramways. These meters are of a special design for working on the conduit system, so that the meter reads always forward on the counter, no matter in which direction the current passes through them.

The Highways Committee received the following tenders for two dynamometers for testing car motors at the central car repair depôt (third section) :—

Buck & Hickman, Ltd.	(recommended) £528
Heenan & Froude, Ltd.	568

With reference to the Council's recent decision to keep the contracts for tramway tires, &c., in the hands of British firms, it is stated that the Council on Tuesday, after all, had to place part of the contract with a German firm, as the great activity in the British steel trade made delivery impossible in less than six or nine months.

The Stores and Contracts Committee has recommended offers from the following for acceptance for 1913 :—

Electric insulating materials.—L. Andrew & Co. ; Wm. Geipel & Co. ; General Electric Co., Ltd. ; J. N. Hardy & Son ; J. G. Ingram & Son ; Micanite and Insulators Co., Ltd. ; Siemens Bros. & Co., Ltd.
Electric lamps.—A.E.G. Electric Co., Ltd. (carbon-filament lamps) (British) ; Brimsdown Lamp Works, Ltd. (metallic-filament lamps, with filament not of "drawn" wire) (British) ; Edison & Swan United Electric Light Co., Ltd. (metallic-filament lamps of "drawn" wire in one continuous length) (British).

Ramsgate.—The T.C. has acepted the tender of Messrs. Vitty & Hopper, of Ramsgate, for the installation of an electric fire call-bell system, at £106, with first year's maintenance, and £12 per annum maintenance, for seven years.

St. Helens.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for 1,000 yd. of trolley wire for an additional feeder on the pole line to the Sherdley district.

Sheffield.—The City Council has decided to extend the contract with Messrs. A. Reyrolle & Co., Ltd., for the supply of 14 panels of extra-high-tension three-phase sub-station switchgear, to provide for a further 14 panels at the same price, viz., £1,682. The tenders of Messrs. T. A. Ashton & Co., Ltd., have been accepted at £121, and £76 for carrying out wiring and fitting work at the Penistone Road depôt, and installing electric light and bells at the Corporation Street baths, respectively. For supplying two water-tube boilers, together with chain grate stokers, superheaters and all accessories, spares, &c., the tender of the Stirling Boiler Co., Ltd., has been accepted at £7,790.

Shipston-on-Stour.—The B. of G. has accepted the tender of Messrs. Brown & Parsons, Ltd., of Leamington, for wiring and fitting the Workhouse for electric light, at £58, and to supply current at 6½d. per unit, or, alternatively, at £35 per annum for five years.

South America.—The Hart Accumulator Co., Ltd., have secured the contract for the supply of storage battery of 222, 700 A.H. cells and automatic reversible booster, for the Talcahauno Electricity Works, South America.

Stockport.—The T.C. has accepted the tender of Messrs. Bayliss, Jones & Bayliss, Ltd., for tie-bars for the tramways, at 1s. 7½d. each, and bolts and nuts, at £9 10s. per ton.

Stoke-on-Trent.—The B.C. has accepted the tender of Mr. Leonard Vaughan, of Hanley, for wiring Longton Town Hall, and supplying fittings, at £498. Messrs. Newton Bros. of Longton, tendered at £520. The Council has also accepted the tender of Messrs. R. Baker & Co. for 10 tons of steel tramrails (18 lb. to the yd.), at £5 15s. per ton.

Stretford.—The T.C. has accepted the tender of Messrs. G. Brady & Co., at £80, for the supply of an electric service lift.

Sunderland.—The Town Council, on Wednesday, accepted the following tenders :—

Cable Accessories Co.—72 sets street lighting fittings.
Ferranti, Ltd., and Reason Manufacturing Co., Ltd.—Meters.
W. G. Farrow & Co.—Cast-iron frames and covers.
British Insulated and Helsby Cables, Ltd.—House service fuse boxes, switch pillar, cable, &c.
I R.G.P. Co.—Service cable.
Reyrolle & Co., Ltd.—Oil switch.
British Westinghouse Co.—Three-phase E.H.T. meters.

Swansea.—The T.C. has accepted the tender of Messrs. Wm. Griffiths & Co., for extending the tramways through Castle Street to Harbour Road, Oxford Street and St. Helen's Road, at £6,226.

Walsall.—The T.C. has accepted the following tenders for annual supplies of stores to the Tramways Department :—

Anti-Attrition Metal Co., Ltd., trolley wheels.
British Insulated and Helsby Cables, Ltd., mechanical ears, section insulators (air gap).
British Thomson-Houston Co., Ltd., controller fingers.
British Hele-Shaw Patent Clutch Co., Ltd., pinion wheels.
J. W. Caparn, malleable iron castings.
Edison & Swan United Electric Light Co., Ltd., "O.K." dry cells.
Electric and Ordnance Accessories Co., Ltd., arc lamp globes, "S.E." opal, and arc lamp carbons.
Fleming, Birkby & Goodall, Ltd., stranded wire.
Le Carbone, "S.S." carbon brushes.
National Rail and Tramway Appliances Co., Ltd., brake blocks.
Siemens Bros. & Co., Ltd., tantalum lamps.

Watford.—At the last U.D.C. meeting, a recommendation of the E.L. Committee, accepting the tenders of the British Westinghouse Co., Ltd., at £3,004, for a steam alternator and regulator, and the Electrical Construction Co., Ltd., at £103, for a generator, and additional feeding panels as required at the firm's schedule of prices, was adopted. In accepting these tenders the Committee protested against being compelled to adopt the general conditions of contract, as drawn up by the British Electrical and Allied Manufacturers' Association, such conditions, in the opinion of the electrical engineer, not being satisfactory from a practical engineering point of view.

West Ham.—The T.C. has decided to extend the contract for cable with the British Insulated and Helsby Cables, Ltd., for two years as from March 31st next, at the present basis charges.

York.—In connection with the Bishopthorpe Road tramway extension scheme, the City Council has accepted the tender of Mr. Wm. Dobson, of Edinburgh, amounting to £15,147, for the construction of the road track.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, December 13th. At 8 p.m. At the Holborn Restaurant. Smoking concert.

Institution of Electrical Engineers (Students' Section).—Saturday, December 14th. At 7, for 7.30 p.m. At the Trocadero Restaurant, Piccadilly Circus, W. Annual dinner.

Wednesday, December 18th. At 7.45 p.m. At the Institution, Embankment, W.C. Paper on "Sterilization by Electric Light," by Mr J. C. Rennie.

Junior Institution of Engineers.—Saturday, December 14th.—At 7 p.m. At Caxton Hall, Westminster, S.W. Reception, dance and whist drive

Friday, December 20th.—Paper on "Electric Power Plant Troubles and Breakdowns," by Mr. E. F. Hetherington.

North of England Institution of Mining and Mechanical Engineers.—Saturday, December 14th. At 2 p.m. At the Wood Memorial Hall, Newcastle. Discussion on papers on "The Ignition of Coal-Gas and Methane by Momentary Electric arcs," by Prof. W. M. Thornton, and "Electrically-Driven Winding Engines in South Africa," by Mr. A. W. Brown. Exhibition and description of the "Ceag," "Stach," and "Tudor" miners' electric safety lamps.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, December 16th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper, "Notes on Design and Running of the D.C. Sub-station," by Mr. H. D. Phelps.

Friday, December 20th.—At Tilley's Market Street Rooms, Newcastle. Annual Dinner.

Royal Society of Arts.—Monday, December 16th. At 8 p.m. Cantor Lecture on "Methods of Economising Heat," by Mr. C. R. Darling. Lecture III.

Institution of Sanitary Engineers.—Monday, December 16th. At 8 p.m. At Caxton Hall, Westminster. Sessional Meeting. Paper on "The Collection of Home and Trade Refuse," by Mr. J. O. Neumann. An electric furnace destructor wagon will be exhibited.

Institution of Electrical Engineers (Manchester Section).—Tuesday, December 17th. At 7.30 p.m. At the University, Manchester. Paper on "Electric Welding," by Mr. P. Bucher.

Institution of Electrical Engineers (Scottish Section).—Tuesday, December 17th. At 6.30 p.m. At the Grosvenor, Glasgow. Eleventh annual dinner.

Physical Society.—Tuesday, December 17th. At 3 and 7 p.m. At the Imperial College of Science, South Kensington, S.W. Annual Exhibition.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, December 18th. Meeting at the University, Birmingham.

Institution of Electrical Engineers (London).—Thursday, December 19th. At 8 p.m. Paper on "The Work of the International Electrotechnical Commission," by Dr. S. P. Thompson.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, December 21st. Meeting. At 4.30 p.m. At the Royal Technical College, Glasgow.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, December 16th. "A" Company. Company training, 7 to 10 p.m.

Tuesday, December 17th.—"B" Company. Recruit training, 7 to 10 p.m., company training, 7 to 10 p.m. Last recruiting night before the New Year.

Thursday, December 19th.—"C" Company. Company training, 7 to 10 p.m.

Friday, December 20th. "D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, December 21st.—Headquarters will be open from 10 a.m. till 12 noon for regimental business only.

Headquarters will be closed from December 21st, 1912, to January 5th, 1913 inclusive, except for business of an urgent nature.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

The I.M.E.A. Convention, 1913.—The eighteenth annual Convention of the I.M.E.A. will be held in London from June 17th to 20th, 1913. The Council of the Institution of Electrical Engineers has kindly placed the Institution premises at the disposal of the Association for its meetings during the Convention. The headquarters of the I.M.E.A. Council will be the Hotel Cecil. As the Convention is being held during the height of the London season, members and delegates are strongly advised to make early arrangements for booking hotel accommodation. A preliminary programme will be issued early in the new year.

Carnegie Awards.—The Carnegie Hero Fund Trustees have made awards of £10 each to John Thompson and Mrs. Ross, who rescued, or attempted to rescue, victims who received electric shocks at Dingwall in August last, as already recorded. An allowance is also being made to the youngest daughter of Mrs. Grant, who was one of those killed.

Under the Round Table.—

The "Electrician."	The Contemporary.
A contemporary complains that the programmes of the Electro-Harmonic Society are not classical enough, and remarks :—"To perform two complete instrumental programmes would be enough to clear the King's Hall." Comment is needless.	*In a programme of but* 11 *items, to perform two complete instrumental items would be enough to clear the King's Hall.*

Comment is, indeed, needless!

Electricity Supply Rifle League.—The following are the results of the matches shot during November in connection with the above League :—Stepney (Barber 99), 555, *v.* Ilford (Brown 94), 541 ; Stepney (Jager 95), 546, *v.* Central (Law 97), 548 ; Westminster (Horley, W. and H. Pearman 96), 563, *v.* Ilford (Brown 96), 548 ; Westminster (H. Pearman 99), 570, *v.* Shoreditch (Weakes, East & Renvoyze 96), 569.

	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster ...	8	8	0	0	16	4,541	4,395
Central ...	8	6	2	0	12	4,435	4,394
Shoreditch ...	9	5	4	0	10	5,043	4,972
Stepney ...	8	3	4	1	7	4,369	4,409
Ilford... ...	9	2	7	0	4	4,849	4,990
Hackney ...	10	1	8	1	3	5,426	5,503

Northampton Polytechnic Institute.—On Friday evening last the annual prize distribution took place at this Institute, in St. John Street, E.C. The awards were distributed by the Marquess of Northampton, after an appropriate address from Mr. Sebastian, the chairman of the Governors, and the reading of the annual report of the Principal (Dr. Mullineux Walmsley). A very attractive programme had been arranged, including organ recitals, lecturettes (kinematograph illustrations of twisting and breaking, by Mr. C. E. Larard, the head of the mechanical engineering department, and "Liquid Air," by Mr. W. M. Wilcox, lecturer in Applied Physics), visits to laboratories and workshops, and the usual gymnastic and swimming displays. In the course of his report, Dr. Walmsley said that the total number of students enrolled during the session was 2,012, as compared with 2,035 in the preceding session. The slight diminution was more than covered by a very special cause, namely, the diminution in the enrolments in the classes in telegraphy and telephony, owing to the state of unrest produced amongst the staffs of the telegraph department of the Post Office and of the National Telephone Co., owing to the absorption of the latter by the former. Apart from the disturbance naturally caused by such a large transaction and the additional work thrown upon numerous members of the staff, the position and prospects of a large section of employés were for a time somewhat uncertain, and in fact it might be said that things had not yet settled down to a condition of normal working, as shown by the fact that the classes in this particular department for the current session were smaller even than for the session under review. The day courses and classes have also been well maintained, especially in the engineering sections, in which, during the session, an exceptionally strong fourth year section was at work. For the eighth year in succession, the Principal was able to place without any payment of premiums the whole of the second and third year students in commercial workshops for the summer, and could have placed additional students had they been available. Still more important was the fact that the students who obtained the certificate for the four years' course in July had practically all obtained good starts in their engineering careers. A new departure in the day classes was the institution of morning classes in horology, following on an experimental and pioneer class of a similar kind, which was continued during the session in the electrochemistry department. The method of these classes is to take apprentices or boys of the apprentice grade for four hours every morning, on five days in the week, their afternoons being spent in the commercial workshops of their employers, for all the students were actually employed in commercial workshops. This meant a certain amount of sacrifice on the part of the employers, which not all were willing to make, but it was believed that the experience of those who had faced it showed that the arrangement could be made without serious detriment to the commercial work of the workshops. Dr. Walmsley felt that unless employers were prepared to make some sacrifices of this kind, the technical training of young apprentices in London could not be carried out under the best conditions, and it was hoped that in the future more employers would be disposed to make these sacrifices for the general advancement of the trades which were so important to them. As regards external examinations, five students of the engineering classes obtained the Degree of B.Sc. (Eng.) during the year, and three of these passed in Honours.

At the conclusion of Friday's proceedings, the Marquess of Northampton was presented with a specially bound copy of the syllabus by one of the students. The students' and members' conversazione was held on Saturday.

Strikes.—Liverpool.—A Liverpool newspaper states that the men employed in the electrical departments of the shore gangs of several of the leading steamship companies of Liverpool came out on strike on December 4th, for an increase of wages to 39s. 9d. per week, and shorter hours. "At present the wages range from 36s. to 37s 6d. per week. The companies affected are said to include the Cunard, White Star, Leyland, Pacific, &c. The notices expired yesterday."

The Clyde Electricians.—According to a Glasgow paper, the Clyde members of the Electrical Trades Union, who have been on strike since November 18th, decided last week by 219 to 149 to adopt the recommendation of their Executive Council in favour of resuming work in the shipyards. The men asked that the "majority" rate in the shipyards should be 9d. per hour, but the employers refused to make any advance on the current rate of 8½d. "In consequence of the strike of shipyard electricians, the Electrical Contractors' Association decided to lock out the members of the Union who were employed in the building trade in Glasgow. These men have also been idle during the past fortnight. Their position was considered at a meeting of the Strike Committee, and it was agreed to issue an instruction to the men not to return to work until they have received the sanction of the Union officials. Unlike the men who have been on strike, those locked out have been in receipt of Union benefits."

Institution and Lecture Notes.—The Royal Institution of Great Britain.—The following is a list of the arrangements for the Friday evening meetings before Easter, 1913 :—

January 17th, at 9 p.m.—Prof. Sir J. J. Thomson, "Further Applications of the Method of Positive Rays."
January 24th.—Prof. John Oliver Arnold, "Recent Advances in Scientific Steel Metallurgy."
February 14th.—Prof. Andrew Gray, "New Gyroscopes and their Applications."
February 28th.—Mr. C. T. R. Wilson, "Photography of the Paths of Particles Ejected from Atoms."
March 7th.—Prof. the Hon. R. J. Strutt, "Active Nitrogen."
March 14th.—Mr. A. E. H. Tutton, "Great Advance in Crystallography" (experimentally illustrated).

Other courses of lectures include the following :—

"Recent Research on the Gas Engine," by Prof. B. Hopkinson. Two lectures on Thursdays, January 30th, February 6th, at 3 o'clock.

"Surface Energy," by Mr. W. B. Hardy, Fellow and Tutor of Gonville and Caius College, Cambridge. Two lectures on Thursdays, March 6th, 13th, at 3 o'clock.

"The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. Six lectures on Saturdays, February 8th, 15th, 22nd, March 1st, 8th, 15th, at 3 o'clock.

Institute of Marine Engineers.—On December 2nd, Mr. A. E. Battle gave the concluding part of a lecture on "Wave Motion and Modern Developments in High-Frequency Electricity," illustrated with experiments.

Junior Institution of Engineers.—On Wednesday the Presidential Address was delivered by Sir A. Trevor Dawson, R.N., M.Inst.C.E., on "Staff Officers in Industrial Works: their Scientific and Practical Training and Duties."

"Modern Developments in Electricity" was the subject of a lecture under the auspices of Edinburgh Typographia, by Dr. George A. Carse, who submitted a number of interesting experiments.

Inquiries.—Correspondents ask for the makers of "lubricon" and "Wilkins" heating apparatus.

Institution of Electrical Engineers (Western Section).—The first ordinary meeting of the Section in Bristol was held on Monday last, when Mr. T. Schontheil read a paper on "The Use and Design of Overhead Lines for the Transmission of Electric Power." A discussion followed, which was adjourned. A stroboscopic demonstration of phase shifting was given in the Electrical Engineering Laboratory of the University after the meeting, and an informal dinner party followed.

Institution of Civil Engineers.—The highest marks in the October Associate Membership Examination have been obtained by Mr. C. Quartanos, of Newcastle-on-Tyne, and Mr. H. Knowler, of Sutton, Surrey. The Council has accordingly directed that Mr. Quartanos, who is ineligible for the Bayliss Prize, by reason of his not being a present or former student of the Institution, receive honourable mention, and that the prize, of the value of £15, be awarded to Mr. H. Knowler, Stud.Inst.C.E., under the conditions of its foundation.

Tramway Social.—The Dunfermline and District Tramway employés held their annual social and dance on Thursday last week, when Mr. J. H. Shepherd presided over a gathering of 80.

Appointments Vacant. — The Government of India invites applications for the post of assistant foreman electrical engineer, for the Gun and Shell Factory at Cossipore; a resident electrical engineer is required, for the Todmorden Corporation (£150); switchman, for the Corporation Electricity Works, Newport, Mon. (25s.); assistant electrician, for the Posts and Telegraphs Department of the Gold Coast Government (£250); draughtsman and design office assistant, for the City and Guilds Engineering College, Exhibition Road, S.W. (£200). See our advertisement pages to-day.

Annual Dinner.—On Wednesday last week the staff of the Cleckheaton electricity works held their first annual dinner. Mr. A. Pickersgill (chief engineer) occupied the chair, and some members of the Council were present. The Chairman of the Electricity Committee (Lieut.-Col. Atkinson) urged the employés to pull together and so make the electricity undertaking a great success. A smoking concert followed, at which songs were capably rendered by Messrs. Pickersgill, McDowell, Kershaw and Fawcett, whilst Mr. J. Beckett gave an interesting exhibition of card tricks.

Electricity Works in Austria.—The Elektrotechnischer Verein, of Vienna, has sent us particulars of a statistical directory of all the public electricity works in Austria, which number about 1,000, and supply energy to almost twice as many towns and villages. The book is issued under the title "Statistik der Elektrizitätswerke in Osterreich," and contains the name and address of the proprietor of each undertaking, makers of the plant, population of the places supplied, system of supply, pressure, &c., and a variety of data relating to the conduct of the business. Information is also given regarding the Austrian electric railways, the towns that possess a supply of electricity, &c. The work will be published in January next, and those who apply for it before December 31st can obtain it for 2s. 9d. The address of the society is Theobaldgasse 12, Vienna VI.

Municipal Tramways Association.—At its meeting on Wednesday, the Sunderland Town Council agreed to invite this Association to hold its next annual conference at Sunderland.

Electrical Treatment Claim.—At the Birmingham Assizes this week, an action has been heard in which O. F. Freeman claimed damages from Dr. F. Hall-Edwards and Dr. E. Jones, for personal injuries sustained through alleged negligent electrical treatment of the plaintiff for analgesia. On Wednesday, after a full hearing, a special jury returned a verdict for the defendants.

Lock-out in Germany.—45,000 metal-workers have been locked out by firms in the Menden district. According to the *Morning Post* there have been differences between employers and employés in the Rhineland and Westphalian metal trades for some time, consequent upon the men's demand for a 50-hour week. The masters are only willing to concede a 57-hour week.

Educational Notes.—We have received from the "University Engineering College" particulars of the correspondence courses in electrical engineering and allied subjects which have been organised by the promoters; the syllabus comprises nine courses, intended to supply the needs of students in the various branches, and a special feature of the course is the fact that it is not limited to a fixed number of lessons, but is continued until the student is proficient. A number of scholarships are offered to students who enter for any course before December 31st.

Electrical Imports and Exports in November.—The trade returns for November show large increases in value in both imports and exports and re-exports. The increases in these three classes are respectively 8·5 per cent., 5·7 per cent., and 22·9 per cent.

Imports of electrical goods and apparatus, other than machinery and telegraph and telephone wire, amounted to £143,983 during the month, a decrease of £8,973. For the 11 months they were £1,320,182—an increase of £23,334 over 1911.

Exports of ditto were £304,409 for the month, a decrease of £15,775; and for the 11 months £4,049,758, an increase of £1,442,706 over 1911.

Imports of machinery advanced by £87,275 for the month, and by £890,569 for the 11 months.

Exports of machinery advanced by £34,060 for the month, and by £2,091,938 for the 11 months.

The B.A. Meetings, 1913 and 1914.—The Executive Committee for next year's meeting of the B.A. meeting at Birmingham was held the other day. The meeting will open on September 10th, with the presidential address of Sir Wm. White.

The *Times* publishes in its issue of December 4th some particulars relating to the Australian meeting of the British Association the year after next. It is expected that some 150 representatives of the Association, including Dominion and foreign scientists, will take part in the visit. The party will arrive at Fremantle on August 4th; Adelaide, Melbourne, Sydney, and Brisbane visits follow, the return to London being completed by October 11th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Parliamentary Committee of the St. Helens T.C. has recommended that the salary of Mr. J. W. Warr, outside superintendent of the electricity department, be increased from £180 to £200 per annum as from April 1st, 1913.

The Burnley Electricity Committee has recommended that the salary of the electrical engineer, Mr. Starkie, be increased £100 a year.

Mr. Bendix has been appointed assistant station superintendent (electrical) under the West Ham Electricity Department at a salary of £200 per annum, and Mr. J. Allan, now mechanical superintendent, is to be station superintendent at a salary of £350 per annum.

Mr. Reginald W. Klitz, who has held the post of mains engineer at Wimbledon electricity works for the past nine years, has been appointed chief assistant electrical engineer with an increase in salary of £25 per annum as from the 1st inst.

General.—The Norwich Corporation electricity staff has presented a barometer to Mr. S. J. Cooper, superintendent of the lamp department, who is leaving to go into business for himself.

Mr. H. W. Butler, engineer, of Craven House, Kingsway, London, W.C., who was chairman of the Executive Committee of the Electrical Exhibition, Olympia, 1911, informs us that he has taken into partnership Mr. S. L. Bentley., M.S.I.E., Paris, representative for many years of the Electrical Power Storage Co. in the North, Scotland and Ireland. Among the sole agencies held by the firm may be mentioned those for Crocker-Wheeler Co., electric plant, Temco electric drills, and Durvite case hardening compounds. They will continue to trade as manufacturers' agents, under the style of H. W. Butler & Co., and will be pleased to hear from firms wishing to be represented in London.

Mr. Henry Talbot, who has been manager of the Todmorden gas and electricity works for the last seven years, has resigned to take up the position of manager of the Holyhead Corporation Gas Works.

The daily Press states that Mr. C. A. Park has resigned his position of managing director to the British Westinghouse Electrical Manufacturing Co.

Mr. E. H. W. Westwood, honorary secretary of the Victorian Institute of Electrical Engineers, is returning to Australia, per ss. *Morea*, from Marseilles on December 20th.

Obituary.—Prof. Andrew Jamieson.—With great regret we announce the death, after a severe illness, of Prof. Andrew Jamieson, M.Inst.C.E., at Glasgow, on the 4th inst. He was born at the Manse of Grange, Banffshire, in 1849, being the eldest son of Dr. George Jamieson, of the Cathedral, Old Aberdeen. After a lengthy apprenticeship at the Aberdeen Ironworks, during which he attended the Aberdeen University, he gained a Whitworth Exhibition and the Sir John Anderson special prize for Applied Mechanics. For a time he occupied a responsible position with the Great North of Scotland Railway; in 1872, he was chosen by Sir W. Thomson (Lord Kelvin) and Prof. Fleeming Jenkin as assistant in the testing and subsequent laying of cables on the coast of Brazil, and later he became chief electrician abroad, between England and India, to the Eastern Telegraph Co., under Sir John Pender and Sir James Anderson, in which capacity he carried out special work during the Russo-Turkish war of 1878, connecting up the positions where the British warships were stationed. In the course of his work he visited almost all the countries between England and India, as well as North and South America and the East and West African Coasts, his last expedition being to the Cape in 1899 to investigate and report upon alleged interference between stray currents from the tramways and the submarine cables.

In 1880 Mr. Jamieson was appointed Principal of the College of Science and Arts, Glasgow, which subsequently, in combination with Anderson's College, formed the nucleus of the Glasgow and West of Scotland Technical College: in this institution he was appointed Professor of Engineering and chief of the Electrical Engineering department, positions which he held until his retirement in 1899. Prof. Jamieson was a most popular and successful teacher, and over 6,000 students passed through his hands, many of whom have since attained to positions of distinction; he took a keen interest in his pupils and in the members of his staff, and his kindly disposition endeared him to all who were associated with him as students or otherwise. He was also the author of numerous text-books for the use of students, which ranked amongst the most lucid and efficient of their kind and of which over 150,000 copies were sold: the best known of his works amongst practical men is no doubt, the "Pocket-book of Electrical Rules and Tables," which has always maintained its position in the foremost rank, and has passed through 19 editions.

Prof. Jamieson acted as consulting engineer in connection with many electrical undertakings, and as arbitrator in engineering disputes; in recent years he established a system of teaching engineering by correspondence, which attained to a considerable measure of success. He contributed to the *Proceedings* of the technical societies, and was awarded a Telford premium by the Institution of Civil Engineers, as well as the Gold Medal of the Institute of Engineers and Shipbuilders in Scotland. He was married twice, and leaves a widow.

Mr. P. C. Roberts.—News received from South Africa brings the details of the death of Mr. Percy Claud Roberts, who had recently returned from a health trip. Mr. Roberts was stopping with some friends in Cape Town, and while showing them a Browning automatic pistol it accidentally exploded in his hands, and the bullet passed through his heart, killing him on the spot. Mr. Roberts was connected with several important works, and for the past four years had been chief electrician on the Giant Mine at Gadzoma. The climate of Rhodesia, however, wore him down, and in June last he was ordered by his medical adviser to take a trip to England. This he did, and had only been back in Cape Town a little more than a week when he met with the fatal accident, as described. He had resumed work in Cape Town the day before his death.

Mr. Wilhelm Scharina.—A Glasgow paper states that shortly after 11 a.m. on 7th inst. Mr. Wilhelm Scharina, of Messrs. Siemens Bros., Ltd., Glasgow, was found dead on the floor of a lavatory in the Central Railway Station, Glasgow. His son, by whom the body was identified, stated that Mr. Scharina had been affected with heart disease for ten years. He was 64 years of age, and resided at Mount Park, Gourock.

Mr. Robert Ingham.—The death took place on Thursday last week, at Devonshire Street, Skipton, of Mr. Robert Ingham, who had occupied the position of electrician at Belle Vue Mills, Skipton, for a period of 30 years.

Mr. T. Ramsay.—The death is announced, after a prolonged illness, of Mr. Thos. Ramsay, head of the firm of Ramsay Bros., electrical engineers, of the Phœnix Works, Albion Street, Whitehaven. Deceased, who was 68 years of age, established the business at the Phœnix Works with his brother, the late Mr. Wm. Ramsay, some 25 or 30 years ago, and since his brother's death, in 1901, he has been assisted by his sons, who will continue the business.

NEW COMPANIES REGISTERED.

Tramways, Light and Power, Ltd. (125,699).—Registered December 3rd, by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital £600,000 in 300,000 preference, 200,000 ordinary, and 100,000 deferred ordinary shares of £1 each. Objects: To take over the undertakings of the Nottinghamshire and Derbyshire Tramways Co., the Derbyshire and Nottinghamshire Electric Power Co., the Leamington and Warwick Electrical Co., Ltd., and the Leicestershire and Warwickshire Electric Power Co., and to carry on the business of contractors for the construction and equipment of tramways and railways, with electric or other mechanical power, owners of tramways, light railways, and electric lighting and other works, &c. The signatories (with one share each) are:—Geo. Balfour, M.I.E.E., 22A, College Hill, E.C.; A. H. Beatty, 22A, College Hill, E.C., company director; W. Shearer, Swanton, King's Avenue, Bromley, Kent, company secretary; W. J. Selley, 36, Holmwood Road, Seven Kings, clerk; E. L. C. Fedden, 57, Gloucester Terrace, Hyde Park, W., Reserve of Officers; H. L. Williams, Brierwood, Worcester Park, engineer; A. S. Valentine, 87, Inderwick Road, Stroud Green, N., engineer. Minimum cash subscription, 100,000 shares. The signatories are to appoint the first directors; qualification, £250; remuneration, £1,000 per annum, divided between them.

Robin Electric Lamp Co., Ltd. (125,723).—Registered December 4th by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital £75,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in incandescent electric lamps and gas mantles, burners and fittings for use in connection with electric light and gas, engineers, &c., and to adopt an agreement with R. F. Synd, Ltd. The signatories (with one share each) are:—A. J. Swan, 4, Sutherland Road, Chiswick, clerk; W. H. Walford, 239, Mortlake Road, Ilford, clerk. Private company. The first directors (to number not less than two or more than five) are to be appointed by the signatories. Remuneration as fixed by the company.

Birchington and Westgate Electric Light Co., Ltd. (125,675).—This company was registered on December 3rd, with a capital of £5,000 in £1 shares, to carry on the business indicated by the title, and to adopt agreements with Sir William J. Ingram, Bart., L. J. Simmons and F. J. Cornford. The subscribers are:—Sir William Ingram, Bart., The Bungalow, Westgate-on-Sea, 1,000 shares; F. J. Cornford, Town Hall Buildings, Westgate-on-Sea, architect, one share. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £50. Registered office, Town Hall Buildings, Westgate-on-Sea.

Ready Syndicate, Ltd. (125,671).—Registered December 3rd, by Courbold-Ellis & Mitchell, 14, Clements Lane, E.C. Capital, £10,000 in £10 shares. Objects, to carry on business as manufacturers of, and dealers in, electrical appliances or specialities, &c. Every subscriber for shares in the syndicate will be required, in respect of each such share, to underwrite or procure the underwriting at par of £85 shares of the proposed issue of £85,000 7 per cent. cumulative participating preference shares in a new company to be formed and called the British Ever-Ready Electrical Co. (1913), Ltd., or similar title. The signatories (with one share each) are:—L. R. Andrews, 53, Grandison Road, Clapham Common, S.W., clerk; G. T. Little, 7, Dorncliffe Road, Fulham, S.W., clerk. Private company. The first directors are not named.

Voight & Haeffner (England), Ltd. (125,729).—This company was registered on December 4th, with a capital of £10,000 in £5 shares, to acquire inventions in relation to improvements in apparatus for the control of electricity. The subscribers (with one share each) are:—A. Haeffner, Renterweg, 82, Frankfurt o/M., general director; G. Cooper, Hampton-in-Arden, electrical engineer; M. Mueller, Falkstrasse, 23, Frankfurt o/M., director; M. Vogelsang, Borkenheimer Landstrasse, 101, Frankfurt o/M., director. Private company. The number of directors is not to be less than three or more than five; the first are A. Haeffner, chairman, G. Cooper, M. Mueller and M. Vogelsang (all permanent). Registered office, 95, Colmore Row, Birmingham. Solicitors, Lane, Clutterbuck & Co., Minories Chambers, Birmingham.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

Mr. R. M. Horne-Payne (chairman) presided on Tuesday at the Great Eastern Hotel, E.C., over the meeting of the above company.

The Chairman, who, in consequence of illness was unable to address the shareholders, had prepared his remarks, which were read by Mr. Blundell Brown. He said the accounts recorded another satisfactory year. Their two hydro-electric installations which had been so long under construction, and had involved the expenditure of such large amounts of capital, were beginning to earn money. In February last the first unit at Jordan River was put into operation, and it had successfully delivered power into the city of Victoria ever since with satisfactory results to the earnings of the Victoria branch. The second unit was also completed successfully about a fortnight ago, and they had commenced the work of increasing the water storage capacity, in accordance with the original plans, so that they might be able to gradually increase the electrical development unit by unit to its ultimate capacity of about 45,000 H.P. Thus they were providing in advance for the increasing demand for power in Victoria and the surrounding districts, where it seemed probable that trade of all sorts, and their business, would increase rapidly. Their great hydro-electric development at Lake Coquitlam and Lake Bunzen was described at some length in the annual report. (See Electrical Review last week.) The completion of this mighty and costly enterprise was now well within sight, and it was safe to say that it would not only be one of the greatest developments in the world, but also one of the most satisfactory from the standpoint of producing cheap power and of requiring comparatively little expense for upkeep and maintenance. They would have been deriving some of the benefit of the increased storage during the past month but for the great delay in the manufacture of electrical machinery, owing to strikes in this country. The directors ordered this machinery so well in advance that it seemed impossible that it would not be ready and would not be delivered in time to assist in carrying the present winter load. In addition to these great engineering undertakings, the company had constructed new lines of railway in many directions, and had carried out improvements on its old lines, to meet demands of traffic, and it had greatly extended its light and power system. This work could not be described in detail, but it had involved large expenditure and a vast amount of thought and planning and work to the management and directors. There were two matters in connection with the company's affairs which had received a great deal of publicity in the Press, on which they would expect him to give some information. It had been stated that the company had entered into a contract for the purchase of power from the Western Canada Power Co. The facts were that the general manager of the Western Canada Power Co. approached the directors in an entirely businesslike and courteous way to ascertain whether the company would be prepared to purchase power from his company. The directors came to the conclusion that although the works at Lake Coquitlam would supply all the power they would need for several years to come, it would be wise to secure an alternative supply of power from the Western Canada Power Co., if it could be obtained cheaply enough. The subject was thoroughly discussed between the representatives of the two companies, but unfortunately the offer received from the Western Canada Power Co. was not acceptable to the company, and a counter-offer put forward by the directors had not been accepted by the Western Canada Power Co. That was all there was to say on the subject. With regard to the long negotiations which had been reported in the newspapers between the municipal authorities of Vancouver and the company, the facts were as follows:—The area covered by what was really one great city, and which might be called Greater Vancouver, was for administrative purposes divided into the three municipalities of Vancouver, Point Grey and South Vancouver. The City of Vancouver originally covered a comparatively small area, and had been extended in recent years to include the areas formerly known as Hastings Town and District Lot 301. The company owned franchises empowering it to carry on its electric lighting and electric power business throughout the whole of the above-named municipal areas, as well as in many other districts, for very long periods. The company also owned franchises authorising it to carry on its electric railway business for long periods of years throughout the whole of the above-mentioned areas and districts, with the exception of the old, not the extended, City of Vancouver, where their franchise might be terminated by purchase on fair terms in 1919. In particular they owned franchises in Point Grey and South Vancouver which had still 37 years to run before these municipalities had their first option to purchase. At the end of 37 years these options occurred at intervals of 10 years in South Vancouver and Point Grey, and in the case of old Vancouver at intervals of five years after 1919. These franchises constituted the guarantees on the strength of which they had invested their money, and the directors were satisfied that they sufficiently protected the future. They had not initiated any steps to get them changed, nor had they asked for further advantages. In the last few years a desire had sprung up in Vancouver and Point Grey and South Vancouver to consolidate the three into one great city, and it was thought by some people to be desirable to at the same time consolidate the railway franchises within the three municipalities, so that they might operate under the same conditions and charge the same fares throughout the new city. They were first approached by the City Council of Vancouver on this subject some three years ago, and had every desire to meet the wishes of the people fairly and even generously, but were compelled to break off the negotiations because they found that the opportunity was being taken to put forward a number of extravagant demands upon the company. They could not concede these demands, as, had they done so, they would have been unable to finance, and would actually have landed the company in bankruptcy, and they found that in refusing them they were making enemies who intentionally or unintentionally published statements which were utterly misleading—some of them grotesquely untrue—to the detriment of the business. On two subsequent occasions they had been approached by the city authorities and induced to reopen and to carry on exceedingly lengthy negotiations, but each time they had been compelled to withdraw for the same reasons, and at last they had to decline to again discuss the subject. A few weeks ago they received a written proposal from a Committee composed of representatives of the Councils of three Municipalities. The terms of this proposal being reasonable they accepted it, but were it not that they had desired to avoid the appearance of unreasonably standing in the way of the development of the city and the wishes of the citizens, he did not think that they would have accepted it. The terms included the consolidation of their franchises in these three municipalities into one franchise for a period of 25 years, and 5-cent fares throughout their area, an increase in the percentage on the railway earnings payable to the city, and the retention for five years of certain cheap tickets, a privilege which they had hitherto voluntarily conceded to the public, but which they had decided to withdraw in consequence of increasing expenses of every description in the Railway Department in Vancouver. This would have involved a considerable financial sacrifice to the company during the next seven years, and they would also have given up the last 12 years of their franchises in Point Grey and South Vancouver, and it was these last 12 years of the franchises which would be by far the most valuable years to them. On the other hand, they would probably have gained a further 18 years in the old city, which would have enabled them to better centralise on Vancouver their plans for the development of the surrounding districts, and they would have gained some other advantages. The Committee in due course reported to the Vancouver City Council, unanimously recommending their proposals, and requesting that they be laid before the ratepayers, but to their astonishment, and to that of everybody concerned, the Council did not approve of the arrangement, and summarily rejected a motion to instruct the city solicitors to prepare a by-law for submission to the people. This closed the matter. Their permanent stability as an enterprise was entirely unaffected by the failure of the negotiations. The position briefly was that the City of Vancouver could purchase in 1919 their lines within the original limits of the city (excluding their interurban lines), and no more. These lines comprised only a very small portion of their 280 miles of railway. In the districts recently annexed to the city their railway franchise covered a long period, and in South Vancouver and Point Grey their franchises had at least 37 years to run. Accordingly, if Vancouver exercised its option to purchase in 1919, people travelling between the outlying suburbs and the centre of the city must pay a double fare. He thought this was likely to be so objectionable to the people and so injurious to the business interests of Vancouver that the option to purchase in 1919 would not be exercised, and that they would continue to operate as at present throughout the city and surrounding areas for another 37 years, when South Vancouver and Point Grey would have their first option to purchase. Their lighting and power business was not touched in any way by these negotiations. In 14 years, they had grown from nothing to be the largest electrical enterprise in the British Empire, with probably one exception. They had expended $36,000,000 of cash up to the present. At a rough, but fairly reliable, estimate, the company had itself expended in wages since 1898 $14,430,000, not including contractors' wages. During the past year alone they had spent on capital and revenue accounts $12,564,717, of which $674,638 represented salaries of the local officials and staff and $3,676,720 the wages of other employés, leaving $8,213,359, a large proportion of which represented wages paid by contractors working for the company. The total number of employés on the company's pay-roll at June 30th, 1912, was 5,660, and the estimated number of employés paid through contractors was 2,500, making a total of 8,160 employés in the service. Assuming an average number of persons dependent on each wage-earner as 2, they had a total number of persons maintained by the British Columbia Electric Railway Co. directly, and through its contractors of 24,480, or 11 per cent. of the total population served by the company. At the end of 1898 they had 40 miles of track; to-day they had over 280. In 1898 they had 2,000 H.P. available; to-day they had 128,000 H.P. In 1898 they were operating 14 passenger cars; in 1908 they had 71; in 1909, 97; in 1910, 128; in 1911, 240; and to-day they owned or had under contract for prompt delivery 359 passenger cars. They had kept well ahead of developments by building lines into territories practically unsettled when they first went there, with the object of building up these districts, and they were giving a splendid service on several lines which did not even pay operating expenses. At the present moment they had extensive development plans mapped out which would benefit all concerned, and he would appeal to the common sense of British Columbians in their own interests to assist them in every possible way in their power, and to vigorously put down all such unreasoning opposition to their plans as was recently raised in connection with the Port Grey Franchise. With regard to the profits which they had made there was no secret. He had taken out the amount of cash invested in their enterprise in each year since 1898, and the amount paid out in dividends and interest. He found that only in one year, namely, 1902, had they paid more than 5 per cent. on the capital actually employed. At the end of the past year the amount of capital involved was $34,976,990, and the amount paid out, including the dividend which they were asked to declare that day, would be $1,457,190, or, say, 4½ per cent. on the actual cash invested. Their enterprise had been carefully and patiently built up in a conservative and thoroughly sound way; their investment was, in the opinion of the directors, an absolutely safe one, and that they believed the success of the company was absolutely assured for many years to come.

Mr. Capel Cure asked whether if the municipality did not exercise its right in 1919, their franchise would continue for 37 years, or would it have to be renewed from time to time. And further, what had happened with regard to the threatened competition they heard about last year?

Mr. Brown said their city franchise terminated in 1919, and after that in five yearly periods. With regard to the competition, they had experienced that for the past six months, and it had not shown any serious effect.

Mr. Davidson expressed the hope that the proportion of working expenses would be reduced when they got the great hydro-electric plant developed.

Mr. Brown said, of course they hoped it would be profitable, but whether the ratio of expenses would be decreased for some years they could not say, as in a new country the development was so large. All the time they were working with this object in view.

Mr. C. W. Butler, speaking from experience, drew a very rosy picture of the future of British Columbia.

On the motion of Mr. Morton, seconded by Mr. J. Buntzen, the report was adopted, and a further motion was agreed to for the payment of dividends at the rate of 6 per cent. on the preferred ordinary stock, and 8 per cent. on the deferred ordinary stock.

Mr. Harold Brown proposed that the best thanks of the meeting be given to the chief manager and officers and staff in British Columbia for their loyal and successful efforts on the company's behalf.

Mr. T. Blundell Brown seconded the motion, and it was carried.

An extraordinary meeting was afterwards held, when a resolution was carried increasing the capital of the company to £4,600,000 by the creation of new shares of £1 each. Resolutions were also carried for the alteration of the articles of association, the object being to put beyond all possible question the right of the directors to make in the future, as in the past, simultaneous issues of preference, preferred and deferred ordinary shares.

Stock Exchange Notices.—The Committee have (1) appointed special settling days as under:—

Wednesday, December 18th.—Bonecourt Surface Combustion, Ltd.—33,642 shares of £1 each, 10s. paid (Nos. 1 to 33,642).

Thursday, December 19th.—Consolidated Cities Light, Power and Traction Co.—Fully-paid scrip for $4,000,000 first lien 5 per cent. gold bonds.

And (2) ordered the undermentioned securities to be quoted in the Official List:—

Consolidated Cities Light, Power and Traction Co.—Fully-paid scrip for $4,000,000 first lien 5 per cent. gold bonds.

Portland Railway, Light and Power Co.—$16,000,000 5 per cent. first and refunding mortgage 30-year sinking fund gold bonds (Series "A") (Nos. M1 to 15,400 of $1,000, D1 to 800 of $500, A to J1 to 200 of $100 each).

Underground Electric Railways Co. of London, Ltd.—Further issue of 12,000 shares of £10 each, fully paid (Nos. 47,693 to 50,692, 469,201 to 474,200, and 480,201 to 484,200); 14,568 "A" ordinary shares of 1s. each, fully paid (Nos. 1,135,910 to 1,150,477); and £80,298 6 per cent. first cumulative income debenture stock and £15,300 6 per cent. income bonds (Nos. 59,028 to 59,180 of £100 each).

North Berwick and District Electric Light and Power Co., Ltd.—At the first annual meeting, Prof. Schäfer, chairman, who presided, said that the shares allotted numbered 4,850. The contract for the erection of the power station had been given to Messrs. John Wilson & Sons, of North Berwick, and it was expected that the works would be completed within three months, and that by the spring a supply would be available for consumers.

British Electric Traction Co., Ltd.—The directors have declared the dividend for the half-year to September 30th on the 6 per cent. cumulative preference stock.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—A dividend of 1¼ per cent. on the common shares (5 per cent. per annum) has been declared for the quarter ending December 31st.

Manila Electric Railroad and Lighting Corporation.—A dividend of $1½ per cent. for the quarter ending December 31st, on the capital stock is declared, also an extra dividend of $1 per cent., making a total of $2½ per cent. per share.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended September 30th, of 2s. 6d. per share.

Winnipeg Electric Railway Co.—The directors have declared a quarterly dividend on the capital stock, exclusive of the recent issue of new shares, at the rate of 12 per cent. per annum.

Continental.—France.—The report of the Societé d'Electro-Metallurgie de Dives for the last financial year shows a profit of £29,895. A dividend of 5 per cent. is being declared.

Western Telegraph Co., Ltd. — The directors have declared the first quarterly interim dividend of 3s. per share for the year ending June 30th, 1913, being at the rate of 6 per cent. per annum. The transfer books will be closed from December 14th to 20th.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The directors' report for the year ending September 30th, 1912, to be presented at the meeting on Tuesday, December 17th, 1912, at 12 o'clock noon, states that the accounts show, after provision for doubtful debts, a net profit of £51,247. Adding £4,657 brought forward and deducting £9,375, the dividend on the preference shares paid in January and July, and £3,125, the preference dividend accrued to September 30th, there remains a disposable balance of £43,404, which, after providing for the proposed dividend on the ordinary shares, will leave £5,904 to carry forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders, and that a dividend of 15s. per share, or at the rate of 7½ per cent. per annum, be paid to the holders of ordinary shares; both these dividends to be payable on January 1st prox. The general business of the company has been fully maintained. The price of its principal raw material had considerable and irregular fluctuations during the year, making the future position very uncertain, and there was a material decline towards the close. In March a general coal strike occurred, and July brought a London dock strike, which interfered both with the free delivery of the raw material which the company was receiving and the dispatch of its manufactured goods. The trading of the French factory and some of the foreign agencies has not been satisfactory, while other foreign agencies have produced quite gratifying results. The volume of the submarine cable work has increased, and the steamers, *Dacia* and *Buccaneer* have had employment. The *Silvertown* has just completed the laying of a submarine cable between Australia and New Zealand, and will probably leave for home towards the end of this month, when the contract period of guarantee should terminate. Profits in this branch of the business are somewhat severely limited by competition. The works at Silvertown and Persan have been maintained in the usual state of efficiency. The directors regret to record the death of Mr. B. Bishop and Mr. D. McNaught, the former having served the company since its inception and the latter for a period of about 25 years. Mr. J. Y. Buchanan resigned from the board at the beginning of the year.

Adelaide Electric Supply Co., Ltd.

The eighth annual general meeting was held on Tuesday at the offices, Finsbury Pavement House, Moorgate Street, E.C., Mr. J. B. Braithwaite presiding.

The Chairman said that they again had a satisfactory report. During the year they had expended £102,646 on capital account, bringing up the total cost of the undertaking to £485,619. That capital had been provided by the issue of the remaining £50,000 5 per cent. debenture stock, which was sold in the market on terms which gave them a profit of £1,454; and by the issue of a further amount of ordinary capital. The shares were offered at £8 each to the existing shareholders, and realised a profit of £29,595. They recommended that the whole of that £31,049 should be put to general reserve and that £3,720 be written off from certain special items in the capital account on the recommendation of the chief engineer. The auditors called attention to the fact that no provision had been made for depreciation. That, as he had told them on previous occasions, was a policy which the board felt bound to adopt, and instead of calling it depreciation, they were building up a general reserve which, with the sum to be added this year, would stand at the substantial figure of £37,329. The investments at cost, made on account of the dividend equalisation account, stood substantially at the prices at which they were purchased, and the account stood untouched at the figure of £25,000, as last year. Turning to the profit and loss account, owing to their losing the tramway load, which, in the previous year, produced a revenue of £30,841, they were very doubtful how the year would work out. They knew that their own business was rapidly increasing, but they felt that it would take them a year or two to make up for the tramway load. He was glad to say they had been agreeably surprised at the rapidity with which their own business had extended, and the result was that they had no need to trench upon the dividend equalisation account in order to maintain the same dividend as last year. The private supply had amounted to £48,647, as against £36,476, an increase of £12,171. The supply for power had amounted to £17,315, as compared with £14,140, an increase of £3,175, and other items in the revenue account, gave them a total of £73,154, against £86,347 in the previous year, an increase—excluding the tramway revenue—on their own business of £17,648, which he was sure they would all consider a most gratifying result. The generation of electricity had cost £18,253, against £25,791, a decrease of £7,538. They had an increase in general charges in Australia to meet of £1,885, and they had had to pay £6,875 interest on their debenture stock, against £1,250. The net result was that they carried forward to the balance-sheet £13,361 less than last year. That, however, still left them an amount which enabled them to pay 10 per cent. dividend on the ordinary shares, and a 2 per cent. bonus, and to carry forward a sum of slightly over £5,000. The increase in the business was shown at every point. The units sold had increased by 1,125,868, the increase being divided fairly evenly between light and power; the lighting increase was 30 per cent., and the power increase 38 per cent. They had had the advantage during the year of a visit from Mr. Wheadon, their chief engineer, and had had an opportunity of conferring with him in detail about the position in Adelaide, and they had also had Mr. J. K. Samuel, one of their local directors, over. They had adopted the policy of giving their consumers the full benefit of the metallic-filament lamp, which was equivalent to reducing the price of current 66 per cent., and he was glad to say that the policy had been crowned with success. He thought that the following figures as to the progress of the undertaking were really remarkable. The area of their district was now 155 sq. miles; an increase of 49 per cent. over last year. The population of the area that they supplied was 198,000, showing an increase of 10 per cent. The miles of street in their supply area was 245; an increase of 41 per cent. The capacity of their plant was now 3,500 kw., showing an increase of 23 per cent. The maximum load during the year showed a decrease owing to the loss of the tramway load; during the year they had connected to their mains no fewer than 3,058 new connections, a record which, he thought, it would be hard to beat even in any English supply company—an increase of 90 per cent., and the total number of consumers connected at the end of the year was 7,868, showing an increase of 63 per cent. He was glad to say that the development was continuing up to the present, according to the latest returns they had received from Australia.

Mr. Arthur F. Parish seconded the motion, and the report was adopted.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

The meeting of this company was held on Thursday last week at Winchester House, E.C., Mr. A. R. Monks, the chairman, presiding.

The Chairman, before moving the adoption of the report (see Electrical Review, page 924), explained that he was occupying the chair because he had been elected by his colleagues on the resignation of Lord Arthur Butler, who, having been chairman of the company since its inception, felt that the time had come when he should be relieved of some of the more arduous duties appertaining to the chairmanship. He (Mr. Monks) and the other directors pointed out to Lord Arthur that he had piloted the company into a more successful position than it had occupied for some years, and that it was a pity he should retire now, but his lordship replied that that was exactly the reason he had taken the step. Coming to the accounts the capital and the loans remained the same; but the creditors had increased by £4,610; which was attributable to further expenditure on plant and mains. During the year they had paid off one creditor's balance of £1,000. On the other side of the balance-sheet it would be noticed that they had expended four sums aggregating £9,440 as follows:—additional machinery, £1,881; new sub-station at Broadstairs, £4,177; electric lighting installations, £3,303, and a small sum of £137 on street lighting. On the revenue side there was a decreased profit of £2,116. The decrease in the receipts from traction amounted to £2,683, but there was an increase in lighting of £1,684, and the expenditure had increased by £1,181. The decrease in the tramway receipts arose from the disastrous summer weather. As they were aware the undertaking was a fair weather line, and he did not suppose a more unfortunate state of affairs was possible than that which they had to contend with during the summer. Their season was mostly in August and September, and it rained every day in the first month and nearly every day for the first two or three weeks in the latter, and when the weather took a change for the better it was too late for them to reap the advantage, as the visitors had gone home. The lighting receipts, he was glad to say, showed an improvement of some 24 per cent. over those of the previous year. The extra expenditure was practically all due to the increased cost of coal and coke—coal having increased 4s. 3d. a ton and coke 3s. 8d. The strike also affected them somewhat, as they were forced to use the best coal instead of coke, but they kept up their service and gave an unlimited supply of light. As to the future, in the coming year they would have to spend considerable sums on further plant. They had contracted for a new Diesel engine which they expected to be delivered about next June, and with an additional expenditure of some £7,000 or £8,000 he hoped they would be able to meet all the demands upon them for lighting, and that they would be free from any further material capital expenditure in the future. Of course there would always be expenditure for mains, and fortunately that was so, because it was to their lighting business that they would have to look for dividends. He would liked to have met the shareholders with an increase in the dividend this year, but in view of the finances, and seeing the importance of progressing with the lighting part of the undertaking, that was not possible.

Mr. W. M. Murphy seconded the resolution.

The Chairman, in reply to questions, said he did not think the board had put too much towards the maintenance of the permanent way. That was one of the most serious problems they had to face, especially as the company got older, and they must remember that in the early days they were not able to do what they ought to have done in that regard. They certainly hoped for great economies in working when they got the Diesel engine in operation.

The report was adopted.

Melbourne Electric Supply Co., Ltd.—The directors have declared a final dividend of 5 per cent., making 7½ per cent. for the year, together with a bonus of 1 per cent., both free of income-tax, on the consolidated ordinary stock, in respect of the year ended August 31st.

Shawinigan Water and Power Co.—A dividend of 1½ per cent. on the common shares (6 per cent. per annum) is declared for the quarter ending December 31st.

Metropolitan Electric Tramways, Ltd.

Mr. Emile Garcke presided on December 4th at the Holborn Restaurant over an informal meeting of the shareholders of the Metropolitan Electric Tramways, Ltd., called to hear an explanation of the proposals recently made by the London and Suburban Traction Co.

The Chairman said that the proposal which they had received to exchange their preference, ordinary and deferred shares into debenture stook and shares of the London and Suburban Traction Co., was an offer which was made by the new company to each individual shareholder in their company, and it was open to the shareholder to accept or decline it, as he thought fit. The formation of the Tramways (M.E.T.) Omnibus Co. led to negotiations with the Underground Railways Co. of London, who controlled the L.G.O.C. and held the majority of the ordinary shares in the London United Tramways. These negotiations had resulted in the present proposals. The three companies in which they were interested, namely, the Metropolitan Electric Tramways, Ltd., the Tramways (M.E.T.) Omnibus Co., and the North Metropolitan Electric Power Supply Co., would each continue to have a separate existence as before, but the London and Suburban Traction Co. would, if the scheme became operative, be the holders of preference shares and ordinary shares in the Metropolitan Electric Tramways and the whole of the ordinary shares in the Tramways (M.E.T.) Omnibus Co., and the shareholders would become shareholders in the London and Suburban Traction Co. But the debentures of the Metropolitan Electric Tramways Co. were not interfered with by the scheme, and for the present the debentures issued by the M.E.T. Omnibus Co. would remain unaffected. Further, no change whatever would take place in regard to the North Metropolitan Electric Power Supply Co. If the scheme became operative, the capital of the London and Suburban Traction Co., Ltd., would consist of £550,000 4½ per cent. first mortgage debenture stock, £1,500,000 5 per cent. cumulative preference shares of £1 each, and £1,750,000 ordinary shares of £1 each, the preference shares having priority as to capital over the ordinary shares. If he assumed for a moment that all the shareholders in the Metropolitan and London United Companies accepted their offer of exchange, the capital of the new company which would have to be issued in exchange for the shares in the two tramway companies would be: £200,000 in 4½ per cent. first debenture stock; £1,449,336 in 5 per cent. preference shares; and £1,749,336 in ordinary shares. They would observe, therefore, that whereas practically the whole of the preference and ordinary share capital would have to be utilised for the scheme, there would be a balance of £350,000 debenture stock available for purposes other than the exchange. It was intended that this £350 000 debenture stock should be issued to the public and the proceeds of the issue applied to paying the expenses of, and incidental to, the formation of the new company and the carrying out of the scheme, the purchase of the share capital of the Tramways (M.E.T.) Omnibus Co., Ltd., and providing the last mentioned company with funds required for completing its fleet of 350 omnibuses, and building and equipping the necessary garages. The preference shares which they now held in the Metropolitan Tramways Co. were £1 each, and were entitled to a 5 per cent. cumulative preferential dividend and to priority of capital over the ordinary shares. The holders of these shares were invited to exchange them for debenture stock and preference shares in the new company, receiving 40 per cent., or 8s. per share, in 4½ per cent. debenture stock and 70 per cent., or 14s. per £1 share in 5 per cent. preference shares. They would therefore receive 22s. of new capital in exchange for 20s. of present capital and their revenue would also increase. In future they would receive £5 6s. per cent. per annum instead of £5 per cent. as at present. With regard to the ordinary shares of the Metropolitan Tramways Co., which were £1 each, and which received a dividend last year of 6 per cent.—the holders of these shares were invited to exchange them for £1 of 5 per cent. preference shares and £1 of ordinary shares of the new company. They would therefore receive a bonus in new capital of 100 per cent., or, in other words, double their present holding. On one-half of this new capital they would receive a fixed cumulative preferential dividend of 5 per cent. On the other half, or the bonus capital, they would receive such dividend as might be distributed on the ordinary shares of the new company. With regard to the deferred shares, the offer to the holders of these shares was on the basis on which they had been placed by the recent resolutions passed by the company, authorising the conversion of the deferred shares into ordinary shares in the proportion of four deferred shares to one ordinary share; *i.e.*, under the present scheme the deferred shares would receive as to one-fourth, exactly the same terms as were offered to the ordinary shareholders. The proposal to convert the deferred shares into ordinary shares was still awaiting the approval of the Court; but the holders of the deferred shares who accepted the offer of the London and Suburban Traction Co. would at once place themselves in the position which they would occupy if the approval of the Court had already been obtained. The chairman next referred to the terms offered by the new company to the London United Tramways Co. in so far as they affected the position of the shareholders in the Metropolitan Co. It might be asked how was it that the position of each party to the bargain could be improved without either making a sacrifice to the other. The answer was that this double advantage would be secured by the consolidation of interests which the scheme proposed to establish. In the first place, they hoped to be able to effect considerable economies by joint management, through bookings, and generally by establishing a community of interests, with results which it might be difficult to express in figures at this stage, but which they with their knowledge of the business felt confident could be brought about. But more important still would be the profits which the new company would earn from the operation of 350 motor-omnibuses to be provided by the Tramways (M.E.T.) Omnibus Co. It might be said that these omnibus profits belong to the Metropolitan Co., and that by allowing them to come into the joint account, the London United Tramways shareholders would be participating in profits which at present belonged exclusively to the Metropolitan Co. This was perfectly true in a way, but shareholders in the Metropolitan Co., must understand that if the scheme did not go through, they would not be able to run 350 omnibuses in the metropolis without exposing them to severe competition, and that the omnibuses in that event would not then earn what they would earn when under the control of the new company. Moreover, competition of motor-omnibuses with their tramways would be still further increased, and altogether the shareholders in this company would not be in as good a position as they believed they would be if they made the exchange and the scheme became operative. He laid particular stress upon this point, because the experience they had already had of the competition compelled him to tell them that the prospect of a bitter warfare between powerful rival interests was certain to involve both companies in heavy loss, without advantage to the public or anyone else. He was sorry to say that the profits of the Metropoliton Co. during the present year had already been materially reduced by omnibus competition, and if it were not for the steady improvement in their electric power business, he would have to prepare them for a serious reduction of dividend. As it was, some reduction of the ordinary dividend was inevitable, but those shareholders who accepted the exchange of shares would be more than compensated for this in future years by the bonus of capital they received from the new company. Continuing, the chairman pointed out that the traffic problem and the competition which the company had to face were peculiar to London, inasmuch as the tramway did not cross the central parts of the Metropolis, and hence the omnibuses had exceptional advantages. They had good grounds for believing that provincial tramway undertakings were not exposed to the same competition from motor-'buses. It was sometimes thought by those who were solicitous for the interests of the public, that combinations of the kind proposed, meant increased profits to the capitalists at the expense of the travelling public, but in this case one could say with confidence that the result of combination and co-ordination of travelling facilities would be to produce greater benefits for both the travelling public and the shareholders. Coming to the question of what were the prospects of the new company earning sufficient profits to pay fair dividends on its capital, he said, in the first place, they must realise that there was no watering of capital in the scheme. Although the Metropolitan Tramway preference and ordinary shareholders received a bonus in new capital, the capital of the new company would not be greater than the combined present capital of the companies. This result arose from the fact that while the Metropolitan Co. shareholders received more than par, the London United Tramways shareholders received less than par. The maximum subscribed share and debenture capital of the new company to be issued under the scheme of exchange would be £3,398,672, as against the present issued capital of the two tramway companies who were parties to the arrangement, of £3,459,848. The profits of the new company would be derived from the dividends which it received on the shares it held in the Metropolitan and London United Tramways Companies, and also in respect of the whole of the ordinary shares in the (M E.T.) Omnibus Co. Of course, it was difficult to gave an exact figure, because they did not know what proportion of the present capital would be exchanged, but there could be no doubt whatever that shareholders who did exchange would receive a larger share of the profits than the shareholders who stood out, because if the scheme became operative, the new company, by reason of holding the whole of the shares in the (M E.T.) Omnibus Co., would receive the whole of the net profits on the working of the 350 omnibuses, while the shareholders in the M.E.T. Co. who did not exchange would, unfortunately, but unavoidably, suffer a diminution of profits by reason of some motor-omnibus competition — for, however much the tramways and omnibus interests might work together, the tramways would certainly have to give up some of the traffic to the omnibuses. Assuming, for the purpose of an estimate, that the whole of the shareholders in the Metropolitan Co. and in the London United Tramways Co. exchanged their shares for shares in the new company, then the new company would receive the whole of the tramway profits of those companies, after paying interest on the existing debentures, and in addition to these profits the new company would have the profits from the working of 350 omnibuses. Of course, it would be some time before this number of omnibuses were in operation. They were being delivered now in batches, but it must take nearly 12 months before the full number could be placed in public service, and by that time the conditions might not be the same as at present. It would therefore be unadvisable, or rather impossible, for him at this juncture to make any definite estimate of the dividend which would be paid on the new ordinary shares. They had taken every possible precaution to protect the shareholders' interests, and the arrangement they had made with the L.G O. Co. was that the new company should receive the average receipts per omnibus of the L.G.O. Co.'s fleet in the metropolitan area, and there were other respects in which the terms were advantageous to them as shareholders. The directors therefore had no doubt whatever that the holders of the preference shares in the Metropolitan Tramways Co. who made the exchange would receive their £5 6s. per cent. in future, which was more than they were receiving at present, and that the holders of the Metropolitan ordinary shares who made the exchange would receive 5 per cent. on one-half of their new shares, and also a fair dividend on the other half, or bonus portion of their new capital, but what the dividends on this bonus capital would be it was not easy to say with any certainty at the present moment. Another advantage of making the exchange was that, inasmuch as the new capital would be a combination of the capital of two separate companies, there would be a better market for the new shares. On the whole, the scheme had been well received, and the number of assents which had already come in was considerable; but he feared that some of the shareholders had not fully understood the scheme. Mr. Devonshire, their managing director, was managing director of the new company, which included the L.U T. He had also joined the board of the new company to represent their interest, and the Tramways (M.E.T.) Omnibus Co. had appointed another director (Mr. Soames). The L.U.T. Co. was represented by Mr. Acworth, the chairman of that company, and by Mr. Stanley, who was managing director of the Underground Railways Co. of London and of the L.G.O. Co. Mr. Barber, their secretary, was secretary also of the new company, and the whole organisation of the new company was designed with a view to securing unity of interests between the various tramway and omnibus undertakings, which at present provided so great a part of the traffic facilities of the metropolis.

Mr. Ennis asked if the burden of the arrears on the London United Tramways 5 per cent. cumulative preference shares would be a burden on the new company, and what proportion of shareholders had already expressed their approval of the scheme.

The Chairman said the arrears of interest on the London United shares would not be the concern of the new company, and would have to be dealt with by the London United Co. in their own way. Assents were coming in continuously, and he had not exact figures before him. In the case of the M.E.T. ordinary shares, they had already a very large majority, and the same remark applied to the deferred shares, and also to the ordinary and preference shares of the London United Co. With regard to the Metropolitan Electric Traction preference, they had a large holding, but not the necessary proportion at present.

Mr. Baldwin contended that they were parting with a very valuable and improving asset in the North Metropolitan Electric Power Co. The preference shareholders felt that the new security offered to them in exchange for their present holdings was not of that value estimated by the chairman, who was generally such an optimist. Then he considered the value of the new security was somewhat sapped by the power of the new company to issue £550,000 of debentures, whilst they were also putting nearly £2,000,000 of debentures of the London United Co. in front of their security. He did not see where it was to the interest of the preference shareholders to share in the undertaking of the London United Co.

Mr. Ennis asked what area was meant when the chairman said the new company would receive a proportion of the omnibus earnings in the metropolitan area.

The Chairman said it meant the County of London area plus the areas served by the Metropolitan Electric Tramways and the London United Tramways—a very valuable concession. Mr. Baldwin's points were good, but it was not true to say that they were parting with the North Metropolitan Power Co. The only way in which it was affected, was that new interests were introduced into the holding company, but the other interests would rank after theirs. There was no sapping in value by the new company having the power to issue debentures. £200,000 of these debentures would go to the preference shareholders, and the remaining £350,000 were for the payment of the omnibuses, and if the holding company did not provide that money, it would have to be provided by the M.E.T. Tramways Co. Consequently, they were no worse off. It was an economical financial arrangement for the purpose of raising capital in the most convenient and the cheapest possible way.

Mr. Baldwin raised the question of the quoted price of the shares, but

The Chairman pointed out that he attached no great value to the recent Stock Exchange fluctuations. At the same time, if they did take Stock Exchange quotations, they were higher in consequence of the scheme than before.

Mr. Ennis remarked that they were all acquainted with the broad facts of the situation in London. They found the London County Council, which pushed the old tramway companies into a corner, were now feeling the pinch themselves. He regarded the present scheme as one of self-defence, and after hearing the chairman, would support it.

Mr. Dade moved: "That this meeting of the Metropolitan Electric Tramways Co. approves of the scheme for the consolidation of the interests of the Metropolitan Electric Tramways and the London United Tramways, and recommends the shareholders to exchange their holdings in accordance with the directors' circular of November 25th, 1912."

Mr. Parker seconded the motion, and it was carried unanimously.

Manx Electric Railway Co., Ltd.—The directors have declared a dividend of 5½ per cent. per annum on the preference shares. £1,000 is placed to reserve for special renewals, and £920 is carried forward.

China Light and Power Co.—The net profit for the past year is nearly $16,000, an improvement of over $10,000 on the previous year. No dividend is to be paid, and $10,000 is to be devoted to depreciation on machinery.—*Indian and Eastern Engineer.*

Prospectuses.—*Tramways, Light and Power Co., Ltd.*—A prospectus has been advertised this week inviting subscriptions for 300,000 6 per cent. cumulative preference shares of £1 each at par. The company has been formed to acquire and work various concerns in the counties of Derby, Nottingham, Leicester, and Warwick, namely, the Derbyshire and Nottinghamshire Electric Power Co.; Nottinghamshire and Derbyshire Tramways Co.; Leicestershire and Warwickshire Electric Power Co.; and Leamington and Warwick Electrical Co., Ltd.; the amount payable being £220,600 (£90,600 in cash, £45,000 in ordinary shares, and £85,000 in deferred ordinary shares). Contracts have been entered into with Messrs. Balfour, Beatty & Co., Ltd., for the construction and equipment of 13½ miles of single tramway track between Ripley and Nottingham, and for the extension of the power plant and distributing system of others of the undertakings mentioned. £150,000 will be issued in 5 per cent. debentures or debenture stock at a later date. A report by Mr. W. C. C. Hawtayne estimates the net earnings of the undertakings at £46,500, and after paying debenture interest and preference dividend, he shows a surplus of £21,000. The operating management of the properties will be in the hands of Balfour, Beatty and Co., Ltd.

The British Electric Transformer Co., Ltd.—This company is offering for subscription an issue at par of 42,286 6 per cent. cumulative preference shares of £1 each. The list is to close to-morrow (Saturday). The increase in the company's business for Berry transformers, "Tricity" cookers, and other electric appliances necessitated the provision of additional manufacturing capacity last year, so that the largely increased turnover might be handled economically. The works were, therefore, extended, and it is chiefly the cost of the new factory and its equipment that has called for the provision of further working capital, which the present issue will produce. In anticipation of this issue 18,000 preference shares were subscribed for and fully paid up in August last, and arrangements have been made under which applicants can purchase these with the benefit of the dividend accruing thereon.

Dorsetshire.—The County of Dorset Electric Supply Co., Ltd., has been formed to deal with the as yet unexploited field for electric supply in Dorsetshire. A good number of towns in Dorsetshire are without electric supply, and this company proposes to operate over a wide area, covering Dorchester, Sherborne, Wimborne, Swanage, Blandford Forum, Wareham, Bridport, Shaftesbury, and other towns. The majority of the directors are Dorset men, and support in raising the necessary capital is anticipated from the county. The prospectus, we are informed, is being issued this week, and we understand that it includes a favourable report by Mr. W. C. C. Hawtayne. The company takes over one going concern, the Lyme Regis Co., which paid 4 per cent. in its second year of working, after placing an equal sum to reserve. Two of the directors are connected with existing undertakings, *i.e.*, Dr. J. H. Hosker, who is a director of the Bournemouth and Poole Electricity Supply Co., Ltd., and Mr. F. W. Reynolds, who is a director of the County of London Company, the City of London, and other companies.

Power-Gas Corporation, Ltd.—The directors report that the works of Ashmore, Benson, Pease & Co., have been maintained in a condition of efficiency and repair during the year, and all expenditure for this purpose has been charged to revenue. The coal strike caused a serious reduction in output of the works and greatly retarded the execution of contracts. The profits for the year are substantially less on this account. The results of the year's trading to September 30th of the Power-Gas Corporation, Ltd., show a total profit of £11,852, plus £3,264 brought forward, making £15,116. The directors propose to apply to reserve fund, £2,000; dividend at 4 per cent. per annum upon the ordinary shares, £9,984; to be carried forward, £3,131.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are moving in zig-zag fashion, the brightness of one day being dimmed by some rumour or other on the next. Business is very fitful, as is only to be expected a fortnight before Christmas, and prices have been depressed by fresh foreign-political fears. The sensation of the week, so far as electrical markets are concerned, was a steep slant in National Telephone Deferred stock. Part of the fall was subsequently recovered.

The market for English Electricity Supply shares continues very hard. It does not, however, take much to move prices rather materially in one direction or the other. For instance, a seller of comparatively few Brompton and Kensingtons formed sufficient excuse for the price of the Ordinary to be dropped 5s. County of London Ordinary rose as high as 12 bid, business being done in the shares at 12⅛—a figure which not unnaturally brought out shares, with the result that the quotation eased off to 11¾, still showing 5s. rise on balance, while the market for the shares is a good one, and there are better buyers than the nominal price would indicate. Metropolitan Preference and Chelsea Ordinary went back ⅛, and Charing Cross remain dull. In City's there is nothing much doing, but the Preference receded 10s., which took the price back to 12¾.

A comical little incident occurred in a certain house in the City the other day which is served by the Charing Cross Company and the City of London Company. Owing to some accident, all the lights of those tenants who take their current from one of the companies went out, and the subscribers to the other were greatly tickled at the sudden demand for candles on the part of their fellow-tenants.

The Railway market lies once more beneath the shadow of strike fears. On the North-Eastern, difficulties have come to an acute point, and certain of the Midland staff are also restless, voicing their grievances in no mild manner. This influence has sufficed to depress prices all round, the Undergrounds not escaping the contagion of general weakness. Metropolitans and Districts, for instance, both lost 1½. Central London fell a point, while City and South London shed 2. The last-named company's four Preference stocks are again each a point to the good, the yields attracting attention from buyers, who found that there was little stock about at the quoted prices.

Considerable publicity has been given during the past few days to the extensive schemes of the London and South-Western for the electrification of part of its suburban system, and this may have something to do with the drop of a point in London United Tramways Debenture. The North-Western, too, is far advanced with its proposals for the conversion of part of its suburban lines to electric traction. It is said that a start is about to be made almost at once.

The prospectus is being advertised this week of the Tramways, Light and Power Company, Ltd., 300,000 6 per cent. Cumulative Preference shares of £1 each being offered at par. The company acquires four undertakings in the Midlands, and although there may be a big future for the concern, investors perhaps might do better with their money elsewhere. The British Electric Transformer Company, too, has been offering 42,286 6 per cent. Cumulative Preference shares of £1 each, also at par. The business of the company consists of the manufacture and supply of electric transformers and electrical apparatus of all kinds for cooking, heating and general domestic purposes, and the new capital should be of substantial use in developing its business.

Foreign tramway issues are quiet, the movements being mostly confined to small fractions. Mexico Trams fell back a trifle, but the Company's 6 per cent. bonds continue in demand, and improvements have taken place in Mexican Electric Lighting bonds and Mexican Light and Power Preferred. Monterey Fives also show a small improvement. On the other hand, Mexican Light and Power Common has given way. Brazilian Tractions fell ⅜ on sales from the Continent, where they are held extensively by the speculative investor. Anglo-Argentine Tramways first Preference hardened up to par, but Calcutta Trams lost 5s., and one or two of the British Columbia Electric issues eased off on sales by those who wish to apply for the new issue of stock. River Plate Ordinary shows a loss of 4, and Northern Light and Power bonds slumped 5 on a little pressure to sell. Shawinigan Water more than regained its drop of last week. Victoria Falls Preference went back $\frac{1}{32}$ in sympathy with the dulness of other shares in the Kaffir Circus.

The bears made a drive at National Telephone Deferred stock on the finding of Monday, when the Company agreed to accept two million pounds instead of three millions claimed. From 152 the price dropped to 143, at which there came a recovery to 148, it being argued that too much stress need not be laid on the figures just "quoted." The latest Stock Exchange estimates at the price at which this Deferred stock will be repaid, range from 140 to 170 per cent.; so, manifestly, as we have said again and again, the stock is no purchase for the small investor.

Marconi's, too, gave way sharply when a few of the tired "bulls" began to press their shares for sale. The fall embraced Canadian, Spanish and American Marconi's, and the market for the time being is a dull one. American Telephone and Telegraph descriptions are lower, because of the suggestion raised that in view of the Supreme Court's finding against the Union Pacific Railroad, the Telephone Company may be attacked on a somewhat similar principle. This contention, however, commands little adherence. West India and Panama's drooped to 3¼, but the Eastern group is steady, Eastern Ordinary again rising a point. Great Northern Telegraphs went up 10s. Indo-Europeans regained the 10s. lost last week. India Rubber shares have been particularly good, with a rise of 35s. on the declaration of an interim dividend at the rate of 7½ per cent., against nothing a year ago. Of the advance, 10s. was subsequently lost. Telegraph Constructions at 35½ are £1 down.

Manufacturing shares are firm on the Board of Trade figures showing how excellent is the trade of the country. Babcock and Wilcox hardened to 3¼, to ease off later to 3⅛ again. Dick, Kerrs are a rather better market, and British Aluminium have improved. Rubber shares have developed unwonted activity, and prices have been going up—in some cases substantially—on the theory that the price of the raw produce will continue its present upward movement.

Bullers, Ltd.—The directors' report for the year ended July 31st last, as abstracted in the *Financial News*, states that the volume of the company's business shows considerable and satisfactory increase; but the trading has been adversely affected by the great rise in the prices of raw materials. The railway and coal strikes also caused heavy losses through stoppage of work and dislocation of business. Several large contracts are on hand, and it is anticipated that the revival of trade will be continued. The accounts show a profit of £11,415, with £583 brought forward. The interest on the preference shares, £7,500, has been paid, leaving £4,498. The directors propose to further strengthen the reserve account by the amount of £4,000, making that account £52,000, and to carry forward £498.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc
Aberdeen	Dec. 4	2,746	+ 23	27	41,933	+ 518	14·4	..
Ayr	,, 7	377	+ 2	29	10,687	+ 268	8	..
†Bath ..	,, 4	639	— 53	49	48,175	+ 2,264	..	..
Birmingham Corp.	Nov. 30	22,212	+5,652	35	874,901	+112,619	57·17	..
Blackburn	Dec. 4	2,156	+ 148	$36\frac{2}{7}$	48,533	+ 968	14·62	..
Blackpool Corp. ..	,, 5	938	+ 78	..	62,684	+ 5,854	11·87	..
Blackpool-Fleetw'd	,, 7	482	+ 2	22	24,521	— 499	8	..
Bournemouth ..	,, 4	2,836	+ 106	$35\frac{3}{7}$	68,274	+ 2,098	21·95	..
Bradford	Nov. 30	10,424	+ 591	35	195,591	+ 509	56	..
Brighton	Dec. 8	1,536	+ 32	36	58,463	— 958	9·5	..
Bristol	,, 6	18,106	+1,446	..	339,097	+ 28,525	80·5	..
Brit. Elec. Trac. Co.								
‡Airdrie	Nov. 29	599	+ 65	48	14,380	+ 3,507	3·65	..
Barnsley	,, 29	201	+ 46	,,	8,725	— 169	..	..
Barrow	,, 29	655	+ 96	,,	18,180	+ 3,345	5·87	..
Devonport ..	,, 29	951	+ 35	,,	25,691	+ 1,740	8·85	..
Gateshead ..	,, 29	2,181	+ 67	,,	50,246	+ 135	11·25	..
Gravesend ..	,, 29	416	+ 36	,,	10,160	— 98	6·5	..
Greenock.. ..	,, 29	1,477	+ 136	,,	38,805	+ 3,967	7·25	..
Kidderminster ..	,, 29	180	+ 6	,,	5,705	+ 104	..	..
Merthyr	,, 29	396	+ 8	,,	9,678	— 870	2·9	..
Metropolitan ..	,, 29	16,586	+ 749	,,	420,747	— 482	22	..
Middleton ..	,, 29	585	..	,,	16,009	— 327	8·5	..
Mid.Joint Com'tee	,, 29	6,768	+ 612	,,	157,506	+ 8,490	..	..
Oldham—Ashton	,, 29	1,154	+ 64	,,	29,318	+ 1,687	9·18	..
Peterborough ..	,, 29	230	+ 19	,,	6,552	+ 375	5·81	..
Potteries	,, 29	4,804	+ 192	,,	93,086	— 1,179	21	..
Rothesay	,, 29	85	+ 8	,,	10,533	+ 500	2·75	..
Southport ..	,, 29	484	+ 22	,,	14,391	— 208	8·17	..
S. Metropolitan..	,, 29	1,442	+ 132	,,	40,493	— 788	..	..
Swansea	,, 29	2,221	+ 65	,,	55,375	+ 340	12·5	..
Tynemouth ..	,, 29	288	+ 3	,,	11,609	— 928	3·75	..
Weston-s-Mare ..	,, 29	52	+ 3	,,	6,812	— 1,296	8	..
‡Worcester ..	,, 29	505	+ 68	,,	14,136	— 64	5·75	..
Wrexham ..	,, 29	228	+ 22	,,	5,535	+ 614	..	..
Yorks. Wool. Dist.	,, 29	2,108	+ 127	,,	51,997	+ 1,369	17	..
Miscellaneous ..	,, 29	413	+ 29	,,	11,087	+ 211	..	..
Burnley	Dec. 7	2,869	+ 226	..	..	..	12·44	1
Burton-on-Trent ..	,, 8	513	+ 6	36	9,829	— 455	6·6	..
Bury	,, 8	2,387	+ 136	36	47,023	— 42	22·5	..
Cardiff	,, 7	4,673	+ 219	36	88,257	— 1,252	17·85	..
Chatham and Dist.	Nov. 28	1,689	+ 136	48	41,105	+ 85	14·98	..
Cork	Dec. 5	864	— 3	49	23,491	— 942	9·89	..
Croydon	Nov. 29	3,291	+ 310	..	68,583	— 512	11·6	..
†Darlington.. ..	,, 30	226	+ 20	35	7,908	— 1,106	4·87	..
Darwen	Dec. 6	514	+ 27	36	10,093	+ 332	4·36	..
Dover	Nov. 30	378	+ 20	35	8,890	— 576	4·75	..
Dublin	Dec. 6	10,566	— 10	..	132,627	— 8,135	54·25	..
East Ham	,, 7	2,043	— 45	36	38,721	— 860	7·87	..
Glasgow	,, 7	36,974	— 906	..	510,636	—10,000	98	..
Hastings	,, 5	1,868	— 3	..	..	— 2,399	19·8	..
Hull	,, 7	6,029	+ 170	36	106,924	+ 1,471	13·5	—1
†Ilkeston	,, 5	109	— 11	36	4,060	— 751	..	..
Ipswich	,, 7	701	+ 83	36	16,865	— 110	10·5	..
†Kilmarnock ..	Nov. 30	147	— 8	28	4,6-7	— 164	4·25	..
Lancashire United	Dec. 4	2,544	+ 81	49	65,957	+ 190	39	..
Leeds	,, 7	14,931	+ 542	36	281,485	+ 9,689	65	7·5
Leicester	,, 7	5,275	+ 347	49	125,369	+ 4,295	20	..
†Leith	Nov. 30	600	+ 17	$28\frac{3}{7}$	19,595	+ 524	8·72	..
Liverpool	,, 30	23,842	+1,703	$47\frac{2}{7}$	574,123	+25,249	119	3
‡L.C.C.	Dec. 6	81,339	—1,758	..	1,452,786	—74,665	141·5	1·25
London United ..	,, 7	10,586	— 80	..	304,167	—18,540	..	..
Lowestoft	,, 7	317	+ 15	9	1,714	— 3	8·5	..
Manchester ..	,, 7	32,823	+1,288	36	605,729	+21,464	105	..
Newcastle	,, 7	8,928	+ 346	..	159,283	+ 3,485	31·8	..
Newport	Nov. 30	1,379	+ 84	35	24 807	— 320	7·25	..
Oldham	Dec. 8	3,792	+ 113	37	76,065	+ 4,617	28	..
Pontypridd	Nov. 30	828	+ 44	35	13,997	— 600	5·5	..
Preston	..	..	..		..	..	10	..
Rotherham	Dec. 4	1,678	+ 355	$35\frac{3}{7}$	27,465	+ 3,023	18	6
Salford	,, 9	9 639	+ 250	$36\frac{1}{7}$	182,204	+ 4,390	41	..
Sheffield	,, 10	18,901	+ 904	..	248,199	+11,131	40	..
Southampton ..	,, 4	2,188	— 3	35	44,808	— 197	11	..
Southend-on-Sea ..	,, 4	1,062	+ 189	36	29,622	+ 3,136	7	..
South Shields ..	,, 7	1,152	+ 9	36	22,999	+ 266	10·25	..
Tyneside	,, 4	861	+ 7	23	11,201	— 579	11	..
Wallasey	,, 7	1,955	+ 3	$35\frac{6}{7}$	40,430	— 248	8·72	..
Walthamstow ..	,, 7	1,269	+ 85	36	26,363	— 1,117	9	..
West Ham.. ..	Nov. 28	4 998	— 151	$34\frac{4}{7}$	91,155	— 3,683	16·45	1·2
Wolverhampton ..	..	..	..			.	13·75	..
Cen. London Rly...	Dec. 7	11,513	+ 774	23	112,890	+ 3,776	6·78	·5
City & S. Lon. Rly.	,, 8	6,165	— 842	23	67,492	— 5,958	7·26	..
Dublin-Lucan Rly.	..	..	..			..	7	..
G.N. and City Rly.	,, 7	3,000	— 424	23	34,459	— 874	3·5	..
L'pool Overh'd Rly.	,, 8	3,132	+ 290	..	37,657	+ 3,174	6·6	..
Llandudno-Col. Bay	,, 6	261	+ 23	..	..	..	6·5	..
Lond. Elec. Ry. Co.	,, 7	29,465	+ 5	..	801,315	+ 4,520	21·25	..
Mersey Railway ..	,, 7	4 638	+ 302	23	49,506	+ 4,866	4·5	..
Metropolitan Rly...	,, 8	36,485	— 149	23	392,015	+ 5,270	75·75	..
Met. District Rly...	,, 7	26,580	+1,848	..	287,779	+ 22,978	25	..
Anglo-Argentine ..	,, 2	109,929	+5,197	..	2,470,298	+116,632	..	
§Auckland	Nov.	19,174	+ 2,580	..	97,203	+15,752	24·11	·8
Bombay (B.E.T.) ..	Nov. 8	6 266	— 310	46	135 526	+ 5,055	..	..
§Brisbane	Nov.	24,310	+ 2,420	11	228,421	— 551	..	..
Calcutta ..	Dec. 7	8 823	+ 1,103	..		..		..
§Kalgoorlie, W.A...	Oct.	2,955		..	31,743		20·5	.
Madras	Nov. 30	1 460	+ 83	..	36,326	+ 3,725	14·7	2
§Montevideo ..	Nov.	29 623	+ 3.009	..		..	.	..
Perth (W.A.) ..	Dec. 6	3 983	+ 539	..	91,807	+ 12,987	29	..

Compared with the corresponding period of 1911. † One week only.

‡ Includes horse, steam and other receipts. § One month.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended September 27th, 1912, amounted to 1,258,799 compared with 1,032,358 units in the corresponding four weeks of 1911. For the five weeks ended November 1st, 1912, the units delivered amounted to 1,386,195, compared with 1,116,408 in the corresponding five weeks of 1911.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 10th.	Rise + or Fall	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9¾ — 10¼	..	5 4 9
Do. 4½ % Pref...	10	4½	4½	8¾ — 9¼	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord...	5	10	9†	8¾ — 9¼	— ½	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¾ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98 xd	..	4 1 8
Charing Cross, West End & City	5	5	5†	4¾ — 5¼	..	4 15 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	4⅛ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4¾ — 5	⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	⅛	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	100 —103		4 7 5
County of London, Ord... ..	10	6	4†	11½ — 12	+ ¼	5 0 0
Do. 6 % Pref.	10	6	6	11½ — 12½	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 8 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 8 3
Edmundson's, Ord.	5	Nil		½ — ⅞	.	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	8 — 8½	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7¾ — 8¼	.	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	..	1½ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3¾ — 4¼	..	5 3 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	3¾ — 4	⅛	5 0 0
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 - 101		4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ - 101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9¾ — 10¼	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	2⅞ — 3⅛	..	5 18 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1⅜ — 1½	..	5 9 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord...	£3	Nil		⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	:	2⅝ — 3⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½ — 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5¼ — 5⅝	..	5 6 8
Calcutta, Ord.	5	8½	7†	6¾ — 7¼	..	5 19 4
Do. 5 % Pref.	5	5	5	4¹⁵⁄₁₆ — 5¹⁄₁₆	.	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	94 — 96	..	5 4 2
Canadian Gen. El. Com. ..	$100	7	7	118 — 122	..	5 14 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	⅞ — 1	..	8 0 0
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95 — 97	..	6 8 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	86 — 89	+ 1	5 12 4
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	¹⁄₁₆ — ⅛	..	Nil
Do. 6 % Pref.	1	6	6	⅝ — ¾	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 88½	+ ½	5 13 0
Mexican Lt. & Power, Common	$100	4	4†	83½ — 86½	—1	4 12 6
Do. 7 % Cum. Pref.	$100	7	7	104 —107	+ 1	6 10 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	85½ — 87½	+ 1	5 14
Montreal, Lt., H. and Power ..	$100	8	9†	234 —239	.	3 15
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	29 — 33	5	..
River Plate, Ord.	Stock	10	.	238 —244	4	4 2 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106 —111	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	141 —145	+ 4	3 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105 —108	..	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	½	4 8 3
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½—101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½ — 96½	..	5 3 8
Victoria Falls Power, Pref. ..	1	11⅞d.	17⅞d.	[illegible] — ½	— ¹⁄₁₆	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½—105½	..	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7⅝ — 7⅞	..	5 14 3
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	142½—144½	—2½	5 10 9
Do. Collat. Trust	$1000	4	4	93 — 95	— ½	4 4 3
Anglo-American Telegraph ..	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½—111½	..	5 7 8
Do. Def...	Do.	80/-	..	25¾ — 26	..	5 15 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½ — 7¾	..	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	10	6	6†	8½ — 9⅛	..	6 6 4
Do. 10 % Pref...	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref... ..	5	10	10	6½ — 7	..	7 2 10
Direct United States Cable ..	10	5	4	7 — 7½	..	6 13 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98½—100½	..	4 9 7
Eastern Telegraph, Ord. Stock	Stock	7	7†	133 —136	+1	5 3 0
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10¾ — 11¼	..	5 7 7
Do. 6 % Pref.	10	6	6	12½ — 13	- ⅛	4 12 4
Great Northern Telegraph ..	10	18	18	29 — 30	+ ½	6 0 0
Indo-European Telegraph ..	25	13	5†	56 — 58	+ ½	5 12 1
Mackay Companies Common ..	$100	5	5†	86 — 89	..	5 14 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	4¾ — 4⅞	— ⁵⁄₁₆	3 17 2
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅛ — 4⅝	— ½	3 13 7
Monte Video Telephone, Ord...	1	6	6†	¹⁵⁄₁₆ — 1¹⁄₁₆	..	5 13 0
Do. 5 % Pref.	1	5	5	²⁵⁄₃₂ — ²⁷⁄₃₂	— ¹⁄₃₂	5 18 6
National Telephone Def. ..	Stock	6	..	145 —148	—9	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	97¾ — 98¾	— ½	4 11 2
Oriental Telep. and Elec. ..	1	8	6†	1⅛ — 1⁵⁄₁₆	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1⁷⁄₃₂ — 1⁹⁄₃₂	+ ¹⁄₃₂	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10⅞ — 11⅜	..	8 16 2
Submarine Cables Trust ..	Cert.	6	6	127 —130	+1	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼ — 7¾	+ ⅛	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅞	..	4 8 11
West Coast of America	2½	2½	..	1¹¹⁄₃₂ — 1¹³⁄₃₂	..	8 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3⅛ — 3⅜	⅛	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs...	100	5	5	101½—103½	..	4 16 7
Western Telegraph, Ltd. ..	10	7	7†	13¼ — 13¾	..	5 1 10
Do. 4 % Deb.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 —101	..	4 9 1

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 10th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅜— ⅝	..	Nil
Do. 5 % Pref.	1	5	5	11/16— 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½— 13½	..	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	90 — 93	..	6 9 0
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	+1	..
Do. 5 % Perp. Deb. ..	100	5	5	90 — 93	—2½	5 7 6
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8†	81 — 83	+1	3 12 3
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	..	80 — 82	..	2 8 9
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord. ..	100	1⅝	1¼†	35½— 36½	2	3 15 4
Do. 5 % Pref., 1891	100	5	5	109 —111	+1	4 10 1
Do. Do. 1896	100	5	5	109 —111	+1	4 10 1
Do. Do. 1901	100	5	5	109 —111	+1	4 10 1
Do. Do. 1903	100	5	5	109 —111	+1	4 10 1
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼— 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	21/32— 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼— 2¾	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5¼— 5¾	..	..
Do. 4 % Deb.	100	4	4	73 — 76	—1	5 5 3

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 10th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1½†	54¼— 54¾	—1½	2 19 4
Do. Surplus Lands	100	2⅝	2¾†	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	—1	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	40¾— 41¼	—1½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	+1	3 19 8
Do. 4½ % First Pref.	100	4½	4½	88 — 90	..	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅛— 1¼	..	4 16
Do. Def.	1	Nil	..	¼— 5/16	..	Nil
Do. 5 % Pref.	1	5	5	13/16— 15/16	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	93 — 95	..	4 14 9
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	5/32— 7/32	..	..
Do. 5 % Pref.	1	5	5	17/32— 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	11/16— 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	4⅛— 4⅜	— ¼	Nil
Do. "A"	1/-	..	..	2/32— 3/32	..	..
Do. 6% First Cum. Inc. Deb.	100	..	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1½	£2	90 — 92	—1	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼— ¾	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	..	4 5
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4¾ — 5⅛	+ 1/16	4 17 9
Do. 2nd Pref.	5	5½	5½	4 11/16— 4 13/16	.	5 17 4
Do. 4 % Deb.	100	4	4	93 — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	97½— 98½ xd	+ ½	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do 5 % 2nd Deb.	100	5	5	99 —101	+1	4 19 0
Brazilian Traction Light and Power	$100	..	..	93¾—94¼	— ¾	..
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16— 7 5/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4¾— 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½—103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	143 —148	—1	5 8 1
Do. Pref. Ord.	100	6	6	118½—120½	1½	4 19 7
Do. 5 % Pref.	100	5	5	106½—109½	— ½	4 11 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 —105	..	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	100 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	5½— 6⅛	— ¼	5 14 3
Do. 5 % Pref.	5	5	5	4 15/16— 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	⅛— ¼	..	..
City Buenos Aires Trams (1904)	5	6	6†	6 1/16— 6 5/16	..	4 8 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32— 3/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	⅛— ⅜	..	..
Do. Pref.	1	6	.	29/32— 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1½	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	112 —114	2½	6 2 10
Do. Gen. Con. 5 % Bonds ..	..	5	5	95½— 97½	.	5 2 7
Do. 6 % Bonds	100	6	6	101½—103½	+ ½	5 16 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7¼— 7⅜	+ ⅛	6 9 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	96½— 98½	..	5 1 6
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1 5/32— 1 11/32 xd	..	3 14 6
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½— 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102 —104	+ ½	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	97 — 99	..	5 1 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101½—103½ xd	—½	4 16 7
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video ..	5	7	..	5⅞— 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	½— ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	11/16— 13/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/16— 1 9/16	..	3 16 10
British Aluminium, Ord. ..	1	Nil	..	⅜— ⅝	+ 1/16	..
Do. 6 % Cum. Pref.	1	Nil	..	11/16— 13/16	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½— 8	..	6 5 0
Do. Pref.	5	6	6	5⅞— 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	103 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	3	Nil	Nil	½— ¾	..	Nil
Do. Deb...	100	4	4	58 — 62	—1	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10½— 11½	..	6 13 4
Do. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	20	3 11/32— 3 13/32xd	..	5 4 11
Do. Deb...	100	4½	4½	105 —108	..	4 3 4

Crompton & Co.	8	Nil	..	⅛— ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16— 13/16	..	..
Do. Pref.	1	6	6	¾— ⅞	— 1/16	6 17 2
Do. Deb...	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid ..	5	Nil	..	¼— ½	..	Nil
Do. fully paid	5	Nil	..	1¼— 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	1 1/32— 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1¾— 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½— 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12¼— 13	..	6 10 9
Do. Pref.	5	4½	4½	4 13/16— 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10¾— 11¼	+1⅜	..
Do. Pref.	10	6	6	9½— 10½	..	4 17 7
Telegraph Construction	12	17½	5†	34½— 36½	—1	5 13 0
Do. Deb...	100	4	4	97 —100	..	4 0 0
Willans & Robinson	1	Nil	..	1/16— 3/16	..	Nil
Do. Pref.	5	Nil	..	½ — ¾	..	Nil
Do. Deb...	100	4	4	57 — 59 xd	..	6 15 7

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* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

INDUSTRIES AND INDUSTRIAL CONDITIONS IN THE ARGENTINE.

By ALFRED H. GIBBINGS, A.M.I.C.E., of Buenos Ayres

THE subject of these articles is one on which there is remarkable dearth of information. With the exception of the Argentine Government's statistics—more or less buried in oblivion—there is no treatise or publication which makes more than the briefest reference to any industry other than that of agriculture and cattle-rearing. Hence the Argentine has been looked upon as a non-manufacturing country in which the exports of wheat, grain, frozen meat, hides, and certain natural products are set against the imports of manufactured goods. In terms of percentage imports to home manufactures, this view is, of course, very largely the correct one; but on closer acquaintance with the country, it becomes evident that the industrial side is already firmly established, and, moreover, that it is making rapid headway.

It is the intention in this article to give a general indication of the position, gathered from residence in the country, and the exigencies of a business which necessitated the compilation of considerable data. By way of preliminary and explanation, it may be stated that neither the Government nor the Municipalities concern themselves with the publication of any other than statistical information necessary for the purposes of taxation and incidental thereto. The only serious attempt at classification and location is contained in the "Guia Kraft," a voluminous directory dealing with the whole of the provinces and territories, and modelled on the lines of the Post Office London Directory. The information given, however, is merely a record of names and addresses, with no attempt at grouping, or indication of the importance of, the respective concerns. The official books issued by the Government are purely statistical, there being nothing to correspond to our Factory and Workshop Acts, Inspection of Factories, or Inspection of Mines. To add to these difficulties, there is the immense area of the country, and the characteristic indifference of the Spanish race to do more than the immediate occasion requires.

In the coming year (1913) some attempt will be made to remedy this state of things by the Union Industrial Argentina, an immense trade organisation whose headquarters are in Buenos Ayres, and to which further reference will be made when dealing with the industrial conditions. Before proceeding with the enumeration of industries, it will be advisable to consider the position as regards the general demand for goods.

Demand for Goods.—It is assumed herein that the characteristics of the country are well known as regards its main sources of wealth, its climate, minerals, productions, geography, inhabitants, and its laws and customs. On this account it is not proposed to deal with the agricultural and cattle-rearing industry, as that is the staple industry on which many voluminous treatises have already been written; but the other industrial features arising directly out of it will be considered, as far as space will admit.

The most startling fact of this most extraordinarily prosperous country is that the annual exports (amounting to over £80,000,000 in 1909) exceed the imports by £20,000,000, or, in other words, the money coming into the country annually is over 30 per cent. more than that going out. Hence, notwithstanding the extremely high prices for everything which rule here, there is ample money available for the development of business and for luxurious living. These two factors, therefore, mean a constant demand for goods of every description, and usually for goods of the highest quality and class.

It would be difficult to find anywhere a more active and busy city than Buenos Ayres. It has an area of 70 sq. miles and a population of 1,500,000, and within an area of 4 sq. miles in the centre, the traffic and business life are equal to the busiest parts of the city area of London. From this and other causes arises a great demand for both office and living accommodation, and consequently the value of property stands at a very high figure. The average rental is about £6 per superficial yard per annum, or twice that obtained in the City of London. This prosperous state of trade clearly indicates that the demand is greater than the supply, and this again is due very largely to the following factors:—(*a*) No local production of manufactured articles; (*b*) inability to obtain goods delivered to the port owing to congestion of shipping: (*c*) increase in population—through immigration—being greater annually than increase of imports; and (*d*) duties on all imported articles.

The quality of all goods has to be of the best, with articles for domestic use highly finished and ornate. No better tailoring or dressing is to be found either in London or Paris. The natural inference from all this is that every country in the industrial world caters for this market. The proportion of such imports among the more important countries for the the three years ending 1909 is shown in the following Table I:—

TABLE I. TOTAL IMPORTS INTO THE ARGENTINE.

	1907.	1908.	1909.
Great Britain ...	£19,587,000	£18,674,000	£19,840,000
Germany	9,162,000	7,569,000	8,911,000
U.S.A.	7,768,000	7,119,000	8,613,000
France	5,093,000	5,295,000	6,160,000
Italy	4,800,000	4 983,000	5,373,000
Belgium	3,181,000	2,550,000	2,714,000
Other Countries ...	7,571,000	8,400,000	9,740,000
Grand Total ...	£57,162,000	£54,590,000	£61,351,000

Works and Factories.—Notwithstanding the foregoing immense importation of manufactured goods, there is a considerable number of works and factories as shown by the figures in Tables II and III.

TABLE II.—WORKS AND FACTORIES CLASSIFIED ACCORDING TO THE NUMBERS OF OPERATIVES EMPLOYED.

	No. of works.	No. of operatives employed.	H.P. installed.
Manufacture of wine ..	3,409	45,776	6,258
Sugar mills	37	38,591	34,650
Boot factories	2 217	13,154	943
Brick works	1,281	11,150	379
Carpenters' shops	2,814	9,324	2,806
Smithies	2,932	8,735	1,569
Saw mills	283	8,081	7,641
Printers	759	6,763	1,757
Cold storage plants... ...	8	5,817	12,424
Carriage and cart works .	876	5,229	1,427
Tobacco factcries	171	4,525	654
Mechanics' shops	335	4 399	2 773
Flour mills	330	4,309	16,348
Leather dealers	747	3 579	128
Foundries	98	3,415	1,853
Tanneries	227	3,389	4,014
Breweries	24	3,049	2,206
Wool factories ...	33	3,006	1,993
Confectionery works .	230	2,998	926
Canvas shoe factories ...	170	2,986	793
Lithograph works	39	2,833	576
Agricultural implements ...	88	2,642	1,935
Meat preserving factories ...	6	2,535	1,404
Electricity works	56	2,402	80,826
Cloth weavers	47	2,390	798
Match factories	10	2,313	239
Vermicelli works	272	2,301	2,379
Sack works	20	2,272	464
Lime works	116	2,249	917
Distilleries	263	2,233	465
Gas works	12	2,208	1,697
Mineral water works ...	560	2,195	890
Mosaic works	149	1,559	281
Ship repairers	23	1,504	107
Cotton mills	5	1,415	800
Paper mills	12	1,405	4,733
Copper mines	5	1,269	1,165
Sugar refineries	1	1,000	1,600
Marble works	215	965	247
Soap factories	200	942	215
Dyers and cleaners	82	872	442
Electric and gas fittings ...	41	759	244
Ice factories	56	593	2,580
Galvanised iron works ...	1	520	200
Other works (small) ...	12,748	99,838	21,614
Totals	31,988	329,490	229,660

The total capital invested in the foregoing industries is over £146,000,000.

These tables are compiled from the "Censo Industrial de la República" issued by the Ministerio de Agricultura of the Argentine Government. They are representative of the position at the end of 1909, since when no further census has been taken. In nearly every instance, however, great increases have taken place, and an indication of the progress

TABLE III.—Works and Factories Classified According to Location in the Several Provinces and Territories.

Provinces and territories.	No. of factories.	Motive power.							No. of employés.
		Horses.	Hydraulic.	Oil.	Gas.	Electricity.	Steam.	Total H.P.	
Federal capital (Buenos Ayres) ...	10,427	—	—	476	1,939	12,505	90,655	105,575	118,435
On the Coast.									
Buenos Ayres (Province of)	8,988	427	783	862	1,147	3,235	35,089	41,543	48,775
Santa Fé ,, ...	2,986	96	415	483	526	2,666	9,701	13,887	21,866
Entre Rios ,, ...	1,513	124	36	149	192	155	3,621	4,277	14,785
Corrientes ,, ...	632	48		35	2	26	1,719	1,830	3,429
Central.									
Cordoba (Province of)	1,310	47	5,266	116	43	1,701	3,010	10,183	11,708
San Luis ,, ...	251	14	—	24		—	110	148	948
Santiago del Estero (Province of) ...	280	15		4	16		1,769	1,804	11,267
Andes.									
Mendoza (Province of)	1,950	97	1,753	1,261	411	894	2,706	7,122	26,864
San Juan ,, ...	673	1	366	158	90	33	1,441	2,089	7,765
La Rioja ,, ...	577	3	721				48	772	4,560
Catamarca ,, ...	418	37	35		—	-	287	359	3,848
North.									
Tucumán (Province of)	652	16	50	43	—	283	32,345	32,737	33,240
Salta ,, ...	369	5	126	66	-	—	1,046	1,243	5,859
Jujuy ,, ...	194	2	43	4	--	9	2,437	2,495	9,145
Territories.									
Misiones	199	4	85	1	—	–	148	238	1,119
Formosa	13	4	15				823	842	1,277
Chaco	114	6	4		-		1,438	1,448	3,171
Pampa	207	9	5	65	1	3	107	190	512
Neuquén	40	—	55	7		--	--	62	89
Rio Negro	83	—	52	4	--		-	56	205
Chubut	65	1		50	10	—	4	65	134
Santa Cruz	17	—				-	—	—	172
Tierra del Fuego	8	—	10			—	405	415	158
Los Andes	1	—				280	—	280	159
Total	31,988	956	9,820	3.808	4,377	21,790	188,909	229,660	329,490

being made will be apparent from the analysis which follows herewith.

The works and factories referred to do not include those of the Government, municipalities, railway companies, tramway companies, steam companies, irrigation, or other undertakings of a public or private character unless operated under the usual competitive conditions of trading.

A large percentage of the works and factories in the Argentine are only small workshops where but few hands are employed, and they cannot be considered as manufactories in the English acceptation of the word. Taking, for example, the industry represented by boot factories, brickworks, carpenters' shops, smithies, sawmills, printers, mechanics' shops, and similar trades, as listed in Table I, although these appear high in the list as regards the number of works and workpeople employed, the average size is quite insignificant at the present moment, and the capital employed is relatively small. At the same time they probably form the nucleus of larger works in the very near future.

The industries already established on a large scale, and the capital invested therein, may be taken to be as follows, viz. :—(*a*) Sugar mills, £15,000,000 ; (*b*) Wine presses, £14,000,000 ; (*c*) Electricity works, £10,000,000 ; (*d*) Gas works, £9,500,000 ; (*e*) Flour mills, £8,000,000 ; (*f*) Frozen meat industry, £6,500,000 ; (*g*) Breweries, £6,000,000 ; (*h*) Tanneries, £2,500,000 ; (*i*) Tobacco factories, £2,000,000 ; (*j*) Boot factories, £2,000,000 ; (*k*) Paper works, £1,500,000.

In addition to these, there is one sugar refinery with a capital of £700,000 ; one wool-washing works with a capital of £600,000 ; one cotton-thread works with a capital of £200,000 ; and one gold mine with £650,000 capital.

These represent a capital of £79,150,000, out of a total capital for all works of £146,000,000.

With respect to "output," the annual value is greatest in the cases of flour mills and the meat preserving industry, each of which has an annual turnover of £20,000,000. Next in order of importance come the wine, bread, sugar, tobacco, spirits, and boot industries. The total value of the production of the whole of the factories in 1910 was £245,500,000.

On reference to Table I, it will be seen that the most important item for motive power is that of the electricity works, which account for 80,826 H.P. This industry, however, has made such rapid strides, that at the end of 1912 the figure is nearly doubled. The Campania Alemana Transatlantica de Electricidad, which supplies current for lighting, heating and power purposes for a portion of the City of Buenos Ayres, has generating machinery of 100,000 H.P., and this, it is anticipated, will reach 150,000 H.P. in another 12 months. For some inexplicable reason the Government has not included in its Blue Book issues any data of the many tramway companies in the Republic, but these have large independent power works and employ many thousands of hands. A tramway, of course, is not strictly a factory or works, but in England it comes under the Factory Acts. The Anglo-Argentine Tramway Co. in Buenos Ayres employs over 8,000 men.

Another interesting feature in this very cosmopolitan country is the nationality of the proprietors of the works and factories. These are given as in Table IV.

TABLE IV.—Nationality of the Proprietors of Works.

Provinces and territories.	Argentines.	Foreigners.	Mixed.	Total.
Federal capital ...	1,347	8,107	973	10,427
On the coast	2,332	10,213	1,565	14,110
Central	322	1,326	193	1,841
Andes	1,149	1,392	1,077	3,618
North	474	432	309	1,215
Territories	126	487	164	777
	5,750	21,957	4,281	31,988

A reference to a map of the Argentine in conjunction with Table III will indicate more clearly the disposition and location of the industries. In nearly all cases the works are situated in and around the capitals of the provinces, and the other towns. For instance, the centre of the sugar industry is located at Tucuman ; the wine industry at Mendoza ; the frozen meat industry in and around the City of Buenos Ayres and La Plata ; electricity works in most of the towns of over 5,000 inhabitants ; breweries, tobacco factories, boot factories and paper mills within the Federal capital.

(To be continued.)

THE LOADING OF SUBMARINE TELEPHONE CABLES.

A Comparison between Coil-Loaded and Continuously-Loaded Cables.

By J. G. HILL.

(Concluded from page 933.)

If n be taken at 1,000 and μ at 110, the formula becomes—

$$11{\cdot}79\ t^3/\rho\ (d + t) \text{ ohms per km.} \qquad (19)$$

As an example, take the conductor with a resistance of 8ω per km. in Table VI, taking ρ at 150×10^{-3}. The values of t and d corresponding to this conductor are given in the tables, and the above formula becomes—

$$\frac{11{\cdot}79 \times (0{\cdot}323)^3}{150 \times 10^{-3}\,(2{\cdot}371 + 0{\cdot}323)} = 0{\cdot}983.$$

t represents one thickness of iron. If there are several windings, each of thickness p, then pt replaces t in the approximate formula (19).

TABLE IV.—Weights and Dimensions of Copper, G.P. and Iron Windings, with Constant Circuit Capacity = ·167 mf. per naut or ·09 mf. per km. at 1,000 pps. and Different Conductor Resistances.

Coil loaded cable.										Continuously-loaded cable.							
Per naut.					Per kilometre.					Per naut.				Per kilometre.			
R.	d.	D.	Weight of g.p.	Weight of Cu.	R.	d.	D.	Weight of g.p.	Weight of Cu.	t.	$d + 2t$	D.	Weight of g.p.	t.	$d + 2t$.	D.	Weight of g.p.
	mils.	mils.	lb.	lb.		mm.	mm.	kg.	kg.	mils.	mils.	mils.	lb.	mm.	mm.	mm.	kg.
3·71	187	524	503	615	2	4·743	13·30	123	150·8	25·5	238	667	814	0·646	6·035	16·93	199·4
7·42	132	370	251·5	308	4	3·354	9·40	61·5	75·4	18·0	168	472	407	0·456	4·266	11·97	99·7
11·13	108	303	167·7	205	6	2·738	7·68	41	50·27	14·7	137	385	271·3	0·373	3·484	9·77	66·46
14·84	93	262	125·75	154	8	2·371	6·65	30·8	37·7	12·7	119	333	203·5	0·323	3·017	8·46	49·85

R = Loop resistance of cable per unit length ; d = diameter of copper conductor ; D = diameter of g.p. core ; t = thickness of iron winding.

We are now in a position to proceed with the consideration of the cost of providing loaded cables of the types under review, and Tables IV and VI have been calculated to permit of this being done. Table IV gives the dimensions and weights of the principal materials required for cables having the efficiencies shown in Table II, including the thickness of the iron winding t necessary to give 16 millihenrys inductance per naut for continuously-loaded cables, and also the amount of gutta-percha required to give a capacity of $0{\cdot}09 \times 10^{-6}$ farads per km., together with the weight of copper involved. Table VI gives corresponding details for use in connection with Table V.

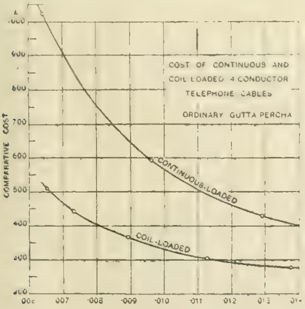

Fig. 1. (Based on Tables III and IV.)

In order to keep continuously-loaded cables equal in capacity to coil-loaded ones, it is fairly evident that the weight of gutta-percha must be increased, as the capacity of coil-loaded cables depends upon the ratio D/d as given in Tables IV and VI. Now d is increased by the iron winding to $d + 2t$, and it can be shown that the relation of the weight of gutta-percha for equal capacities in the two types of cables is as given in the following equation—

$$W_1 = (1 + 2\ t/d)^2\ W, \qquad (20)$$

where W_1 is the weight of gutta-percha required to give the same capacity in a continuously-loaded cable, as the weight of gutta-percha W gives in a coil-loaded cable, t is the thickness of the iron winding, and d is the diameter of the conductor used for both cables (the assumption being that circuits of equal ohmic resistance are being dealt with).

It may be seen that so long as the ratio t/d is unaltered, the expression $(1 + 2\ t/d)^2$ is unaltered. This means that, in order to keep the capacity in the continuously-loaded cable the same as in the case of a coil-loaded cable having the same gauge of copper conductor, the gutta-percha in the former must always be a fixed percentage heavier than the gutta-percha required for an ordinary cable, and this percentage obviously depends on the thickness of the iron wire, and therefore on the amount of inductance added. In the case where the inductance is 16 mh. per naut, the thickness required is that given in Tables IV and VI, and the increase in gutta-percha is in every case 62 per cent., as compared with that required to give a coil-loaded cable the same capacity. The actual value of the capacity does not affect the matter so long as it is the same in both cases, the percentage given will hold for *equal* capacities so long as 16 mh. per naut is required, and the thickness t of the iron given is necessary to produce it. The effect of this added gutta-percha would be to increase greatly the cost of continuously-loaded cable as compared with coil-loaded cable, even if the β of the former were not, on the whole, much higher than that of the latter. The curves in fig. 1 show the relative cost of β in the two cases, assuming that ordinary gutta-percha is used, the assumption being that the capacity is equal in the two cases, and that it is constant in all cases. The relative β's in the two cases are given in Table III, and on the cost of cables to provide those β's the price is based. It will be seen that for small values of β, the cost is twice as great in the case of the continuously-loaded cable as in the case of the coil-loaded cable, but that the difference

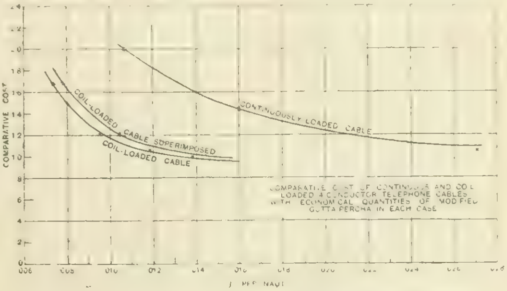

Fig. 2. (Based on Tables V and VI. The cost of the cheapest cable in the tables is 1·0.)

TABLE V.—Electrical Constants and Corresponding "β's" in Cables with Economical Quantities of Gutta-percha consistent with Safety.

Coil-loaded Cables (without Superimposing Coils) with Minimum Quantity of G.P.

Per naut.								Per kilometre.					
Cond. R.	Coil R_1.	S/K.	R_1/L.	K.	L.	β.	√LK.	Cond. R.	Coil R_1.	K.	L.	β.	√LK.
3·71	3·12	12	60	1·98 × 10^{-7}	52 × 10^{-3}	7·27 × 10^{-3}	512	2	1·68	10·7 × 10^{-8}	28 × 10^{-3}	3·92 × 10^{-3}	512
7·42	6·18	12	60	1·73 ,,	103 ,,	9·64 ,,	771	4	3·36	9·3 ,,	56 ,,	5·2 ,,	771
11·13	6·18	12	60	1·67 ,,	103	11·81 ,,	784	6	3·36	9·0 ,,	56 ,,	6·37 ,,	784
14·8	6·18	12	60	1·57 ,,	103	13·76 ,,	806	8	3·36	8·46 ,,	56 ,,	7·42 ,,	806

Coil-loaded Cables with Extra Coil for Superimposing.

Cond. R.	Coil R_1.	S/K.	R_1/L.	K.	L.	β.	√LK.	Cond. R.	Coil R_1.	K.	L.	β.	√LK.
3·71	3·21	12	72	1·98 × 10^{-7}	45 × 10^{-3}	7·8 × 10^{-3}	477	2	1·73	10·7 × 10^{-8}	24 × 10^{-3}	4·22 × 10^{-3}	477
7·42	6·4	12	72	1·73 ,,	89 ,,	10·38 ,,	717	4	3·45	9·3 ,,	48 ,,	5·6 ,,	717
11·13	7·48	12	72	1·67 ,,	103 ,,	12·5 ,,	784	6	4·03	9·0 ,,	56 ,,	6·74 ,,	784
14·84	7·48	12	72	1·57 ,,	103 ,,	14·49 ,,	806	8	4·03	8·46 ,,	56 ,,	7·81 ,,	806

Continuously-loaded Cables (same Capacity as Coil-loaded Cable).

Per naut.								Per kilometre.					
Cond. R.	Added R_2.	S/K.	R_2/L.	K.	L.	β.	√LK.	Cond. R.	Added R_2.	K	L.	β.	√LK.
3·71	1·76	12	110	1·98 × 10^{-7}	16 × 10^{-3}	10·0 × 10^{-3}	284	2	·96	10·7 × 10^{-8}	8·7 × 10^{-3}	5·4 × 10^{-3}	284
7·42	1·76	12	110	1·73 ,,	16 ,,	15·34 ,,	304	4	·96	9·3 ,,	8·7 ,,	8·28 ,,	304
11·13	1·76	12	110	1·67 ,,	16 ,,	21·1 ,,	310	6	·96	9·0 ,,	8·7 ,,	11·37 ,,	310
14·8	1·76	12	110	1·57 ,,	16 ,,	26·23 ,,	320	8	·96	8·46 ,,	8·7 ,,	14·14 ,,	320

Continuously-loaded Cables with Minimum Quantity of G.P.

Cond. R.	Added R_2.	S/K.	R_2/L.	K.	L.	β.	√LK.	Cond. R.	Added R_2.	K	L.	β.	√LK.
3·71	1·76	12	110	2·25	16 × 10^{-3}	10·62	267	2	·96	12·1	8·7 × 10^{-3}	5·72	267
7·42	1·76	12	110	1·88	16 ,,	16·00	291	4	·96	10·14	8·7 ,,	8·62	291
11·13	1·76	12	110	1·73	16 ,,	21·5	304	6	·96	9·3	8·7 ,,	11·6	304
14·8	1·76	12	110	1·68	16 ,,	27·05	307	8	·96	9·0	8·7 ,,	14·56	307

TABLE VI.—Weights and Dimensions of Copper, G.P. and Iron Windings in Cables with Economical Quantities of Gutta-percha consistent with Safety.

Coil-loaded Cables with Minimum Quantity of G.P.

Per naut.					Per kilometre.				
R.	*d*.	D.	Weight of g.p.	Weight of copper.	R.	*d*.	D.	Weight of g.p.	Weight of copper.
	mils.	mils.	lb.	lb.		mm.	mm.	kg.	kg.
3·71	187	449	350	615	2	4·743	11·4	85·7	150·8
7·42	132	360	235	308	4	3·354	9·14	57·5	75·4
11·13	108	303	167·7	205	6	2·738	7·7	40·9	50·27
14·8	93	279	145	154	8	2·371	7·08	35·5	37·7

Continuously-loaded Cable with same Capacity as Coil-loaded Cable.

Per naut.				Per kilometre.			
t.	*d* + 2*t*.	D.	Weight of g.p.	*t*.	*d* + 2*t*.	D.	Weight of g.p.
mils.	mils.	mils.	lb.	mm.	mm.	mm.	kg.
25·5	238	571	567	0·646	6·035	14·5	138·8
18·0	168	458·6	380·7	0·456	4·266	11·64	93·2
14·7	137	385	271·3	0·373	3·484	9·77	66·46
12·7	119	357	234·9	0·323	3·017	9·06	57·5

Continuously-loaded Cable with Minimum Quantity of G.P.

t.	*d* + 2*t*.	D.	Weight of g.p.	*t*.	*d* + 2*t*.	D.	Weight of g.p.
25·5	238	512	432	0·646	6·035	12·97	105·9
18·0	168	429	311	0·456	4·266	10·66	76·2
14·7	137	370	248	0·373	3·484	9·39	60·8
12·7	119	333	203	0·323	3·017	8·45	49·7

t = thickness of iron winding.
d = diameter of conductor.
D = diameter of dielectric.
R = loop resistance per unit length.

in price gradually becomes less as the β gets higher, owing to the fact that the expensive item, gutta-percha, becomes a less prominent factor in the total cost, and the manufacturing cost becomes a greater proportion of it. The quantities and prices on which the estimate is based are made up on a manufacturing basis and have been independently supplied for purposes of *comparison*. The *actual* cost is not the main consideration in this case, and the table is merely given for comparative purposes.

It should be remarked that the amount of gutta-percha required to give a capacity of ·09 mf. per km. is considered to be rather too small for safety in the case of the coil-loaded cable with a resistance of 8ω per km., and is unnecessarily large in the case of some of the other cables. It is always the cheapest method to obtain efficiency in a loaded cable by the use of the smallest quantity of gutta-percha consistent with safety. I have, therefore, calculated the cost of the most expensive items in such cables and plotted the *relative* cost of β on that basis; this gives very approximately the comparative prices of the cables. The efficiencies and dimensions of the cables are shown in Tables V and VI, and the curves in fig. 2 give the comparative cost of β. It will be seen that the comparison is again greatly in favour of the coil-loaded cable. Of course, the comparative cost depends to some extent on the cost of materials and labour, and is not an invariable quantity. As a basis of comparison, gutta-percha has been taken at 6s. 8d. per lb., copper at £4 10s. per cwt., and the special kind of sheathing wire used by the Post Office at £16 per ton.

Now the actual cost of heavy-gauge cables is in any case very great, and such cables would only be required for long-distance cable service. If a cable 250 nauts in length were required, it is very doubtful whether a paying commercial service could be provided in the case of a continuously-loaded cable, owing to its high cost, combined with the fact that the β *l* of such a circuit would be 2·65, against 1·82 in the case of the coil-loaded cable (see Table V), which could be provided much more cheaply.

In view of the foregoing facts, it appears clear that a coil-loaded cable is of greater electrical efficiency, and therefore is to be preferred to a continuously-loaded submarine cable of the type examined, if it can be satisfactorily maintained. It follows from the nature of the case that it is not possible to state absolutely the life of such a cable, and this is, of course, a necessary consequence of its recent introduction, but the Anglo-French loaded cable has now been immersed nearly 2½ years, and has not yet required any attention whatever. The Anglo-Belgian cable also has not been interrupted since it was handed over to the Post Office by the contractors. Those who have the greatest knowledge of the design of such cables, moreover, do not anticipate any exceptional difficulty in the future.

So far as continuous loading is concerned, considerable attention has been, and doubtless will continue to be, devoted to its development, but even if it be assumed that material progress is made, now or at an early date, the increase in the diameter of the conductor brought about by the iron wrapping, and the necessity for an increased weight of gutta-percha as compared with a coil-loaded cable, would in any case appear to be a serious drawback to it. The type of continuous-loading examined in this paper, that produced by the Telegraph Maintenance & Construction Co., represents good work in that direction, inasmuch as the speaking range of the cable so loaded was rather more than doubled, as compared with an unloaded cable. It will, however, be necessary to decrease the ratio $R_3/L = 110$, and to increase considerably the permeability of the iron winding before continuous-loading can be considered to be electrically equal to coil-loading as an efficient electrical device.

Erratum.—In connection with equation 11, page 932, it should have been stated that "$2\,d$ is the distance between the centres of the conductors," not "d" as previously stated

COSTING.

[COMMUNICATED.]

Costing is a common generic term denoting any systematic procedure of recording the elements of the cost of production, output, construction, or whatever suitable appellation may be given to the result achieved. The ingredients of costing are naturally those of labour, materials, and expenses, and the art of costing may be said to consist of the display of such knowledge and skill as are necessary in recording and allocating the details or minutæ of these factors, so that they may be of practical utility for the purpose which they are intended to serve.

Subject to the prevailing degree of personal opinion and point of view, which loom largely in matters of classification and in other respects, and which not infrequently are mere distinctions without differences, we may exhibit the general composition of cost in the following manner :—

1. Wages	Prime or flat cost.		Total cost.	Selling price.
2. Materials				
3. Direct expenses—*e.g.*,				
Wages				
Rent				
Insurance	Plant, machinery, buildings, &c.	On cost.		
Rates				
Repairs and maintenance				
Water				
Light (and other charges)				
4. Indirect expenses—*e.g.*,				
Directors' fees				
Office rent and salaries				
Travellers' salaries, commissions and expenses				
General expenses				
Warehouse wages and expenses (and other expenses)				
5. Profit				

All methods or systems of remunerating labour owe their existence to the following principles :—

1. Day work, *i.e.*, paying for the time spent on work.
2. Piecework, *i.e.*, paying for the quantity of work done.

Let us notice some of them.

Differential piecework rates may be stated as meaning a high rate of pay for a definite high of large production, with a lower price if such definite production be not attained. For instance, if the maximum number of operations, or products, as the case may be, for a workman, be 20 per day, and the rate 8d. per operation or product, he would receive 13s. 4d. if he performed the work satisfactorily. Should the quality of the workmanship be indifferent or below the recognised standard, he might be entitled only to a 7d. rate, or it might be graded, that is to say, if ten operations were performed satisfactorily he might receive therefor an 8d. rate, if six, then a 7d. rate, with a minimum rate of wage per diem.

One of the principle defects of piecework remuneration is that of "cutting," or reduction of rate, and if it be cut the workman soon discovers the length he can proceed without incurring risk of reduction, and limits his production accordingly. Absolute or fixed piecework rates are those which are, of course, fixed, but usually without the grading to which we have alluded.

We may here note some of the premium or bonus methods in vogue. As is well known, the basis generally embraces an hourly rate with a standard time for each operation or job, the workman receiving in addition to his hourly rate of pay a premium, or a proportion of a premium, the monetary value of which varies according to the intensity of production, or the time saved on the completion of the job. Let us suppose the following data :—

Time allowed, 54 hours, hourly rate, 9d. ; workman actually completes the specific work in 49 hours.

1. The workman receives 49 hours at 9d. ... ... 441d.
Saving on standard time 5 hours at 9d. = 45d.
One-third of ... ... 45d. 15d.
456d.
= 456/49 per hour for the work.

2. Or 49 hours at 9d. ... ... 441d.
Saving 5 hours at 9d 45d., one-half thereof ... 22·50d.
463·50d.
= 463·50/49 per hour for the work.

3. Or 49 hours at 9d. ... ... 441d.
$\frac{1}{10}$th of 49 hours = $4\frac{9}{10}$th hours at 9d. ... ... 44d.
485d.
= 485/49 per hour for the work.

Taking 54 hours as the time of an ordinary week's work, it will be perceived that the workman in the usual course without earning any premium, would receive 486d. for the week, *i.e.*, 54 at 9d., as against—

Detail.	Case 1.	Case 2.	Case 3.
49 hours	441d.	441d.	441d.
Bonus	15d.	22·50d.	44d.
5 hours at 9d. ...	45d.	45d.	45d.
	501d.	508·50d.	530d.

It is not clear why, of the total premium earned by the workman, the employer should participate therein to the extent of two-thirds in Case 1 and one-half in Case 2. If the workman were paid the whole of the premium earned, he would be entitled, for his week's work, to 531d., to which Case 3 approximates.

It is often stated that, in the industrial world, the employer seeks to obtain the labour that he requires for the least possible pay, whilst the workman seeks the highes remuneration for the minimum amount of labour. As a step towards substituting some measure of practical confidence and goodwill for the present and long-existing antagonism, the principle of co-operation, profit-sharing, or co-partnery, which in various forms is in restricted evidence to-day, seems to be accorded only a mixed acceptance, and consequently has its detractors as well as its supporters. Only by some such means, it is often averred, can the establishment of confidence between capital and labour, the encouragement of production, and the security of economical and excellent workmanship, be realised. Some who favour the idea go so far as to say that the principle is applicable to all forms of business with general success, that it produces good results by getting men to work more intelligently and with less waste, whilst it brings out more sympathetic management, and that some losing concerns by adopting co-partnery usually "turn the corner." Others emphasise its unsuitableness for some businesses. Some allege that the principle is not worth while pursuing, and that a liberal system of piecework or bonus remuneration acts much more to the pecuniary advantage of the employé than that of profit sharing. Where the employer, whether he be in the form of an abstract entity or otherwise, obtains money at, say, 4 per cent., and lends it to the employés at, say, 5 per cent., to give effect to profit-sharing proposals, the principle seems to be, it is sufficient to state here, objectionable.

An effective system of costing implies the efficient purchase of stores and materials for consumption in manufacture or construction, and an efficient system of storekeeping for the reception, custody and issue of stores, whilst it is desirable that the cost accounts should be interlocked with the principal books of account.

Referring to the appropriation of direct and indirect charges where numerous or many varied jobs, orders or contracts, are in course of execution, some of the former charges in their entirety may be readily allocated to a job, whilst many others necessitate apportionment in the process of arriving at their final destination. What the basis of apportionment should be —and this may vary as between certain forms or descriptions of expenditure —will depend upon the decisions arrived at from a practical consideration of the precise circumstances. As to indirect charges, these are for the most part inherently of an apportionable character if in some instances there be any special object to be attained in so exhausting them over the cost accounts. It is necessary to bear in mind that apportionment in costing merely means in this case estimating, and that to the extent that costs contain computations of this character, they are naturally estimated.

In many cases a large production is essential to the profitable working of a company having regard to the amount of capital sunk therein (though the Companies' (Consolidation) Act provides a means for removing the incubus of lost capital), and to the narrow margin of profit made, and generalising in this connection we may conclude our elementary notes with the introduction of efficiency, increased capacity of plant, and on cost, the latter varying as it does with output. For instance :—

To materials	£20,000	By sales	£40,250
,, wages	9,000		
,, on cost	6,000		
,, profit (15 per cent. on cost)	5,250		
	£40,250		£40,250

If the sales be increased to £80,500 owing to the doubling of the plant, we may have :—

Materials	£40,000	By sales	£80,500
Wages	17,000		
On cost	9,000		
Profit (say 22 per cent. on cost)	14,500		
	£80,500		£80,500

Supposing that it be unnecessary to double the machinery installation, as after careful consideration of the details of the operations of the workmen and of the existing production machinery and appliances, it is estimated that the increased output can be obtained by some slight extensions and improvements and by greater labour efficiency, we may have :—

Materials	£40,000	By sales	£80,500
Wages	13,500		
On cost	8,000		
Profit (say 30 per cent. on cost)	18,500		
	£80,000		£80,500

On this basis (first and third examples)—

£35,000 on £40,250 = say 87 per cent.
£61,500 on £80,500 = say 76 per cent.

a decrease in cost of 11 per cent.

Particular attention should be paid to the item of on cost, by which is here meant every addition to revenue expense, financial, administrative, distributive, or of whatever nature, and whether it be fixed or fluctuating. Its relativeness to its neighbours of labour and materials should be under constant supervision, and to be of value it should be comprehensive of suitable detail. G. J.

The Electrical Refining of Nickel.—It is reported from Kristiansand that the Kristiansand Nickel Refining Works, which only a short time ago increased their capital and extended their plant, have now decided on further extensions so as to be able to double their present production. This extension may have some connection with an invention that was made a short time ago, viz., an electrical refining furnace for nickel. Experiments with such a furnace have been in progress for some time at the Technical College at Trondhjem, with good results, and it is anticipated that the furnace will prove as satisfactory for commercial purposes as it already has proved to be in metallurgical respects. It is stated that this furnace is the first of its kind in which metallic nickel can be produced by an electrical process. The Zigeland Aluminium Manufactory, which is also situated in the neighbourhood of Kristiansand, is now worked to its full capacity, but as the demand for aluminium has increased lately, it has been resolved to increase the production further by erecting a new building and equipping it with the necessary plant. The cost of the building alone will mount to £5,555, apart from the plant.

PROCEEDINGS OF INSTITUTIONS.

Earthed v. Unearthed Neutrals on Three-phase A.C. Systems.

(*Discussion on paper read by* Mr. J. S. Peck, *before the* Institution of Electrical Engineers, *at Birmingham, November 27th*, 1912. *For abstract of paper see p.* 935.)

Mr. R. A. Chattock agreed that with 10,000 volts and upwards it was probably beneficial to earth ; but below this voltage he did not consider that it was necessary. In Birmingham, on their 5,000-volt three-phase 25-period system they had not yet found the slightest necessity for earthing, and they did not propose to do so as long as the conditions remained as satisfactory as at present. While he admitted that an earth on one phase generally produced a complimentary earth on another phase, and a short circuit occurred, he had known cases in which an earth on one phase had developed and it had been possible to maintain the supply for some considerable period until this earth had been located and rectified. With an earthed neutral under such conditions a section of the supply would have been automatically cut off. Maintenance of supply was one of the chief points that supply undertakings had to consider, and any arrangement that tended to carry this out should always receive first consideration. The second point was the greater safety to human life in case of accident. With an earthed system, if a man touched one of the phases he was bound to be killed, but more than one case had been known in which on an unearthed system, a man had accidentally touched one of the phases, and had not been killed. The third point was the complication and the unsatisfactory nature of the arrangements used for earthing. Mr. Peck described two or three methods of earthing, and advised trying one, and if it were found to be unsatisfactory, then another should be tried. This did not look as if the methods adopted were at all standardised. If the generator neutrals were connected solidly together, there appeared to be liability of large currents circulating in the windings, the effect of which, superimposed upon the wattless currents which circulated in the generator windings under conditions of low-power factor, must be very serious on the heating of the generators, and must cut down the capacity of the machines to handle useful load. These circulating currents depended upon the wave-form of the alternators, and it was highly probable that the wave-forms of machines designed by different people would be dissimilar, the result being that it was impossible to prophesy what quantity of circulating current would have to be dealt with. The alternative to this was to connect one generator neutral to earth, and this had to depend upon the attendant in charge, or else upon the very complicated apparatus installed at the London County Council power station at Greenwich, which was so complicated that, under prolonged use, there was no doubt trouble would be experienced. Again, with one machine coupled to earth, in case of a fault on one phase, it was quite likely that the overload circuit-breakers on this particular machine would be opened at the generating station, and the system would then be running unearthed just at the time when further trouble was most likely to appear. In Birmingham they had designed their high-tension cables to stand the full voltage to earth on any phase rather than cut down the insulation, as was possible with an earthed system. He considered that economy of this kind was far from advisable, and the results obtained in Birmingham had fully justified this provision. Very few breakdowns to earth of any kind had been experienced, and these had always occurred in connection with broken insulators in the switchgear, or coils in generators. He considered, therefore, that for a system having a pressure up to 10,000 volts, it was certainly better to allow a large factor of safety in the insulation, and to run with an unearthed neutral.

Mr. F. Forrest said that in considering the earthing of the neutral of any three-phase transmission system, the factor of safety of its insulation to earth should largely determine this point. By the factor of safety of the insulation was meant the ratio between the normal working voltage to earth (in all systems whether earthed or not this was ⅓ of the voltage between phases) and the voltage to earth which would cause breakdown when continuously applied under the worst atmospheric conditions likely to be met with. In the case of bare overhead transmission lines working at voltages above 50,000 between phases, this factor of safety was usually about 2·5. In order that this factor of safety might be maintained, and also in order to save a large additional capital expenditure for insulators, such transmission lines should always be operated with an earthed neutral. In this country, where voltages were comparatively low and underground systems prevailed, the factor of safety was usually much higher than 2·5, and the question of earthing would largely be decided by other considerations. One of the chief points in favour of earthing the neutral was the question of lightning or pressure arresters. If full use was to be made of these, they should be set to spark over at a voltage 25 per cent. in excess of the normal working pressure to earth, so as to clear the system of all pressure surges, but if the neutral was unearthed, the arresters must be set so high that they were never likely to operate at all.

Dr. C. C. Garrard said that the sole advantage of the earthed neutral which we need consider in this country, was the possibility of cutting off any wire or feeder in the event of an earth upon it. Considering the case of a generator feeding a network of underground cables, if earthing of the neutral was adopted it must be through a current-limiting resistance. He agreed with Mr. Peck that the simplest method was to connect the neutrals all together on to one bus-bar, earthing this through a resistance. Even with turbines, however, heavy circulating triple-frequency currents might flow. A case which came under his notice was with water turbines. Efforts were made to test the generator wattmeters under inductive load by altering the relative excitation of the machines. This, however, caused large cross currents to flow through the neutrals which were connected together, which upset the tests altogether. The method of balanced protected gear illustrated in fig. 1 was very interesting. Would Mr. Peck also advocate the protection of underground feeders by this method alone, or would he install overload protection in addition? The very clear exposition of the case of the generator supplying transformers which stepped up to a very high voltage, in which Mr. Peck showed the absolute necessity for some form of earthing, would apply to sub-stations in which were situated step-down transformers feeding converters. In a sub-station fed by step-down transformers having a primary voltage of 10,000 and a secondary of 500 volts. The secondaries of the transformers, although heavily insulated, kept on breaking down to earth, and examination of the point of puncture showed clearly that it was the result of an abnormally high potential. The difficulty was obviated by putting a permanent leak on the low-tension side of the transformers by means of resistances connected between phase and earth. It was not possible to earth the neutral, as the transformers were delta-connected. He fully agreed with the author's condemnation of earth shields between the primary and secondary windings of transformers. He was very doubtful, however, of the utility of a spark gap in the earth connection; instead of the spark gap, a permanent leak from line to earth through resistance would be better if earthing of the neutral were impossible.

Mr. S. A. Mahood said the conclusions arrived at in the paper were not very convincing. His experience with a three-phase 5,500-volt, 25-cycle system, in which the neutral was earthed solid without any resistance between, had been quite satisfactory in actual practice for eight years. They had had no complications due to the way in which the system was earthed, and saw no reason why they should make any change.

Dr. W. E. Sumpner said that he favoured the view that the neutral should be earthed in all cases, except where it could be clearly shown that there was a great disadvantage in doing so. This opinion was based on general considerations of simplicity. A three-phase circuit really consisted of three circuits interlinked, except when the neutral was earthed, when the circuits were essentially separate. In the latter case a defect in one circuit was not likely to affect the others, though it might prove more serious in the circuit in which the defect occurred. On the whole it seemed preferable to localise the trouble, especially in view of possible dangers arising in high-tension systems from what were known as surges. These were likely to occur whenever a sudden change occurred in the circuit conditions, and they might give rise to much higher potentials than those indicated by a simple theory, such as that given by Mr. Peck in connection with fig. 2. At one time almost the only formula needed for electrical engineering was Ohm's law. Nowadays, with high-tension work, engineers were face to face with what might be called the "lightning-flash" stage of theory, a theory which as yet no one had been able to make very simple, but in which they had to consider phenomena akin to lightning discharges and to wireless telegraphy.

Mr. A. M. Taylor thought that Mr. Peck had not proved the necessity for earthing the neutral on a low-voltage system such as that at Birmingham. To put in an earthing resistance sufficiently heavy to pass enough current to operate the feeder over-load trip gear, was quite out of the range of practical politics. Consider the serious interruption to supply that would result from cutting off even one feeder carrying 400 amperes at 5,000 volts. If the neutral were earthed this interruption was deliberately invited for even a trifling fault. In most cases the faults did not occur in the cable, but on the consumer's premises. Hence, it was much better to devise means to cut off the faulty consumer, rather than the whole feeder. The other alternative, viz., to install apparatus as in fig. 1, again assumed that the whole feeder had to be cut off for the sake of a fault that might be quite unimportant. Mr. Chattock had already spoken of a case where the fault was on the system for over an hour, and was cleared without affecting anyone but the consumer concerned, and the speaker knew of other cases. Moreover, the arrangement shown in fig. 1 gave no protection against shorts between phases. As regarded working with the arrangement in fig. 1, but having no earth whatever, this was only possible on very large systems having a capacity current of perhaps 100 amperes and many feeders. Even then there tended to be an operation of the relays on all the feeders, and not only on that on which the fault had developed.

Dr. Wall asked the author whether he had any data as to the magnitude of the equivalent capacities as shown in fig. 2, and whether it was likely that the capacity currents would ever cause an appreciable amount of heating.

Mr. T. P. Wilmshurst said with an earthed neutral on a star-connected system, the voltage between any phase and earth could not exceed 58 per cent. of the line voltage, and in consequence a smaller dielectric thickness might be used. The difference in cost between a cable built for work with an earthed neutral and one built for non-earthing was about 7 per cent., and this might amount to several thousand pounds on a large system.

The Faraday Society.

"The Billiter Alkali-Chlorine Cells." **Dr. A. J. Allmand** presented a paper describing these cells, which are coming into extensive use on the Continent and in America, before the November meeting of the Society. In the opinion of the author, and as a result of personal observation of some of the plants at work, the newer type of Billiter cell, known as the "membrane" cell, is one of the most efficient electrolytic alkali cells now being operated on a technical scale, but it does not seem to have attracted much attention in this country. The earlier type of cell (Billiter-Siemens) is a diaphragm cell, but it differs from others of its class in having horizontal instead of vertical diaphragms. Apart from the disadvantage of occupying more floor space, and being less accessible, the horizontal cell seems to have the balance of advantages, for the diaphragm is attacked more slowly chemically, and the hydrostatic pressure upon it being uniform, there is a more uniform flow of liquid through it, and consequently a more efficient checking of the movement of the OH' ions towards the anode, and thus greater electrochemical efficiency. The diaphragm in this cell consists of a mixture of asbestos wool and barium sulphate spread out on top of a sheet of asbestos cloth that is carried by the iron network forming the cathode. The cathode makes contact with the iron bottom of a trough, the sides of which are lined with cement, and the anode chamber is formed by a non-conducting bell-jar which is cemented around the edges of the diaphragm. The electrolyte is heated by means of earthenware pipes immersed in the brine at the top of the bell-jars. Working at 85-90°, 12 to 16 per cent. caustic soda, or 18 to 20 per cent. caustic potash can be made at a 95 per cent. cathodic current efficiency with a voltage of 3·5. The process is now in operation at the following places:—

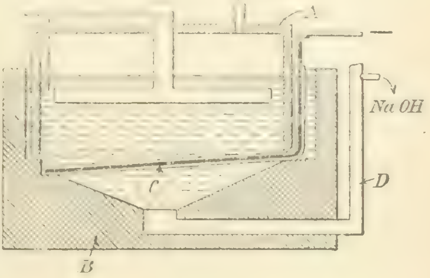

Fig. 1.

(*a*) In Aschersleben, Saxony, by the Kaliwerke Aschersleben A.G. Ten 2,000 ampere units.

(*b*) In Höchst, by the Farbwerke Höchst.

(*c*) In Brückl, Bosnia, by the Bosnische Elektrizitäts A.G. Sixty-four 2,500-ampere units.

(*d*) In Krumdu, Bohemia, by Ignaz Spiro und Söhne. Thirty-two 500-ampere units.

(*e*) At Niagara Falls, by the Niagara Alkali Co. A 1,000-kw. installation of 3,000-ampere units. This plant is now being increased from 1,000 to 3,000 kw. It has also been made known that a new factory for caustic alkali and bleach is being erected, commencing with 78 2,000-ampere units, and that a textile factory is installing 24 100-ampere units.

In the newer type of cell referred to above, the Billiter-Leykam cell, the diaphragm is done away with altogether, and the cathodes are hooded in asbestos tubes, as shown in fig. 2. The special feature of the cell is that these cathodes are not placed at the sides of the bell-jar, as in other bell-jar cells, but immediately underneath it, as shown in the accompanying diagrams. This arrangement ensures uniform current density and also uniform flow both of electrolyte and of current between the anode and cathode, and the motion of the brine being directly opposed to that of the current lines, the OH^1 injection towards the anode is everywhere uniformly overcome. Hence high current densities can be used, stronger caustic liquors produced, high current efficiencies obtained, and large units constructed, while at the same time the essential advantage of the bell-jar cell, absence of diaphragm, is retained. The liquid which passes the cathode hoods—made of woven asbestos—is charged with caustic, and this

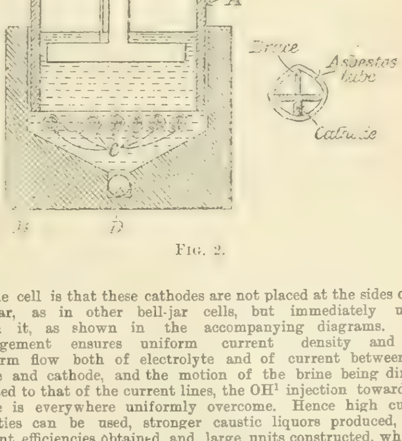

Fig. 2.

protects them from the chemical action of chlorine compounds ; no purification of the brine is necessary at all. The only function of the hoods being to lead off the hydrogen gas (for which purpose the cathodes are slanted, as shown in fig. 1), they can be made quite coarse, so that their resistance is inconsiderable. The general construction of the cells will be quite apparent from the sectional diagrams, figs. 1 and 2. The cell B itself is made of reinforced concrete, the upper part being lined with earthenware bricks set in cement. In the plant at Gratwein, in Austria, there are 56 of these cells, each measuring internally 5·5 metres long, 1·1 metres broad, and 1·3 metres high. The cement lids A, which in practice are cemented with putty on to a shallow shelf cut out of the walls of the cells, together constituting the bell-jars, carry the Acheson graphite anodes. At Gratwein each cell has three lids, each carrying eight anodes, measuring 1·0 × 0·18 × 0·05 metre. Each anode takes 50 amperes at a C.D. of 1·6-1·7 amps./sq. dcm., so that every cell takes 1,200 amperes. The cathodes C are made of T-iron, and, as already indicated, they are enclosed in asbestos tubes, which carry off the hydrogen gas. The cathodes are 1 m. long, and the tubes are about 5 cm. broad ; between each two there is a space of 5 to 8 mm. At Gratwein, some of the cells, at the time of inspection, were being worked at low temperature, and some were steam heated up to about 70° C. The voltage of the former was about 4, and of the latter 3·4 to 3·5. The brine is led from a reservoir to distributing boxes placed above each cell, proceeding thence by a series of short capillary tubes to 22 tin tubes, which pass through the cell lids. The causticised brine is drawn off by means of siphon overflows, shown diagrammatically at D. The cells are worked under slightly reduced pressure, so there is no escape of chlorine into the air.

The Gratwein plant, which is the first that has been installed, is in the paper factory of the Leykam-Josefsthal A.G. The plant has a capacity of 350-400 H.P., and it produces some 1,700—1,800 kg. of active chlorine daily at a total cost, as far as power is concerned, of £7 10s. per H.P.-year. The current efficiency is as high as 92 per cent. when the cells are worked at 85° C., and the voltage is then 3·1. The cathode liquors contain 12 to 13 per cent. caustic soda and about 20 per cent. salt, yielding, on evaporation and concentration, 97 per cent. caustic soda. A second installation of this cell is now being erected in Saxony.

At the same meeting papers were read by MR. RIDSDALE ELLIS on "A Neutral Oil Emulsion as a Model of a Suspension Colloid," and by MR. J. H. STANSBIE on "The Electrolysis of Nitric Acid Solutions of Copper."

Mr. Ellis's work was carried out with a view to obtaining some quantitative data on the relations between the electrical charge carried by the particles of an emulsion, the surface tension on the oil-water interface, and the phenomenon of coagulation, with a view to throwing light on the nature of colloidal solutions, and particularly on the conditions which cause coalescence to occur. An emulsion, of course, contains in suspension particles very much larger than those of a colloid ; in Mr. Ellis's experiments the size of the oil globules was about 2 μ, but in all probability there is no essential difference in the two classes. As coalescence or coagulation is deemed to be an electrical phenomenon, Mr. Ellis has studied the influence of the presence of acids and alkalies on the interface potential at the surface of the oil globules, by direct measurements on a microscope slide apparatus. He has found this potential to be altered enormously by acids, and to a lesser degree by alkalis. The maximum interface potential corresponded to a concentration of about 0·001 N alkali, and this was also found to be the point of maximum stability of the emulsion. Stability appeared to depend only on the interface potential, and not on the surface tension, as Bredij has taught. The explanation suggested by Prof. F. G. Donnan is that the presence of an electrical double layer around the particles prevents them from coming into sufficiently close contact unless the kinetic energy of the collision of two particles is sufficient to enable the electrical double layer to be disrupted, and if so the less chance there will be that two particles colliding with one another will coalesce or adhere to each other. Strong confirmation of this view is given by the data obtained in connection with the iso-electric point. According to the above theory, when the charge is zero there is no opposition to the force tending to produce coalescence or aggregation, so that in the case of a colloidal solution in which all the particles are in rapid movement or vibration, coagulation will occur extremely rapidly.

Indirect evidence that coagulation occurs at the iso-electric point is given by the ratio of concentrations of salts with mono-, di- and tri-valent kations required to just neutralise the charge on the oil globules, since the ratio of these concentrations forms a geometrical series agreeing with that obtained by coagulation experiments, a result, be it said, however, not confirmed by some experiments of Freundlich quoted by Dr. Senter.

In order to study the coagulation of one colloid by another of opposite sign, the coagulation of oil emulsions by colloidal ferric hydroxide was tried, and it was found that the oil was completely precipitated within two well-defined limits on either side of the iso-electric point of the oil emulsion. Mr. Ellis considers the coagulation here to be due to surface precipitation effects taking place between the oil globules, similar to the condensation of water vapour on surfaces of various curvatures. Thus when two oil particles come into contact there is formed at the point of contact the equivalent of a surface of negative curvature with a very small radius on which $Fe(OH)_3$ will very readily precipitate, thereby uniting the two particles together. This precipitation will not occur until the amount of the $Fe(OH)_3$ is sufficient to produce, in the short space of time the particles are in contact, a bond sufficiently strong to prevent the globules separating again by Brownian movement. When the globules are united in pairs, others will be joined to them in exactly similar manner until all the oil globules are held together in large columns cemented by ferric hydroxide.

Mr. Stansbie's short note explained in a very interesting way why it is not possible to deposit copper completely from nitric acid solutions. It appears that in the electrolysis of such solutions nitrous acid is formed, and it is the action of this or of nitrites which dissolves away the deposited metal. The presence of free sulphuric acid retards the formation of nitrous acid, and a rotating cathode also very effectively prevents redissolution, so that under proper conditions, all but the merest trace of copper can be deposited.

Roller and Ball Bearings.

AT the Leeds University on Wednesday last week, PROF. GOODMAN lectured to the members of the YORKSHIRE LOCAL SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS on "Roller and Ball Bearings." He explained in detail the use of the testing machinery operating at the University, particularly emphasising the facilities that it afforded for measuring the end thrust, which, he said, was an extremely valuable accomplishment. The reason why there was end thrust on a roller bearing was that the roller was not perfectly parallel to the shaft as it rotated, and thus it tended to give in the direction normal to itself. If there was a millionth of an inch of error, the end thrust was just as bad as if there was an error of an eighth of an inch.

Discussing the extravagance of the claims made by some makers, he instanced in particular an American roller bearing guaranteed to be free from end thrust and with no friction which, on being put into the testing machine, proved to have so much end thrust and friction that the rollers were smashed. The last time he addressed them, he said, he had declared that there was not a single roller bearing on the market worth having, but since then he had found one which, so far as his tests had gone, was entirely satisfactory. They had tried to break it and could not ; they had broken the shaft in their efforts, and had had to put in another, but the bearing remained as good as when it was put in. That was a bearing with a short roller. The length of the roller was only equal to the diameter. He had run it at a great overload, much beyond what the maker intended it for, and the results were still satisfactory. Some of these particular roller bearings had failed in actual practice, but he believed that the reason for the failure was that grit had got into them. It was most important to keep grit out of roller and ball bearings. These bearings ought to be as carefully guarded as the springs of a watch. The short roller bearings cost about 25 per cent. more than ball bearings, but they would carry twice the load. What the maximum load was he could not say definitely yet, because he had not yet smashed one of them. So far as his tests had gone, the short roller was an entire success. There was a little end thrust, but it was a negligible quantity.

With regard to ball bearings, he said that in the early days the makers thought that adjustment was necessary, and some of them did not appear to have got over the adjustment fit yet, but, as a matter of fact, there was no necessity whatever for adjustment, and they could not adjust a ball bearing if they wanted to. The early four-point bearing was good for light work, such as bicycles, but beyond that it was never used.

Later on thrust bearings came: 45° grooves were made for the balls to race in, and it was very soon found that the grooves were very badly scored, showing that they had been grinding. That type of bearing was wrong, because they could not increase or decrease the load without failure. The three-point bearing failed because of excessive friction and other faults. The two-point bearing was eventually found to be the proper thing, the friction being very much less and the load carried much higher. Then it was found that the hollow race was the right thing instead of the flat race. Hoffmann's were the first in this country to use the hollow ball race. If there was any doubt about being able to keep the shaft and the bearing in line, the flat race was the better. If they were certain of keeping everything in line, then the hollow race was unquestionably the right thing. A properly-fastened bearing with a hollow ball race would carry about twice the load that one with a flat race would.

The best practice was to make the radius of the groove 10 per cent. greater than the radius of the ball. The theory was that the closer they could make this groove fit the ball, the higher was the load that the bearing would carry ; but the friction would go up at the same time. The friction was least on a flat surface, but it would only carry half the load, so they had to take into consideration all the circumstances of the case.

After discussing the effect of static friction, Prof. Goodman dealt with the use of an adapter. The fixing of the sleeve on the shaft, he said, was by far the most important problem connected with ball bearings, and four-fifths of the failures had been due to improper fixing. The man who worked to the nearest sixty-fourth of an inch went hopelessly astray. By far the best thing to do in preference to using the adapter, was either to make the shaft deeper and use a nut and fix it solid on the shaft, or have a ring bored out parallel and either forced on by hydraulic pressure or shrunk on. But they must be very careful in the shrinking. If they did not allow enough shrinkage it would get loose ; if there was too much shrinkage it would jam the bearing. They would think they had got a 2-ton load upon it, when they had got 20. Thousands of ball bearings had been destroyed by getting too much shrinkage, or by forcing them on at too great pressure. The amount of shrinkage should be $\frac{1}{2000}$th part of the diameter, and if they materially departed from that they would have trouble. They should heat the ring in a bath of oil up to about 154° F., and if then they could not get the ring on to the shaft, it would clearly prove that they had got too much shrinkage.

In most cases in which the maker was blamed, the fault was due to people using ball bearings carelessly. The housing of the bearings must be properly arranged. If the outer ring was fitted into a housing which was too small for it, as had frequently been done, even if it was only a thousandth of an inch too small, it would nip in the side when the load came on. If there was noise in the use of ball bearings, it was clear proof that they were doing something wrong. At the University they ran ball bearings under much more severe conditions than any in practice, and got no noise. Step bearings for heavy pressures he described as not a bit of good. In the Skefco bearing the shaft could move relatively to the housing to any extent. Whilst ordinary ball bearings were guaranteed to a ten-thousandth of an inch, the Skefco was made to a hundred-thousandth of an inch. It had been tested, terribly overloaded, with success.

With regard to rings, he said it was very important not to depart greatly from the spherical form—the simple form of ring. Emphasising the need of accuracy of workmanship, Prof. Goodman said if they were wrong to the extent of one-thousandth of an inch—say a thousandth over the inch—they would, approximately, increase the load of the bearing by 100 per cent. Hence there must be accuracy at all costs—wonderful accuracy. Whilst there were some firms in this country who worked to a millionth of an inch, if necessary, there were others who even yet hardly seemed to realise that there was anything less than an eighth of an inch, and the latter were the people who were always complaining of ball bearings. In the University they had carried out thousands of experiments in the attempt to find out the safe load and speed of ball bearings. They had been at it for 10 years, and they had found out how to get it.

If they looked at a ball under the microscope, as soon as ever they exceeded the safe load or speed, they would find it covered with fine specks where crystals had broken away. As soon as these specks appeared they might know to a certainty that the ball was damaged, and would ultimately fail; otherwise, if he had to run ball bearings until they failed, he would be as old as Methuselah before it occurred. The examination of the ball under the microscope had been a complete success. Speed was a most important point, and he illustrated on the blackboard the way in which they were able to find the relation between the speed of the ball and the safe load. He did not know why speed had anything to do with the matter. The wear of the balls was practically *nil* under proper conditions, even after very severe running. After dealing with some misconceptions of the rough-and-ready manufacturers as to the effect of slight variations in the sizes of the balls, Prof. Goodman spoke of lubrication. Provided that there was absolutely no rust at all, the balls would be better without lubrication, for oil or grease always increased the friction. Lard oil was the best lubricant. Lubrication was needed only for the sake of preventing corrosion, and once in 12 months was probably sufficient.

Speaking in conclusion of the general qualities of ball bearings, the lecturer said the friction was extremely low; with a properly fastened ball bearing, the starting effort was so small that they did not get a jump, and the friction was entirely independent of the speed. The ball bearing cost three times as much as the ordinary bearing to carry the same load, but the friction was less, no attention was required, and practically no lubrication, and an important point also in the case of a dynamo or motor was that the use of the ball bearing would shorten the shaft and shorten the bed. That was of very great importance, as they saved metal; but what was of importance also with regard to a motor was that the mechanical efficiency of the motor was very considerably higher with a ball bearing than with a plain bearing. So they could supply a smaller machine with ball bearings to give the same horse-power that a much larger machine would give if it had plain bearings. If they asked makers to quote for motors with and without ball bearings, they would find that in many cases the quotations would be lower with ball bearings than with plain bearings.

It was true that there were some people who said they would not have ball bearings at any price. They were generally people who had not yet learned that there was anything smaller than one-eighth of an inch—the rough-and-ready people.

Discussion.

The **Chairman** (Mr. Wilson Hartnell) said it would appear that roller bearings, except the narrow sort, were practically out of it. Ball bearings would last a great length of time under proper conditions, one of which was that they should fit tightly on the shaft. In putting a ball bearing on an alternating-current dynamo, however, they were met with difficulties, and he had found that there was a danger of cracking. From experience in the working of dynamos, it appeared that every shaft with ball bearings should have an end-thrust collar on it. He knew of a case of roller bearings running very well for many years.

Mr. T. Harding Churton said a great deal of the trouble with ball bearings in electric motors appeared to have been due to the high speeds at which these motors usually ran, but he thought that a more productive cause of trouble was a failure on the part of the makers in many cases to realise the imperative necessity for accuracy in the fitting of the housing of the ball bearings. He had confined his attention with regard to ball bearings to relatively small machines, and he had been absolutely free from trouble.

Dr. Pohl said that the earlier experiments with ball bearings in electric motors in Germany ended in complete failure, and he believed the reason for this was the inaccuracy of the ball bearings themselves. Some years ago he induced his firm to start afresh with ball bearings and roller bearings, and the result had been unqualified success from every point of view. The first thing they discovered was that if they wanted to use ball and roller bearings they had to employ machines of much greater accuracy than those which they had been using. The new ones they had used for over four years, and they had turned out in that period at least 3,000 to 4,000 motors, and the number of complaints that they had received since, was only a fraction of those that they had received before. The chief trouble in electrical motors was the presence of oil, and he attributed the diminution of complaints entirely to the absence of oil. The great point was the accuracy of the machine, and that applied, perhaps, even more to the housing than to the shaft—an easier fit on the outer race, and a tighter fit on the inner race, and making absolutely sure that the inner race did not revolve on the shaft. As to lubrication, he had known cases of friction being increased to such an extent from this cause that the bearing got hot, and they had to stop the lubrication altogether. A great point in connection with ball and roller bearings was that it was so extremely simple to make them dust-proof.

Mr. J. W. Dawson said that in communications with motor-car manufacturers he had pointed out that at least the inner races should be a tight fit on the shafts, and the outer races should be a fit in their housing. He had to object to bearings which were quite loose both in the outer and the inner housing. End thrust would be very simply dealt with if they had a combined bearing which would take both end thrust and the ordinary load. The weakness of the bearing ordinarily was its inability to carry any large proportion of the end thrust. The L.C.C. tramways had tried ball bearings, and found that at the end of 11,000 miles the bearings were as good as when they were put in, but in spite of that the motor manufacturers said "No." If they could bring into general use for tramway motors either the short roller bearing or the ball bearing, there would undoubtedly be a great saving.

Prof. Goodman, in replying to the discussion, said a good many people wanted him to tell them which were the best ball bearings, but he would not tell them, as it was unfair. Some of the lists were woefully wrong. He knew several firms who had put roller bearings on crank-pins, and found them work very well. He had such faith in the short roller bearings, that he had chosen them on occasion rather than the ball bearings, because he thought they would carry a higher load. Streibeck quite unintentionally led people astray at first, when he published a formula for a safe load for ball bearings, taking no account of the speed. A great many people commenced working upon that formula and at too high speeds, and the ball bearings failed. Whilst some of the makers' lists were distinctly too high, others were too low. Some of the ball bearings on the market would safely run on bigger loads and speeds than the makers gave. The success or failure of ball bearings depended enormously on accuracy of workmanship; nine-tenths of the failures had been due to rough-and-ready workmanship. With regard to the suggestion of cone roller bearings for taking end thrust, he did not think any bearing ought to be put to the double purpose; they ought to use two bearings, one to take the radial load and the other to take the end thrust. There were ball bearings on the market intended to take both, but he had never seen one which he considered to be a success. With regard to the overhung pinion on a tramway motor, he would not hesitate to put in a ball bearing there, provided it was not overloaded. He was talking to a chief railway engineer the other day, and said, "Why don't you put ball bearings on some of your rolling stock?" The reply was, "We have tried it, and it was too successful. If you put ball bearings on any of your rolling stock for goods traffic you must put them on all, because if you don't you will kill all your shunters. If you get one truck fitted with ball bearings and another not, the driver cannot judge the distance the truck is going to run." That was a point which had never occurred to him before; and it was a striking illustration of the way in which the practical man could teach things to a mere theorist.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

FRANCE.—The French Customs authorities have decided that "locomobiles" driven by gas are to be dutiable as gas motors, according to kind, under No. 510 of the French tariff as follows:—

Weighing from 250 to 100,000 kg.	12 fr. per 100 kg.
„ less than 250 kg.	20 „

Bearings for the shafts of electric alternators are to be dutiable as detached parts of machines, at rates varying from 12 to 20 fr. per 100 kilograms according to weight. Speed reducers, whether or not imported at the same time as the machines with which they are to be connected, are also to be dutiable under this latter heading

HOLLAND.—With reference to the paragraph on page 727 of the Electrical Review of November 1st calling attention to a new tariff which it was proposed to put into force in Holland, the Board of Trade have now issued certain corrections to their original translation of the proposals. The details given in our extract require modification as follows, as a result of these corrections:—

Machine tools, boilers, pumps, &c., should read *prime movers*, boilers, pumps, &c.

Appliances (apparatus) not being *machine or hand tools*, not specially mentioned, should read appliances (apparatus) not being *prime movers or tools, machines or appliances for producing an alteration of form in some given material.*

The following headings should also be added to the extract we gave, immediately before "implements not separately mentioned":—

Other tools, machines and appliances not separately mentioned	Free
Parts of tools, machines and appliances:	
(*a*) In so far as they are recognisable as being parts of tools, machines or appliances exempt from duty	Free
(*b*) Other...	6 % ad val.

AUSTRALIAN COMMONWEALTH.—The Customs authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation; the duty quoted is in every case the preferential rate applicable to British goods:—

Batteries, storage, imported with and for street tramway cars	35 %
Binders, made of round copper wire which has been flattened at each end	10 %
Switch case. A cast-iron case enclosing a switch and fuses only	Free
Switch case, as described above, when containing compensating or rheostatic equipment	20 %
Switch. Time. A clockwork apparatus to switch on or off at fixed intervals or at fixed times	Free
Tapes, for electrical purposes, being merely copper strips cut to length	Free
Magnetos for use in the manufacture of motor cycles, provided security be given that they will be incorporated in motor cycles manufactured in the Commonwealth, and that proof of such use be furnished to the satisfaction of the collector within six months after delivery, by the Customs	Free
Electrical stoves	10 % ad val.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,024. "Solenoid coil for alternating current arc lamps." Korting and Mathiesen Akt.-Ges. (Convention date, December 2nd, 1911, Germany.) November 25th. (Complete.)

27,046. "Live rails and collectors of electric roundabouts, scenic railways and the like." L. A. Hackett and E. W. Whattam. (Divided application on 28,899 of 1911, December 22nd.) November 25th.

27,049. "Electric lamp." J. J. Kelly, J. M. Doyle and A. Cohen. November 25th.

27,065. "Incandescent lampholders, ceiling roses, and like electrical fittings." E. B. Gray. November 25th.

27,069. "Regulation of electric installations and systems." Akt-Ges. Brown, Boveri et Cie. (Convention date, February 3rd, 1912, Germany.) November 25th. (Complete.)

27,090. "Automatic reverse current cut-outs." P. Ackerman. November 25th. (Complete.)

27,094. "Means for reducing the duration of sparks produced by magneto-electric generators." P. Mascow. (Convention date, January 25th, 1912, Germany.) November 25th. (Complete.)

27,160. "Lamp and shade holders for incandescent electric lamps." G. A. Collier. November 26th.

27,235. "Regulating mechanism for electric distribution systems." British Thomson-Houston Co., Ltd., E. Garton and A. H. St. C. Watson. November 26th.

27,236. "Electric control systems." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany.) November 26th.

27,244. "Means for and methods of changing the frequency of alternating currents." A. M. Taylor. (Addition to 8,853, 1911.) November 27th.

27,246. "Armature for direct-current watt-hour electricity meters." H. E. Moul. (Körting & Mathiesen Akt.-Ges., Germany.) November 27th. (Complete.)

27,276 "Reflectors for electric incandescent lamps." C. Damey. November 27th. (Complete.)

27,325. "Electric lamp." C. W. Hillier. November 27th.

27,345. "Covering for telephone receivers and the like." E. M. Davies. November 28th.

27,348. "Electro-dynamometer instruments." J. T. Irwin. November 28th.

27,351. "Galvanic batteries." A. F. Hawdon. November 28th.

27,382. "Apparatus for winding up and starting of the number switches in automatic telephone subscribers' stations." Zivnostenska Banka v Praze (Firm of). (Convention date, November 28th, 1911, Austria.) November 28th. (Complete.)

27,403. "Short circulating device for the ignition mechanism of internal combustion engines." R. Bosch (Firm of). (Convention date, January 13th, 1912, Germany.) November 28th. (Complete.)

27,432. "Incandescent lamps." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats Ges., Germany.) November 28th.

27,433. "Manufacture of filaments." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 28th.

27,442. "Manufacture of bodies of tungsten, with small additions of other metals, for use in electric incandescent lamps." Wolfram Lampen Akt.-Ges. (Convention date, June 3rd, 1912, Germany.) November 28th. (Complete.)

27,482. "Dynamo-electric brakes for electric motors." Etchells, Congdon and Muir, Ltd., and F. Muir. November 29th. (Complete.)

27,496. "Electric welding tool." E. H. Jones. November 29th.

27,500. "Apparatus for controlling electrical energy for lighting, heating and power purposes." A. I. Grabham. November 29th. (Complete.)

27,501. "Switchboards." C. A. Vandervell and A. H. Midgley. November 29th. (Complete.)

27,503. "Electric lampholders." M. J. Railing and J. H. Collings. November 29th.

27,504. "Electrical controlling devices for lifts." R. S. T. Henry. November 29th.

27,510. "Apparatus for use in forming joint ends on electrical conduits, drain pipes and the like." R. Lawton. November 29th. (Complete.)

27,526. "Electric arc lamps." British Thomson-Houston Co., Ltd., (General Electric Co., United States.) November 29th.

27,530. "Automatic electric circuit-breaking arrangements." E. O. Muller. (Divided application on 6,990/12 September 21st.) November 29th. (Complete.)

27,534. "Means for indicating when the flow of current in an electric circuit is interrupted or varied." A. F. Berry. November 29th.

27,535. "Methods of reducing the loss of energy in lines for variable electric currents." F. A. Becker. (Addition to 65, 1911.) November 29th. (Complete.)

27,563. "Controlling devices for electric motors." A. H. Curtis, A. H. Macley and Adams Manufacturing Co., Ltd. November 30th.

27,575. "Cords and weights of telephone switchboards." M. S. Conner. November 30th.

27,609. "Combined interrupter, commutator, and current reverser." L. L. Leduc. November 30th. (Complete.)

27,610. "Electro-magnetic bolts for locks." L. L. Leduc. November 30th. (Complete.)

27,612. "Method or process for utilising or re-energising exhausted electric dry cells." A. H. Mayes. November 30th.

27,620. "Means for communicating orders and information from one place to another." Evershed & Vignoles, Ltd., and S. Evershed. November 30th.

27,624. "Control of electric motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) November 30th.

27,633. "Electric batteries." W. H. Lowe. November 30th.

27,634. "Electrolytes." W. H. Lowe. November 30th.

27,651. "Production of insulating layers or coatings on electrical conductors." J. Loewenthal. November 30th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

Incandescent Electric Lamps. G. Ludecke and Brimsdown Lamp Works, Ltd. 27,263. December 5th.

Materials for Dynamo Brushes, Shaft and other Bearings. British Thomson-Houston Co. (General Electric Co.) 27,621. December 8th.

Combined Electrical Switch and Resistance or Current Graduating Device. Dimming Switches, Ltd., and W. L. Barber. 29,284. December 28th.

Apparatus for Lighting and Extinguishing Lights at Predetermined Times. J. Gunning. 24,707. November 7th.

Apparatus for Automatically Maintaining a Uniform Load on the Prime Mover of an Alternating-Current Generating Set. Lancashire Dynamo and Motor Co. and H. C. Siddeley. 25,109. November 11th.

Electric Clocks. W. J. Blenheim. 25,244. November 13th.

Means for Pressing an Intensifying Screen against a Photographic Plate in X-Ray Apparatus. W. Otto. 25,328. November 14th.

Overhead Systems for Transmitting Electricity. J. Paul. 25,364. November 14th. (November 29th, 1910. Addition to 28,687, 1910.)

Couplings for Electric Mains or Wires on Railway Passenger Coaches and other Vehicles. J. Stone & Co., Ltd., and A. H. Darker. 25,377. November 14th.

Electric Resistances. J. A. Hirst and P. S. Brook. 27,189. December 5th.

1912.

Miners' Lamps. T. Heaton. 239. January 3rd.

Apparatus for Controlling Motion from a Distance, applicable more particularly to the Control of Searchlights or Projectors, Steering Gear and the like. Siemens Schuckertwerke. 956. January 12th. (September 28th, 1911.)

Automatic Tension Regulators for Shunt Dynamos. J. Gallay. 1,539. January 19th.

Telephones. F. C. Shardlow. 1,721. January 22nd.

Protected Electric Fuse Blocks. W. F. Price and Callender's Cable and Construction Co. 2,880. January 30th.

Method of Supporting the Commutators of Dynamo-Electric Machines. A. W. Jones. 3,282. February 9th.

Continuity of Electric Conduit Systems. M. J. Railing and T. Taylor. 3,479. February 12th.

Impulse Transmitter for Automatic Telephone Systems. M. Baum. 6,305. March 13th. (March 13th, 1911.)

Selective Electric Signalling on Telephone Exchange Party Lines. G. H. Crook. 6,640. March 18th.

Lamp Pillars for Electric Lighting. J. Southall. 7,056. March 22nd.

Electric Apparatus for Recording the Discharge of Materials from Wagons. J. Wasgestian. 7,889. April 1st.

Apparatus for Phonographically Recording Telephonically-transmitted Conversations. Walseck & Starcke (Firm of). 9,751. April 24th. (October 30th, 1911.)

Apparatus for Phonographically Recording Telephonically-transmitted Conversations. Walseck & Starcke (Firm of). 9,752. April 24th. (November 25th, 1911.)

Impulse Transmitter for Semi-automatic Telephone Systems. Siemens and Halske Akt.-Ges. 10,444. May 2nd. (May 2nd, 1911.)

Impulse Transmitters for Semi-automatic Telephone Systems. Siemens and Halske Akt.-Ges. 11,464. May 14th. (May 16th, 1911.) (Addition to No. 10,444, 1912.)

Apparatus for the Operation of Electrical Clocks by Electric Waves. F. Schneider. 12,680. May 29th. (Divided application on No. 3,966, 1912. February 16th.)

Devices for Protecting Telegraph and like Lines against Inductive Action from Neighbouring Circuits. O. Moll and P. Kuschewitz. 12,764. May 30th.

Combined Electric Lamp and Magnetic Compass. H. Neuburger. 13,001. June 3rd.

THE

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(J. A. Berly's).

1913 EDITION

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CANADA.

KNOWING something of the habit of mind of some men to-day, we can imagine a few of our trade readers exclaiming, not without a sign of impatience, as they observe the heading to this article: "Here's the REVIEW at it again! What is the use of talking to us about Canada?" Well, let us each settle for ourselves the matter of our relation to the trade of that vast territory, now in the fever-heat of development, but not without the ripest deliberation. If the reader knows all that there is to know about Canada let him kindly pass on to the next article—maybe there he will find something more to his liking, but if perchance he is still open to receive information, let him read at any rate these present notes to the very end.

We have written so much respecting the largeness of the opportunity across the Atlantic that it might be thought that we had little more to say, unless in repetition of the old story, but the subject is as inexhaustible as the resources of the great Dominion, and every man whom we meet after his journeyings across the thousands of miles that separate the Atlantic from the Pacific, sees something new and interesting, or sees something old in his own particular way, and thus furnishes new material for our assistance, either by way of encouragement or guidance. Some months ago we announced the departure of Mr. C. Hamilton Wickes from these shores, as H.M. Trade Commissioner to Canada and Newfoundland. Possessing an intimate knowledge of the value of the work done by him in the interests of British trade in Australia, we looked with eager expectation for information concerning his impressions formed in Canada. An emphatically strong man in more senses than one, a man of ripe experience and great determination, and knowing the difficulties which the Canadian market was alleged to present to the British manufacturer, he went to this great field with which he was already to some extent personally familiar, with a firm resolve to get at the bottom of things and do everything reasonably within the power and scope of a Government functionary to render the market more accessible to the Britisher. We have had the good fortune to cross his path this week, more or less accidentally, he being back in England for a brief holiday, and, naturally enough, we wanted to know what he had to say for our readers' enlightenment. In a few months one would hardly expect more a than preliminary survey of the situation to have been made, but already Mr. Hamilton Wickes has left his impress where he has gone, and he has prepared material on questions of vital import to the future of British electrical trade, concerning which more, perhaps, in a later issue. Of course Mr. Wickes has not gone to Canada purely as an *electrical* representative—that is but one out of a hundred different industries whose interests he is out to foster, though the importance of electricity to the future of Canada and the reasonableness of the Mother Country in wanting to get her due share of the resultant business would have amply justified his being sent even exclusively in that capacity. As we have said before, if the British Government were sufficiently alive to the importance of the matter, it would make a very generous vote to enable this matter of Trade Commissioners and Consuls to be dealt with in a most aggressive and complete manner. Fancy, one Commissioner to work the vast territories of Canada and Newfoundland on behalf of the British Board of Trade, and the entire British industries! To those of us who are thirsting for valuable information and keep a running stream of inquiries under the eyes of such officials, the position seems nothing short of ludicrous. How can the British electrical manufacturer expect to have prepared for him, and distributed to him in reasonable time, well-thought-out reports which will be of real assistance to him in his operations when those whom the Board of Trade sends out to perform these services find the activities of their office so circumscribed by financial considerations? One has only to imagine the great distances to be traversed in a colony of such vastness as that of Canada, to bear in mind the immense opportunity that there is now open for all departments of industrial development, the desire from our people at home for answers to queries, the high cost of living, and other such like factors in the situation, to feel that there should be an immediate allocation of many thousands of pounds a year, in order that the Trade Representative of the British nation may have at his command all the machinery, organisation and funds necessary to enable him to fulfil the manifold duties of his office without handicap and with maximum efficiency.

Returning, after this digression, to the impressions of Mr. Hamilton Wickes, we find him convinced, as the result of his present study of the position, that the trading opportunities in Canada are not utilised to anything like the full capacity by British manufacturers. Indeed, he goes further than this, and says the same with regard to our trade efforts in the United States. Some of our readers would as soon think of selling electrical goods at the North Pole as below the Canadian border line, but we know of a number of British electrical firms who have taken the trouble to try even the United States market, and they have got in to their satisfaction with their own special lines of goods. Mr. Wickes affirms that a high tariff does not form a sufficient wall to prevent our people from selling goods that the other people desire to have. He would hardly have had the temerity to mention it himself had he not first had representatives of American houses in England expressing to him their astonishment at the goods which they found made in the United Kingdom, and which they had bought and shipped to America within the last 12 months, and had sold at a profit. Mr. Wickes is anxious to direct our manufacturers' attention to the following aspect of the matter:—What are the imports into the United States of manufactured merchandise? What are the proportions shipped there by Germany, by France, by Italy, by Austria, and by the United Kingdom, of the article in the manufacture of which they are particularly interested? If the share of any of these other countries in a leading line exceeds that of Great Britain, is that a satisfactory position?—It is quite clear that if the tariff does not keep out the German and the Austrian trader neither should it keep out the British.

As may be gathered, one's pen may run away with one after only a brief vacation conversation with Mr. Wickes, and we must conclude this article with a reference to one other point concerning Canada. Are our consulting engineers so weighed down with work that they cannot spare time to consider whether there is any scope for their activities on the other side? Mr. Wickes's advice to them is to open branch offices there, and he supports that advice by pointing to the multiplicity of public water, sewerage, electrical, goods-handling and transportation, and other undertakings which are the problems of the hour in many parts of Canada, with its new and ever-growing cities and towns. We leave this seed in the fertile brains of gentlemen in Victoria Street and other members or non-members of the Association of Consulting Engineers.

Large Diesel Cylinders. Some time ago there was an impression abroad that for some occult reason the cylinder of a Diesel engine could not have a diameter greater than 20 inches. Such a limitation could not arise, outside mere imagining, from any mechanical difficulty. The causes of the limiting diameter of the Diesel cylinder are, we believe, solely of a physical nature, and connected with the ignition and supply of the fuel. A given weight of fuel can be burned at a given centre. Any further weight of fuel at that one centre cannot meet the oxygen necessary for its combustion. To the lay mind two remedies suggest themselves. By one the fuel must be injected at more than one point, so that oxygen may be available for its complete combustion. By the other the fuel would be injected at a tangent to the circle of the cylinder, so that the incoming high-pressure air blast should set the compressed air charge in a whirl, and so expose the fuel to a sufficient proportion of air. The burning of the charge is a matter of time, and is not a sudden explosion like the burning of a mixed charge of gas and air. Is this time effect of such duration that the tangential method would meet the difficulty? These are matters for experts, who may have made all these experiments which suggest themselves. It can at least be rationally anticipated that there are no limits to the size to which the Diesel or any other internal-combustion engine can be made, unless we allow as a limit the largest machine tools that are available, or the largest lifting cranes. In its early days the gas engine was often granted very small sizes beyond which it could not be made. We never heard of any limits being set to the diameter of steam-engine cylinders. These have certainly been made 120 in. in diameter, if not more. That a 2,500-H.P. Diesel cylinder has been made already, is interesting, and it will be of greater interest when the fuel supply arrangements are available as general knowledge. It may well be asked, why should the Diesel or any heat engine have limits set to its dimensions? Indeed, would not a double fuel entry be particularly advantageous? In any new departure, it is at least better not too early to put limits on the extension that may be possible.

Competition at Buenos Ayres. Although confirmation is not obtainable in Berlin administrative circles of the German Trans-marine Electricity Co., it is reported from Buenos Ayres that the dispute with regard to lighting concessions in the Argentine capital is in a fair way of being adjusted. It is stated, for instance, that the Lacroze Tramway Co. is prepared to renounce the privileges granted by the National Government with regard to the supply of light and power in Buenos Ayres, of which details were given in this journal a few weeks ago, provided that the municipal council will confer upon the company an incontestable concession for supplying on the same conditions as prevail in the case of the German company. It is impossible to say what motives have prompted the Lacroze Co. to make a promise of this kind, unless it is desired to obviate the prospect of protracted legal proceedings through the interference of the National Government in the municipal affairs of the capital. At any rate, the municipal council is said to be agreeable to the offer made by the company, but the latter intends to maintain its special rights under the Government decree until the new concession is actually in its possession. When this has been obtained, the German company will be placed upon an equality with the Lacroze Co. and the Italo-Argentine Co., to which a lighting concession was also recently granted, and the supply business therefore is likely to be divided among the three undertakings in the future. The large area of the city and the enormous possibilities of expansion in the next 50 years, over which the concessions will or do extend, certainly afford scope for the activity of more than one individual enterprise.

BELT ACCIDENTS: THEIR BEARING UPON THE INDIVIDUAL ELECTRIC DRIVE.

By W. O. HORSNAILL, A.M.I.M.E., A.M.I.E.E.

A strong argument in favour of the individual electric drive for certain industries is afforded by the number of accidents arising from the putting-on of belts.

Where a number of independent machines, many of which stand idle for a week or more at a time, are driven through shafting, it is customary to keep all belts off except those of the machines which are actually in use. In fact, this is the only efficient method of driving through shafting, as the losses incurred by constantly running a large number of belts and loose pulleys through which power is only occasionally transmitted would be very considerable.

These conditions obtain especially in grain warehouses, where machines have to be maintained for the many kinds of cereals dealt in. The trade in foreign wheats, horse fodder, and so forth, varies a good deal with the seasons, hence certain machines may be idle for months at a time, and it is not uncommon to find some of them driven through a couple of countershafts, two or three belts, and perhaps a bevel gear. Fast and loose pulleys are obviously out of place under such conditions, the usual alternative being to take off the belts and stop all the driving gear until it is required. In cases such as these, a separate motor for each machine is undoubtedly the correct solution, both as regards economy and the absence of danger from the putting-on of belts when the machinery is running. That such belts will be put on without slowing down is abundantly evident to those acquainted with this industry, as, although a considerable number of accidents occur throughout the whole country, they are rare enough in individual cases to make the men careless.

Malting is another grain-handling industry where the machines are run under similar conditions, and a horrible accident recently happened in a large malting at Mistley, in Essex. In this instance a man was putting a belt for a large elevator on to a pulley running at 185 revolutions per minute. The floor was several inches deep in barley, and he had to stand on a stool about 3 ft. high to reach the pulley. In spite of a guard rail he was caught in the belt and his body was torn in two, one part being hurled through a window. In justice to the firm owning the malting, it may be said at once that every suggestion made by the factory inspector as regards fencing the machinery had been carried out, and it was actually possible to stop the shaft in question by fast and loose pulleys. The latter were, however, situated in another department, involving a walk of some distance to get at them, and to save this amount of trouble the man essayed to put on this large belt at full speed, as he had no doubt done successfully many times before.

There is very little doubt that the individual electric drive is the correct method for *new* grain warehouses and maltings, except as regards the ship elevator gear, as the latter, with its inside elevators and conveyors, forms an interdependent collection of machinery which is always running together.

The application of electric driving to *old* undertakings of this nature is a different proposition, as the shafting already exists, while in almost every case the capital expenditure is a serious item, and the installation of separate motors would be at once condemned on the score of excessive initial outlay.

In spite of this drawback, individual motors would probably pay for themselves in a year or two by the saving in power, particularly where old buildings are concerned. The weight carried in grain warehouses varies enormously according to the stock of grain, and old buildings always "give a little" according to the load, the result being heavy frictional losses in the shafting. Then again, shafting and belting involve a considerable amount of attention, together with occasional breakdowns which may entail costly delays, particularly when ships are waiting to be discharged.

The reduction in the cost of electrical apparatus—and we have not reached finality yet in this direction—is continually strengthening the case for the individual drive, and we may hope to see in time the entire elimination of accidents arising from the putting-on of belts.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Official Balance.

The writer had intended to ignore the childish gibes contained in "Representative's" last letter, but a desire to hold one's end up is a natural one, hence this trespassing once more upon your space.

"Representative" is singularly destitute of imagination. If a motor gets so saturated with moisture through standing in a compartment awash with water, for months—the writer never said the motor was immersed—that the task of getting up the insulation, owing to an exceptional combination of circumstances, becomes a long and difficult one, then, according to "Representative," it points to a "poor quality of insulation," or "exceptional carelessness" on the part of those in charge.

As a matter of cold fact, the erector in charge had agitated daily for several months to get the water removed, the only result being a bale out now and again, but nothing done to stop the water accumulating afresh.

The writer has never tried six coke fires in one unventilated compartment, and has no wish to. He had other reasons for not using coke, but space forbids. "Representative" might try to guess another reason, or he might go so far as to credit the writer with sufficient intelligence not to spend a sovereign upon prepared charcoal if a few pennyworths of coke would have done, or its use been allowed.

Respecting the head room, the writer, being a "careful engineer," duly measured this, and finding it a near thing, had no alternative but to attempt what he did. With regard to the tallow dip, if "Representative" has ever been "below" during "balancing," he must know that different circuits, sometimes all of them, are cut off for hours at a time while testing for, or picking up, faults. With regard to transporting the coils while hot, the writer duly covered them with sailcloth, but it was certainly not dry at the journey's end. Any dampness contracted in transit, or odd drops of rain getting on while the coils were being carried on board, quickly dried off before getting through the outer tape, thanks to the heat in the coils.

The gem of "Representative's" letter, however, is when he suggests blaming the dockyard people and insisting upon help being given, also his assertion that assistance is always given if trouble arises through ill-luck. This latter, as applied to dockyards, is the most amazing assertion the writer has ever heard. The suggestion to "blame the dockyard" is simply delicious. The writer once only, on his first ship, when very green, was going to blame the dockyard for something, but was providentially restrained by the erector, an old hand, with an extensive knowledge of dockyards. Now, Sir, the writer will, with your permission, give "Representative" the following challenge:—Will he carefully study the conditions under which the writer had to do the work, and say how he would have got the insulation up, or rather how much better he would have done it? The conditions were:—Six days to complete everything (two motors and two controllers), the parts not to be disconnected as the motors were required during the week. At the end of the week a few days more were given. Only after several false alarms being given about the ship's leaving was time given for stripping the motor. "Representative" must not assume at first that more time was going to be given later. No assistance from the dockyard was possible, even when the writer signed the usual requisition on behalf of his firm, undertaking to pay for such assistance, owing to shortage of men. No appliances were obtainable from the dockyard, even if paid for, owing to all available gear being in use. A limited amount of current only was available for running the motor—none at all after taking the armature out the first time. No coke or coal fires were allowed, owing to several seamen's hammocks being slung across the opening to the compartment, and, of course, as "Representative" says, no responsible engineer would burn charcoal. It took the writer a fortnight's hammering at the dockyard people to get the water stopped from entering the compartment.

Now if, after carefully reading the article again, and bearing all the conditions in mind, "Representative" will describe how much better he would have done the work, he will, no doubt, provide some more "amusing reading."

A.M.I.E.E.

[Regarding this instance of difficulty in meeting the official requirements, we are in possession of further particulars which it would not be to the interests of those concerned to publish, but which go to prove our contributor's contention that the case was one of exceptional complexity. Without a knowledge of these facts, criticism would be neither fair nor profitable; this correspondence, therefore, is now closed.—Eds. E.R.]

The Dangers of Termini.

In the case Hull Corporation *v.* Stickney, reported in this week's Electrical Review, the point in question appears to be which is the driver's platform and which the conductor's when a tramcar is stopped at a terminus? To my mind this is easily answered irrespective of the position the car occupies in the roadway. The driver's platform is that which has its exit on the off side and the conductor's that which allows the passengers to alight on the near side as close to the curb as possible.

Tramcars are already sufficiently dangerous in that they are unsteerable vehicles, and discharge their passengers in the roadway on the near side; drivers of other vehicles, however, are now used to this, but if passengers are to be allowed to alight from both ends of the cars chaos prevails.

The writer knows at least one terminus which is a positive death trap on Saturday and Sunday afternoons due to this and the heavy motor traffic, and no doubt when there has been a fatality or two this will be seen to.

The sooner the B. of T. Regulations are altered and enforced to give other road users a chance, the better.

F. Percy Seager.

Sheffield, *December 10th*, 1912.

The Institution of Electrical Engineers.

The suggestion of Mr. A. J. Abraham in your issue of December 13th that *all* engineers in charge should join the "Institution" and "shout for themselves," might appear at first to be a solution of the problem of getting chief engineers to pay a living wage to their engineers in charge of generating and sub-stations; but can anyone imagine employer and employé discussing questions of hours and wages at an Institution meeting? One might as well suggest that the directors of the railway companies should become active members of the Amalgamated Society of Railway Servants.

The question of hours and wages could only be *effectively* put forward by an Association to which employers could not belong.

Such an Association, as suggested by "Zantha" in your issue of November 22nd, could be formed, I know, in the eastern and northern districts of London; and it is proposed to make a start early in the New Year. It is not so much a matter of subscriptions, as of a little time and energy, devoted by a few men in the various districts, in obtaining members for such an Association. I should be pleased to hear from all those interested.

W. J. Ebben.

Stratford, E., *December 16th*, 1912.

Enough has been said by unfortunate sub-station men to show that we have a real *grievance*; take, for instance, "W.M.E.'s" letter in this week's issue. He says he knows of milkmen taking charge of a sub-station; they, I suppose, would be experts where "milking boosters" were installed, knowing so much about the dairy in their "apprenticeship" days. "Flashover's" letter is much to the point, and only goes to show, like most of the other letters, what a "rotten" state the electrical profession has deteriorated into.

I notice most of your correspondents are in favour of an "association of shift men," but, like myself, it is not advantageous for them to disclose their names. I know some submen myself who will join this association if this correspondence comes to anything.

No wonder so many young engineers go abroad when such a state of affairs exists at home. I know myself, personally, some who did so and who are getting on well now, where, as they say themselves, they get a fair chance of a living wage.

Booster.

During the past month I have been an interested reader of the various letters appearing in your valuable journal *re* the Institution and the conditions of sub-station engineers. Interested because I myself happen to be one of the "Unfortunate Individuals" alluded to by Mr. A. J. Abraham in last week's issue.

The pay is exceedingly bad, and I can vouch for the accuracy of "Motor-Generator's" reference to 5s. engineers. I know a yardman who has boasted to me on more than one occasion as to how he used to start up and synchronise in a traction sub-station some few years ago.

I believe that an association should be formed in the interests of sub-station engineers alone; but it must be approached very carefully, otherwise many men might be quietly dispensed with when it became known that they had joined.

"Flashover" has correctly stated that Trade Union principles are not applicable to station engineering. Therefore I hope the Association when formed (perhaps I am too optimistic) will not be based to any great extent on Union principles, some of which are decidedly bad.

During all this correspondence the consensus of opinion is that the Institution is of no advantage to young men; an opinion which I share, and believe it to be only a medium of social intercourse to its full and well-positioned members.

Surging.

I am heartily glad to see so many readers voicing their grievances as regards the salary paid to sub-station engineers, assistant engineers, &c., but I am sorry to see that there are other companies which employ 5s. a week engineers besides the particular company that I mentioned before.

Now the great cry is, "Why not form an Association?" How many have used that expression! yet, how many would be ready to give a helping hand? In my last letter I stated that I would do all in my power to help in the organisation of an Association, and I now guarantee that all the submen and assistant engineers in this town would join hands.

"Sub-Man" remarked in a letter appearing in a recent issue of the Review that he would be pleased to act as hon. secretary. I would ask "Sub-Man" to send his name and address to the Electrical Review offices endorsed "Motor-Generator," as I would like to have a word or two with him regarding the forming of an Association.

I propose that this Association be restricted to those actually doing shift work, or those in any way responsible for the running of a plant, *e.g.*, assistant engineers, sub-station engineers, switchboard attendants, or anyone who would be in any way capable of furthering the interests of this Association, to be called "The Electrical Shift Engineers' Association," the object being the furthering of a living wage cause, and to be recognised as a body of men of education and training; the Association not to be run on Trade Union principles. Then the I.E.E. could be approached for recognition of the Association, and, as practically all "chiefs" are M.I.E.E., our object would be attained. I wonder would it ever be possible for an Electrical Association to be as strongly united as the British Medical faculty are to-day? Let us only hope so.

Could any sane man expect a sub-station engineer or others in responsible positions to have the economical running of a station at heart when they have, perhaps, thousands of pounds' worth of machinery under their control, spending every day of the year in the station, including Sundays, Bank Holidays, and Christmas Day, for the princely salary of from 5s. to 20s. per week? What on earth will become of the young engineer 10 years hence?

Fellow sub-station engineers, assistant engineers, and switchboard attendants! I entreat you all once more to join hands, be united, and strike one blow for this great cause, form an Association, refuse starvation wages, and let us all start the New Year with fresh hope and vigour, and "shut down" this sweating once for all!

I propose that every town in which reside more than 10 individuals who would be eligible for membership to the proposed Association should form a committee and hold a meeting, the names and addresses of members to be taken, with a nominal subscription. Let the head branch of this Association be formed in London (the reason being obvious), and let the names and addresses of outside branches be forwarded to the head. Canvass for members, and do not restrict the names to those actually in need of the Association, but include all those in the electrical profession who are likely to further the interests of the Association; this ought not to be very hard. I would like to see other proposals put forward.

I am sure we are all grateful to the Editors of the Electrical Review for allowing us the use of these columns to voice our cause, and hope that they will leave them at our disposal for some time longer.

Motor Generator.

The Kelvin.

I read in a contemporary that as long ago as 1892 the Board of Trade attempted to persuade the industry to adopt the name of Kelvin for the outrageous unit called now a Board of Trade unit.

Many, I am sure, will be glad that this attempt has not succeeded, for if the name Kelvin is to be used for any unit, it must be adopted by general approval and not by coercive pressure, and for obvious reasons it must be international. How can we expect the logical mind of the Frenchman to accept the name Kelvin for a unit which is an odd number of a well-established unit?

We call the unit of work an erg, and as this is small (about one-thousandth of a gramme-centimetre), it is convenient to take 10 million of them, and call this new unit a joule. This is what we sell to the public, our predecessors having selected the coulomb and the volt such that their product equalled the mechanical unit of work (the joule). Our other units, the ampere, &c., are derived from these.

We, however, having been misled, selected 3,600,000 joules, and called it a Board of Trade unit or kilowatt-hour, but this is no reason for degrading the name Kelvin.

Why not go back and become logical, and call 10,000,000 joules 1 kelvin? We then get a simple decimal system:—

10,000,000 ergs, 1 joule.
10,000,000 joules, 1 kelvin.

The kelvin is then a mechanical as well as an electrical unit.

The effect in practice would be to convert a present price of 4d. per "unit" to 11d. per kelvin.

If there is any good reason, some other multiple of 10 could be used, but not an odd number.

Percy Good.

London, S.E., *December 14th*, 1912.

NOTES FROM INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

Nagpur.—The Nagpur Electric Lighting Co. has been started to provide the chief city of the Central Provinces with electric light and power. Work has already been commenced, and it is expected to have some of the engines and dynamos running by next hot season. The prospects of a good load are healthy, as all the new and old Government buildings are to be wired for fans and lights. An arrangement has been come to with the local Government, whereby a minimum load is guaranteed; this, together with the current required for 14 miles of street lighting, private bungalows, and railway yard lighting, should be a fair start. In time to come, the local cotton mills might be induced to buy power in bulk from the company. The machinery is to be provided by Messrs. Crompton & Co., who are the main contractors and local agents.

Delhi.—The Government of India is now gradually taking up its winter abode in the new capital, and the amount of electrical work which has been carried out departmentally during the past few months, reflects great credit on the engineers responsible for it. Many firms of contractors who felt that the work should have been put out to open tender have been disappointed that the authorities should have decided to do a good deal of it themselves departmentally; but the indefatigable electrical engineer has a will of his own, and knows best how to shape his own line of action in these matters.

Hooghly Side Mills.—A few very modern electric power drives are now to be seen in some of jute presses and flour mills on the Hooghly side. The earlier ones were 6,000-volt A.C. motors; but experience has taught that at this pressure insulation troubles, due to nitric acid and general dampness of the atmosphere (in the rains this latter is often 96° saturation) were numerous; it is now, therefore, the custom to transform down from the supply company voltage, 6,000 volts A.C. to 500 volts A.C.

Darjeeling.—This single-phase 83·3 ~ 220-volt hydraulic installation is one of the oldest in India, and its energetic engineer has boosted up its load very considerably within the last few years. The local tea gardens are finding it economical to install motors to drive their machinery now that wood fuel is becoming scarcer year by year. It is a difficult matter to get British motor builders and local agents to quote for single-phase motors of the above strange periodicity. Some of them refuse point-blank to quote, others say they will "refer the matter home." There is at least one home firm, reminiscent of Tennyson, and whose picturesque and cheery advertisements adorn your pages, several of whose motors are dotted here and there through the tea fields, and are working successfully.

PROCEEDINGS OF INSTITUTIONS.

Overhead Transmission Systems.

At Bristol, on December 9th, the Western Section of the Institution of Electrical Engineers held their first meeting in that city. During the afternoon a number of the members were shown over the chocolate factories of Messrs. J. S. Fry & Sons, Ltd.

Following this a meeting was held in the University of Bristol, at the Merchant Venturers' Technical College, by the permission of Dr. J. Wertheimer. An address was given by Mr. T. Schontheil on "The Use and Design of Overhead Lines for the Transmission of Electric Power." As time went, he said, the necessity of being able to buy and sell electrical energy at as low a cost as possible would be of increasing moment. In that connection the cost of transmission was a very important item. In the construction of overhead transmission systems the question of wayleave played a very important part, and it would be seen that a compulsory modification of the veto possessed by local authorities and a modification of the present Board of Trade regulations would be desirable. In many respects this country was hampered in not having abundant water power to employ for generation purposes, and with that fact in view it was only reasonable to ask that further difficulties should not be placed in the way of power supply by fantastical arrangements of wayleaves. Dealing with transmission itself, wooden poles of Norway fir were chiefly used in this country, being creosoted with 10 lb. of oil per cubic foot of timber. Of all modes of preserving the timber against the ravages of damp and insects, creosoting was the most satisfactory, providing that the wood when treated was reasonably dry. For heavy lines A poles were preferable to singles poles. Careful tests showed that an A pole, properly scarfed and braced, would sustain a load in a direction across its two members nearly five times greater than would a single pole of the same diameter as one of the members of the A pole. A ratio of height to base of 8 to 1 for A poles, and a factor of safety of 10, with flexibility in the direction of the line, were desirable for all wooden poles.

Steel poles were usually constructed in tower form of either angles or tubes, as the main members, braced together in the form of a hollow square, by flat sections, which formed a lattice work. Such lattice poles were of good appearance and had great mechanical strength, together with a certain amount of flexibility. Owing to the difficulty of properly protecting them from corrosion with paint or other anti-corrosive material, they were open to considerable objection on that score.

In Italy and France iron poles of single channel section for straight tires. and two-channel sections bolted together for strain poles were being largely used. Such poles possessed the advantage of being easy to handle, and easy to keep in good condition, besides being much cheaper than the lattice type. Tubular steel poles, owing to their cost and the difficulty of keeping the interior free from corrosion, were seldom used for transmission lines. In this respect it was quite likely that some of the older tramway systems would soon have either to replace many of the poles now in use, owing to their weakening by corrosion from the inside, or else fill the centres with reinforcing concrete. The reinforced concrete pole had not yet been used in England, but it seemed to have many points in its favour. It was easy to construct, and could, if necessary, be made on the site, with a consequent saving of the cost of transportation. At Oklahoma City, U.S.A., about a thousand concrete poles were in use for transmission lines. They were 30 ft. long, and hexagonal in section, with a hollow centre 16 in. in diameter at the base and 17 in. at the top, the walls being 2¾ in. thick. Running through each pole were 12 ¼-in. diameter twisted reinforcing rods at a tension of 11,000 lb. The weight of each pole was about 2,000 lb., and the cost $8.50. A mixture of one part cement, two of sand, and three of crushed stone, was employed in their manufacture. Another American concern, which had some 30 miles of high-voltage line, used poles 30 ft. high, 6 in. square at the top and 9 in. at the bottom. These poles were reinforced with six ½ in. square high carbon steel rods, extra short lengths being added to take the excessive strain near the ground.

The efficiency of any line depended chiefly on the ability of the insulators to withstand not only the conditions of service, but such increases of electrical and mechanical pressure as were likely to be met with. In this country, porcelain insulators were almost exclusively used.

An insulator, consisting of several units linked together and known as the suspension type, was coming into very general use for high-tension lines.

Of conductors there were only two metals commonly used, *i.e.*, copper and aluminium. Alloys of copper, such as phosphor bronze, were stronger, but were not as good conductors; whichever was used, the most important consideration was its strength. The factor of safety required by the Board of Trade, of ten, was much too high, one or two, or at most three, being ample for copper and aluminium lines, but no conductor should be smaller than No. 6 S.W.G. The respective merits of the two metals resolved itself mainly into a matter of cost, and aluminium seemed to have all in its favour, the present prices representing a saving of about 35 per cent. in favour of the latter. To secure a continuity of supply it was often deemed advisable to run double the number of transmission lines actually required, either on the same poles or on a duplicate set. In the majority of cases, however, one line was quite sufficient to serve as a stand-by.

The question of earthing was most important, but was too often neglected or done in as cheap a manner as possible.

Perhaps not the cheapest, but certainly the most reliable and efficient arrangement was to affix underneath the lowest cross-arm of each pole a small bracket carrying a reel insulator supporting a line of No. 8 gauge copper wire, this being run from one end of the line to the other. A similar-sized copper wire was fixed to project about 6 in. above each pole roof and then led down the pole backwards and forwards along each cross-arm, under each insulator pin collar, and so to the main earth wire, which should be properly grounded at each third pole.

Guard wires or cradles, when used to prevent lines falling to the ground, were often a source of danger, and it was far better to run an extra length of conductor on separate insulators, placed as close as possible to the others, over roadways and crossings. The end of the extra conductor to be extended well beyond the extreme width of the roadway or crossing and bound to the main conductor for a length of 4 ft. or so.

Accumulations of dust and dirt often gave rise to faults, and at pressures usual in this country. If the line ran near collieries or railway lines, it was advisable to have the insulators washed and wiped occasionally. Insulator pins were often a common source of weakness, and which could be guarded against by having them of ample strength. Wooden pins were useless, as they soon burned through. Weak binding was to be avoided as a frequent source of trouble. Of all the forms of wire clasps designed, none was equal to binding wire properly applied and of sufficient size. The great advantage of binding wire was that if a conductor broke, no insulator pins in the immediate vicinity of the fracture were damaged, the conductor being allowed to slip through its bindings.

A frequent cause of failure was due, not to any weakness, but a punctured insulator causing a partial leak, and so generating sufficient heat to burn the conductor through. In this respect a decided advantage could be gained by metal bands around the insulators to assist in dissipating the heat. Pole troubles were not numerous, but wooden poles, if not properly treated, were sometimes attacked with wet rot. Replacing such poles was a costly matter, and occasioned much inconvenience and loss, owing to the fact that the line had to be kept "dead" whilst the work was going on. A remedy of some value would be found in cementing the poles from the bottom to about 3 in. above the ground line, and leaving an annular space between pole and cement to about 5 in. below the ground line, the space to be filled with bitumen or a similar material. Another method of guarding against rot was, when the poles had become firmly set, to make an opening 4 in. to 5 in. wide round each pole to a depth of 3 or 4 ft., and into such hole pour concrete, tamping it well in and finishing off the top with an inclined watershed a few inches above the ground level. Such a method not only prevented water collecting around the base of the pole, but gave it a neat appearance. The lecture was illustrated by a number of photographs and line drawings, and examples of the different insulators.

The discussion that followed was carried on by Messrs. S. F. Walker, L. A. Hards, A. T. Kinsey and J. L. Wilson, and was adjourned to the next meeting of the Section.

The Generation and Distribution of Producer-Gas in South Staffordshire.

By H. A. Humphrey, M.Inst.C.E.

(*Abstract of paper read before the* Institution of Civil Engineers, *December* 10*th*, 1912.)

The South Staffordshire Mond Gas (Power and Heating) Co. is a pioneer undertaking, since it is the first example of a company giving under Parliamentary powers a supply of producer-gas for public purposes. The advantages of such a supply have now been amply demonstrated. The company's Act contains clauses prohibiting the sale of gas for domestic purposes or for illumination, and the limit of carbon monoxide in the gas distributed is fixed at a maximum of 14 per cent.

The area of supply comprises 123 sq. miles, within which there are six Corporations, 16 Urban District Councils, and three Rural District Councils. For the central station an area of about 40 acres of land, adjacent to railway and canal, was secured at Dudley Port, Tipton, which is practically the centre of gravity of the whole area. The designs of the central station plant and buildings, and the distribution system, were carried out by the author, as consulting engineer to the company, and the contract for the whole of the work was let to the Power Gas Corporation, Ltd.

The unit of plant adopted was based on a capacity for gasifying 140 tons of coal per day, and consisted of eight Mond gas producers, together with the necessary gas-cooling, cleaning, and compressing plant; plant for the recovery of sulphate of ammonia and tar; and the machinery, comprising steam boilers, circulating pumps, electric generating plant, motors, fans, &c. The first unit erected was started in operation in February, 1905, and at the present time additions are being made which will increase the output by about 80 per cent.

The supply to the public was commenced in May, 1905, and up to date there has not been a single stoppage of the gas supply from the station, the pressure being maintained in the trunk mains throughout the whole period.

For each ton of coal gasified, more than two tons of steam have to be blown into the producer with the air blast; most of this steam is generated by a recuperative system, and the remainder is derived from the exhaust of the engines and pumps about the works, which are driven by steam with this object in view. The boilers were originally of the "Climax" type, burning small coal with the aid of forced draught. At times when the demand for gas is small, the boilers are fired with gas. The Climax boilers are capable of generating steam quickly to meet a sudden demand, and have a very large grate area necessary to burn small fuel. The author devised a method for gas-firing without interference with the ordinary coal-firing. In order to prevent the deposit of scale on the boiler tubes, which are of a shape difficult to clean, the feed water had to be softened, and further purified by heating it to the full steam temperature, with the unexpected result that excessive priming resulted. As this could not be remedied, Lancashire boilers were substituted, with Bennis stokers and a simple but successful system of gas-firing. The latter gave a heat efficiency of 79·1 per cent.

The blowers are of the Roots type, driven by steam, as reliability is of the first importance, and work at a pressure of 28 in. water-gauge. An automatic device is used for controlling the pressure.

The producers are 10 ft. in diameter inside, of the Power Gas Co.'s standard type, with a special fuel-distributor which gives a level surface to the top of the bed of fuel. Each producer can gasify 20 tons of coal per day of 24 hours, or 30 tons on occasion. The ashes are drawn from the bottom of the producer through a water-lute once in eight hours. Over each producer is a large storage hopper holding 50 tons of fuel, as a measure of precaution against breakdown. The gas from the producers passes through superheaters to heat the incoming blast into the collecting mains, each of which receives the gas from four producers; it is delivered to the mechanical washer through an emergency valve. There are two washers, each fitted with three electrically-driven dashers throwing up large quantities of spray to cool the gas and wash out the solid particles of dust. Various cross-connecting pipes and by-pass valves are provided; for the 5 ft. 6 in. gas mains special valves have been designed, which can be operated in spite of deposits of tar and hard carbon.

From the washers the gas is led to the lead acid-towers, which are 14 ft. in diameter and 59 ft. high, and are filled with 4½-in. metalline ring tiles, over which the acidified liquid is distributed, meeting the ascending gas as it trickles downwards; the ammonia in the gas here combines with the sulphuric acid, forming sulphate of ammonia, which is allowed to remain in the solution until it accumulates to 40 per cent.

Next the gas passes through two or three cooling towers in series, 14 and 12 ft. in diameter and 57 ft. high. The hot water from the first tower is pumped to the top of the air-heating tower, which is 10 ft. in diameter and 57 ft. high, to heat and saturate the air from the blowers. The same water is returned to the first cooling tower. The water from the second tower is pumped to the top of a Worthington cooling-tower, of which two are installed, each 12 ft. in diameter and 40 ft. high, with forced draught produced by electrically-driven fans; the water is then returned to the second tower.

A third tower has been provided with an independent circulation of cooling-water.

Three electrically-driven fans with water injection are provided for cleaning the gas, which finally passes through six sawdust scrubbers in parallel, emerging with less than 0·5 gm of tar per cubic metre of gas.

After passing through large rotary meters on the anemometer principle having a capacity of 500,000 cb. ft. per hour, the gas is compressed to 10 lb. per sq. inch by three steam driven compressors for distribution. No storage is provided.

Two three-cylinder 250-H.P. Westinghouse gas engines driving dynamos supply current to the various motors, and for lighting the works. The exhaust from these passes through tubular boilers to reclaim some of the waste heat.

The liquid containing sulphate of ammonia is concentrated by evaporation until it crystallises out, when the superfluous liquor is drained off and the sulphate dried in electrically-driven centrifugal machines before it is bagged for sale. Both the annual consumption and the market price of the sulphate have been increasing during the past 10 years.

The majority of the machines run about six weeks continuously day and night before being stopped for examination. The acid towers run for two years continuously, and during the seven years of operation it has not been found necessary to change over the gas cooling and air-heating towers.

The tar collected from various parts of the plant contains 30 to 40 per cent. of water; before selling it, it is heated to 80° C., and stirred until it contains less than 10 per cent. of moisture.

The fuel used has an average calorific value of 11,000 B.TH.U. per lb., and the ashes contain about 10 per cent. of carbon. The Mond gas distributed averages over 150 B.TH.U. per cb. ft. with great regularity.

The gas is used by consumers in gas engines and furnaces, and practically every gas producer in the neighbourhood has been shut down; the price varies from 1½d. to 2¾d., according to the quantity supplied, the average price received being 1¾d. per 1,000 cb. ft.

There are 150 gas engines connected to the mains, aggregating 9,500 H.P., and for the last four years the Wednesbury Corporation has generated all its electricity by this means, at a works cost per unit generated lower than that of any other station having the same output. The original estimates for cost of production have been practically realised, though based on a very much larger plant. New plant is now in course of erection.

Institution of Electrical Engineers.

THE report of the Research Work Committee, which was adopted by the Council on December 12th, states that the Committee, in considering the scope and scale of the research work which might be undertaken by the Institution, is of opinion that it is desirable to avoid overlapping the work of other Societies, and therefore suggests that the work of the Institution be confined, as far as possible, to the following lines:—

(*a*) The organisation and correlation of research work in electrical engineering.

(*b*) The origination and supervision of specific researches in subjects connected with the electrical industry, and the allocation of grants in aid of the same.

The former should include: (1) The establishment of a General Committee for research, to which investigators would be invited to send particulars as to the subject and character of the researches they are undertaking. Members of the Institution, especially those connected with the manufacturing side of the industry, would also be invited to communicate to this Committee any special difficulties they had encountered which called for investigation, and to make suggestions for subjects for research. The General Committee would thus act as a species of "clearing house" for research topics, receiving suggestions from various sources, and sending them on after consideration to the most suitable quarters. (2) The collection and publication of particulars of plant available for special testing and investigation work in the various laboratories, together with a list of the subjects in which researches have been carried out. (3) The compilation and publication of bibliographies of specific fields of research.

With regard to the second heading, the Committee considers that it is desirable that the Institution should originate and direct researches in certain subjects, and suggests that the General Research Committee should have power to appoint sub-committees of experts to deal with researches in selected subjects.

In the first instance a series of investigations might be initiated on "The Electrical Properties of Materials," which would deal with such matters as:—Magnet steel, copper, carbon, paper, rubber, mica, porcelain, oils and varnishes, &c., for which fuller data are required.

Auction Sale: No Bids.—By order of the Receiver in the matter of C. & A. MUSKER, 1901, LTD., Messrs. G. N. Dixon and Co., of Liverpool, offered for public auction at Liverpool on Thursday, December 12th, the whole of the land, buildings, plant and machinery used by Messrs. C. & A. Musker, for the purposes of electrical and general engineering works at Tue Brook. The motive power plant embraced two Stockport gas engines of 120 and 95 H.P. supplied with gas from a bituminous gas-producer plant, and two Westinghouse generators of 85-KW. and 65-KW. capacity. The property was offered in one lot, and was withdrawn, there being no bids.

LEGAL.

The Distribution of the Assets of the National Telephone Co.

PENDING the award to be made by the Railway and Canal Commission in the proceedings between the National Telephone Co. and the Postmaster-General as a result of the taking over of the company's system by the Government, the Liquidator of the Telephone Co., Mr. George Franklin, applied in the Chancery Division this week to Mr. Justice Swinfen Eady asking his decision on certain questions as to the distribution of the assets.

MR. DANCKWERTS, K.C., who, with Mr. Percy Wheeler, appeared for the Liquidator, said the object of the summons was to get from his Lordship a decision upon certain points connected with the distribution of the surplus among the various classes of shareholders and stockholders. The surplus was used in two senses. First, in the sense of a surplus of assets over liabilities to outsiders, and secondly, in the present case it was used in the sense of surplus over liabilities and over the nominal capital returned to the various stock and shareholders. In the order which his Lordship might make counsel asked him to make it clear that he was dealing with the surplus of the assets of the company over the liabilities of the company to outsiders, and after adjustment of the accounts between the Postmaster-General and the company, and after the return to the stock and shareholders of the amount of the nominal capital, and the payment of the costs of the liquidation and arbitration. There were altogether five classes of shareholders and stockholders.

The first preference shareholders who had got a small holding, viz., £150,000, were represented by Mr. Butcher, K.C., and Mr. Cartmell.

The second preference shareholders also held £150,000, and they were represented by Mr. P. Ogden Lawrence, K.C., and Mr. Beebee.

The third preference shareholders held £1,250,000, and they were represented by Mr. Astbury, K.C., and Mr. Tomlin.

The preferred stockholders held £2,225,000, and were represented by Mr. Frank Russell, K.C., and Mr. Whinney.

The deferred stockholders held £3,725,000. They were represented by Sir Alfred Cripps, K.C., Mr. Younger, K.C., and Mr. Herbert Asquith.

The 3½ per cent. debenture stockholders amounting to £1,537,464, were paid off on January 29th last; the 4 per cent. debenture stockholders to the amount of £1,652,362, were paid off, with interest, on November 28th last. The capital of the first preference shareholders was paid off on March 1st; and of the second preference shareholders on April 3rd. Both first and second preference shares were £10 shares. The third preference shares were £5, and were paid off on July 31st last. The 6 per cent. preferred stockholders were also paid off on July 31st last. The total capital amounted to £10,683,780, including loans at the date of the winding-up in January last. The stock and share capital, without loans, amounted to £7,500,000.

His LORDSHIP: Is your short point this? All the debenture debt has been paid off, and all the capital repaid except £3,725,000 deferred stock.

MR. DANCKWERTS: That is so.

Continuing, Counsel described the position and nature of the National Telephone Co.'s business. The company, he said, ran a telephone system throughout the three kingdoms and the Isle of Man, and did so under a licence granted by the Postmaster-General, under which the company paid to the Postmaster-General 10 per cent. of their gross takings. The licence came to an end on December 31st last. In 1904 a contract had been made, subject to the sanction of Parliament, with the Postmaster-General, whereby, upon the expiration of the Telephone licence, he agreed to take over the whole of the plant of the company on an agreed sum, or, in default of agreement, the sum to be fixed by arbitration, the arbitral tribunal to be the Railway and Canal Commission. That arbitration had been going on for some months, and came to an end last week. A great number of items, amounting in value to some millions, had been agreed upon between the parties, and the remainder was dependent on the award of the Arbitration Court.

His LORDSHIP: What is the present position?—The figures have been agreed up to a certain amount.

MR. DANCKWERTS: Yes, upon certain parts of the claim.

His LORDSHIP: How much has come to the company as regards agreed figures?

MR. DANCKWERTS: Between two and three millions.

His LORDSHIP: Has the Liquidator exhausted the assets already received?

MR. DANCKWERTS: We have had payments on account.

His LORDSHIP: But has the liquidator exhausted what he has received?

MR. DANCKWERTS: Nearly.

His LORDSHIP: So that if that were all that were to come, and if the claimants did not succeed upon any of the disputed items—

MR. DANCKWERTS: Which is out of the question.

His LORDSHIP: True, but in such case there would not be sufficient to pay the deferred stockholders?

MR. DANCKWERTS: Yes

In answer to further questions by his Lordship, counsel said the claim, over and above some two or three millions representing agreed figures, was £18,000,000. They had received £7,000,000 on account. The original capital of the company was £600,000, divided into 5,000 preference shares of £10 each, and 90,000 ordinary shares o

£5 each. The ordinary shares formed part of the deferred and preferred stock of the company.

His Lordship asked if the whole of the National Telephone Co.'s business had gone; it did not continue on any restricted lines?

Mr. Danckwerts said it could not do that: everything had been handed over to the Postmaster-General. The company had also sold a private wire business.?

His Lordship: That was what was in my mind when I asked the question. I did not know whether they were entitled to continue in that business?

Mr. Danckwerts replied that that was not so; everything had been taken over by the Postmaster-General.

Mr. Butcher, K.C., on behalf of the first preference shareholders, claimed that his clients were entitled to share the surplus assets of the company rateably with the other classes of shareholders. They were entitled to 5 per cent. cumulative dividend out of profits upon the whole of the paid-up capital, and they got their preference dividend down to December 31st, 1911. There was a sum of profits available to pay them not only down to that time, but down to March, 1912, when the nominal amount of capital was paid off. He asked his Lordship to say that they were entitled to interest on dividends down to this latter date. He based his claim on the original articles of the company and on the rights conferred by those articles, and he asked his Lordship to say, as regarded the articles, their rights were specially preserved.

Mr. Cartmell followed also on behalf of the first preference shareholders.

Mr. Ogden Lawrence, on behalf of the second preference shareholders, first combated the contention put forward by Mr. Butcher—that the first preference shareholders were entitled to any anticipation in the surplus assets. Secondly, he submitted that his clients were entitled to anticipation in the assets. The extent to which they were entitled was the extent which their capital bore to the capital of the deferred stockholders, plus the amount the preferred stockholders would get under a splitting resolution of 1901. In other words, they were entitled under that resolution to a certain portion of the surplus assets in respect of preferred stock created by that resolution, but not to any suplus profits in respect of future preferred stock issued.

His Lordship asked counsel what attitude he took up with regard to the third preference stock.

Mr. Lawrence said he was in some difficulty with regard to dealing with that class of stockholder until he had heard what the learned counsel appearing for them had to say.

His Lordship: And as to the others?

Mr. Lawrence said with regard to the £3.725,000 deferred stock, he admitted the whole of that would share the surplus assets, but with regard to the £2,225,000 of preferred stock, that would only share to the extent of £1,000,000 under the splitting resolution of 1901.

Mr. Astbury said he appeared for the third preference shareholders, and he opposed Mr. Lawrence's claim, and submitted the claim of the first preference shareholders was also a bad one. It was clear that the latter were entitled to their 6 per cent. out of the annual distribution, and to have their capital back on a final distribution. Beyond that they were entitled to nothing. The articles clearly provided that the excess capital was to be distributed among members of the company other than the first and second preference shareholders. The assets should be more than sufficient to repay the whole of the paid-up capital, outside liabilities, &c. Then the excess should be distributed among the members in proportion to capital paid other than the first and second preference shares.

His Lordship said that the only two figures apparently which were material were the £1,225,000 third preference shares rateably with £4,950,000 stock.

Mr. Astbury said that was so.

Mr. Tomlin, for the third preference shareholders, argued that on the true construction of Article 126, the first and second preference shareholders were expressly excluded from participating in the excess.

His Lordship pointed out, that there was no special term entitling the third preference shareholders to participate.

Mr. Tomlin said they based their case on a decision given by his Lordship in another action.

Mr. Russell, K C., on behalf of the preferred stockholders, said his claim was twofold. First, he claimed interest; and, secondly, he claimed to be entitled to share in the surplus assets. As regarded the first, the business was sold on December 31st, 1911, but his clients were not paid off until July 31st, 1912. The payment of the purchase-money, for the convenience of the purchase, was postponed, but on the terms of interest in respect of the postponed purchase-money. With regard to the right of the preferred stockholders to share in the surplus assets, he realised he must get to the right side of the door before he shut it in the face of other people. There would be a very substantial sum to divide by way of the surplus assets. If that were not so, they would not be before his Lordship in such large numbers. Since the splitting resolution the preferred stockholders had received their 6 per cent., and the deferred stockholders had also received 6 per cent., but between 1901 and 1907 the dividend varied, and did not reach 6 per cent. He conceded that in the division the deferred stockholders should reseive a sufficient sum to level them up to the preferred stockholder in the way of dividends and business.

Mr. Younger, on behalf of the deferred stockholders, said it was his duty to resist all the attacks which had been made from every quarter. The surplus assets ought not to be diminished by the payment of any interest or dividend on any of the stock or shares of the stockholders.

(*To be continued.*)

Petition by British Westinghouse Electric and Manufacturing Co., Ltd.

The petition by the British Westinghouse Co. for the compulsory winding up of the Garnant Anthracite Collieries was again before Mr. Justice Neville in the Companies' Court on Tuesday last.

The petition had been standing over since December 3rd with a view to an arrangement being come to, and his Lordship now, with the consent of all parties, adjourned it until the first petition day in the next sittings.

Hampton & Sons, Ltd., *v.* Princess Annie de Lusignan.

A claim for electrical fittings by plaintiffs, of Pall Mall East, S.W., was heard in the Official Referee's Court before Mr. Verey, against Princess Annie de Lusignan to recover £162 5s. 11d., for decorative and electrical work done in her flat at 11, Wellington Court, Knightsbridge, S.W., last year.

Mr. Frank Mellor, for the plaintiffs, said the flat was on the fifth floor, the kitchen and domestic offices being on the floor above Most of the work was in respect of the fifth floor.

The defence was apparently an allegation that the work was negligently and unskilfully done, and that £100 which was tendered was sufficient payment.

Counsel said that from the first the plaintiffs had taken up the position that if anything had been defective they should have been allowed to put it right, but the defendant had never given them that opportunity.

Matthew Greenwell, electrician in the plaintiffs' employ, said they altered existing wires, and did work in respect to counterweight fittings. They rewired pendants and refixed bell pushes. Some of this witness did with his own hands. He also supervised men in the employ of Messrs. Hampton in their electrical department.

After evidence for the defence, the Official Referee said that, on the whole, he came to the conclusion that the plaintiffs had carried out the work specified, and, taken on the whole, in a proper manner. The plaintiffs had been ready and willing at all times to put right whatever small defects there might be, if only they had been allowed, and he thought that the defendant, in not giving them access, had taken a rather unreasonable attitude. He thought that £2 5s. 11s. should be allowed for the cost of making good these little things to complete the work. There would, therefore, be judgment for the plaintiffs for £160 and costs.

Motor-car Accident: Damages.

At Durham County Court on the 16th inst., before Judge Bonsey, Joseph Cooper was awarded £50 as damages for injuries received through being knocked down by a motor-car belonging to the County of Durham Electrical Distribution Co. It was agreed that the damages, if any, should be assessed at £50, and the question before the Court was one of liability only. This was decided in plaintiff's favour, with costs.

The Earthing of a Switchbox: Appeal.

In the King's Bench Divisional Court on Monday, the Lord Chief Justice, and Justices Coleridge and Rowlatt, heard the appeal of Mr. John Atkinson, Inspector of Mines, against the decision of the Gateshead Justices, who had refused to convict Mr. Henry M. Imrie, the manager of the Chopwell Colliery, Gateshead, for an alleged offence under the Coal Mines Regulation Act.

Counsel, who appeared on behalf of the appellant, said Mr. Imrie was summoned at the instance of the Inspector for neglecting to have an electric switchbox earthed, which was contrary to the regulations of the Act. The justices, however, declined to convict, holding that an offence had not been committed. The whole question turned, said counsel, on the meaning of the word "construction." It appeared that the switch in question was used for controlling a portable electric motor, which worked a conveyor for carrying coal. The box was not properly earthed, and last May, while it was out of order, a workman touching it was killed by an electric shock. If the switchbox had been in proper order and earthed, this would not have happened. The box in question was constructed before 1911, and to earth it, it would be necessary to carry a new cable to the surface. His contention was that it constituted an installation, but it was the respondent's argument that it was covered by the word construction, and that he was shielded by the special rules of the Act, which did not come into force until 1920, and which provided for the earthing of all electrical apparatus in mines after that date, and exempted all apparatus constructed before 1911. Counsel contended that the plant in question could easily have been earthed by "placing a piece of copper wire around it and sticking it into the earth," and that the respondent had been guilty of an offence.

Counsel for the respondent said the justices dealt with the question very carefully, they saw the plant, and had it described to them, and they decided that earthing the switchbox would come within the meaning of construction, and that, therefore, the respondent was protected by the special rules. In this case he did not fight the matter on the ground of expense, but in some mines, where they had not an armoured cable, the expense of earthing the electrical plant would be enormous, because cables would have to be taken the whole length of the mine. The special rules dealing with the construction of electrical plant in mines had been made enforoeable in 1920, so that some of the old plant would become worn out before the colliery owners were bound by law to incur the expense of earthing, and to give them an opportunity of purchasing new machinery. In the present case, seeing a new cable would have to be laid down, he argued that it was a part of the construction, and he was therefore protected by the special rules.

Their Lordships reserved judgment.

The Telephone Arbitration.

(*Concluded from page 952.*)

Continuing his summing up of the case for the company, Sir Alfred Cripps dealt with the question of plant depreciation, which he described as a most important part of the case, and which he said required very careful consideration. According to the estimate of the Post Office, the value of the plant when new was £12,000,000, and by its method of calculation, the figure of £7,000,000 was arrived at, after allowing for depreciation. In considering this figure, he submitted that the Court must have regard to the life of the plant, and by that phrase he meant the period of time for which the plant could be efficiently used, after eliminating the human element and changing conditions consequent on changing business. That was the basis Mr. Gill, engineer-in-chief to the National Telephone Co., enunciated at the start. On the other hand, the Post Office had taken as its basis, what was called effective life, the period of efficient user diminished by changes brought about for business reasons. He contended that the basis adopted by the company was the correct one, and that the figure arrived at by the Post Office for deductions in respect of depreciation was simply ludicrous. The Court must eschew from their minds any notion that they were valuing second-hand plant. They had to ascertain what was the proper cost of construction and the proper amount to deduct in respect of depreciation. The plant had to be valued on the basis that it was established and ready to earn a profit. Although they had nothing to do with the business element they had none the less to bear in mind that they were valuing the plant as a going concern. As to the cost of raising capital, the company claimed that it was entitled to the cost of buying the capital used in connection with the construction of the plant. The arrangement between the Post Office and the company was that the latter should be paid in Exchequer bonds terminable in 18 years. He wished to point out that when the company received some of these bonds a short time ago they were only able to get £92 6s. for £100 bond. That meant 7 per cent. discount on any sum the Court awarded the company.

Sir Jas. Woodhouse asked if counsel suggested that that 7 per cent. was a charge the company were entitled to make.

Sir A. Cripps said he did not, but he simply mentioned the fact to show what the company had to pay.

Sir J. Woodhouse: Do you limit the claim to brokerage and commission?

Sir A. Cripps: That is so.

Concluding his speech, Counsel said: The company have neither asked for nor given any quarter. They ask for nothing more than fair treatment, and I am confident that this Court will give them nothing less.

The Solicitor-General, dealing with the question of the cost of raising capital to construct the plant of the company, submitted that that was an expenditure which should not be added to the charge for the plant.

Mr. Justice Lawrence asked if it were not conceivable that plant of some £10,000,000 in value could not be constructed without expense having been incurred in raising capital.

The Solicitor-General: I submit, my Lord, that before a man can hope to pay for a thing, he must first take the necessary steps to find the money.

Sir A. Cripps said he was only entitled to what was necessary as an element of cost in raising capital. He did not suggest he should receive more under that head.

This brought the proceedings to a close, the arbitration having occupied 71 days.

The Commissioners, of course, reserved their judgment. No announcement was made as to when the Court would sit again to deliver its verdict.

British Economical Lamp Co., Ltd., v. Empire, Mile End, Ltd.

In the Lord Mayor's Court, before the Recorder (Sir Forrest Fulton, K.C.) on Friday last, plaintiffs, of Old Bailey, E.C., sued the defendants and Mr. Alexander Bernstein, of 140, Fenchurch Street, E.C., the managing director and largest shareholder in the company (a picture palace concern), to recover 1,099 electric lamps or the sum of £135 10s. 11d., their value. Mr. S. Mayer was counsel for the plaintiffs, while the defendants were represented by Mr. Rankin.

Mr. Mayer stated that the defendants were the lessors of a theatre in the Mile End Road, and apparently they let the building to a concern known as the Yiddish Opera and Operetta Co. The latter found that the electric lamps in the theatre were not suitable for them, and they applied to the plaintiffs for fresh metal-filament lamps. In all, the plaintiffs supplied 1,099 electric lamps, of which 846 were metal-filament lamps at 3s. each, 250 carbon lamps and 300-c.p. lamps. Those lamps were not sold, but were let to the Opera Co., under an agreement at £3 a week. The plaintiffs had never succeeded in getting any of that money. Unfortunately the plaintiffs also supplied new fittings for the theatre, but as those were sold they could not claim for them from the defendants. So far as the lamps were concerned, they were let to the Opera Co. on September 13th last, and by October 5th, as nothing had been secured, an application was made for payment. They were then informed by the manager that he had closed the theatre, but hoped to open again very shortly. Subsequently it was found that Mr. Bernstein, the manager of the defendant company, was in possession. He said that he was the landlord, and everything was forfeited to him. The defendants had taken possession, as the Opera Co. had not paid the rent of the theatre. Correspondence then ensued between the solicitors to the parties, and the defendants' solicitors stated that the lamps were fixtures, and could not be removed after the tenancy of the Opera Co. had been determined. The defendants offered to allow the lamps to be removed on certain conditions, but the plaintiffs did not see fit to accept that offer, and therefore proceeded with the present action. In the defence which had been filed, the defendants said that when they let the premises they contained certain lamps which belonged to them, and which were affixed to the building. That, declared Mr. Mayer, could not be true, as an electric lamp was never affixed to premises. The defendants further admitted that they entered into possession of the theatre and determined the lease in October last, as the rent had not been paid. The defendants set up that if the lamps claimed were in the theatre, then they had been affixed to, and become part of, the premises, and were now their property. Counsel added that the worst feature of the case was that the defendants had been running the theatre as a picture palace with the plaintiffs' lamps, and, doubtless, making a good thing out of it.

Evidence was given by Mr. Charles Butfield, an inspector in the employ of the plaintiffs, who said that the defendants were being sued for 3s. for each of the metallic-filament lamps, although it had been agreed that the Opera Co. should only pay 1s. 9d. for each of the lamps which were broken. The witness declared that there was a ring in existence which kept up the prices of metallic-filament lamps. His firm supplied metallic-filament lamps which were made in this country. They were better than the German lamps imported into this country, but he declined to say who the manufacturers of the lamps were or where they were manufactured.

On behalf of the defendants, it was urged that the lamps were tenant's fixtures and not landlord's fixtures. As the lease was forfeited the tenant could not expect to take the lamps away.

Mr. Mayer said that no distinctions could be made between a landlord's and a tenant's fixtures. The sole question was whether the lamps were fixtures, and the plaintiffs claimed that they were not.

The Recorder: If they are fixtures you cannot claim them?

Mr. Mayer: That is so.

Mr. Rankin said that if the lamps were chattels and not fixtures then the trade of the plaintiffs would probably be ruined. If the lamps were chattels and not fixtures a distress could have been put in immediately the rent was in arrears, and the lamps distrained upon.

Mr. Mayer: Before the Law of Distress Act of 1908 you could have done so.

Mr. Rankin further stated that when the defendants let the premises they were fitted with electric lamps, which had been removed, and those supplied by the plaintiffs were substituted.

After hearing further legal argument, the Recorder held that the lamps were trade fixtures, and entered judgment for the defendants with costs.

Leave to appeal was applied for and granted, and a stay of execution granted on the usual terms.

BUSINESS NOTES.

Trade Announcements.—Last week we had the pleasure of going over the very fine premises into which Messrs. Krupka & Jacoby, Ltd., have removed at 26-36, Chapter Street, Westminster. The buildings cover a very large area, with most extensive office and storeroom accommodation, and since their purchase by the firm, have been transformed and generally adapted for the purposes of the business at large expenditure, and in very fine style. When the transformation is perfectly complete—a number of finishing touches were being given at the time of our visit—and the stock is well displayed and stored, with the staff accommodated in bright and comfortable surroundings, there will still remain ample room for further extensions, which it is expected will be necessary as a result of the firm's policy of commercial expansion. At present the buildings are two-storied with flat roofs, so that new floors can easily be added. The Graetzin metal-filament lamp is, of course, used throughout for lighting, and much of the store accommodation will be devoted to keeping large stocks of these lamps, in sizes from 16 to 1,000 c.p. for high voltage. The wiring is effected in screwed conduit, and a 20-line Sterling intercommunication system of telephones serves all departments. In addition to Graetzin lamps, the stocks to be carried will include carbon brushes, cables, and general electrical accessories.

The Armorduct Manufacturing Co., Ltd., announce that their agency arrangement with Mr. H. B. Done has come to an end; the Midland business will in future be handled by Mr. A. H. Broadribb, who has been connected with the company for a number of years. Mr. Broadribb will make his headquarters at the firm's Witton works as from January 1st next, when correspondence should be addressed to the company there. Until that date letters should be sent to Farringdon Avenue, E.C.

Mr. W. S. Wilson, electrical engineer, of Watford, has removed his business from High Street to larger premises in Water Lane.

Messrs. W. V. Waite & Co., Ltd., announce that their address, from January 1st next, will be Alpha' Works, Taffs 'Well, Glam., where they have taken more convenient premises, and will extend their business along additional lines.

Messrs. Watlington & Co., Ltd., announce that from Christmas all communications should be addressed to them at their new premises at Britannia House, 48, Milton Street, London, E.C.

Germany's Electrical Exports.—During the autumn of this year, says *Elektrotechnik und Maschinenbau*, the exports of the German electrotechnical industry underwent a remarkable expansion. While in September, 1911, the deliveries of electrotechnical products abroad totalled 86,953 quintals, in the same month this year the figures rose to 102,106 quintals. In the period from January to September the progress was also evenly sustained, reaching a total of 808,620 quintals, or an advance of 54,698 quintals, on the amount for the previous year's corresponding period. In the values of the exports the progress was illustrated by the difference between the figures for the current year of 161·8 million marks, and those for last year, namely, 154·23 million marks, and this improvement was effected notwithstanding that the most important articles of export hitherto—viz., cables—showed a considerable retrogression. Exports of these latter articles in the first three-quarters of the preceding year were 286,813 quintals, against 260,690 quintals in the current year. The cause of this decline is not so much the lesser exports abroad, as the shrinkage in the shipments of submarine cables, which, in the first 10 months of last year, were exported to the extent of 59,835 quintals, while this year the figures fell to 13,814 quintals. Contrasted with Swiss exports of dynamos, which, in the first half of the current year, showed a falling off in both quantity and value, German exports of these goods in the first eight months registered steady improvement. The January to August figures for the last six years in double centners make the following showing:—1907, 468,341; 1908, 532,829; 1909, 491,284; 1910, 569,394; 1911, 666,969; and 1912, 706,407. How quickly the German electrical industry has recovered from the evil effects of the 1907 year of depression is shown by the fact that in that year Germany's exports of all kinds of electrical goods aggregated 108·67 million marks, whereas in the current year the figures were 141·04 million marks. Compared with last year, there is, too, an increase of 4·35 million marks. As regards the export of individual articles, advance was most noticeable in small dynamos, motors and transformers. These were shipped in the eight months to oversea markets to a total of 63,920 quintals, against 53,305 quintals in the corresponding period, their values also rising from 11·36 million marks to 12·85 million marks. Austria was the chief purchaser and took 10,637 quintals, against 8,563 quintals last year. The exports of large dynamos, motors, &c., of above 5 quintals in weight failed to maintain the height of the previous year, the figures being 146,641 quintals, against 158,997 in the same period last year. Values also declined from 19·36 million marks to 17·66 million marks. Shipments to particular countries, however, showed numerous increases. Thus, Italy took 17·62 million marks' worth, against 14·34 million in the preceding period; Belgium, 10,723 quintals, compared with 7,504; and the shipments to Argentina rose from 9,693 to 17,453 quintals. Notwithstanding general trade shrinkage, exports to Japan attained the figure of 18,824 quintals. Complete armatures and commutators were shipped in the first eight months of the year to the extent of 26,018 quintals, representing a value of 3·98 million marks. Important purchasers were likewise Italy and Great Britain. The export of electric cable in this period under review amounted to 228,778 quintals, the relative money worth being 17·04 million marks. Holland took 35,081 quintals, or 8,357 more than in the eight months of the foregoing year; the exports to Japan rose from 33,441 quintals to 34,160. Taking third place, Argentina was a purchaser to the extent of 29,179 quintals, or 3,792 more than in the previous year In Europe, Sweden took 24,499 quintals and Belgium 24,407 quintals. Lastly, fittings for lighting and power transmission, &c., were exported in steadily growing volume, the figures being 71,989 quintals last year, against 91,429 from January to August in the current year. Values likewise increased from 19·76 to 24·37 million marks. Russia, Austria and Argentina were takers together of about half of the total of Germany's exports.—*Elektrotechnik und Maschinenbau.*

The Advertising Exhibition.—This Exhibition was held at the Horticultural Hall, Westminster, during last week. The Horticultural Hall certainly does not lend itself to the exhibition of large electric signs, but there are innumerable small electric flash and transparency signs for external and window use, and why more of these were not exhibited must remain a mystery. Broadly speaking, not a single electrical advertising device received adequate representation, though honourable exception must be made in the case of the British Electrical Federation, the activities of which are, however, chiefly concerned with tramcar advertising. The Federation is able, by its association with the electricity supply undertakings in 24 districts, to offer specially favourable terms for the supply and maintenance of electric signs of any kind, but the exhibits shown were practically confined to improved styles of plates for advertisements on tramcar and other vehicles, and to transparency and rocker signs for the same purpose. The transparencies shown included "orograph" plates for use in the back of destination boxes and small panels for use in place of ordinary shades over the other lamps used to illuminate tramcars. In both cases the advertising sign is as effective by day as by night, and since the artificial light employed by night has necessarily to be provided for other purposes, the rental for these signs is actually lower than the cost of the energy consumed in the lamps.

The rocker sign mentioned is constructed under Huckle's patent, and employs a 6-in., eight-spoked star wheel to oscillate an indicator or disk device in any appropriate advertising sign. The star wheel is actuated by a metal ball rolling to and fro in a runway (as the vehicle oscillates), and displacing, in one direction or the other, the vanes of the wheel, which reach into its path of motion. The mechanism is the acme of simplicity and strength, and the driving force, being that of gravity, costs nothing.

Numerous examples of electric sign transparencies—offering considerable advantage over earlier types as regards artistic effects and durability—were shown by the Orograph Process Co. In all the exhibits including transparency signs, appreciation was shown of the fact that "spot" effects must be avoided—by the use of reflected illumination or by placing the lamps at a suitable distance behind the transparency, with the interposition of diffusing screens if necessary. The arrangement of the illumination with regard to the subject of the transparency also showed a marked advance on what is, even now, very common practice on users' premises. It is, of course, essential for good effect that lamps should be placed behind the high lights of the design or, in other words, the artificial illumination should be from that direction which is assumed by the artist in designing the sign.

It is to be hoped that, at the next Advertising Exhibition, electrical activity in this field will be adequately represented. Apart from electric signs proper, pertinent lines for exhibition in the recent show would have been various types of flasher motors and controllers, electric motors for use with multigraphing machines, display light fittings for electrical publicity.

Sheffield.—Messrs. Thos. A. Ashton, Ltd., have just secured the following contracts for electrical work in the Sheffield district:—Penistone Road destructor, lighting; Corporation Street baths, lighting and bells; Yorkshire Garage Co., garage and body building shop, light, power and telephones; Swinton U.D.C., water-level indicating system between reservoir and pumping station.

Christmas Holidays.—The Cable Accessories Co., Ltd., of Britannia Street Works, Tividale, announce that their works will be closed until the Monday morning following Christmas.

The Midland Electric Manufacturing Co., Ltd., Rea Street South, Birmingham, announce that their works will be closed from noon on Tuesday next, December 24th, until the morning of Wednesday, January 1st, for stocktaking. A small office staff will attend to urgent correspondence.

Bankruptcy Proceedings.—Samuel Lord, director of a limited company, 18, James Street, Liverpool.—The first meeting of creditors in this matter was held at the offices of the Official Receiver, Union Marine Buildings, 11, Dale Street, Liverpool, last week, when it was reported that the receiving order was made on the debtor's own petition, and according to the statement of affairs the liabilities amounted to £3,338, and were made up of the claims of unsecured creditors, £1,190, three contingent liabilities of £2,144, the whole of which were expected to rank for dividend, and preferential claims for £4. The assets consisted of a watch, chain and two rings, valued at £2, and one fully paid-up £1 share in the Lord Howe Electrical Engineering Co., Ltd., valued at 10s., making a total of £2 10s. The failure was attributed to the difficulties of the firm of the Howe Electrical Engineering Co., which had been caused by bad trade, bad debts, and losses on contracts. The debtor stated that he was employed as managing director of an Electrical Engineering Co. at a salary of £3 a week; and about 18 years ago he was admitted into a partnership with two others under the style of the Howe Electrical Engineering Co., paying £600 into the partnership, which sum he borrowed on the security of his reversionary interest in his father's estate, the loan being repaid on his mother's death, when the estate was distributed. About 15 years ago one of the partners retired, and the debtor continued the business at Redcross Street, Liverpool, with Mr. Wesley Sutton, the other partner, when a Mr. J. W. Garsden was admitted into partnership, and a branch was opened at Blackburn. In September, 1909, the partnership assets, with the exception of book debts, were sold to a company called the Howe Electrical Engineering Co., Ltd., for £1,200 in cash, and £2,400 in shares, the partnership liabilities not being taken over by the company. On October 30th, 1909, the debtor and Mr. Garsden paid Mr. Sutton £100 on the dissolution of the partnership, and in the deed of dissolution they agreed to indemnify him against all liabilities. The company only lasted until February, 1911, when it was voluntarily liquidated, part of the assets being acquired by a new company, in the employment of which the debtor was at present. The debtor stated that the whole of the cash consideration of the sale in October, 1909, was applied in payment of trade liabilities, but the book debts turned out so very badly that nothing remained wherewith to pay the cash creditors. One of the cash creditors in May last obtained judgments against Messers. Sutton and Garsden and the debtor. Garsden filed his own petition in June last in the Blackburn Court, and proceedings were taken against Mr. Sutton in the Liverpool Court in November last, in respect of the judgment, and each partner had now been adjudicated. There was not a quorum of creditors present, and the matter was therefore left with the Official Receiver.

The hearing of a bankruptcy motion took place at Blackburn County Court, on December 12th, when Mrs. Annie Simpson, widow, Birkenhead, applied for a decision of the trustee in the estate of John Wm. Garsden, electrical engineer, in Duke's Brow, rejecting her claim of £1,183 8s. 9d., to be reversed. Garsden formerly carried on business as an electrical engineer in partnership with Samuel Lord (applicant's brother) and Wesley Sutton. That partnership continued until September, 1909, applicant having lent a considerable sum of money to the partnership. When the partnership was dissolved, the partnership assets were transferred to the Howe Electrical Engineering Co. In June last applicant recovered judgment against Garsden and the two other partners. Then Garsden became bankrupt, and Mrs. Simpson put in proof in the ordinary formal way, but the trustee rejected it on the ground there were joint partners. The application was dismissed, with costs

Electrical Tapes.—Messrs. John MacLennan & Co., of Glasgow and London, who specialise in fine cotton tapes such as are largely used by electrical engineers for insulating purposes, were recently awarded the New Zealand Government contract for railway cords.

For Sale.—The Ayr T.C. has for sale one 50-I.H.P. Belliss compound engine, direct coupled to a 25-KW. single-phase alternator, with exciter, and one 20-I.H.P. Belliss compound engine. See our advertisement pages to-day.

Catalogues and Lists.—Messrs. Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden.—This firm has recently issued four different picture postcards in colour emphasising the strength and economy merits of the Elasta metal-filament lamps.

The British Thomson-Houston Co., Ltd., Rugby. Folder relating to their "Fabroil" pinions which were described in our pages some months ago. We understand that the pinions are being very widely used for driving cranes, pumps, printing presses, &c. Also a folder showing and giving prices of the firm's electric convectors and radiators.

British Thomson-Houston Co., Ltd., London, E.C.—8-page booklet (No. 2,302) giving information respecting their B.T.H.-Edison carbon lamps.

The A.E.G. Electrical Company of South Africa, Ltd., Caxton House, London, S.W.—A batch of publications has been received as follows:—42-page illustrated catalogue very fully describing the Tirrill automatic voltage regulators; pamphlets describing respectively A.E.G. electric crucible furnaces, house water supply pumps, 3·5-100 H.P. C.C. motors and generators with auxiliary poles, electric sinking pumps and cables, and in most cases tabulating prices and other information; reprint describing the Dorman Long electric generating stations at Middlesbrough; and an article relating to reflector selection and height of suspension for street lighting metal-filament lamps.

Messrs. Neville Williams & Co., 80a, Southwark Street, London, S.E.—Pamphlet illustrating their "Ensign" standard pattern electric fire, and the "Ensign" fire-box. The former gives a red-hot appearance, and is made for all voltages up to 250 volts. It is a simple design in iron, with a copper ledge in front, and is suited for halls, smoke-rooms, offices, &c. A 12 months' guarantee is given with the heater wire.

Messrs. Litholite, Ltd., 55 and 57, Hackney Grove, London, N.E.—Revised sheet No. 16, showing and giving prices of standard Litholite insulators, including tube-end bushes, lampholder insulators, electrolier nipples, &c.

Mr. H. D. Boret, 9, Billiter Square, London, E.C., sends a list of sailings for 1913 for vessels of the Deutsche-Australische Dampfschiffs-Gesellschaft, from Hamburg, Rotterdam, Antwerp, Lisbon and Scandinavia to South Africa, Australia and Netherlands India.

Messrs. Baxendale & Co., Ltd., Miller Street, Manchester.—Very fine bound catalogue of 120 pages, art paper, admirably illustrated, covering their electric light fittings. Alphabetical and numerical indexes precede illustrations of great varieties of designs of brackets, ceiling fittings, pendants, electroliers, Holophane fittings, wireless cluster fittings, hall lamps, table and floor standards, church pendants, linen, glass, bead and bamboo shades, and accessories.

The British Insulated and Helsby Cables, Ltd., Helsby, near Warrington.—Two new leaflets, one describing, and tabulating sizes and prices of, the Helsby patent condensers, "Telephone" type, and the other the "Power" type for the improvement of power factors and the suppression of arcing in contact breakers and switches, and for high-voltage lighting on A.C. circuits with metal-filament lamps.

The Concordia Electric Wire Co., Ltd., Crown Parade, Cricklewood Lane, N.W.—Priced leaflet respecting the "Johnston" automatic pipe wrench and spanner.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Leaflets, in their uniform style, relating to aluminium switch connections, aluminium field coils, aluminium in the gas industry, and the erection and jointing of aluminium overhead conductors.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—48-page catalogue (January), well-illustrated, with carearranged prices, brought out in very clear figuring. The contents include switchboards for various kinds of service, switches, cut-outs, fuses, and fuseboards, motor-starters, various electric meters, and other instruments. Owing to radical alterations in prices, clients should have this new catalogue, and a note of discounts, without delay.

The Hurley Machine Co., Chicago.—16-page pocket pamphlet, attractively illustrating their "Thor" electric wringers and washing machines.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—56-page illustrated pamphlet (No. 13) containing descriptive and tabulated information relating to their electric heating and cooking material, copiously illustrated and priced. The lines covered include flat-irons, for domestic service, and for heavier work in laundries, tailoring, and other establishments, electric kettles, coffee makers, toasters, sterilisers, water boilers, cooking ranges, ovens, Bastian heaters, and so forth. Copies of the catalogue will be sent on application.

Book Notices.—*Whitaker's Almanack, 1913.*—London. Half-bound edition, 2s. 6d. net; paper covers, 1s. net.—To the office, *Whitaker* is as necessary as a directory; to the library of the reader or student, as essential as the dictionary—perhaps more so, in cases. To both it comes with the regularity and promptness of the income-tax paper, but it receives the welcome always accorded to old friends. The work has deservedly a great popularity in many countries, and at home *Whitaker* is a household word. The present is its 45th annual appearance since Joseph Whitaker first brought together his heterogeneous collection of notes, newspaper cuttings, and Blue Book extracts in a form for publication. The present editor has included a number of new features, bringing the contents up to date, among them being articles on the Insurance Act, Labour Unrest, tables dealing with the devolution of intestates' estates, the last-named being an old feature restored.

The International Whitaker.—London. Cloth, 2s. net. After what we have said of the above, little need be said in commendation of this new volume. Naturally there is not the need among English-speaking abroad for precisely the same information as in the home edition, so, in the place of some sections, the *International* editor has given more complete information relating to other nations. The first part deals with the relative functions of the components of the universe, the second with a general description of the earth, physical geography, &c.; the third, which really forms three-quarters of the entire book, deals with each nation, its area, population, history, industry, trade, communications, and so forth, the fourth giving a list of British and American diplomatic and Consular representatives in foreign countries. This summary of contents should indicate to our readers the almost certainty of the book containing matter which will be of value to them when going abroad or if already there. We understand that the first issue of the book is already exhausted and a reprint is now in hand.

Whitaker's Peerage, Baronetage, Knightage, and Companionage for 1913.—London: 5s. net. This is a third work received from the same publisher. It has now reached its seventeenth edition. The great bulk of the contents consists of an alphabetical directory of peers, baronets, knights and Privy Councillors, together with sons and daughters of peers, dowager ladies, Lords of Session, Scottish, Irish, Colonial, missionary and retired bishops, Companions of Orders of Knighthood, Maltese Peers, &c. It is a low-priced guide to these charmed circles, and is therefore a popular one. Every effort has been made to ensure accuracy, but if any of our readers happens to find his name missing from the list, we hope he will not communicate with us, for the editor may not be altogether responsible for the omission.

Rules of Golf.—The Royal Insurance Co., Ltd., 1, North John Street, Liverpool, has issued the sixth edition of this excellent little pocket set of rules. It contains important alterations made at the autumn meeting of the Royal and Ancient Golf Club of St. Andrews, and a comprehensive index, and, we are sure, would be very acceptable to our golfing readers. The company will be pleased to forward copies as far as their stock will permit.

"The Practical Electrician's Pocket-book and Diary, 1913. London: S. Rentell & Co., Ltd. Price 1s. net.

"Winding Engines and Winding Appliances." By George McCulloch and T. Campbell Futers. 1912. London: Edward Arnold. Price 21s. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 9. November, 1912. New York: The Society.

"Regulations and Syllabuses for the Examinations in Science and Technology, 1913." London: Wyman & Sons. Price 3d.

"Recherches Expérimentales et Théoriques sur La Commutation dans les Dynamos à Courant Continu." By A. Mauduit. 1912. Paris: H. Dunod & E. Pinat. Price 9 fr.

"*Journal* of the University of Liverpool Engineering Society." Vol. I, No. 2. December, 1912. Liverpool: University Press. Price 1s. 6d. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 2. December, 1912. Newcastle-on-Tyne: The Institution. Price 5s.

"La Télégraphie sans Fil pour Tous." By F. Duroquier. Paris: E. Orlhac. Price 3 fr.

"Science Abstracts." Vol. XV, Part 2. November 25th, 1912. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"A Laboratory Manual of Alternating Currents." By John H. Morecroft. 1912. London: Longmans, Green & Co. Price 7s. 6d. net.

Dissolutions and Liquidations.—Cowper-Coles Inventions Development Co., Ltd.—This company is winding up voluntarily, with Mr. W. Craddock, 10, Vestris Road, Forest Hill, as liquidator.

Hartlepool Electric Tramways, Ltd.—At a meeting held at Electrical Federation Offices in London on November 25th, it was resolved to wind up voluntarily, with Messrs. H. W. Davis and H. A. Stagg as liquidators. A meeting of creditors is called for December 30th.

Rose's Recording Target Co., Ltd.—A meeting is called for January 20th at 85, Gracechurch Street, E.C., to hear an account of the winding up from the liquidator, Mr. J. Leith.

Punjaub Electric Traction Co., Ltd.—A meeting is called for January 16th at Broad Street House, E.C., to hear an account of the winding up from the liquidator, Mr. W. L. Waite.

Calendars for 1913.—Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, have again favoured us with one of their khaki-coloured desk blotting pads. Along the top border there is a complete calendar for the coming year, and on the right-hand side, as before, there is an ample supply of squared paper, also a number of illustrations, with abridged specifications and tabulated particulars and prices, of various electrical machinery manufactures of the firm, also views of the works. The right hand side is probably a convenient position for this material if desks are less congested than those of an editorial office must be.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have sent us one of the excellent pocket diaries which for some years have constantly reminded us of their good taste. The diary is printed on sectional paper, a week to an opening; at the beginning and end of the book, and nowhere else, some particulars are given of the many Simplex specialities, together with a model specification and a collection of useful data. Neatness and convenience are marked features of this useful companion.

The Victa Electrical Co., Ltd., of 60, Queen's Road, Battersea, S.W., has issued a wall calendar for 1913, with monthly tear-off slips.

Messrs. Mawdsley's, Ltd., of Zone Works, Dursley, Glos., have sent us a wall calendar for 1913 with monthly slips. The design is very pleasing, and the copy, in suitable colouring, of "A Lassie from Lancashire," (W. E. Webster), in an old plaid shawl, with an appropriate setting with smoky chimneys in the background (wait till all those mills are electrified with Mawdsley's motors!) is quite appropriate for an industrial calendar.

From Messrs. Stewart & Lloyds, Ltd., of Winchester House, London, E.C., we have received a most acceptable hanging or desk calendar with monthly slips in a neat white and gold frame.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. Bell, the city electrical engineer, has recently presented a report to the Electricity and Cleansing Committees adverse to the proposal to install a refuse destructor and utilise the waste heat for generating electricity. Mr. Bell shows what is fairly well understood now, that there is no saving in using refuse instead of coal as fuel under the conditions obtaining in the modern power station, and suggests that the available power might be employed in making artificial paving.

Argentina.—Messrs. Arias and Torres have obtained a 20 years' concession for an electric light station at Vera (Sante Fe), and also one for a similar period in San Lorenzo (Santa Fe).

Messrs. J. G. White & Co. have applied to the Legislature of the Province of San Juan for a concession to make use of the various water powers in the province for electric power stations, which would embrace nearly the whole of the province.

According to the *Review of the River Plate*, the question of the electric light concession in the city of Buenos Ayres is still engaging the attention of the authorities. A new phase has been given to it by Messrs. Lacroze Bros. who, after numerous interviews with the members of the Council, expressed their willingness to accept a concession from the Corporation under the same terms as those accorded to the German Electric Light Co., and more recently to the Italo-Argentino Co. According to the local Press, however, this willingness on the part of Messrs. Lacroze will not overcome the question raised by the German Electric Light Co., unless the decree of the Minister of Public Works regulating the law which granted the concession to Messrs. Lacroze is derogated. It would appear that the only method of finally arriving at a solution would be by Congress derogating this law, and our contemporary says it will require very strong grounds of argument before taking such a step.

The plans relative to the installation of a hydro-electric power station in the district of the Rio Tercero works, have been approved. The work is to be done by the Central Argentine Railway, and the cost will amount to $150,000.—*Review of the River Plate.*

Bingley.—At the request of the U.D.C., the Electricity Cummittee of the Bradford Corporation has decided to supply electricity to Bingley district at the usual rate. The cost of installation will amount to about £4,000.

Birmingham.—The Electric Supply Committee of the City Council has had under further consideration the scheme for making extensions to the electricity undertaking which have been rendered necessary by the steady increase in output during recent years, and especially since the extension of the city area. Some time ago the Corporation decided to seek Parliamentary powers to acquire from the Birmingham Tame and Rea Drainage Board for extension purposes about 17 acres of land situated between the Nechells destructor and the bacteria beds of the sewage farm at Saltley, and also to raise additional capital to the extent of £500,000 for the purchase of the site and the erection thereon of the necessary works. Under the scheme of Mr. R. A. Chattock, the engineer, it is proposed to erect eventually buildings and plant capable of producing 100,000 KW., but the work will be carried out in sections as the development of the undertaking may warrant. If the proposals meet with the City Council's approval it is intended to commence next spring with the first section; this provides for the putting down of buildings and plant for 25,000 KW. at an outlay estimated roughly at £250,000. The Committee has generally approved of the idea, but before settling the details of the scheme, some of the principal stations in the country are to be visited in order that the Committee may see for itself recent developments in plant, &c. Afterwards the question of estimates will be discussed, and the report and recommendations of the Committee presented to the City Council.

Blackburn.—The town's first electrically-driven weaving shed, the India Mill of the Little Harwood Manufacturing Co., has started with between 200 and 300 looms each with its own motor.

Bolton.—The B. of T. has formally approved of the construction of the new generating station at Back-o'-th'-Bank. The scheme involves an expenditure, for buildings and plant, of £120,000.

Bo'ness.—The T.C. has decided to borrow an additional £1,000 to carry out further extensions upon the burgh electric light installation.

Bradford.—As a resnlt of the action of the Drighlington and Gildersome Gas Co. in increasing the price of gas supplied to the Hunsworth (Yorks.) D.C., it was suggested that the Corporation should be requested to extend its electric lighting system from Tong Street, Bradford, to Hunsworth, and eventually it was resolved that the Corporation should be asked to receive a deputation from the Hunsworth Council to discuss the matter of suppying electric light for Hunsworth.

Carlisle.—The Electricity Committee of the T.C. has decided to entertain applications for the hire, hire-purchase, or purchase from the electricity works of electric cookers, heating appliances, &c.

Continental Notes.—Denmark.—An important scheme—that of establishing a plant at Holmstad, in Western Sweden—to utilise certain available water-power in the generation of electrical energy, and to transmit the same to Copenhagen for lighting and power purposes, is at present under consideration. It is stated that 15,000 H.P. is available.

Sweden.—A correspondent writes that the idea of transmitting electrical energy from the Trollhättan waterfalls to Denmark by a submarine cable from Seania to Zeeland, over the Sound, has been under discussion in interested circles for a considerable time. It is now reported from Copenhagen that an agreement has been made between the South Swedish Power Co. and the North Zeeland Electrical Works and Tramway Co. for the transmission of about 10 million units per year from Trollhättan to Zeeland. This contract is the result of negotiations, carried on since last summer between the two contracting parties, and there is no doubt that the coal famine in Zeeland last summer, in consequence of the British coal strike, acted as an impetus to the speedy realisation of the idea embodied in the agreement made. The permission of the respective Governments has not yet been obtained, but it is thought that the Swedish Government will raise no objection to such an arrangement, by means of which the surplus energy from Trollhättan, which is now wasted owing to the lack of consumers, can be made use of. As far as the consent of the Danish Government is concerned, it is merely a matter of form. Having crossed the Sound, the submarine cable will be landed somewhat to the north of Elsinore, and the electrical energy conveyed to a sub-station, from which it is to be distributed to Copenhagen, where the Danish company is running several tramways, and to other places in the northern part of Zeeland.

Crewe.—The T.C. has decided to replace the oil lamps used for public lighting at Church Coppenhall with electric lamps, at an estimated cost of £430, for which a loan is to be applied for. The annual cost of maintenance will be £2 19s. 6d. per 50-C.P. lamp, or £2 per 16-C.P. lamp.

Croydon.—At the last meeting of the Education Committee a report from the General Purposes Committee was considered recommending the expenditure of £954, in addition to the ordinary estimates of the Committee, for improving the artificial lighting in 10 schools by converting the present lighting from flat-flame gas burners to electric light. Councillor Newnham moved that the question be referred back. It would, he said, cost only £87 to satisfactorily light the schools by incandescent gas. Councillor West said that Councillor Newnham's remarks were somewhat misleading. The £87 was only for converting the present flat-flame to incandescent burners, but the gas company said that would be very unsatisfactory. Incandescent gas required special fittings, and the cost of properly equipping the schools would be over £1,000. It was pointed out that the Winterbourne Road School, with an accommodation for 1,376 children, cost on an average £20 a year for electricity, which included replacement of old-fashioned lamps by new ones. Portland Road, with accommodation for 1,483, was lighted by incandescent gas, at an average cost for the three years, without any extraordinary expenditure, of £28 a year. At Tavistock Road the average cost was £15 for electricity, against Princess Road, with about the same acoommodation, £19 for gas. There was a saving of about £50 a year, which would represent a capital expenditure of £1,000. Counciller Roberts, replying, said that if they were to fit up the schools properly with incandescent gas according to the gas company's ideas they would have to spend £1,100. On the question being put to vote, the amendment was carried by 13 votes to 9.

Darton (near Barnsley).—The U.D.C. has again had under consideration the question of having the district lighted by electricity. The Electrical Distribution of Yorkshire, Ltd., which submitted terms, stated that its figure was £9 15s. 6d. per "pole," which included the full equipment. The estimated cost for the respective localities would be: Darton, 40 lamps, £391; Staincross and Mapplewell, 60 lamps, £664; Barugh and Higham, 46 lamps, £449; approximate total, £1,504. The poles would be of wood; if steel poles were used the increased approximate cost would be 30 per cent. It was decided to refer the matter to the Lighting Committee.

Dawlish.—At a meeting of the U.D.C., on the 11th inst., the surveyor presented a summary of the tenders received for lighting the town from the Gas Co., and the Electric Light Co. Resolutions were adopted by the Council, the effect of which is that the town will be supplied with 34 electric lights at £5 2s., and 106 at £2 17s. per lamp (£537), a reduction of £13 10s. on the gas contract.

Edinburgh.—Recently the Corporation decided to obtain estimates of the cost of lighting the Calton Hill by high-pressure gas. At a meeting of the Parks Committee last week, however, it was agreed that the electric lighting department should have an opportunity of reconsidering its tender for the lighting of the hill, and with this object in view the matter was remitted back to a sub-committee.

Gravesend.—The T.C. intends applying to the L.G.B. for a loan of £2,700 for the electricity undertaking, and for £300 in respect of that at Northfleet. The Empire Cement Co., which desires a large supply of current, has, it is stated, decided to accept the terms of the T.C. as to the supply and guarantee.

Heywood.—At a special meeting of the Electricity and Tramways Committee, the report of Mr. S. J. Watson, electrical engineer of Bury, on the general condition of the electricity undertaking, was discussed. The Committee decided that consideration be deferred, and that Mr. Watson be asked to attend the next meeting.

Hindley.—The agreement between the Lancashire Power Co. and the Council for the supply of electricity in bulk is to be revised to the extent that (1) the electricity will be measured at the sub-station where it is transformed for the service of the Council; (2) that the charge will be at the reduced rate of £4 per KW.; and (3) an acknowledgment of £1 1s. 1d. for large consumers supplied by the Power Co., will be paid to the Council annually in recognition of the Council's rights. A letter has been received from the Board of Trade, stating with regard to the above revised agreement that, under the circumstances, the Board reserves for the present further consideration of the question of revoking the Hindley Electric Lighting Order, 1901.

Hove.—The T.C. on December 12th decided by 25 votes to 4 to proceed with the Bill, the clauses of which include powers to purchase the undertaking of the electric light company.

Hyde.—On the motion of Councillor Pope, the T.C. has instructed the Highways Committee to consider and report to the General Purposes Committee as to the advisability or otherwise of lighting by electricity the whole of the streets on the Stalybridge Joint Board's tramway route from Hyde market place to the corner of Ashton Road and Bennett Street, Newton.

Leicester.—The controversial question of electrical and gas lighting for the streets has arisen. Up to the present the local gas department has been in sole possession of the public lighting but the electricity department having claimed a share in the work, rival installations of high-power lamps have been put up for test purposes, and a local paper suggests that it may be necessary to indulge in blue spectacles when visiting the experimental area. It is to be hoped that the Corporation will seriously consider the question of electric lighting, in view of the recent Manchester reports.

London.—ISLINGTON.—The Special Committee appointed by the Guardians to consider the advisability of introducing electric light and power into the several institutions of the Board, has issued its report. The Committee states that it has considered statements from the Gas Light and Coke Co. as to gas lighting, also reports from Mr. J. Enright, consulting engineer, as to the uses of electricity; in addition it has conferred with the Lighting Committee of the Borough Council as to the lowest terms upon which current could be supplied, with the result that an offer had been made to supply at the flat rate of 2d. per unit under a five years' agreement, the Board to take not less than 125,000 units for power, and after the first year to take a supply to the minimum value of £1,000 per annum. Regarding the question of the cost of the two systems, the Committee makes the following comparison:—Cost of gas per annum £1,320, which, after five years, would be reduced to £1,129; cost of electricity for first year, 100,000 units at 2d. per unit, £833; repayment of cost of installation, £270; maintenance, lamps, &c., £120; total—£1,223. There would also be a saving of expense in cleaning, but the Committee did not go into detail on this point, as it states that in modern public buildings where electricity has been installed, the result has been that considerable saving was effected. Having fully considered the matter, the Committee recommends (1) that the L G.B. be asked to sanction the installation of electricity for light and motor power in the two workhouses, school and relief offices; (2) that Mr. Enright be employed to prepare plans and specifications, &c., and supervise the works at a commission of 5 per cent. on the expenditure. The consideration of the question was held over at the last board meeting.

BETHNAL GREEN.—In connection with the proposal of the Electricity Committee to take a supply of electricity in bulk from the Stepney undertaking, which was referred back to it at the meeting of the Council in September last, the Committee now reports that it has carefully inquired into the effect of (*a*) the proposal of the Stepney B.C. as to the administration of an electricity supply, and also (*b*) the liability of the Shoreditch B.C. in respect of the mains laid by that authority in the Bethnal Green area, upon the estimates set out in the report of Mr. Snell. Inquiries are continually being made by large manufacturers and others for a supply of electricity, and the Committee is confident that if it were available, some, at all events, of the existing empty property would be let, and a substantial inducement would be afforded for other firms to remain in the borough, rather than to remove to a district where a supply of electrical energy is obtainable. The Committee accordingly recommends (1) that the report of Mr. Snell be received, and the scheme contained therein (already given in this paper) for the proposed supply of electricity within the borough, be approved; (2) That the Council accept the proposal of the Stepney B.C. for a supply of electricity in bulk, on the extra H.T. three-phase system for a period of 15 years, at a charge in accordance with a sliding scale, of £3 per KW., and 0·25d. per unit; (3) That the Committee be authorised to take such action as may be requisite for the purpose of settling the terms of, and entering into, an agreement with the Stepney B.C. to carry into effect the acceptance of this proposal, subject to confirmation by the Council; (4) That application be made to the B. of T. for sanction to the proposed system of electrical distribution, &c.

ST. MARYLEBONE.—In accordance with instructions, Messrs. Price, Waterhouse & Co. have issued a report upon the financial effects of the operations of the Council's sales department arising from the sale of apparatus and works incidental thereto, as distinct from the other duties of that department. The firm state that, as it is always a matter of difficulty to separate entirely the accounts relating to any particular section of business done from those of other sections, they have drawn up a profit and loss account covering, as nearly as could be ascertained, the year ended March 31st last. This account they have divided into two parts, the first of which covers the proceeds and the direct cost of articles sold and services rendered by the sales section, and the second the apportionment of the general expenses of the department. Dealing with the former, the firm state that the gross turnover of the department was £21,388, and the direct cost £15,803, leaving a gross profit of £5,585. Thus the price charged for supplies and work done includes a gross profit of 26·11 per cent., or an addition of 35·3 per cent. to the direct cost of the work done. With regard to the second part of the account, the expenses so apportioned amounted to £4,539, exclusive of any interest on the capital employed, or 21·2 per cent. upon the turnover already referred to. Deducting these expenses from the gross profit, there remains an estimated net profit of £1,045, which is equivalent to 4·9 per cent. upon the turnover, or 8·36 per cent. upon the capital of £12,500, which they estimate to be invested in this section of the department. In another report, upon the revenue account of the whole undertaking for the past quarter, Messrs. Price, Waterhouse and Co. state that the increase in the sales of energy over the similar period last year amounts to 409,128 units, or 19·72 per cent. Eliminating the public lighting figures, the rate of increase is 22·54 per cent. For the six months to September, the increase is 518.505 units, or 11·68 per cent. The number of units sold during this period, so far as private consumers are concerned, is 13·11 per cent. above the quantity sold for the first half of last year. This rate of increase (13·11 per cent.) compares with the rate of 7·5 per cent. allowed in framing the revenue estimates for the current year. The average yield per unit sold to private consumers during the September quarter works out at 2·64d., last September quarter's average being 2·837d. Thus there is a reduction of 6·94 per cent. in the average price obtained during the quarter. In June quarter the reduction was 5 per cent., and the previous September 1·5 per cent. only. Taking the six months, the rate of diminution in price is 5·98 per cent., compared with 5 per cent. diminution allowed in the annual estimate. The income from the sale of energy to private consumers, including meter rentals, amounted to £25,332 for the quarter, against £22,431 for last September—an increase of £2.901, or 12·92 per cent. This is the largest increase in revenue yet obtained in any quarter, summer or winter.

At the meeting of the Council last week, the first portion of the report regarding the sales department came under discussion. Councillor Duncan Watson said there was no evidence that the sales department had been of any use at all to the undertaking. The whole report was based upon the assumption that the sales department was necessary, but this was not the case. Alderman Debenham said the sales department was not an undertaking started because there was a loss on the electricity undertaking; it was to expand the work and to double the sales of electricity. Councillor Strauss supported the Committee, because he was of opinion that it had done its work well, especially in the direction of reducing the price of energy. Alderman Hopkins, chairman of the Electric Supply Committee, pointed out that that Committee had nothing whatever to do with the report. Surely it was not expected that there would be a profit on the publicity department, the object of which was to push the sale of electricity. Did not the gas company advertise their commodity? Councillor New said he looked upon the sales department as being part of the advertising department, and he would not be concerned if it did show a loss, so long as the sale of energy was increased. After further discussion, the report was adopted.

£1,750 is to be borrowed from the L.C.C. for the provision of 50 accumulator cells at the Rathbone Place sub-station.

HAMMERSMITH.—The Electricity Committee has decided to purchase from the Fulham undertaking such electricity as may be required for the purpose of furnishing Olympia with a separate supply of electricity for the purpose of a duplicate system of lighting required by the L.C.C., at the rate of 2d. per unit for a period not exceeding seven years.

Lowestoft.—The T.C. has appointed a committee to report as to the lighting of the streets by incandescent gas and electric light.

Mansfield.—The B. of G. has received the consent of the L.G.B. to the expenditure of £835 for the electric light installation at the Workhouse.

Merthyr Tydfil.—The Public Works Committee of the T.C. has decided to take no action with reference to the purchase of the undertaking of the Electric Traction and Lighting Co.

Peterborough.—From statements dropped by members of the T.C., it is now certain that considerable extensions of the Corporation electricity works are in immediate contemplation. The chief cause is the application by one of the largest of the engineering firms in the town for electricity for power purposes.

Portslade-by-Sea.—The U.D.C. has received notice that the Hove T.C. intends to include in its Bill powers to supply electricity at Portslade.

Radcliffe.—The U.D.C. has applied to the L.G.B. for a loan of £1,000 for additional feeder cables.

It is proposed to open showrooms for electric appliances.

Romford.—The R.D.C. has consented to the application by the County of London Electric Supply Co., Ltd., for a prov. order for electric lighting in the rural area.

Runcorn.—The U.D.C. has sealed an agreement with the Mersey Power Co. for the supply of energy for the pumping station.

Stroud (Glos.).—The R.D.C. has appointed a Committee to meet a representative of Mr. J. H. Edwards, electrical engineer, of Bristol, who is applying for a prov. order for electric supply, and who has asked the Council to waive the serving of the necessary notice. The parishes proposed to be supplied are Whiteshill, Randwick, Cainscross, Stonehouse, Rodborough, Uplands, Thrupp, Stroud Rural, Painswick, Leonard Stanley, King Stanley, and Woodchester.

Swinton and Pendlebury.—The U.D.C. has consented to the Lancashire Electric Power Co. supplying Messrs. A. Knowles and Sons with electricity for haulage purposes, principally at the Pendlebury and Clifton Hall Collieries. The present requirements are about 320 H.P. at Pendlebury and 250 H.P. at Clifton Hall.

Tilbury.—The U.D.C. has decided to oppose the application of the County of London Electric Supply Co. for a prov. order unless the company embodies all that the Council has asked for, including the payment of Trade Union rates of wages in the district to employés.

Torquay.—The T.C. has applied to the L.G.B. for a loan of £6,300, for the purchase of new plant for the electricity works.

Truro.—The General Purposes Committee has interviewed Mr. W. T. Pressland and Mr. E. Lakin Smith, who propose to form a company for the purpose of applying for a prov. order for electric lighting. The consent of the Council was asked for, but the Committee declined to make any recommendation until full particulars of the scheme were given, together with an undertaking that the work would be carried out within a reasonable time. The Committee has also interviewed Dr. Purves, of Exeter, who was instructed to prepare the necessary scheme, plans, &c., for the Council's own prov. order.

Whitstable.—The U.D.C. has decided not to waive the right to receive earlier notification of the proposed application by Mr. G. Stanton for a prov. order for electric lighting. Consequently the application cannot be proceeded with at present.

Worcester.—The application of the City Council for sanction to borrow £7,900 for electricity purposes, has formed the subject of an inquiry by the L.G.B. It was stated by Mr. R. Clarke, the chairman of the Electricity Committee, that there had been an increased demand in the city following the change over to the polyphase system, and additional plant was necessary. The Inspector commented on the progress of the undertaking, which, he said, appeared to have been hard hit by the metal-filament lamp. He thought, however, that two or three years would see it round the corner.

TRAMWAY and RAILWAY NOTES.

Australia.—According to the *Australian Mining Standard* good progress is being made with the erection of the White Bay electric power house, opposite Swan Park, Balmain (N.S.W.), for the purpose of supplying electric power in connection with the western suburbs tramway system. The total estimated cost of the work is £608,500. The buildings are to cost £250,000, and the machinery complete £315,500, including five turbo-alternators and all necessary equipment. The plant is designed for 10 units each of 7,000-KW. capacity. The plant already ordered consists of three 7,000-KW. turbo-alternators and one 7,500-KW. alternator, boilers, and a quantity of other equipment.

Some particulars of the 7,000-KW. sets are given on another page of this issue.

According to the *Mining and Engineering Review*, the Railway Commissioner states that ultimately the whole of the Sydney suburban system will be operated by electric traction, and that a start will be made on the North Sydney to Hornsby line, which carries a large passenger traffic, but terminates on the other side of the harbour, and provides a good harvest for the ferry boats. The Commissioner's idea is to utilise some of the reserve power which will be available when the new White Bay power house, now in course of construction, is completed, and, in the course of a few years, when the bridge across the harbour becomes an accomplished fact, the line will be connected up with the central station, whilst an underground station will be erected in the neighbourhood of Wynyard Square. If electric traction proves a success on this line, the system will be extended to the whole suburban area.

According to the *Mining and Engineering Review*, Mr. Charles Hors, a well-known consulting electrical engineer, has been engaged by the West Australian Government to report on the Berth tramways.

Bingley.—It is recommended that the Bradford Corporation be asked whether it will assent to the provision of a service of railless vehicles between Wilsden and the Bradford tramway terminus; and that application be made to the L.G.B. for the borrowing powers for the estimated cost of street improvements and for the cost of tramway track and equipment.

The District Council has determined to apply for powers to borrow £43,500 to provide for an electric tramway system.

Bradford.—The Corporation is considering the difficulties which have arisen in various parts of the country, as well as in Bradford, in connection with the wearing of roads by heavy motor and trackless tramway traffic. A report on the subject by the city engineer, Mr. W. H. S. Dawson, states that since 1900 the cost of repairing tramway tracks has increased enormously, but it is difficult to say how much of this is due to tramcars, horse vehicles or motor vehicles. The excessive weights and steel tires of motor lorries, however, appear to be chiefly responsible. A clause with a view to regulating this traffic has been inserted in the Bradford Corporation Parliamentary Bill (1913).

Chile.—A new plan for the electrification of the railways from Valparaiso to Santiago and Talca, with branches, has been presented to the Chamber.

Colne.—The T.C. at a special meeting unanimously carried a recommendation to apply in the next session of Parliament for an Act to confirm the purchase of the undertakings of the Colne and Trawden Light Railways Co., and to extend the area of supply of the Corporation for electricity purposes.

Continental Note.—France.—La Societe Electrique Lille-Roubaix-Tourcoirg has just secured the concession for the construction and working of new electric tramways between Lille and Armentreies, Halluin and Lille, and between Wambrechies and Lille. The new lines will have a length of about 25 miles.

Dundee.—The Corporation Tramways Committee has asked the manager to report on the question of extending the railless-trolley system from Clepington Road to Lochee.

Folkestone.—The National Electric Construction Co. is to be informed of the Council's decision not to reopen the question of varying the terms of the agreement entered into between the company and the Corporation in 1906, in regard to the construction of tramways in the town. The company suggested promoting a scheme for railless traction, in substitution for the authorised tramways.

Glasgow.—A number of cases of fraud practised on the T.C. Tramways Department have been dealt with by the local magistrates recently, and sentences running up to 60 days' imprisonment with hard labour have been imposed. The *modus operandi* was to pretend that injuries had been sustained through accidents on cars, and in several cases the insurance underwriters of the Tramways Department were induced to grant monetary compensation.

Hamilton.—An important question affecting the electric undertaking in the burgh was referred to at the monthly meeting of the T.C. According to a Committee, a letter had been received from Messrs. Edmundsons, intimating that they had received notice from the Lanarkshire Tramways Co., terminating the agreement for the supply of electricity as at June next. It was pointed out that the loss to the undertaking would be nearly £1,000 per annum, and that Messrs. Edmundsons understood that the rescinding of the agreement was not due in any way to the question of price, as the Tramways Committee was proposing to pay the same rate to the Clyde Valley Co. The withdrawal of the contract was held by the Council to be unfair to the burgh, especially in view of the Council's attitude in the recent negotiations for the acquisition of the tramways by the County Council of Lanarkshire. It was also maintained that part of the bargain at the close of these negotiations was that all existing contracts in the burghs were to be preserved. In order to avoid any possible misunderstanding in the matter, the Council appointed a deputation to interview the Tramway Co. on the subject of the electric contract.

Heywood.—The Electricity and Tramways Committee has decided to communicate with the Bury and Rochdale Corporations with regard to a supply of current for tramway purposes during the proposed alterations at the electricity works.

Ilford.—The question of applying for powers to extend the tramway system through the Cranbrook Park and Grange Estates, is to be considered at the next meeting of the Tramways Committee.

Leeds.—A serious situation has arisen through the dismissal of four Corporation employes on the tramways and the reduction in grade of another. On Monday the Tramways Committee sat again to consider the case of the men as presented by a deputation from the Association of Tramways and Vehicle Workers, and fully considered the case. It decided to uphold the position of the general manager (Mr. J. B. Hamilton) in regard to each of the five cases. The next move rests with the men, who are very sore at the decision of the Committee. A short time ago a ballot was taken on the question of whether or not they were prepared to withdraw their labour if the men concerned were not reinstated, and the result of the ballot was not made known. Meetings are to be held forthwith to discuss the situation.

Little Hulton.—The U.D.C. on December 12th received from the South Lancs. Tramways Co. an undertaking to construct electric tramways in the township within the next 12 months. The need for such communication between Farnworth and Walkden has long been felt.

London.—The Highways Committee of the L.C.C. has recommended that through services of tramway cars be instituted in connection with the Metropolitan Electric Tramways, Ltd., from Edmonton to Holborn; Seven Sisters' Corner to Euston Road; Finchley to Holborn; Waltham Cross to Smithfield; Muswell Hill to Bloomsbury; and New Southgate to Aldersgate Street.

Morley.—The T.C. has applied to the B. of T. for an extension of time until December 31st, 1913, for the commencement and completion of the tramways authorised by the Morley and District Light Railways Order, 1901.

Ramsbottom.—The U.D.C. has entered into an agreement with Mr. J. B. Hamilton in connection with his services as engineer for the section of the railless traction scheme relating to car equipment, &c.

Rotherham.—A big scheme of tramway extension was foreshadowed by Alderman Winter on Wednesday last week, at the annual tramway staff dinner at Rawmarsh. Mr. Winter, who is chairman of the Rotherham Corporation Tramways Committee, and also a director of the Mexboro' and Swinton Tramways, stated that his company had in view a scheme for the linking up of the districts of Mexboro', Wath, West Melton, Swinton, Goldthorpe, and Bolton-on-Dearne.

Southampton.—The accounts of the tramways undertaking for the half-year ended September 30th last, show a surplus, after providing for working expenses and interest, and redemption charges, of £2,332 over the corresponding period of last year. The total receipts per car-mile amounted to 11·006d., and working expenses to 7·394d.

Tyneside Railway Extension.—The North-Eastern Railway Co. is to carry out extensive alterations to and some extension of its electrical lines at Monkseaton and Seaton Sluice with the object of developing the latter place as a residential area. The estimated cost of the work is £30,000.

Yarmouth.—The borough surveyor has been instructed to submit a comprehensive report, together with plans and estimates, of the cost of laying a double tramway in Regent Road, and on the west side of Market Place, or a single line on the east side.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephones.—In reply to a question, the Postmaster-General recently stated that the experimental automatic telephone exchange at Epsom had, up to the present, proved very satisfactory, and schemes for the establishment of larger automatic exchanges in Leeds, Brighton and Portsmouth were under consideration.

Cable Rate Reductions.—Replying to a question in the House of Commons, Mr. H. Samuel stated that further reductions in the cable rates between this country and North America, Australia, and New Zealand were in contemplation, and he hoped they would be introduced by January.

Canadian Marconi Co.—The Marconi Wireless Telegraph Co., of Canada, has signed an agreement with the Newfoundland Government under which the Canadian company is granted exclusive rights for wireless telegraph stations until the year 1926. A number of coast stations are to be erected forthwith, in connection with which the company is to receive a Government subsidy.—*Times.*

France.—It is reported from Sweden that the French authorities have recently adopted the Ericsson telephone apparatus as the standard for use at their exchanges. All the French telephone manufactories will be entitled to manufacture the new model, and also to sell it to the public. The Ericsson instruments are at present manufactured in France by a subsidiary company of he Swedish Ericsson Co.

Germany.—A new company has lately been formed in Berlin with a capital of £65,000 and the title the Deutsche Sudsee Gesellschaft für Drahtlose Telegraphie, to establish wireless telegraph and telephone services.

Imperial Wireless System.—On Wednesday last week, Mr. J. E. Taylor was further examined by the Select Committee of the House of Commons on the Marconi Agreement. He stated that if he were free to choose he would adopt the Poulsen system in preference to the Marconi, purely from the technical point of view, but he would not place the contract with the Poulsen Co. without considerable inquiries as to whether they could do the work within 12 months. He admitted that there was a certain amount of risk involved, but he believed the continuous-wave system was more efficient than the spark system. He did not make a definite statement to the Post Office on the subject, as he was not asked to do so. When he realised that he might have a direct connection with the carrying out of the work, he sold his Marconi shares.

Commander F. J. Loring, Inspector of Wireless Telegraphy to the Post Office, was next examined. He stated that at the request of the Foreign Office, the British Consul-General at San Francisco invited the Federal Wireless Co. to arrange for a 10 days' test of the Poulsen system, but the company would not allow it. He held the opinion that the Poulsen system could not be used for long-distance transmission. He thought it had reached the limit of its power. He was convinced that it would be exceedingly risky for the Government to adopt any system that had not been fully proved capable of doing the work. Nevertheless he favoured the continuous-wave system, and believed it would come into general favour sooner or later. He held the view that the agreement with the Marconi Co. would terminate what was at first practically a monopoly; he would not support the agreement if it perpetuated a monopoly. There was no reason why the Marconi Co. should not adopt the continuous-wave system. The erection of the stations by the Government would involve delay, and would hamper the work of the Admiralty. The effect of the agreement would be to allow the Marconi Co. to remain as long as they kept pace with the science; they were in advance of all the others, and the Government had no alternative but to accept their terms if they were reasonable. He thought that experts jumped to conclusions, and that very often, when a question of practical policy arose, it was better to take the opinion of someone who knew a good deal less of the subject.

No one was able to explain some of the troubles met with in communication over long distances. He considered that the present system of communication between Clifden and Glace Bay would be satisfactory from a strategical point of view. The reason why the Wireless Committee's recommendation that the Poulsen system should be inquired into was not carried out was because Clause 4 gave them all the protection that was necessary. He was not more closely in touch with the Marconi Co. than with any other company. It was absurd to ask people to tender when they had no chance of success. He had no financial interest in the Marconi Co., or any company connected with them.

On Thursday Sir George Reid, High Commissioner for the Australian Commonwealth, gave evidence. He said that his Government declined to join in the Marconi agreement, because they preferred to erect their own stations. The Commonwealth Government in December last year did not regard the Marconi Co. with much favour, and had accepted tenders from the Australian Wireless Co., a rival concern. The impression he had received was that the Marconi Co. had established reliable communication over long distances, and that no competitor was in a similar position. His Government did not appear very desirous of joining in the agreement; they had their own expert, Mr. Balsillie, and seemed inclined to erect their own stations. He had not realised the danger of delay, in view of the possibility of foreign Governments establishing long-distance stations. He was not surprised that the report of the Technical Sub-Committee was never submitted to the Imperial Wireless Committee. He regarded the establishment of an Imperial wireless chain entirely from a strategic point of view, and laid most stress on reliability and urgency. There was a conference in Melbourne in 1909, which showed the urgency of the matter. Australia led the way, as usual; long-range stations had been erected at Fremantle and Sydney, with ranges of 1,250 miles by day, and 2,500 miles by night. Several other stations had been erected in Australia, and communication could be effected with New Zealand. The contracts were for the Telefunken system. Between Port Darwin and Singapore the Balsillie system would be used, which was said to be quite clear of the Marconi patents. The Australian Government would co-operate with the Imperial Government in connection with the Imperial wireless chain, and had no feeling whatever against the Marconi Co.

Sir Richard Solomon, High Commissioner for the Union of South Africa, was next examined, and said that his Government joined the agreement when it appeared that the Poulsen Co. could not carry out the necessary tests within the time available. Distance covered, speed and reputation were the considerations that decided him in favour of the Marconi Co.; and his Government approved the agreement because delay was dangerous, the Marconi Co. was the only one that could do the work, and good terms had been arranged by the Post Office. Even if the Poulsen Co. had shown that they could comply with the conditions, no good purpose would have been served by summoning the Imperial Wireless Committee to consider the report of the Technical Sub-committee; the Committee would not have reopened the negotiations, even if the report had been favourable to the Poulsen Co. The Committee wanted to get on with the work.

Mr. Davis, solicitor to the Post Office, and Mr. Farnall, one of the assistant secretaries, gave evidence regarding the draft agreement and the course of the negotiations.

Military Wireless.—It is reported that the Army authorities have decided to establish 20 wireless sections, similar to that of the Royal Engineers, at Aldershot. Each of the new sections will carry its apparatus upon light wagons, capable of keeping pace with the Royal Horse Artillery or the cavalry if necessary. As a result of this extension, it will be necessary to enlist a number of skilled operators.

Postal Telegraphs.—The report of the Postmaster-General for the year 1911-12 was recently issued. It states that during the year 71,716,000 ordinary telegrams were transmitted, an increase of 2·8 per cent.; 4,472,000 Press telegrams, and 16,931,000 foreign telegrams were also handled. The receipts were respectively £2,216,592, £148,394, and £502,413. Railway telegrams (mostly free) numbered 1,535,000, and Government free telegrams 546,000, the total of all kinds being 89,200,000, bringing in a revenue of of £2,867,934. The telegraph system was extended to 110 post offices, and on March 31st there were 11,561 post offices open for public service, as well as 2,425 offices at railway stations, &c.

A night telegraph-letter service was introduced on January 1st experimentally, and has since been extended to all offices open all night. The delivery by telephone of telegrams addressed to telephone numbers has been extended.

The coast communication system has been improved, 150 extensions to lighthouses, &c., having been made.

The underground telegraph line between Leeds and Hull is approaching completion, and during the current year cables will be drawn into pipes between Canterbury and the coast, completing the line, and enabling the landlines in connection with France and Belgium to be put underground. The Birmingham-Bristol line has been extended to Cardiff. The stability of the overhead lines has been increased, and the liability to breakdown considerably lessened.

The use of the telephone in small offices instead of the Morse sounder has been extended, and proves very efficient both in speed and accuracy. Two superposed telegraph circuits for duplex working have been installed between Leeds and Scarborough with excellent results, and the system will be extended. The use of high-speed machine telegraphs has been adopted on several additional routes, and the Baudot working between London and Birmingham is satisfactory. Eight telegrams can now be sent over this one circuit simultaneously, and 600 have been dealt with in one hour. Murray multiplex working has been introduced between the Central Telegraph Office and Manchester, and the Murray automatic system on one of the London-Leeds wires.

The increased use of high-speed working has set free room on the poles for many trunk telephone circuits.

Baudot multiplex working has been permanently established on wires to Amsterdam and Berlin, with satisfactory results, and the system will be extended.

Reference is made to the steps which have been taken to secure Government control over the rates charged for trans-Atlantic telegraphy through the licences for landing rights. The arrangements made for day cable letters, plain language deferred telegrams, and non-urgent Press telegrams, and the reductions of foreign telegraph rates generally, are also described.

About 425 British ships are now equipped with wireless apparatus, as compared with 290 in the previous year; the outward radio-telegrams to ships numbered 6,680, and inward telegrams, 37,827, an increase of 11·8 per cent., the revenue being £7,941. In March last the Cullercoats station was purchased, and the whole of the ordinary commercial ship-and-shore business of the country is now in the hands of the Post Office, apart from the long-distance Marconi stations at Clifden and Poldhu. The coastal service is undergoing complete reorganisation.

From May 1st, telegrams for the United States and Canada have been accepted for transmission *viâ* Clifden and Glace Bay, at 4d. a word less than the cable rate for ordinary and 2d. less for deferred telegrams. During the year, 153 new licences for wireless telegraphy, covering 202 land stations, were issued. On March 31st, there were eight licences in existence for private business and 258 for experiments.

The telephone transfer is dealt with at considerable length, and the difficulties consequent on the transfer are explained in detail; it is admitted that the present position is unsatisfactory, and that the service has suffered from the effects of the transfer, but the troubles are of a temporary character and will be removed as quickly as possible.

Besides the automatic exchanges installed at Epsom and the Official Exchange of the Post Office, another type is to be tried at Hereford. Conversations over the trunk lines numbered 33,499,495, bringing in a revenue of £855,411 from inland calls, and £25,772 from Continental calls. The original Post Office London Exchange system included 81,339 subscribers' stations and 905 call offices; the total number of calls originated was 99,890,000, and the length of underground wires (including 49,168 miles for telegraph and 15,202 miles for trunk telephone purposes) was 552,973 miles, the net increase during the year being 41,919 miles. The number of telephone stations transferred from the National Telephone Co. was 140,947, and the total of the combined systems on March 31st was 232,009. During the year 110 Post Office exchanges were opened in the provinces, and 46 public call offices at small places, besides 34 call offices with limited facilities. The total number of Post Office telephone stations in the provinces at the end of 1911 was 45,607, and the National Telephone Co.'s total was 420,791; at the end of March the combined total was 471,972. The rates for "farmers' lines" had been revised, and an active canvass is in progress. The Corporation of Hull, whose licence expired on December 31st, will continue to work the telephone system as agents of the Post Office until the terms of purchase are settled. The licence of the Corporation of Portsmouth does not expire till 1926, and the Post Office having taken over the National Telephone Co.'s plant is therefore in competition with the Corporation.

As soon as it is possible to bring the new submarine telephone cable laid by the French Government into use, the rates for telephonic communication with Paris will be lowered by half, and other reductions will be made. The Anglo-Belgian telephone cable will be brought into use as soon as the necessary landlines in Belgium are completed, and negotiations are in progress with a view to obtaining a telephone service between this country and Holland and Switzerland.

The total mileage of Post Office wires at March 31st, 1912, was, for telegraphs, 313,805; for telephones, 2,234,215; and private wires, 62,630. Of these, 870,973 miles were aerial, 1,729,131 underground, and 10,546 submarine—total, 2,610,650.

On the transfer of the National Telephone Co.'s business, 10,592 men and 8,404 women were taken into the service of the Post Office.

The telegraph revenue of the year was £3,149,484, a decrease of £16,523: the expenditure, including interest on the purchase-money, was £4,276,877, a decrease of £75 803. The net deficit was thus £1,127,393, or £59,280 less than last year.

The telephone revenue was £3,542,187, an increase of £1,603,858, and the expenditure £2,788,216, an increase of £789,025, subject to adjustment when the purchase price of the National Co.'s system is known. The net revenue of the postal, telegraph and telephone services was £5,165,175, an increase of £939,179.

South Africa.—The telegraph department has arranged to keep wireless stations at Durban and Slangkop in continuous communication with Cape Town, East London, Port Elizabeth, and Mossel Bay, to ensure that distress signals received at either station will be instantly transmitted to the port in the best position to render succour to any vessel needing it.

The Telephone Service.—Replying to questions, the Postmaster-General stated that for the year ended March 31st, 1912, the capital expenditure on trunk lines was somewhat less than the expenditure for the previous year. A very large number of additional circuits was being constructed during the current financial year. He also gives the following figures regarding telephone subscribers and rentals:—

	National Telephone Co.'s system.	Original Post Office system.
Total number of subscribers' lines (excluding call offices) on January 1st, 1912	362,614	80,456
Approximate percentages of these paying subscriptions at the following rates (with approximate rentals where available):—		
Unlimited service ...	39 per cent. (£1,574,000)	17 per cent.
Message and measured service rates introduced before 1907 ...	26 per cent. (£684,000)	65 per cent.
Measured service rates introduced in 1907 ...	35 per cent. (£1,027,000)	18 per cent.
Party line rates (included in the above)...	11 per cent. (£160,000)	·3 per cent.

Wireless Telegraphy.—The *Century Magazine* says that there are nearly 100,000 amateur wireless receiving stations in the United States, of which about 40,000 are also equipped for transmitting messages to short distances.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—January 24th. Two 1,000-kw. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" November 22nd.

January 8th.—Railways Construction Branch of the Commonwealth Dept. of Home Affairs. Tubular iron or steel poles and fittings for 1,062 miles of two-wire telegraph line (average 20 to 30 poles per mile), with insulators, copper wire, &c., for the Kalgoorlie—Port Augusta Railway.—*Board of Trade Journal.*

January 3rd.—1,100 opalescent arc lamp globes, for the Melbourne City Council. See "Official Notices" to-day.

January 28th.—Paper-insulated lead-covered cable for the P.M.G.'s department. See "Official Notices" to-day.

February 21st.—Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

Sydney.—January 20th. Storage batteries, motor-generators and switchgear. City Electrical Engineer, Town Hall.

Tasmania (Hobart).—January 13th. P.M.G.'s department:—Paper-insulated lead-covered cables. See "Official Notices" December 6th.

Queensland.—January 29th. Detectors (Schedule 242), for the P.M.G.'s Department. See "Official Notices" to-day.

Western Australia.—February 19th, 1913. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day

Belfast.—January 1st. The Harbour Commissioners are inviting tenders for a 120-ton electric derrick crane at Alexandra wharf. Specifications, &c., from Mr. W. R. Kelly, Harbour Engineer, Harbour Offices, Belfast.

Belgium.—BRUSSELS.—Tenders are requested for the telephone instruments and accessories needed for the projected improvement of the telephone system throughout Belgium. In 23 lots. Particulars in cahier spécial de charges No. 3,605, of Musée Commercial, Rue des Augustins, Brussels.

Bohemia.—SMICHOV.—January 3rd. Tenders are invited for the installation of the electric light in the new Post Office buildings. Particulars of the K.k. Statthalterei, Prague.

Eastbourne.—January 14th, 1913. One 1,000-KW. horizontal steam turbine and alternator, without condensing plant, for the Corporation. See "Official Notices" to-day.

France.—BOURGES (CHER).—January 16th. Tenders are invited for the supplying of two lots of electric cable, wire and accessories for the electric installation at the Bourges railway workshops. Particulars obtainable at the works or at 2, Avenue de Saxe, Paris, and samples submitted before December 23rd to the Directeur de l'Atelier de Construction de Bourges. Lots not adjudicated upon will be reconsidered on January 30th, and samples therefor should be forwarded before January 21st.

VOSNE-ROMANEE (COTE-D'OR). December 23rd. Tenders are required for the construction and installation of electric hydraulic machinery, to raise the waters of the River Bornue to the Le Grande Rue reservoir. Guarantee, 500 fr. Particulars from the Mairie of Vosne Romanée.

Harwich.—January 13th. Four motor-driven centrifugal pumps, two motor-driven sewage rakes and screens, with switchgear, and about 400 yd. of 15-in. cast-iron rising main, for the Corporation. See "Official Notices" to-day.

Hebden Bridge.—December 31st. One 240-KW. Diesel engine and dynamo, for the U.D.C. See "Official Notices" December 13th.

Leeds.—December 27th. Electric lighting installation at Holbeck Union Workhouse. G. Diment, Clerk to Holbeck B. of G., Lane End Place, Holbeck.

London.—FULHAM.—January 9th. Steam dynamo, switchboard and connections for the Workhouse, Fulham Palace Road, W., for the Guardians. See "Official Notices" December 6th.

Manchester.—December 23rd. Testing battery at the Polygon Works of the Electricity Committee. Specifications, &c., from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—January 6th. Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Norway.—December 28th. The Norwegian State Railway authorities in Christiania are inviting tenders for the supply of an electrically-operated travelling crane.

South Africa.—December 31st. 107,580 yards of insulated wire, 6,336 yards of flexible wire, and 25 cwt. of bare copper wire, for delivery during February next. Tenders to Secretary to Tender Board, S.A. Railways. Headquarter Offices, Johannesburg. Further particulars at the B. of T. Commercial Intelligence Department in London, and in the current *Board of Trade Journal.*

JOHANNESBURG.—January 22nd. Tenders are requested for the supply and erection of electric bells and carillons in new Government buildings in a large South African town. Tenders to be forwarded by mail leaving Southampton at latest on December 25th. Particulars of South African Union Offices, Victoria Street, S.W.—*La Métallurgie.*

January 21st.—31,800 tungsten wire-drawn lamps for train lighting, for the South African Railways Administration. Secretary, Tender Board, S.A.R. Headquarters Offices, Johannesburg; High Commissioner, 32, Victoria Street, London; B. of T. C.I. Department, London.

Spain.—The municipal authorities of Huesca have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Sweden.—December 31st. An electrically-driven trestle crane of 50 tons; 17 metres gauge for Alfkarleby power station. B. of T. C.I. Department in London.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

CLOSED.

Australia. — MELBOURNE. — The *Australian Mining Standard* reports the placing of the following contract by the P.M.G.'s department:—

5-KW. 500-period converter, £325; two tuners, £105; six 7-KW. rotary converters, £1,950.—Maritime Wireless Co. (Shaw System), Ltd., Sydney.

BRISBANE.—P.M.G.'s department:—

2,000 Hellesen dry cells, at 2s. 9d. each.—B[illegible] Electrical Co., Brisbane.

Ayr.—The Corporation has agreed to accept the tender of Messrs. Walter Scott, Ltd., for Sandberg rails, at £1,930 15s., plus 5s. per ton payable to the patentee; and Messrs. Callender's tender, of £2,048 13s., for the cables has also been accepted.

Barnsley.—The Corporation has accepted the tender of Messrs. S. Rushforth & Son, amounting to £35, for electric wiring at new waterworks and workshops.

Brighton.—The B. of G. has decided to have a private telephone service installed between the new receiving homes and infirmary and the superintendent's office, &c., together with an electric fire-alarm system, at an estimated cost of £82.

Chester-le-Street.—The B. of G. has accepted the tender of Messrs. S. Stobart & Co., amounting to £375, for lighting by electricity the workhouse, offices and other buildings. The other tenders were:—

N.E.G. Electric Co., Ltd.	£378	R. W. Cairns	£497
Falconer, Cross & Co.	437	Robson & Coleman	480
T. G. Usher & Co.	467		

Douglas (Isle of Man).—The T.C. has accepted the tender of Mr. Hanson Perry for wiring and fitting the Villa Marina for the electric light, at £520, and appointed Mr. F. R. Edmondson to supervise the work.

Dublin.—The Dublin United Tramways Co. has ordered 50 car meters from Messrs. Chamberlain & Hookham, Ltd.

Dundee.—Messrs. D. H. Fleming, Sons & Co., Lochee, have ordered from the Schorch Electrical Co., London, 150 "Schorch" single-drive motors for their jute weaving and preparation machinery.

France.—The competition for the supply of telephone instruments and material in 11 lots to the French Administration des Postes et Telegraphes, tenders for which were returnable on November 23rd, has been decided as follows:—Lot 1, successful tenderers, Mambret et Cie., 25·35 fr. each. Lot 2, Association des Ouvriers en Instruments de Précision, 21·60 fr. each. Lot 3, not adjudged, all tenders above price limit. Lot 4, ditto. Lot 5, M. Delafon, 5·53 fr. each. Lot 6, ditto, 5·49 fr. Lot 7, ditto, 5·48 fr. Lot 8, M. Sidot, 5·58 fr. each. Lot 9, Société des Téléphones Système Berliner, 3·95 fr. each. Lot 10, Société Industrielle des Téléphones, 3·57 fr. each. Lot 11, Mildé Fils et Cie., 6·45 fr. each. The competing firms included, besides those named, Messrs. Thomson-Houston and Le Matériel Téléphonique.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named

WAR OFFICE.

Electric cable.—Johnson & Phillips, Ltd.
Electric motors.—Laurence, Scott & Co., Ltd.
Installation of electric light, &c., Old College, Sandhurst.—A. G. Middleton.
Overhead conductors and supports for electricity supply at Tidworth and Bulford.—British Insulated and Helsby Cables, Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Cells.—Siemens Bros. & Co.

CROWN AGENTS FOR THE COLONIES.

Diesel engine set.—Willans & Robinson.
Insulators.—Bullers, Ltd.

GENERAL POST OFFICE.

Telephonic apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telephonic cable.—British Insulated and Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.; Guest, Keen and Nettlefolds, Ltd.; T. W. Lench, Ltd.
Secondary batteries, Central Telegraph Office, London, E.C.—Sandycroft, Ltd.
Telephone exchange equipment, Hop Exchange, London, and Kensington, W.—Western Electric Co., Ltd.

Gravesend.—The T.C. has received the following tenders for the supply of boosters for the Northfleet station:—

Crompton & Co., Ltd.	£150
Lancashire Dynamo Co.	150
Electromotors, Ltd.	221
Cie. de l'Industrie Electrique et Mecanique	246

The Council has accepted the tender of the Lancashire Dynamo Co. for a switchboard panel, at £50.

London.—L.C.C.—The Stores and Contracts Committee recommends the acceptance of tenders from the following for materials during 1913:—

Electric carbons.—Sloan Electrical Co., Ltd.
Electric flexible cords.—Liverpool Electric Cable Co., Ltd.

BERMONDSEY.—The Electricity Committee has accepted the tender of Messrs. Lassen & Hjort, at £535, for new softening plant at the electricity works, capable of treating 7,000 gallons per hour.

Lowestoft.—The T.C. has accepted the tender of Messrs. Estler Bros. for a supply of tramway trolley wheels; also the tender of the British Thomson-Houston Co. for three sets of resistances for tramcars. The tenders of Messrs. J. W. Brooke and Co. have further been accepted for a supply of brake blocks, at £6 12s. 6d. per ton, and metal castings, at 1s. per lb.

Mersey.—The Mersey Docks and Harbour Board has accepted the following tenders —

Spencer & Co., Ltd.—To convert the present floor of No. 6 bridge, Prince's landing stage, into two movable electric baggage platforms.

Edison & Swan United Electric Light Co., Ltd.—Insulated electric cable.

Reading.—The T.C. has accepted the tender of Messrs. Allen & Simmonds, of the Thames Side Engineering Works, for carrying out improvements to the steam engines at the power station, at £185.

West Bromwich.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Musgrave & Co., Ltd., for induced-draught plant for new boilers.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 20th. Paper on "Electric Power Plant Troubles and Breakdowns," by Mr. E. F. Hetherington.

Institution of Electrical Engineers (Newcastle Students' Section).—Friday, December 20th.—At Tilley's Market Street Rooms, Newcastle. Annual Dinner.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, December 21st. Meeting. At 1.30 p.m. At the Royal Technical College, Glasgow.

NOTES.

Our Next Issue.—Owing to the Xmas Holidays our issue of next week will go to press two days earlier than usual, and all matter must be in our hands by Monday mid-day, excepting late news, which can be handled up to Tuesday morning.

"A Merry Xmas."—The Electrical Review wishes everyone whose eyes these words may meet a merrier Xmas than he has ever had before. The Scrooge of the electrical industry has buried his past, and the Spirit of Christmas is abroad. At the moment grumblers are not numerous. Many men will leave their offices and works with a lighter heart this year than they have sometimes had on Xmas Eve, for trade is good. After a few days' respite, they will return to work off accumulating orders and ready to prepare for a record year in 1913. To many of our foreign and Colonial readers these lines will only come when Xmas is an event of the past. To these—indeed, to all—we send a wish for a New Year of Great Prosperity.

Copper.—Messrs. Merton's statistical circular for mid-month (December 14th) shows stocks in England and afloat thereto at 39,393 tons, a reduction of 1,323 tons on the quantity under the same heading on November 30th. The quantity actually in English ports has increased by 617 tons, the reduction being made up of 715 tons less at Havre, 225 tons less afloat from Chile, and 1,000 tons less from Australia. The European stocks are less by 1,394 tons, Hamburg having put out or consumed 71 tons. Stocks in Rotterdam, at 350 tons, are very low just at present.

In detailed supplies North America sends Europe 13,576 tons, which, if doubled, would give an average quantity for the month. Spain and Portugal have sent nearly two-thirds of their average in the fortnight; Chilean shipments are above the average, and Australian the same. The total deliveries, at 24,096 are fairly high, though, with the holidays intervening, there is no reason why the second half of the month should show figures the same as the first half. American producers' stocks, at 38,466 tons (end of November) showed an increase of 4,205 tons over the figures for October 31st. The world's supply for November 30th showed an increase of 1,145 tons over that on October 31st. The figures are 81,747 tons.

Feeder Pillars Again.—A serious interruption to the lighting and power supply at Stretford, happened on the 16th inst., about 11 o'clock in the forenoon. A main feeder pillar-box, situated at the junction of Chester and Stretford Roads, was completely demolished by a heavily-laden horse lorry, which had pulled up at an adjacent water trough. The horse, it appears, started prematurely, crashing with great force into the pillar-box. In connection with the feeder pillar, which is a very large one, containing some 30 or 40 main cable connections, there is a sub-pit directly underneath the pillar base, and the lorry was precipitated therein. The *débris* caught fire and ignited the lorry, but this outbreak was quickly suppressed, and, fortunately, both horse and lorry were extricated, little the worse for their mishap. After the pyrotechnic display, nothing remained of the feeder pillar but an almost unrecognisable mass of blackened ruin. The supply to the district affected (Old Trafford) served from the feeder pillar, was totally cut-off until about 4 p.m., by which time temporary arrangements had been made for practically normal supply. Fortunately, no interruption was occasioned to the public street arc lamps and tramway supply, these circuits being both controlled and fed from a different point.

Will.—According to the *Times* the late Sir J. Irving Courtenay left unsettled property of the gross value of £48,694, of which £48,204 is net personalty.

Parliamentary Notes.—Tramway Accidents.—Mr. Fell asked the President of the Local Government Board if any further Orders had been granted for the construction of tramways on steep gradients; if his attention had been called to the recent accidents to tramway cars on such hills owing to the failure of the brakes to act; and if any brake had been found for tramway cars which was really efficient under all circumstances.—Mr. Robertson, in reply, said that all proposals for tramways on steep gradients were carefully considered by the Board of Trade, and provisional orders authorising such tramways were submitted to Parliament for confirmation only when the Board were advised by their inspecting officer, that, subject to the provision of proper arrangements and the exercise of due precaution, there was no ground for refusing sanction to the proposals. Some of the recent accidents to which the hon. member referred, were not due to any fault of the brakes, but to the brakes being improperly used. There was no brake which was really effective in all circumstances if not properly used, but tramways on gradients were approved only on condition that the brakes provided were sufficient if properly maintained and used to control cars.

Wireless Telegraph Experts.—Attention having been called to the statement of Capt. Charlton at the Marconi Inquiry that there was great difficulty in finding suitable wireless experts, Mr. Churchill said that the only three civilian experts in wireless were required to assist naval officers, and there was no probability of another being required under present circumstances. The definition of a University education had been interpreted in a wide sense, and provided that the candidate possessed the requisite technical qualifications, no rigid line would be drawn as to the college or institute at which he might have been trained.

Royal Assent.—The Light Railways Act, 1912, and the Electric Lighting Orders Confirmation (No. 4) Act, 1912, have received the Royal Assent.

The Melbourne Railway Electrification Contracts.—In connection with this scheme the total amount of the suggested appropriations for which is £2,537,000, £1,112,000 being in respect of tenders that have not yet been invited, while £1,425,000 is based upon the tenders that have already been submitted, *The Melbourne Argus* says that the items in respect of which tenders have been invited, and the approximate appropriations, are:—

Power Station.—Boiler house and boiler house equipment and structural steel work, £300,000; turbo-alternators and transformers, £140,000.

Distribution System.—Sub-station equipment, £225,000.

Rolling Stock.—Rolling stock electrical equipment, £760,000.

The following firms have tendered:—A.E.G., Berlin; Allen, Son and Co., Ltd., Bedford; Babcock & Wilcox, London; Belliss & Morcom, Birmingham; B.T.H. Co., Rugby; British Westinghouse Co., Manchester; Brown, Boveri & Co., Ltd., London; Danks & Co., Ltd., Birmingham; Dick, Kerr & Co., Ltd., London; Escher, Wyss & Co., London; Ferranti, Ltd., Hollinwood; General Electric Co., Ltd., Birmingham; General Electric Co., New York; Mirrlees, Watson & Co., Glasgow; Parsons & Co., Ltd., Heaton; Reyrolle & Co., Ltd., Hebburn; Richardsons, Westgarth & Co., Hartlepool; Siemens Bros. Dynamo Works, Ltd., London; Stirling Boiler Co., London; and Willans & Robinson, Ltd., Rugby.

The detailed capital expenditure estimated as necessary to furnish an electric service to deal with the traffic in 1915 is as follows:—

Power station		£761,053
Transmission system—		
Underground cables		83,188
Overhead transmission lines		59,875
Sub-stations		328,708
Track equipment		562,280
Alterations to ways and works—		
Overline structures		4,350
Telegraph and telephone wires and other sundries		20,000
Equipment of car-sheds, pits, &c.		66,000
Rolling stock—		
Electrical equipment of coaches	£634,354	
Coach bodies and bogies	485,050	
	£1.119,404	
Less cost of providing additional steam stock—		
Credited to electric scheme	£821,438	
Net cost of electric rolling stock		297,966
		£2,183,420

It is interesting to note that the resolution embodying the recommendation of the Government that the report should be adopted, has been passed by the Victorian Legislative Assembly (Lower House) by 43 votes in favour to 5 against. The resolution comes before the Upper House this week.

Clyde Electricians' Strike.—A settlement has been arrived at, and work resumed by the Clyde electricians, members of the Electrical Trades Union, who had been idle for about three weeks in consequence of a wages dispute. The men returned at the same rates of wages as prevailed before the dispute arose.

Railway Fraud.—The sixteen employés of the London Electric Railway Co., who, as already reported, were charged with defrauding the company by intercepting and selling unclipped tickets, have been committed for trial, bail being allowed.

(*Continued on page* 1004.)

LARGE WILLANS TURBINES FOR SYDNEY.

Messrs. Willans & Robinson are completing the third of four large steam turbines for the New South Wales Government Railways.

In 1911 a 5,000-kw. Willans turbine set was brought into use at the Government's Ultimo Power Station, and subsequently the N.S.W. Government ordered the four units mentioned above. The first of these is a duplicate of the plant already supplied, and will be installed in the Ultimo Station, but the remaining sets are to be installed in a new station situated at White Bay—both stations being in Sydney.

The White Bay sets differ in size from those at Ultimo, in having a capacity of 7,000 kw. each. All these sets run at a speed of 750 r.p.m., which apparently low speed is due to stringent conditions imposed by the specification in the matter of temperature rise; moreover, where such large units are nstalled thousands of miles distant from the makers' works reliability is obviously of paramount importance.

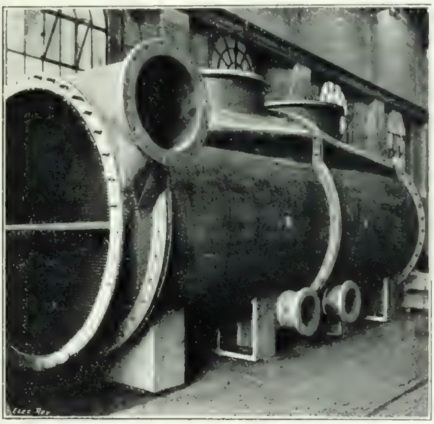


Fig. 2.—Condenser, Built in Halves for Transport.

The Ultimo turbines are designed to work with steam at a pressure of 150 lb. at the turbine stop valve, superheated 100° F.; the White Bay machines will work with a steam pressure of 190 lb. and a superheat of 200° F.

Fig. 1 illustrates the first of the White Bay turbines in Messrs. Willans's erecting shops connected up for steaming light. The machines are of the maker's standard disk and drum type, and embody the following special features of design:—The nozzle chest consists of a separate cast-steel body to withstand high degrees of superheat. The governor gear is of the standard direct-acting throttle type, a simple arrangement which at the same time ensures sufficient accuracy in governing to meet the severe conditions prevailing on the pure traction load at Sydney. The impulse blading used is of special bronze, and the reaction blading is of the Willans patent shrouded type built up in sections, no individual caulked distance pieces being used.

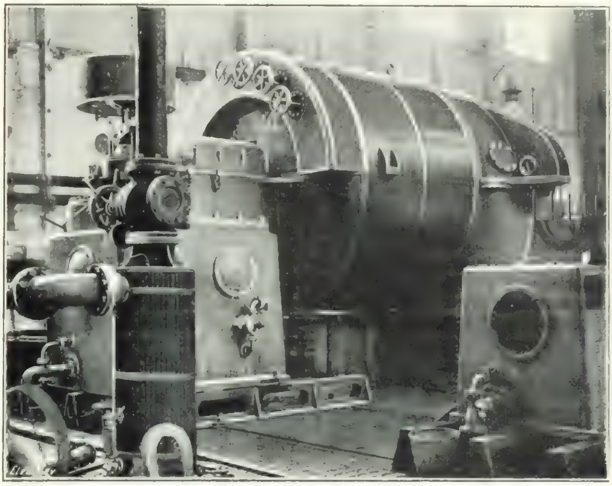


Fig. 1.—7,000-k.v.a. Willans Disk and Drum Turbine in the Erecting Shop.

The condensing plants for all these sets are of the Willans vacuum-augmentor type, with motor-driven Edwards air and circulating pumps. Fig. 2 shows one of the White Bay surface condensers in the erecting shop; this condenser has a cooling surface of 13,750 sq. ft., and it will be noted that the condenser body is split vertically to facilitate transport.

The plants are designed to maintain a vacuum of 28·35 in. (Bar. 30 in.) when supplied with cooling water at a temperature of 70° F., and when dealing with the exhaust steam from the turbine when working on full load.

The generators throughout are of Messrs. Dick, Kerr and Co.'s manufacture, designed for a pressure of 6,600 volts, unity power factor, and a frequency of 25 cycles.

These machines have salient pole rotors, and are of the makers' standard totally enclosed, chimney type, vertically divided in the case of the 7,000-k.v.a. machines, and horizontally divided in the 5,000-k.v.a. machine. Each machine is provided with an independent blower set, driven by a low-tension motor for ventilating purposes, the cool air being led into the machine through ducts in the foundations and the heated air discharged, after passing through the machine, at the chimney opening above the stator.

The guaranteed temperature rise after a normal full-load

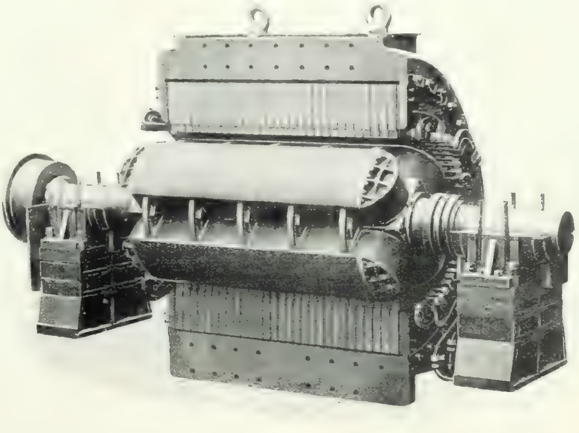


Fig. 3.—7,000-k.v.a. Turbo-Alternator, with Vertically-Divided Stator.

run of 12 hours will not exceed 45° F. above an air temperature not exceeding 77° F., and after a subsequent overload of 50 per cent. for two hours the temperature rise will not exceed 75° F.

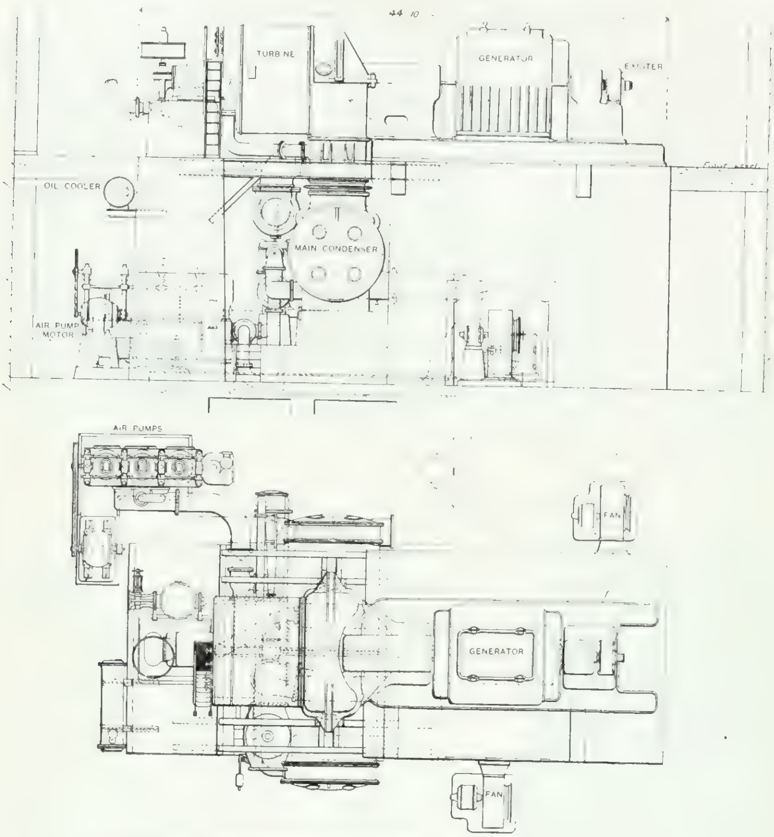


Fig. 4.—Showing Arrangement of 7,000-k.v.a. Willans-Dick, Kerr Turbine Unit for N.S.W. Railways.

The overload capacity of the machines is 25 per cent. continuously and 50 per cent. for two hours.

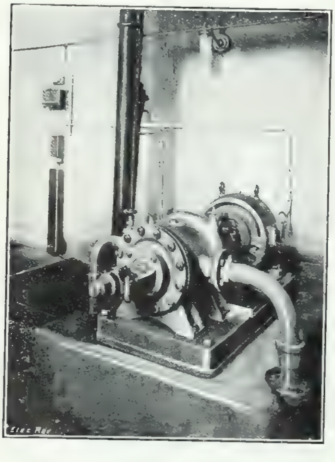
Fig. 3 illustrates one of the 7,000-k.v.a. White Bay alternators with half the stator removed.

We are indebted to Messrs. Willans for supplying us with the foregoing particulars, and to Mr. O. W. Brain, chief electrical engineer to the N.S.W. Government, for facilitating their publication. We understand that Messrs. Willans have in hand a number of other large disk and drum type turbines at the present time, including one of 8,500-kw. output for the Sheffield Corporation, and a 7,500-kw. unit for the Leeds electricity department.

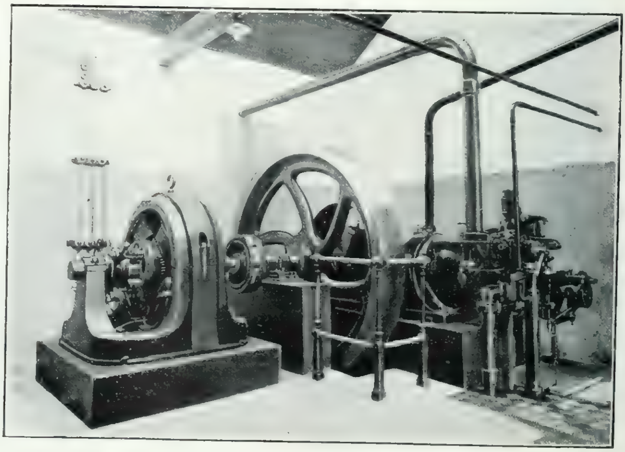
A KILKENNY ASYLUM INSTALLATION.

An electrical installation has recently been carried out at the Kilkenny District Asylum under the supervision of Louis J. Lawless, of Rathmines, to whom we are indebted for the following particulars regarding the work.

The generating plant comprises two 40-b.h.p. Hornsby Stockport gas engines and two suction gas plants, the connecting mains between the engines and plants being arranged so that either producer may be used to supply either engine. The engines are fitted with heavy fly-wheels carried in outer bearings, and are coupled direct through flexible couplings to



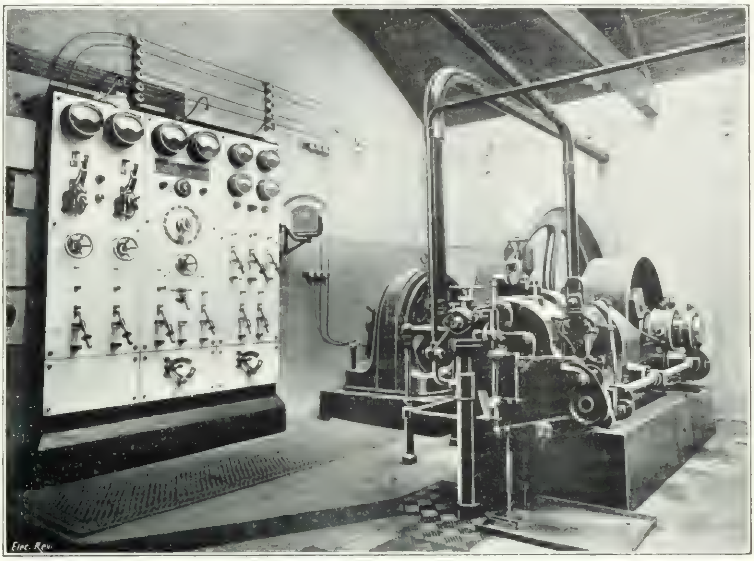
Electrically-Driven Pumping Plant.



Hornsby-E.C.C. Generating Set.

Kilkenny District Asylum Installation.

open type shunt-wound dynamos by the Electric Construction Co. Each set has an output of 25 KW. at from 220 to 240 volts. A D.P. storage battery has also been installed, having a capacity of 160 ampere-hours at the ten-hour rate, with a final voltage of 220. The cells are placed on single tier pitch pine stands supported on porcelain insulators on brick piers, and battery charging is carried out by a Newton motor-booster. A fine white marble panel switchboard by Messrs. Veritys, Ltd., and equipped with Elliott instruments is provided for the control of the generators, battery, &c., and asylum circuits. Separate fittings are provided for each circuit, including the main and auxiliary asylum buildings, pumping plant, laundry power plant and power house. The power house circuit is fitted with a switch and fuse only; the other circuits have an ammeter in addition, and the pump motor circuit also has a starting switch, shown on the bottom panel. The board is provided with a general service voltmeter mounted on the centre panel with a four-way D.P. switch, and a sector pattern voltmeter with an illuminated dial is mounted on a swinging arm at the right hand side of the board. All the main connections consist of bare copper conductors supported on porcelain shackles bolted to wrought-iron straps.



Interior of Engine Room, Kilkenny District Asylum.

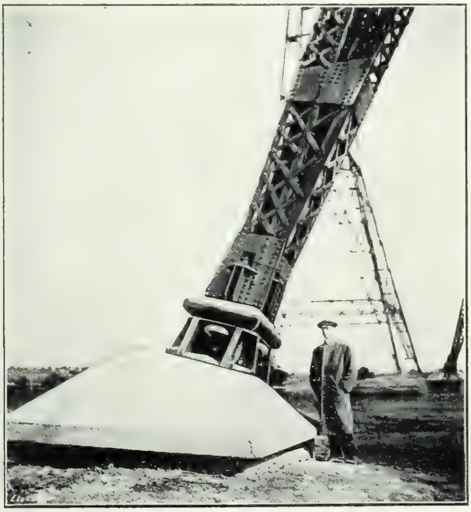


Fig. 1.—Marble Insulator and Concrete Base for Aerial Tower.

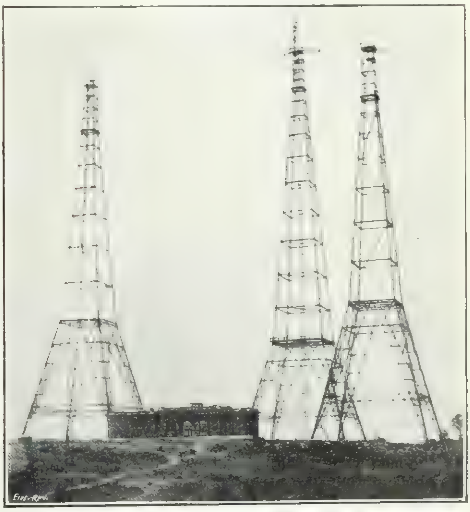


Fig. 2.—General View of Station.

Wireless Telegraph Station at Fort Myer, Virginia. (See page 1002.)

The Asylum is wired for about 537 lamps. About 419 of these lamps were originally 8 and 16-C.P. carbon lamps, and the remainder Osram metal lamps, as it was anticipated that trouble from broken filaments would attend the adoption of metal-filament lamps throughout. These fears have proved groundless, and 20 and 30-watt Osram lamps have practically replaced the carbon lamps throughout; the life of the metal-filament lamps has been very satisfactory, some of the original ones being still in use.

The whole of the asylum wiring has been carried out with C.M.A. 600-megohm grade cables, run in whitewood casing in all positions except in the pump house, where steel tubing is adopted, carried on insulators.

The main conductors between the various buildings and the power house are lead-covered paper-insulated and armoured cables of Messrs. Glover's make, and are laid direct in the ground.

The laundry is driven by a 7-B.H.P. Siemens protected-type geared motor, and six electric irons have been provided. An 8-C.P. lamp is placed in circuit with each iron as a shunt, at the point of connection with the flexible cord, to show when the current is on.

The pumping plant comprises two direct-coupled turbine pumps and motors of the Rees Roturbo type, each designed to deliver 2,000 gallons of water per hour to a height of 160 ft. The water is supplied from a well situated about 40 ft. below the level of the Asylum and about two-thirds of a mile distant from the main buildings. The pumps deliver into two 15,000-gallon storage tanks placed on towers at each end of the Asylum, about 90 ft. high. The motors require no attention beyond periodical inspection, and are controlled entirely from the Asylum power house switchboard.

The initial outlay on the complete equipment, including building and foundations, was £2,500. The fuel cost per annum for all purposes, including lighting, pumping, laundry power and ironing, only amounts to £60 when using Welsh anthracite at about 30s. per ton. The cost of gas previously was £360 per annum, and the coal for pumping purposes another £180, although the pumps were not giving more than 12,000 gallons per day. The Resident Medical Superintendent, in his report to the Committee of Management for the financial year ending March 31st, 1912, stated that there was a saving of £165 per annum after allowing for repayment of loan and interest, cost of upkeep, running and insurance of plant. The illumination of the house has been doubled, and the water supply has been greatly increased.

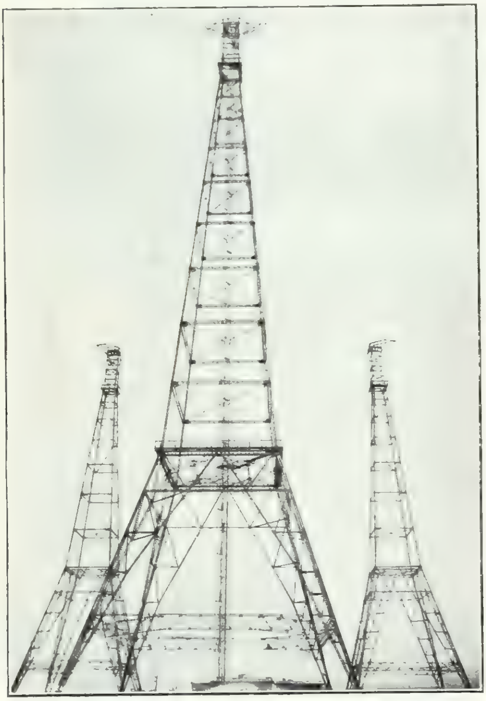


Fig. 3.—View of Tower Structures for Aerials, Fort Myer.

The men who formerly had charge of the steam engines and boilers were trained to work the electrical installation, and the plant has now been in use for over 12 months. The whole installation, with the exception of the generating plant, was carried out by Messrs. Maguire & Gatchell, of Dublin; the engine and dynamo contract was given to Messrs. R. Hornsby & Sons.

Cardiff.—A L.G.B. inquiry was held on December 12th into the application of the T.C. for a loan of £7,672 for service transformers and additional plant. There was no opposition.

THE NEW WIRELESS TELEGRAPH STATION AT FORT MYER, VIRGINIA.

By DAVIS H. TUCK and MILLARD B. HODGSON.

Until quite recently, the United States and Italy, of all the important nations, were the only ones that had not installed Governmental coastal wireless telegraph stations with facilities for intercommunication with the mercantile marine. Although quite a number of private commercial stations had been established in the United States, these

Fig. 1. Plan of Station and Circuits.

Fig. 5.—Diagram showing Construction of Aerials.

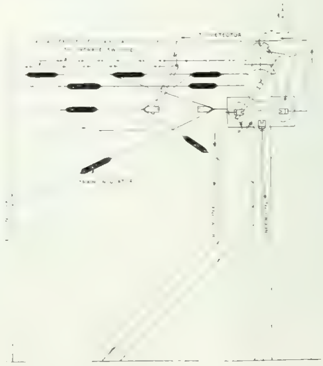


Fig. 6.—Arrangement of Switches on Distributing Pole.

were operated with the single idea of business gain, were merely news channels for incoming and outgoing steamers, and rarely performed, except by special contract, the function of a distributor of general items, such as storm warnings, &c. Also, due to trade jealousy, little was attempted along co-operative lines; each company used its own system and each was free to give and receive as it pleased. This lack of co-operation was brought out very prominently at the time of the *Titanic* disaster. The few stations operated under the Federal Government confined themselves strictly to military and naval uses.

It is to meet this lack of co-operation that the Government of the United States, acting through the Navy Department, has installed at Fort Myer, Virginia, the wireless telegraph station described in this article. While primarily a naval order distributing centre, it has been designed to include a much greater range of activity. In addition to its use as a naval distributing centre, the equipment and facilities for an experimental station have been installed which, together with the practical working equipment, will be very valuable as a laboratory for the development and testing of new apparatus and appliances. This station, acting in conjunction with coastal stations, will also comprise a bulletin distributing bureau. At a pre-arranged time each day, notification of which will be made to the mercantile marine of all nations, news bulletins stating the bearings of ships, derelicts and icebergs (reported), together with storm warnings, will be sent out. Also individual reports of maritime interest will be recorded and sent out.

The station is situated just outside of Washington, D.C., in the Virginia hills, and is 150 ft. above the sea level. The entire plant, which comprises the laboratory and the three towers, occupies a federal reservation of about five acres. It was designed and built under the supervision of the Bureau of Yards and Docks of the Navy Department, the Baltimore Bridge Co. being awarded the contract for the erection of the three towers, and the Electric Signal Co., Pittsburg, Pa., supplying the special apparatus.

The three towers are built on the corners of an isosceles triangle, and are respectively 450, 450 and 600 ft. in height, the 600-ft. tower being erected at the apex of the triangle. The dimensions of the two smaller towers are identical, being 125 ft. sq. at the base, and tapering to 15 ft. sq. at the top. The 600-ft. tower is 160 ft. sq. at the base, and tapers to 15 ft. at the top. All three are of the same general construction (shown in figs. 2 and 3), being built up of box girders whose angles are of ½-in. steel reinforced with ⅜-in. plates. The platforms at the top are accessible by zig-zag ladders arranged with convenient landings. The four legs of each tower are embedded in a mass of concrete 10 ft. sq., running into the earth a distance of 12 ft. to a rock and clay sub-foundation.

The entire structures are insulated from the ground by marble washers waterproofed with varnish (see fig. 1). There being no reliable data on the possible effects of great electrical capacity, such as that of the towers, on the signalling devices, it was deemed advisable to take this precaution. The towers are connected to earth by ground wires and disconnecting switches, so that the above-mentioned data can be obtained.

The laboratory building in connection with the station was designed to meet the requirements of an up-to-date radio plant, including well-equipped research and testing laboratories. Space has also been included for a machine shop and dormitories for employés. On the first floor, occupying a space of about 2,400 sq. ft., is the generating room. At present the energy is supplied by a local power company at 6,600 volts, 25-cycle, three-phase, and is stepped down to a pressure of 220 volts to operate a Westinghouse synchronous motor rated at 200 H.P. at 500 R.P.M. This motor is separately excited by a direct-connected direct current generator. This direct-current generator-exciter is also used as a source of energy for auxiliary apparatus. The synchronous motor, which is first brought up to speed as an induction motor, is belt-connected to a Westinghouse 220-volt, 500-cycle, single-phase generator running at 1,250 R.P.M. The voltage of this machine is then stepped up to a working pressure of 25,000 volts. The revolving type of spark-gap is employed, being a 4-ft. wheel whose 50 terminal spokes, corresponding to the 50 poles of the generator, give 1,650 discharges per second. These pole spokes are ½-in. copper, about 8 in. in length. Because of the great centrifugal force which their fastenings must withstand, life and apparatus are safeguarded by a 12-in. beam erected so as to repel any flying spokes. The minimum spark-gap is $\frac{1}{64}$-in., but owing to the high potential the air breaks down about 3 in. before and after the $\frac{1}{64}$-in. gap discharge. There is a constant capacity of a bank of nine condensers in parallel, each having a capacity of 0·036 mf. These condensers are made up of steel plates set in steel cylinders, and all air insulated at an air pressure of 300 lb. per sq. in. The wave length is varied by means of three variable-inductance units. These inductance units, together with the condenser apparatus, are the same that were formerly used at the Fessenden station at Brant Rock, Massachusetts. The signalling contacts are actuated from the operating room by relay, a variable resistance of 220 ohms maximum being shunted across the contact points on the low-voltage side to prevent excessive sparking at the contacts. The ground wires, which are led out through the basement, terminate in 6,000 ft. of bare copper wire laid in trenches between the towers. The generating or sending wires to the aerials are led out through a 1-in. thick window pane to a distributing pole (see fig. 6); this distributing pole is a very interesting and ingenious device. The sending wire from the generator, the receiving wire from the detector, and a third wire, deeply grounded, terminate here. The two wires from the generator and the detector respectively are heavily insulated from their wire supports by composition strain insulators, and from the posts of the distributing platform by double-petticoat porcelain insulators of special design. The terminals of these three wires form the three contacts of a three-way switch, which is controlled from the operating room by a system of chains and pulleys. The moving arm of the three-way switch is connected to the wires leading direct to the aerials. A second switch, suspended between the distributing poles and the wall of the building, but insulated from both by strain insulators, is placed in the detector side of the line. This switch is also actuated from the operating room by means of chains and pulleys. With this three-way switch arrangement it is obvious that the operator can at pleasure close the circuit for receiving messages, change over to sending them over the same route, or ground the entire system, as in time of electric storms.

The wires are run direct to the aerial spreaders in the manner shown in fig. 4. These aerial spreaders are built up (see fig. 5) of 2½-in. galvanised iron pipe reinforced with ⅜-in. strapping of galvanised steel. They are 88 ft. in length, square in section and 3 ft. on a side at the largest part. Their weight and that of the wires of the aerial is held up by a bridle of 15 $\frac{5}{16}$-in. galvanised steel cables, connected to the pipe by turn-buckles, and terminating at the top in a 10-in. steel ring. The aerial wires proper, 23 stranded cables of ⅛-in. diameter phosphor bronze, are soldered both directly to the iron pipe and by auxiliary wires to the bridle. These bridles are connected to and insulated from the trusses at the top of the towers by 10-in. buck links. The connections from one aerial to another are made by means of cages (see fig. 4). This cage contains 23 phosphor-bronze wires soldered directly to the bridles of the spreaders. Hence connections at any point are not dependent at any place on one strand or cable. The wires between the 600-ft. tower and the 450-ft. towers are about 400 ft. in length, and between the two smaller towers 300 ft., 40 ft. being allowed in each case for sag. It is estimated by needle-point test (length of spark being 11 in.) that an electromotive force of 150,000 volts is obtained at the topmost point of the antennæ. As an illustration of the great current density, a piece of cloth which was blown from the top of one of the towers and landed on the aerial, instantly burst into flame.

The operating room, situated on the first floor in the extreme southern wing of the building, is an example of all that is modern in receiving and transmitting devices. As outlined before, the telegraph key operates, by relay, the contacts in the generating room, which in turn control the rate at which the radiant energy leaves the aerials, the impulse being transmitted to the topmost antennæ from the spark-gap, and the wave-length being kept at the desired value by the variable inductance units.

The generating room when entirely equipped, in addition to the apparatus already enumerated, will contain some novel features. To put an end to the dependency on the local power company, an internal-combustion engine will be installed. With this the officials in charge hope to do away with the somewhat elaborate spark controlling system now used, by being able to maintain a close regulation in the flow of current. In addition to this gas engine set, several small motor-generator sets will be available for lighting and storage battery systems, and also to operate a number of lines of 25, 40 and 60 cycles, as they may be needed, for laboratory experimental and testing purposes. The switchboard by which these changes can be made is the latest pattern of laboratory board of the plug type, and is thoroughly equipped with ammeters, voltmeters, frequency meters, &c. By the storage battery system any electromotive force of from one to 250 volts will be made available for laboratory use. A novel and useful item in the equipment of this room is the provision made for testing out complete generating sets for any of the Governmental stations. A space of about 20 ft. square is reserved, I beams being laid 3 in. apart in the floor, to which heavy apparatus, such as motors and generators, may be temporarily bolted. This testing platform will have a special switchboard and current distributing system, so that any desired voltage or frequency may be obtained.

With this magnificent equipment for both practical work and experimental endeavour, it is safe to say that the United States will soon be abreast of the European nations in the development of wireless telegraphy. Officials of the station hope to attain, when working at full capacity, a maximum range of from 3,000 to 4,000 miles. Already communication has been established with the Marconi station at Glace Bay, Canada, and the Naval station at Key West, Florida.

Up to the present time the Marconi stations at Glace Bay, Canada, and at Clifden, Ireland, both being nearly alike, signified the latest development in the wireless telegraph field. Those two stations with towers of 450 ft. have intercommunicated for some time. There has also been a German station at Nauen, with a mast of 450 ft., but little is known of what it has accomplished. Hence this station at Fort Myer, Virginia, with its 600-ft. tower, and its maximum range of 4,000 miles, should rank foremost among the recent radio developments.

NOTES.

(*Concluded from page 998.*)

Institution and Lecture Notes.—THE INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).—The ninth annual dinner of the Students' Section of the Institution of Electrical Engineers was held on Saturday evening last, the 14th inst., at the Trocadero Restaurant, Piccadilly Circus. Mr. J. C. Rennie, chairman of the Section, presided, and amongst others present were Mr. W. Duddell, F.R.S., President of the Institution, Mr. W. M. Mordey and Prof. Silvanus P. Thompson, F.R.S., Past Presidents ; Messrs. A. Russell, J. Rennie, P. G. Bowie and S. A. Smith. Between 50 and 60 were present, and a very pleasant evening was spent ; Mr. Fred Rome, in his humorous items, and Mr. Louis Nikola, in his repertoire of magical problems, were specially good. After the usual loyal toast, Mr. D. Betts, vice-chairman of the Section, proposed the toast of "The President and the Institution." Referring to Mr. Duddell as an example that all Students should try to copy, inasmuch as he had worked through all grades of the Institution, from Student to President, he pointed out that the Students were hoping for very sympathetic consideration of any requests they might make to the Council during his term of office. Mr. Duddell, in his reply, thanked Mr. Betts for his remarks, and urged all to do their best for the Institution. Every effort was being made to use the Institution for the best interests of the industry. An influential Business Committee had been formed on one side, and within the past week or two a Research Committee on the other. The aim of this Committee would be to co-ordinate as far as possible electrical research work. This would be of great use to Students, who might obtain valuable advice as to the direction in which they might usefully turn their energies. The President then referred to the changes now being made in the constitution of the Institution, and pointed out that the new Graduate Class was only intended as a temporary resting place in the progress from Studentship to full Membership.

The toast of "The Students' Section" was proposed by Mr. W. M. Mordey, who spoke of the importance of the Students' class, which numbered over 1,300, or one-fifth of the entire membership. He dwelt on the advantages which students obtained by association with the Institution, and urged all to see that they subscribed to *Science Abstracts*, a valuable publication for which the Institution was principally responsible. Mr. J. C. Rennie, the chairman of the Section, in responding, spoke of the advantages which the Students' Section gave not merely of a technical but also of a social character, Now that Local Students' Sections were in existence at Newcastle and Manchester there was growing up a healthy rivalry, and it might be that in future it would be possible to arrange social intercourse with them. All such joint action would be productive of good.

Mr. Moir, in proposing "The Colleges," coupled with the toast a warm eulogy of the work of Prof. S. P. Thompson, and the cordiality with which the toast was received spoke volumes as to the esteem and affection in which Dr. Thompson is universally held. Dr. Thompson, in his reply, spoke of the good work which so many of the small colleges in provincial towns were doing in training real electrical engineers. He then denounced the premium pupil system, which had done much in the past to keep good men out of the profession, and permitted incapable but rich men to enter. He was glad to know that some of the best up-to-date firms were now setting their faces against it, and in this movement he wished them every success. Dr. Thompson then spoke of the coming examinations for admittance into the higher grades of membership of the Institution. He pointed out that the aim of the examinations, as he understood it, would be to find out what a candidate knew, not what he did not know. They would be human in character, and should not frighten anyone from trying to pass them. Finally, Dr. Thompson referred to the fact that the Colleges at heart were the students, and that the students made the colleges. Without them, the colleges were mere buildings, mere staffs of professors. It needed the life and energy of the students to make them really live.

The remaining toast, that of "The Guests," was proposed by Mr. Mould, and responded to by Mr. P. G. Bowie and Mr. S. A. Smith.

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH SECTION).—There was a large and representative attendance at the annual dinner of the Scottish Local Section, held in Glasgow on Tuesday, December 17th. "The Imperial Forces" were proposed by Mr. Robert Caird, L.L.D., and responded to by Engineer-Commander Wood, R.N., and Sir George Thomas Beatson, M.D., K.C.B. Sir John Ure Primrose gave "The City of Glasgow," and Lord Provost Stevenson acknowledged. The toast of "The Institution of Electrical Engineers" came from the Bishop of Glasgow and Galloway, and Mr. Wm. Duddell, F.R.S., president of the Institution, replied ; while the "Scottish Local Section" was submitted by Mr. R. K. Morcom, member of the Council I.E.E., and Mr. Wm. McWhirter, chairman of the Scottish Local Section, replied. There was a larger attendance than at previous functions, the company numbering about 300.

At a meeting of the Section held in Edinburgh on December 10th, Mr. F. Creedy read a paper on "The Turbo-Converter."

INSTITUTION OF ELECTRICAL ENGINEERS (DUBLIN SECTION).—On Thursday last week an informal paper was read by Mr. E. Handcock on "Illumination—Metal-Filament Lamp Lighting in relation to the Eye." A discussion followed, in which many members took part. It was decided that the day of meeting should be changed to the second Friday in each month.

ROYAL SOCIETY OF ARTS.—On December 11th Dr. F. Mollwo Perkin read a very interesting paper on "Natural and Synthetic Rubber," in the course of which he stated that when all the new sources of supply were in full swing there would probably be a glut of rubber on the market, unless new uses for rubber were found. The Badische Anilin und Soda-Fabrik had put aside £1,000,000 for research in connection with synthetic rubber. In the discussion, Mr. R. Kaye Gray pointed out that the raw rubbers differed in their properties according to their origin, and plantation rubbers had their drawbacks ; they could not be expected to be absolutely uniform. He had no doubt that synthetic rubber would be produced in the future, but it would involve a great amount of work. Mr. W. F. de Bois Maclaren believed that plantation rubber would eventually be sold at 5d. a lb. Mr. W. F. Reid did not think there was a great future for synthetic rubber.

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).—On Tuesday evening a paper was read on "Electric Welding," by Mr. P. Bucher ; a discussion followed, to which the author replied.

SOCIETY OF ENGINEERS (INC.).—The third annual general meeting was held on Monday, December 9th. The report of the scrutineers of the postal ballot for the election of council and officers for 1912, showed that Mr. Arthur Valon had been elected President, and Messrs. H. C. H. Shenton, Norman Scorgie, and T. E. Bower Vice-Presidents. The President's gold medal was awarded to Mr. W. P. Durtnall, for his paper on "The Generation and Electrical Transmission of Power for Marine Transportation."

INSTITUTION OF ELECTRICAL ENGINEERS (LONDON).—On Thursday last week a paper was read on "A Single-phase Motor with Pole-Changing Windings," by Messrs. J. S. Nicholson and B. P. Haigh, and a discussion followed. The annual dinner of the Institution will take place on Thursday, February 6th, at the Hotel Cecil.

The annual dinner of the LEEDS ASSOCIATION OF ENGINEERS was held on Saturday, December 7th ; the sole subject of the speeches was the Leeds electricity supply.

BRIGHTON.—Mr. J. Christie, engineer and manager of the municipal electrical undertaking, on Monday delivered a lecture on "The Brighton Electricity Supply Undertaking" to the members of the Preston Literary and Debating Society. The conclusion was devoted to the advantages of the "Tricity" cookers and utensils, and afterwards an interesting demonstration was given.

Appointment Vacant.—Switchboard attendant, for the Corporation Electricity Works, Paisley (25s.). See our advertisement pages in this issue.

Fatalities.—A youth aged 14 years, named Harold R. Raymond, son of a farmer, of Erdington, near Birmingham, had been in the habit of making electrical experiments and giving himself light electric shocks in a bath. As a rule, he contented himself with a small battery, but on Saturday he fixed his wires to the electric light apparatus and got into his bath, and was afterwards found dead. At the inquest it was stated that the pressure was 230 volts. A verdict of "Accidental Death" was recorded.

According to *Lloyd's* newspaper, Mr. Thomas Smith, traction inspector of the electrified section, was knocked down by a train and killed while crossing the line on the elevated electric line of the London, Brighton and South Coast Railway, in the vicinity of the workshops at Peckham Rye Station on 14th inst.

Physical Society Exhibition.—On Tuesday last the Society's annual exhibition of electrical, optical and other apparatus was held at the Imperial College of Science. The number of exhibits was less than usual, but several very interesting novelties were shown, and will be described in our later issues.

A Christmas "Caution."—The British Fire Prevention Committee has issued a timely "Caution" as to certain fire dangers common to the festivities of the Christmas season, such as entertainments and parties; Christmas trees are fruitful sources of fires, as well as paper lanterns, tissue paper, cotton wool and celluloid, and children especially are liable to dangerous accidents at this time. Copies of the "Caution," in packets of 10, 25 or 50, will be provided free upon written application to the offices of the Committee, 8, Waterloo Place, London, S.W.

Educational Notes.—As will be seen from an announcement in our advertisement pages, the new course at the Crystal Palace School of Practical Engineering will commence on January 8th.

Battersea Polytechnic.—Mr. Edwin Tate, J.P., has given to the Battersea Polytechnic the sum of £7,000, the interest upon £5,000 of this sum to be utilised for scholarships, and the interest upon the remaining £2,000 to be devoted to the purchase of books for the Tate Library, which was also given by the same donor.

Magnetic Sender for Wireless Work.—From small equipments, such as may be used in outlying stations and by explorers, &c., where accumulators cannot be conveniently charged and maintained, quite good wireless signals can be emitted by aid of a simple magnetic tapper. As early as 1855, Ruhmkorff observed that, under certain conditions, the sparks obtained from the secondary circuit of his induction apparatus were longer and more intense when the primary circuit was broken by hand than when a high-speed hammer break was employed. This phenomenon was attributable partly to incomplete saturation of the magnet core in the latter case (owing to the short current duration), and partly to the effect of "extra current" on closing the primary circuit. These facts are applied in the following apparatus:—

The core of a Ruhmkorff apparatus, without primary winding, is excited by a bundle of high-class permanent magnets (weighing a few pounds). To obtain a long spark from a light apparatus, the reversal of flux in the core must be as rapid as possible, the magnetising period must be as long as possible and the air-gap in the magnet circuit must be reduced to a minimum. A convenient arrangement is to place a number of highly saturated U magnets of decreasing perimeter parallel to each other and so as to form opposite poles in two straight somewhat divergent extensions. The ends of the magnets terminate in soft-iron blocks. This arrangement permits the core of the induction apparatus to lie between the two poles, and the core is provided at its ends with two pairs of iron arms, of which one surrounds the two poles at the end where the latter lie closer together and the other lies between the poles at the other end. This arrangement enables the magnetic circuit to be completed through the core, and practically the whole of the flux can be made to traverse the latter if care be taken that the movable arms make good contact with the magnet extensions. The displacement of the magnet core and arms, to reverse the direction of flux through the core, requires a certain expenditure of energy, but can easily be effected by hand. *L'Elettricista.*

Trading with Russia.—A correspondent who has recently visited Russia sends us the following communication:—

In view of the large number of manufactories in Russia, and the large amount of money which appears to be available in that country, it seems strange that the quantity of electrical goods imported from this country should be so small. During a recent visit to Russia the writer looked round carefully for English electrical machinery, but, alas! "made in Germany" seemed to be the only label to be seen, the whole of the business being apparently in German hands. In vain was the name of an English firm sought for; not a single one was discovered, while Siemens & Halske, the A.E.G. and other German firms have branches there, and are doing a large and profitable business.

In the Clado Egorivsky Mill, near Moscow, 2,250 H.P. was recently added, in three Diesel units of 750 H.P. each, by Sulzer, with generator and motors of German manufacture, and elsewhere the same thing is going on.

Naturally the writer made inquiry as to the causes of this exclusion of English goods, and found that the first reason was that English firms were not represented on the spot; the second reason, that they did not take the trouble to quote to the requirements even when large orders were in the market; and thirdly, when they did quote, their prices and terms of payment were not acceptable, as the competing German firms offered much better terms for payment, giving lengthened credit wherever asked for by a firm of repute.

As regards representation, the British firms expected to get a representative on terms that no one in Russia could or would accept, forgetting that, in the large centres, the cost of living is just double that in England, the standard being higher. They expect the agent to pay cash on B/L even on goods sent over for sale, instead of sending goods on consignment, to be paid for when sold.

What this means is not generally realised, but it amounts to this: On a 10 per cent. basis, an agent must do £12,000 to £15,000 per annum turnover to make the business worth his while, as his remuneration would have to be at least £600 to £800 per annum to allow him to live in such style as to aid him in obtaining business, while his office, showroom, travelling and other expenses would make a big hole in £500, and in the case of large contracts the expenses mount up enormously. The Englishmen employed at the mills must not use a restaurant or place of entertainment below a certain grade, and the cheaper cafés are practically barred to them; and this applies to commercial agents equally, as it is only in the first-class places that the buyers can be seen outside of their own offices.

Even when a British firm sends over a representative, he is seldom familiar with the language, manners or customs of the Russian; his catalogues are in English, list prices, weights and measurements are in English also, and when he has departed, they are seldom again referred to, the metric system and home currency as used in the catalogues issued by German houses getting at once that preference which comes from familiarity.

Finally, there is the question of bribery, direct and indirect, on a scale hardly understandable here, and without which doing business is well-nigh impossible.

Tramway Social.—The Lancaster Electrical and Tramways staffs held a social evening the other day in the Alexandra Hall, 120 being present, including the Mayor and Mayoress and Councillor T. Wilkinson (the new chairman of the Tramways Committee). Mr. Milnes, electrical engineer, acted as chairman of the Organising Committee.

Electricity Applied to the Finding of Lost Pipes.—It has been a common experience in the older towns that metallic pipes which have been useful in their day have been discarded, and after their abandonment have been lost. Moreover, even if they are still in use it sometimes occurs that accurate plans have not been kept during the process of laying the pipes, with the result that when it becomes necessary to determine the position underground of the pipe service, even the most important pipes are sometimes situated at positions varying somewhat from those at which they were expected to be. In the case of extensions and street improvements, this sometimes leads to difficulty, and it is, therefore, interesting to hear that a device well-known to mains engineers has been usefully applied to the purpose of detecting the position of pipes underground, and has been adopted by a considerable number of water companies and gas companies in the United States, as well as by the Water Department of the United States Government at Washington. The principle which the Modern Ironworks, of Quincy, Ill., the manufacturers of the apparatus, have adopted depends on the fact that a conductor carrying an intermittent electric current is surrounded by a magnetic field, and if a coil of proper construction is brought within this field an electrical current is induced in the coil. If the coil is connected to a telephone receiver, the effect of the current is manifested by a sound produced in the receiver. Moreover, the nearer the coil is brought to the conductor the louder is the tone. The pipe localiser consists of a specially formed vibrator and induction coil placed in an oak box, provided with a space for the battery; this part of the apparatus is designed to produce the necessary current in the lost pipe. A specially-constructed detector coil and receiver is provided for tracing the circuit. Supposing, for example, that it is not known to which main a service pipe is attached, which supplies a particular house on a street corner. The circuit is formed by connecting the instrument on one side to the house service and on the other to, say, the nearest fire hydrant. On closing the battery circuit the current flows through a certain area underground, and anywhere in the field formed by the pipes and the wires the tone can be heard by the operator so long as he carries the coil parallel to the ground and applies his ear to the detector telephone. In passing over the service pipe or main an abrupt change in the tone is noticeable; stopping where this change takes place, the operator will be found to be standing almost directly over the pipe. By this means it has been made possible to find pipes which were buried more than 15 ft. underground, while pipes in walls or floors are easily found. For general street work the device is obviously of considerable use, as it will find pipes without pulling up the pavement and digging for them.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Two switchboard attendants have been appointed to the Portsmouth Corporation electric lighting department following on the recent advertisement, namely, Mr. R. L. Axford, formerly of the Bradford electricity works, and Mr. W. Taylor, formerly of the Manchester electricity works.

Mr. William Jones, superintendent at the Valley Road Electricity works of the Bradford Corporation, has resigned his position owing to ill-health, and Mr. Fairburn has been appointed to succeed him. Mr. Jones has been with the electricity department since it commenced operations 23 years ago.

Tramway Officials.—Mr. Binns, the retiring engineer and manager of the Reading Corporation tramways, has been presented by the borough officials with an engraved silver salver and silver tea tray, and by the workmen of the tramway department with a set of gold cuff links and gold studs. As announced in the Electrical Review, Mr. Binns is leaving for Brazil.

General.—On Thursday last week the engineering staff, past and present, of the City of London Electric Lighting Co., entertained Mr. Frank Bailey, the chief engineer of that company, to a complimentary dinner at the Waldorf Hotel. The company, which included a number of the contractors intimately connected with Bankside in the past, totalled 70 odd, was presided over by Mr. R. A. Chattock, chief engineer of the Birmingham Corporation electric supply department. Among those present were Sir Alexander Kennedy, Bart., Mr. S. Z. de Ferranti, Mr. J. H. Rosenthal, Mr. A. L. C. Fell, Mr. G. Nisbett, Mr. A. Bruce Anderson, Mr. J. C. Bull, Mr. A. F. Harrison, Mr. F. J. Walker, Mr. S. Dobson, Mr. H. W. Kolle, Mr. T. Browett, and Mr. F. H. Jackson. Sir Charles Parsons, Mr. W. W. Blunt and several others wrote expressing regret at their inability to attend. Mr. Chattock was in quite his best form, and the proceedings went with a splendid swing. In proposing the guest of the evening, Mr. Chattock recalled first meeting Mr. Bailey 23 years ago, and being put through the mill. Those were the days of colossal difficulties, but in spite of these, Mr. Bailey had always been a friend to the men under him, and had done his best to give them good advice. Mr. Bailey also had a wonderful personality with the directors of the company, and obtained their complete confidence even during the times when interruptions of the supply occurred almost daily. He regarded Mr. Bailey as one of the generals of the industry, for he had carried his plans through with complete success, as witness the position of the City of London Electric Lighting Co. to-day. The presence of Sir Alexander Kennedy reminded him of the D.C., A.C. controversy, when D.C. stood for "doubtful continuity" and A.C. meant "all correct." Singularly enough, the years had completely reversed the positions of the then champions of the two systems, Mr. Bailey being now for D.C. and Sir Alexander for A.C. Mr. Chattock recalled the manner in which Mr. David Wilson used to handle the boiler plant. At the conclusion of his speech, Mr. Chattock presented Mr. Bailey with a handsome solid silver tea tray as a token of the esteem and regard in which he is held by past and present Banksiders. The toast of Mr. Bailey's health was then drunk with great enthusiasm. Mr. Bailey, in reply, said that it had always been an honour and pleasure for him to work with the members of the Bankside staff, and he felt that his was a difficult task to thank them appropriately for their magnificent present. He would cherish it in memory of that occasion, and of their many agreeable associations in the past. He could not help feeling that he had done nothing especially to deserve such a gift, nor was it yet his intention to retire from active service. Recalling the troublous times of pioneering they only seemed like yesterday. He remembered the incident in which Rothschild's Bank, in St. Swithin's Lane, was nearly burned out through a short on a small length of bitumen cable and how the authorities warned them to be careful what they were doing. The staff at Bankside were then experts in spectrum analysis, and when a flash occurred would remark quite casually, "Ah! that's an armature by the colour." The relieving watch always inquired anxiously how many machines were left, and they never received the same answer. In all those trials and difficulties he always had had the cordial sympathy of the entire staff, and was greatly encouraged by it. But many things were done then which would not be dreamed of now. The City Company was, he believed, the only one which ever signed a contract and drew up a specification afterwards. This had actually happened in General Webber's day. The chief difficulty with which the company had always been confronted was the procuring of plant of the required size. Mr. Ferranti had proved of great assistance then, not only in the way of big units of his own, but in rebuilding the coils on other machines. In switchgear also Mr. Ferranti had replaced inadequate designs and saved the concern from a disastrous end. Mr. Bailey humorously described the Ferranti engines at Bankside as "a sort of fair," and said that the valves never missed whatever else happened. The Ferranti plant was still at Bankside because all the heavy parts were shrunk together and could not be taken to pieces. They were the despair of metal merchants, who could make offers but could not get the plant away. Mr. Bailey's speech was bristling with many other humorous incidents, which amused the company immensely. In conclusion, Mr. Bailey remarked that he hoped to continue to carry on the good work of the City Co. In response to the toast of "The Visitors," proposed by Mr. A. F. Harrison, Sir Alexander Kennedy referred to the pleasure it gave him to join in the expressions of esteem and affection for Mr. Bailey which had been voiced that evening. Speaking of the "battle of the systems," he thought that experience had proved the wisdom of combining them, and he suggested that "absolutely complete and devilish current" would describe that combination. Mr. J. H. Rosenthal (Babcock & Wilcox) proposed "The Bankside Staff, Past and Present," and recalled the interesting fact that 12 of the old members held positions as the chief engineers in important electric supply undertakings and two had joined his own staff. Mr. F. Jackson replied and was amusingly reminiscent, recalling the proud feeling with which the H.T. amperes used to be read with a magnifying glass. He also mentioned an incident in which a driver reported the vacuum had escaped, and was last seen near No. 4 machine, slightly blue in colour! Mr. Ferranti was also very amusing in his proposal of "The Chairman." He said that, as a contractor, he had to try and make money but it was Mr. Bailey's fault if he had not done so. He eulogised the good work which Mr. Chattock had done both during and since the days of Bankside, and referred to the geniality with which he had presided over the evening's proceedings. An excellent concert programme was gone through after the dinner, and the gathering broke up at a late hour. A hearty vote of thanks was given to the Committee and hon. secretaries, Mr. F. Sumner-Smith and Mr. P. F. Rycroft, for the work which they had done in organising the party.

Mr. F. W. Cooke, M.I.E.E., is retiring from the Great Northern Railway Co.'s employ at the end of this month, after 43 years' continuous service as head of the technical staff and assistant superintendent of the telegraph department. He is commencing business immediately as consulting engineer and electrical expert, with offices at 50, London Road, Retford, Notts., where he will be glad to receive communications. Mr. Cooke will be remembered by some of our readers in connection with the early experiments in, and introduction of, train lighting by electricity on the Great Northern Railway during the eighties, also in the electrical interlocking of blocks and signals, and various other applications of electricity to railway working.

The staff of the Corporation Electricity Works at Peterborough has presented a framed photograph of the whole of the electricity undertaking to Ald. Clifton, chairman of the Electricity Committee.

Mr. W. F. Lloyd, who has resigned his position with the Coatbridge and Airdrie Electric Supply Co., to take up an appointment at the steelworks of Messrs. Wm. Beardmore & Co., of Parkhead, near Glasgow, has been presented by his colleagues with a gold watch.

Mr. Ernest Taylor, of the electrical staff at Denaby Main Colliery, has been appointed chief electrician at the newly developed Rossington Colliery, near Doncaster.

Sir Clarendon Hyde has been elected a director of the Metropolitan Railway Co., and Mr. Paul Speak has been elected deputy-chairman.

The Western Union Telegraph Co. have appointed Mr. Stanley J. Goddard, lately general superintendent of the National Telephone Co., Ltd., to be their European representative. Mr. Goddard, who will exercise general control of the business in Europe in connection with the Western Union Atlantic Cables, will have his office at 26, Old Broad Street, E.C.

Mr. Francis Pollard, of Preston, has been appointed electrical and mechanical engineer at Salford Infirmary.

NEW COMPANIES REGISTERED.

Electric Tramways of Ribeirao Preto, Brazil, Ltd. (125 780).—Registered December 7th, by G. W. Grice Hutchinson, 30, Bedford Row, W.C. Capital, £210,000 in 200,000 preferred ordinary shares of £1 each, and 200,000 deferred shares of 1s. each. Objects, to construct, purchase, lease or otherwise acquire any tramway or tramways in the State of Sao Paulo, Brazil, to equip and work the same by electricity, steam, oil, horse or other power, and in particular to enter into an agreement (the parties to which are not named), for the acquisition of a business of tramway proprietors at Ribeirao Preto, in the said State. The signatories (with one share each) are:—A. J. Hughes, 1, Pump Court, Temple, E.C., barrister; H. Burnett, 13, Featherstone buildings, E.C., engineer; W. Gwyn Jones, 55, Chancery Lane, W.C., company secretary; A. R. Pratt, 81, Goldsmith Avenue, Manor Park, E.; F. W. Roser, 221, Earlsfield Road, S.W., law stationer; H. J. Thornborrow, 8, Belgrave Street, King's Cross, W.C., law stationer; W. H. Masters, 27, Urlmington Square, W.C., gentleman. Minimum cash subscription, £100. The first directors (to be not less than seven or more than 11) are to be appointed by the signatories; qualification, 100 shares; remuneration, £200 each per annum. The company may pay underwriting commission not exceeding 25 per cent. to the nominal value [illegible]e shares.

Thistle Syndicate, Ltd. (8,464).—This company was registered in Edinburgh on December 6th, with a capital of £1,000 in 250 preferred ordinary and 750 deferred shares of £1, to carry on the business of makers of electrical appliances, machinery, &c. The subscribers (with one share each) are:—C. Robinson, Beechworth, Dunoon, engineer; H. M. MacCallum, 175, St. Vincent Street, Glasgow, consulting engineer. Private company. The number of directors is not to be less than two or more than four; the first are not named. Registered office, 37, Bank Street, Kilmarnock.

Gleeson O'Dea & Co., Ltd. (3,917).—This company was registered in Dublin on December 2nd, with a capital of £5,000 in £1 shares, to acquire and carry on the business of ironmongers, electrical engineers, &c., carried on by Gleeson O'Dea & Co., at 21 and 22, Christchurch Place, and 2, Werburgh Street, Dublin. The subscribers (with one share each) are:—J. O Dea, 162, Capel Street, Dublin, ironmonger; J. A. Foley, St. James, Kilmanham, Dublin, ironmonger; K. O'Dea, South Circular Road, Dublin, book-keeper. Private company. The number of directors is not to be less than three or more than five; the first are J. O'Dea, J. A. Foley and K. O'Dea: qualification, one share. Registered office, 21 and 22, Christchurch Place, Dublin.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Krupka & Jacoby, Ltd.—Particulars of £8,000 debentures, created November 26th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged. The company's undertaking and property, including uncalled capital. No trustees.

Sunderland District Electric Tramways, Ltd.—A memorandum of satisfaction in full on December 2nd, 1912 (a) of charge dated December 14th, 1906, securing £20,000, and (b) of mortgage or charge dated May 29th, 1908, securing £20,000, and (c) to the extent of £40,000 on same date of mortgage and charge dated December 8th, 1903, securing £100,000, notified. Particulars of first mortgage income bonds not exceeding £72,000, created December 2nd, 1912, also filed, pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £70,074 13s. 1d. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. Particulars of second income bonds, not exceeding £12,000 created same date, also filed pursuant to same section, the amount of the present issue being £11,241 6s. 1d. Property charged: As above. No trustees. Particulars of £80,000 prior lien debentures, created December 2nd, 1912, and secured by trust deed of even date also filed, pursuant to same section, the amount of the present issue being £20,000. Property charged: The company's undertaking and property, present and future, including uncalled capital; interests in the Houghton-le-Spring District Tramway Order: land in Newbottle, benefit of agreements, and the company's undertaking and property, present and future, including uncalled capital. Trustees: F. Last, 7, Norfolk Place, S.W.; and G. Cursons, Grove Park, Chiswick.

Vaughan & Son, Ltd. (61,526). Capital £50,000 in £1 shares (20,000 preference and 30,000 ordinary). Return dated August 21st, 1912. 16,880 preference and 26,789 ordinary shares taken up. £43,169 paid. Mortgages and charges, £6,000.

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—Capital £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. Return dated October 2nd, 1912. 42,297 "A" and 12,500 "B" shares taken up. 3s. 9d. per share called up on 42,297 "A," £7,986 18s. 9d. paid. 10s. per share considered as paid on 12,500 "B" (£6 250) and 5s. per share on 42,297 "A" (£10,574 5s.). Mortgages and charges, £15,000.

Pirelli, Ltd. (103,068). Capital £8,000 in £5 shares. Return dated October 7th (filed October 14th), 1912. All shares taken up. £8,000 paid. Mortgages and charges, nil.

Grindell-Matthews Wireless Telephone Syndicate, Ltd. Particulars of £3,300 debentures, created November 28th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,500. Property charged: The company's undertaking and property, present and future. No trustees.

Pontelec Welding Patents, Ltd.—Issue on November 22nd, 1912, of £300 debentures, part of a series of which particulars have already been filed.

Egham and Staines Electricity Co., Ltd.—Issue on November 28th, 1912, of £500 debentures, part of a series of which particulars have already been filed.

James Keith & Blackman, Ltd.—Particulars of £10,000 second debentures, created November 18th, 1912, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908. There is no issue at present. Property charged: The company's undertaking and property, present and future, including uncalled capital of various properties in Forfarshire and London. Trustees: Sir Francis Webster, Kt., and W. K. Macdonald.

Yarmouth (I.W.) Electricity Supply Co., Ltd. (56,884).—Registered April 7th, 1898; capital, £5,000 in £1 shares return dated October 31st (filed November 7th, 1912); 361 shares taken up; £1,865 considered as paid. Mortgages and charges: Nil. Registered office, Yarmouth, I.W.

Pacific and European Telegraph Co., Ltd. (36,683 C.).—Capital, £100 000 in £10 shares; return dated November 26th, 1912 (filed November 28th, 1912); all shares taken up. £4 per share called up; £40,000 paid. Mortgages and charges £72,400.

A. S. Cartwright, Ltd.—Charge on 75 and 76, Ford Street, Hockley, Birmingham, dated November 28th, 1912, to secure all moneys due or to become due from the company to United Counties Bank, Ltd., 63, Colmore Row, Birmingham.

Rhondda Tramways Co., Ltd.—A memorandum of satisfaction to the extent of £2,800 on November 28th, 1912, of charge dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd.—A memorandum of satisfaction in full on November 26th, 1912, of debenture dated February 20th, 1911, securing £100, has been filed.

Yorkshire Cable Co., Ltd. (99,015).—Return dated October 28th, 1912. Capital £5,000 in £1 shares. 2,422 shares taken up. £2,422 paid. Mortgages and charges, £1,200.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Calgary Power Co., Ltd.—Further issue of £31,000 5 per cent. 30-year first mortgage bonds of £100 each.

Toronto Power Co., Ltd.—Further issue of £619,316 4½ per cent. consolidated guaranteed debenture stock.

The Committee have (1) appointed special settling days as under:—

Friday, December 20th.—General Electric Co.—Scrip, fully paid, for $4,000 000 5 per cent. gold debenture bonds (London issue).

Sao Paulo Electric Co., Ltd.—Scrip, fully and partly paid, for £1,880,000 5 per cent. 50-year first mortgage bonds.

And (2) ordered the undermentioned securities to be quoted in the Official List:—

Canadian Western Natural Gas, Light, Heat and Power Co., Ltd.—Further issue of £113 013 5 per cent. first mortgage debenture stock.

General Electric Co.—Scrip, fully paid, for $4,000,000 5 per cent. gold debenture bonds (London issue).

Sao Paulo Electric Co., Ltd.—Scrip, partly paid, for £1,880,000 5 per cent. 50-year first mortgage bonds.

Yorkshire (West Riding) Electric Tramways, Co., Ltd.—The Transfer Books, so far as they relate to 6 per cent. cumulative preference shares, are closed to December 31st. Dividends will be payable on January 1st.

CITY NOTES.

Melbourne Electric Supply Co., Ltd.

The report of the directors for the year ended August 31st (as printed in the *Times*) states that the balance of the company's holding of ordinary shares in the Adelaide Electric Supply Co. has been disposed of during the year at satisfactory and advancing prices; the total net profit so realised amounting to £30,381. The increasing prosperity of the company enabled the directors to conclude an arrangement in January last for the sale of the unissued balance of £125,830 consolidated ordinary stock at a price equal to par net to the company. Before the close of the year under review, the whole of such stock had been allotted and paid for in full. By arrangement with the holders of the above stock, they will waive the undermentioned final dividend, receiving in lieu thereof interest at 1 per cent. above bank rate for an agreed period. The saving thus effected enables the board to recommend a bonus of 1 per cent., free of tax, on the consolidated ordinary stock, which, with the final dividend of 5 per cent., makes a total dividend for the year of 8½ per cent., free of income-tax. The proceeds of these transactions enabled the temporary loans from the company's bankers to be paid off; provided the funds necessary to cope with the expansion of the company's undertakings at Melbourne and Geelong; and at the close of the financial year left a balance in hand of £78,242 available for further capital expenditure. The profit and loss account shows that the gross profit derived during the year from the Melbourne and Geelong undertakings, including the Geelong tramways, was £56,272. After payment of management and general expenses at the London head office, together with interest on debenture stock and temporary loans, &c., and after placing to depreciation and general reserve £10,860, there remains a credit balance of £24,892, to which has to be added £5,207 brought forward, making a total of £30,100. After paying the dividend and bonus there will remain £5,585 to be carried forward. With regard to the profit of £30,381 realised on the sale of the company's holding of Adelaide shares, the directors have added thereto £46, representing the difference between the purchase price and par value of debenture stock redeemed during the year; and they recommend that out of such fund a sum of £10,287 be applied in writing off certain items in the Melbourne and Geelong accounts, and that the balance of £20,140 be added to the depreciation and general reserve account, making a total addition to the latter of £31,000, and thereby raising it to a total of £55,000.

In the tables of progress the following figures appear:—

Date.	No. of consumers.	Lighting in KW.	Motors in rated H.P.	Total equiv. connections expressed in KW.	Total units sold.	Gross profit.
Melbourne—						
August 31st, 1910	3,005	4,097	3,688 H.P.	7,576	3,394,525	£19,279
,, 1911	5 076	5,680	5 196 ,,	10,668	5,099,162	33,226
,, 1912	8,696	8,282	7,153 ,,	15,735	7,082,871	50,281
Geelong—						
August 31st, 1910	726	1,018	994 H.P.	1,918	418,101	£2,022
,, 1911	884	1,138	1,133 ,,	2,225	566 267	3,206
,, 1912	1,099	1,453	1,880 ,,	3,049	753,611	5,251

In the case of Melbourne, the number of consumers has increased by 71 per cent., the total connections by 47 per cent., the total units sold by 38 per cent., and the gross profit by 51 per cent., as compared with the previous year. Further illustration of the development of the Melbourne undertaking is afforded by graphic curves. Orders in Council for the supply of electricity in the Melbourne suburbs of Sandringham, Hampton and Oakleigh, have been granted to the company during the year, and distributing mains are being laid in these districts. The Geelong undertaking also shows satisfactory growth, and the directors are pleased to say that the small system of electric tramways at Geelong, a portion of which was opened for traffic in March last, is working well, and already shows a small profit. The remaining section of the lines—viz., that to South Geelong—which, owing to circumstances beyond the control of the company, could not hitherto be proceeded with, is now under construction; and the directors anticipate that the completion and opening of the same will materially increase the traffic returns.

The shareholders at the meeting on Monday next will be asked to pass two resolutions increasing the number of directors from five to six, and also increasing the remuneration of the directors.

It is intended to nominate Mr. Benjamin Brookman for election as the sixth director.

Central London Railway Co.—The directors have sent a circular to stockholders inviting them to take in exchange for their stock an equal amount of a new stock to be issued by trustees against the deposited Central London stock, and carrying a dividend of 4 per cent. per annum, guaranted by the Underground Electric Railways Co., of London, Ltd., and a right to 40 per cent. of the amount paid in dividends on the nominal amount of the deposited stocks in excess of 4 per cent. in any year after the dividends received by the trustees on the deposited stocks for three successive years shall have exceeded an average of 4 per cent.

Alldays & Onions Pneumatic Engineering Co., Ltd.—For the past year the directors recommend a dividend on the ordinary shares at the rate of 5 per cent. per annum, and a bonus of 5 per cent. per annum, leaving to be carried forward £20,097.

Costa Rica Electric Light and Traction Co., Ltd.

The directors in their report for the year ended June 30th, 1912, which is to be presented at the annual meeting to-day, stated that the net earnings in Costa Rica, after charging all expenses incurred amount to £22,034, as compared with £18,451 for the previous year, being an increase of £3,582. The net surplus profit for the year is £5,732 (against £3,643 last year) and the directors propose to carry the whole of this amount to the credit of discount and commission on debenture issues account. At a meeting of the 5 per cent. debenture-holders, held at the offices of the company on June 24th, 1912, it was unanimously resolved to suspend the operation of the 1 per cent. sinking fund until the year beginning July 1st, 1916, the amount thus released to be applied to the development of the company's business. The number of lamps installed in the lighting department increased by 18 per cent. during the 12 months, and the motor supply by 55 per cent. The first section of the new power station at El Brasil was inaugurated in December last, and has been supplying electricity since that date, for all the purposes of the business, with entire success. As stated in the last report, the directors deemed it necessary to install a second pipe line, for safety's sake, and to increase the power of the station by enabling the management to run all the plant (three sets of 500 KW. each) at the same time, if required for peak load. This work has been carried out, and the danger of a breakdown through accident to one of the pipes reduced to a minimum. In view of the increased output of electrical energy demanded for tramway and power purposes, the installation of a second main feeder from the Anonos sub-station to the city of San José was found to be necessary. This work has been carried out at a cost of approximately £3,300, and three new cars have been purchased and delivered, costing about £2,600. To provide the necessary cash for the above-mentioned items, and for the installation of a fourth unit of plant, so as to utilise the full power of the second pipe line when needed, the directors have arranged for the increase of the loan, referred to in the last report, to £20,000, secured on the unissued 5 per cent. debentures, which the lenders have an option to purchase. The installation of the fourth 500-KW. set will mark the completion of a fully-equipped and homogeneous power station capable of supplying 2,000 KW. on an emergency at the switchboard—and with a reserve of water-power equivalent to a further 1,000 KW. available whenever the exigencies of the undertaking may demand the acquisition of further machinery to utilise it. The management of the business in Costa Rica continues to give the directors every satisfaction. During the year the gold premium has averaged 112½ per cent., as against 113 per cent. for the previous year. The general manager certifies that all buildings, machinery, plant and permanent way have been kept in good working order. The insurable buildings and machinery, including the new erections at El Brasil, and rolling stock are adequately covered against risk from fire.

Manx Electric Railway Co., Ltd.

The tenth annual meeting of the shareholders of the above company was held on Tuesday at the offices, 3, Finch Lane, E.C., Col. Sir A. G. Boscawen, M.P., presiding. The Chairman, in moving the adoption of the report, said that unfortunately they had had a very bad summer as regarded weather. He also rather thought that the resources at the disposal of the holiday making public were, in consequence of the strikes and lockouts which preceded the season, somewhat seriously crippled. He also pointed out that the counter attractions of up-to-date rival holiday resorts on the mainland might be responsible for the falling-off of visitors to the island. This fact was beginning to be realised in Douglas, and a committee was formed there last spring for the purpose of dealing with the advertising of the island. A fund was started called the "Chamber of Commerce Advertising Fund," to which they amongst others contributed handsomely, and of which committee their general manager was an active member. More than that might be done, as he had pointed out on former occasions, to make the island generally, and Douglas in particular, more up to date, and they could only hope that the powers that be might see their way to do this. The fact remained that a considerable falling off in the total number of visitors to the island, and consequently also in their passenger traffic, had to be recorded. He thought they might congratulate themselves that the consequences were not more serious, for when all was said and done the net result of the year's working, after taking into account the whole of the revenue from the various sources, and deducting working expenses, various depreciations as last year, debenture interest and interim dividend on preference shares, was only about £900 worse than last year, that was to say, with the carry forward from the previous year, they showed a balance on net revenue of £5,501, as against £6,456 last year. They proposed to apportion this balance as to £3,580 for final dividend on the preference shares; £1,000 as reserve for special renewals; and £920 as carry forward. Their reserve was thereby raised to £8,232, which was a considerable sum, but which he hoped to see increased within the next few years, both as a safeguard for their large debenture issue and as the nucleus of what he might call an insurance of their share capital. The official figures of visitors to Douglas between May and September gave 493,073, as against 540,067 in 1911, a decrease of 46,994, and the number of passengers carried on their lines totalled 574,187, as against 606,497 in 1911, a decrease of 32,310. He might, however, point out that although they had this decrease of 32,310 passengers carried, they were still 27,500 higher than the previous best, which was in 1907. The gross revenue amounted to £34,375, as against £36,013 last year, and the working expenses totalled £17,669, as compared with £17,214, an increase of £455 over last year. This increase, however, was largely accounted for by extra expenditure incurred in day work, &c., and from this source, goods traffic, &c., they actually had an increased revenue over last year of £615, which more than made up for the increased expenditure. The ratio of working expenses to receipts was 51·4 per cent., as against 47 78 per cent. last year, and 53·12 per cent. the year before. The mileage run was 325,640, as compared with 344,968 last year. Passenger traffic receipts per mile was 22·33d. this year, 22·64d. last year, or per passenger carried, 12·66d. this year, 12·88d. last year.

Sir W. H. Vaudrey seconded the motion.

Replying to a shareholder, the Chairman said he would be very unwilling to say to what figure they wished to get the reserve for special renewals before paying any dividend on the ordinary shares. It was most important for the financial position of the line that they should continue to build up that account, which was the best guarantee that when it had reached a certain amount, ordinary dividends would be paid. What they aimed at was thoroughly to maintain the line out of revenue, and in view of the fact that it was an electrical undertaking, and that heavy renewals might be required any day, they must have a substantial fund to fall back upon.

The report was adopted.

Tata Hydro-Electric Co.

The annual meeting of Hydro-Electric Power Supply Co., Ltd., was held recently in Calcutta, and is reported in the *Calcutta Statesman*. Mr. R. J. Tata presided, and said that the third report was a record of progress and construction, promising that power would be supplied to consumers at the date intended. "Construction costs will be higher than estimated. The estimates had been made in 1906, and since then land alone has gone up immensely in value. Our engineering advisers also, when they came to close quarters with problems, found it necessary to increase hydraulic quantities, and to make more expensive electric and mechanical recommendations. On the other hand, we are confidently advised that we shall get very good work. The demand for power has proved gratifying. The whole of the original installation has been sold; and it has been found necessary to contemplate a small extension at once if we are to meet the applications already made, and others apparently waiting for the extension. At first it looked as if outside the cotton mills there would be no demand for power, but recently negotiations seem to indicate the probability of substantial demand from other sources. Your directors have decided to apply for licence to supply power outside the Island of Bombay. Firm application for about 3,000 H.P. has already been received from the moffussil; and the promised electrification opens out an obvious market for your company's power. As you are aware, arrangements have been completed for the extra capital of 25 lakhs which the directors have found necessary to meet the cost of the small extension contemplated. For the present, nearly all the necessary orders have been placed for electrical material. Staff quarters, the power house, and the receiving station are being erected. The pipe line is being laid. The transmission line is in course of construction. Cables for feeder system have been laid; and the work at the Thana and Panval creeks has proceeded throughout the year."

The report was adopted. A dividend of 4 per cent. from the capital was declared.

Prospectuses.—*County of Dorset Electric Supply Co., Ltd.*—This company is inviting subscriptions for 51,000 ordinary shares of £1 each. The list opened on Saturday last and will close on Saturday, December 28th. The company proposes to commence business by giving a supply in Dorchester, Sherborne, Wimborne and District, Swanage, Blandford Forum and Lyme Regis. The prospectus mentions that competitive tenders were obtained for plant and mains for the towns affected other than Lyme Regis, and the lowest tenders complying with the specification had been provisionally accepted. The estimated capital expenditure at the end of the second year of working is £44,250, which includes £5,750 for the acquisition and development of the Lyme Regis undertaking. Messrs. J. & W. Purves are the promoters of the company. They will receive £2,000 in cash for their services in securing prov. orders and agreements; also 5 per cent. on plant, mains and apparatus capital expenditure for engineers' fees as the works are carried out.

Continental.—Belgium.—The balance-sheet of La Compagnie Belge d'Electricité Siemens-Schuckert, of Brussels, for the last financial year shows a profit of £3,264.

The report of the Compagnie Internationale de Lampes Electriques Zircone-Wolfram, of Brussels, for the financial year ending June 30th last, shows a loss of £29,167.

France.—The balance-sheet of La Société des Trefileries du Havre, wire and cable manufacturers, Le Havre, for the last financial year shows a net profit of £161,498, as compared with only £113,248 in the preceding 12 months.

La Société Manufacture Française de Lampes Electriques à Filament Etiré Incassable is the name of a new company which has lately been formed at Levallois-Perret (120 Rue de Courcelles) near Paris, with a capital of £8,400, to manufacture a new unbreakable metal-filament lamp.

Automatic Telephone Manufacturing Co., Ltd.—The dividend for the half-year ending December 31st inst. on the 6 per cent. preference shares has been declared, and the transfer books will be closed from 17th to 24th inst.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Major Darwin (chairman) presided on Tuesday at the offices. 106, Cannon Street, E.C., over the forty-ninth ordinary general meeting of the above company.

In moving the adoption of the report, the Chairman regretted that by inadvertence they had omitted a reference in the report to the death of Mr. P. M. S. Brodie, which took place in February last. Mr. Brodie at the time of his decease occupied the position of works manager at Silvertown. He was much esteemed by his co-workers in the company's service. He was glad to find himself before them under pleasanter circumstances than was his fortune at the last annual general meeting of the company, as the board on this occasion felt themselves fully justified in making the recommendation that the ordinary shareholders should receive a dividend of 7½ per cent. for the year. When the payment of a dividend to this class of shareholders was passed a year ago, every sympathy one could express was expressed ; but the fortunes of war were against them. He pointed out at the time that in his opinion the stage they were passing through was quite abnormal, and that, although one could not prophesy as to dates, yet they felt sure that the normal condition would before long re-assert itself. The board were grateful to the ordinary shareholders for the manner in which they accepted the situation. It was, therefore, with all the greater pleasure that the board found they could recommend a substantial dividend to the holders of ordinary shares. The year under review had not, however, passed without its anxieties. The coal strike in March forced them to pay heavy prices for coal for a short time, as they had on hand work of a seasonal character, which could not be completely arrested. Even in spite of these costly purchases they were obliged to curtail their working hours at Silvertown. In July a London dock strike occurred. This strike interfered with the reception of raw material and the dispatching of manufactured goods. The result to them, however, was not so serious as it might have been had the general labour situation been quieter in the provinces, because their competitors established there did not have the whole advantage over them which they would otherwise have enjoyed. The raw rubber market had on balance been in their favour, but its uncertainty and the fluctuations it had undergone had made it a difficult factor in their calculations. He was glad to say the quality of their goods continued to command the respect of buyers, and that their turnover had increased during the year. In this connection they must ask the shareholders to commend to their friends the Palmer tire whether for motor, motor-cycle or bicycle. In the report it was stated that the trading of the French factory and some of the foreign agencies had not been satisfactory, while other foreign agencies had produced quite gratifying results. The foreign agencies, it must be remembered, were not so immediately affected by home disturbances as they were in Great Britain, though their markets were subject to local conditions. Their competitors might or might not be stocked with goods in these distant places, and on this to a great extent depended the result of the business done in each locality. He did not think it was in the company's interest to enter into too much detail on these questions, as it was manifest that if they were doing a fair business in any locality they should not draw too much attention to the fact, nor, on the other hand, did they wish to point out the places where things were less favourable. Indeed, with regard to many matters the position of a chairman of a manufacturing company was a difficult one, for although he wished to communicate to his co-shareholders as much information as he could, yet he must always have before him the fact that while his shareholders heard him, his company's competitors and those who dealt with the company as buyers and sellers had also the opportunity of hearing the information he gave, and the opinions he expressed. As mentioned in the report, they had just completed the laying of some 1,300 nautical miles of submarine cable for the Pacific Cable Board between Australia and New Zealand, and their staff had carried out the work with their usual efficiency and dispatch. They expected the *Silvertown* to sail from Australia about the middle of January, under charter. They regretted to say that local taxation at Silvertown was increasing again after a short period of some slight relief. They had, moreover, to face in the future charges under the Insurance Act, which were not inconsiderable, and increased premiums payable for insurance under the Workmen's Compensation and Employers' Liability Acts. Still, these extra charges were applicable to all home manufacturers, and would not unduly affect them prejudicially so far as the home competition was concerned. They found, however, that the increasing quantity of regulations and forms to be filled up was becoming rather a serious matter, and preoccupied the minds of those who should be engaged in the more useful work of attending to their business as manufacturers.

Mr. R. K. Gray seconded the motion.

Mr. Flint asked a question on behalf of Mr. Lloyd, whether there was an annual stock-taking and audit of the company's shops in provincial towns to ascertain whether they paid their way or not.

Mr. H. Sullivan inquired (1) Whether, in the agencies where losses had occurred, steps had been taken to reorganise them ; (2) What were the separate amounts of each item under the heading "Debts and loan from bank owing by company, and amounts received on account of partly executed contract, £262,374" ; (3) How much of the reserve fund of £400,000 was invested in the business of the company and how much in subsidiary companies ; (4) How the value of shares in other companies was arrived at ; and (5) What was the proportion of the freehold and leasehold property of the company.

Mr. Charrington wanted to know to what extent the rates at Silvertown had risen, and if the company was affected.

Mr. Brook asked why there had been no depreciation on the steamships.

The Chairman, in reply, said that the ships had been heavily written down and were kept well under repair. They believed they were not shown at too high a price. With regard to the agencies, there had never been a case of want of organisation. It was only a case of some agencies not doing so well as others. The books of the agencies were closed on July 1st, and, consequently, they were somewhat more affected by the bad times which they had passed through. They always had their misfortunes in trade, but there was really nothing wrong in the agencies, although some had not done so well as they hoped they would in the future. The reserve fund was invested in the company's business. Most of the shares in other companies were mere cross entries in the balance-sheet. For instance, the Palmer Tire Co., of which they held $\frac{29}{30}$ths, appeared on both sides of the accounts, and, therefore, it was not a very material matter what value was placed on it. The shares were, to the best of their ability, valued at a figure at less than they were worth ; but as the shares did not come into the market, it was impossible to get a fixed value for them. They had also investments in two electric lighting companies, whose shares were never in the market, but they were paying, and the shares were put in the accounts at less than value. He could not give the items as to freehold property, as it had not yet been valued, according to Form 4. The largest item in the not-completed contracts was the cable he had referred to which had been laid, and in a week's time they would receive payment for it.

Mr. R. K. Gray said the stocks in the home agencies were taken each year, but they had not large stocks, and there were always the stocks at Silvertown to fall back upon. The rates at Silvertown had been down to 9s. 4d., but this half-year's rate was 11s. 2d.

The report was adopted, and the Chairman was re-elected a director.

Mr. Flint brought forward a motion to the effect that in the future the directors' remuneration should bear a fixed relationship to the dividends paid. He disclaimed any idea of the motion being in the nature of a vote of want of confidence, but thought that such a sliding scale would encourage the directors to pay better dividends.

Mr. S. Sullivan seconded the motion.

Mr. E. J. Fox said he knew neither the directors nor the officials of the company, and had only recently become a shareholder. Before doing so he took the advice of the chairman of a concern which was one of the largest competitors of the company. That gentleman said to him, "In these matters you are in the hands of the directors, and if the directors wish to deceive you they can do so ; but," he added, "There is no more honest company trading in Great Britain than the India-Rubber and Gutta-Percha Co., and you can take every item in the balance-sheet as not only being true but probably very much under-valued." He opposed the amendment.

The Chairman said the directors did receive extended remuneration when the profits rose above a certain point, but that was not payable on the amount of dividend paid. He agreed with what one shareholder had written to him, that to pay directors on the dividend declared was fundamentally pernicious.

The motion was defeated by a large majority.

City & South London Railway Co.—The *Financier* states that the holders of considerably more than 75 per cent. of the ordinary stock of the City and South London Railway Co. have accepted the offer of exchange recently made by the Underground Electric Railways Co., of London, Ltd., and that the offer has in consequence become binding.

A Norwegian Electrolytic Copper Co.—It is reported from Kristiania, that the Norwegian Electrolytical Copper Extraction Co., which has adopted the Hybinette process, has increased its capital from £25,000 to £41,700 minimum, and £55,500 maximum. The company has recently taken over the Bandak Electrolytical Works, and the increase of capital is in connection with this transaction. The purchase sum in question is £14,000, which is going to be paid in shares.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets as a whole remain depressed and unhappy. The approach of Christmas is heralded by more than the usual crop of troubles at home and abroad. Uncertainty seems to dog the footsteps of finance and politics alike. "Nothing is cheap nowadays," said an experienced member of the Stock Exchange. "In many cases prices are considerably undervalued, but in view of the abnormal condition of the times, you cannot call anything really cheap." This, of course, is looking at it from the speculator's point of view ; but the investor, too, is troubled by the obscurity of the outlook.

One of the bargains to be found in the markets with which we deal, is Westminster 3½ per cent. Debenture stock. The price is nominally about 87½, at which the yield is 4 per cent., allowing for the accrued interest ; but inasmuch as the stock is redeemable at par in March, 1920, the return on the money is raised to at least 2 per cent. more, and 6 per cent. on a security which is absolutely gilt-edged, must be regarded as a real bargain. Unfortunately, there is a scarcity of the stock, but if a buyer could get hold of it at the present price, he would be indeed foolish to allow his opportunity to slip.

Other prices in the English Electricity Supply department are scarcely so firm as they have been recently. Brompton Preference were marked down 5s., but soon rallied again, and Charing Cross Ordinary fell ⅛. County of London Ordinary are somewhat easier at 11⅝. Edmundson's shares are now quoted in their new guise, as a reference to our price lists will show. Kensington Debenture has been in request, and at 93½ is 2 points up on the week.

The Railway market, after being depressed by the North-Eastern business, braced up upon the conclusion of the strike on that system. The decision arrived at by the Commissioner has been received with a good deal of dissatisfaction in the Stock Exchange, since it is feared that it opens an avenue to fresh trouble hereafter. However, prices rallied to some extent, but substantial falls remain so far as Undergrounds are concerned. Metropolitans and Districts are flat. Central London Ordinary and Deferred show falls of a point apiece, notwithstanding the publication of the company's circular to shareholders anent the amalgamation with the Underground Electric group. City and South Londons fell away—this, too, in spite of the fact that the shareholders by the necessary majority have decided to accept the offer made by the same group. Underground Electrics themselves are lower, the 1s. shares falling $\frac{3}{32}$ and the Ordinary losing 5s., though it is argued in well-informed quarters that the latter are amongst the cheap speculative lock-ups.

London United Tramways and Metropolitan Electric Tramways issues became a nominal market as the last day approached for sending in consents to the London and Suburban scheme. The quotations for London and Suburban issues themselves are 8s. 6d. for the Deferred, 14s. 9d. the Preferred and the Debenture stock about 87. British Electric Tractions are steady, the 5 per cent. Perpetual Debenture stock being 2½ better at 94. Business has been fairly animated in most of the Railway and Tramway descriptions, but, like everything else, prices suffered from the general uneasiness which prevailed throughout the Stock Exchange.

The Telegraph market has seen a good deal of excitement over Marconi shares. At one time the price of the Ordinary fell to $4\frac{5}{16}$, holders getting out for the reason advanced here last week. This drop upset the prices of the subsidiary companies, Canadians, Americans, and Spanish indicating falls—severe in the case of the first-named. A slight rally followed as the price of the parent shares recovered, but still a fall of 10s. remains on balance. National Telephone Deferred, after being 146, fell to 136, hardening from that price to 137½, a drop of 18 points in a fortnight. Market anticipation does not look for an unofficial announcement as to the purchase price by the Government until the middle of next month; and, pending this, some of the holders have been getting fidgety. The intrusion into the situation of claims from holders of First and Second Preference shares is another cause for modification of optimism as regards the Deferred stock.

Amazon Telegraphs have been flat, falling 7s. 6d. Direct Spanish dropped ⅛, and West India and Panama 1s. 8d. The market, as a whole, suffered from depression, though for the prior charge securities there has been a fair demand, and improvements are shown in Direct West India Debenture, Eastern Telegraph Debenture, and West India and Panama Debentures. Various issues were marked *ex* dividend last Thursday. Allowing for this, there is no particular net change in the quotations.

Foreign Traction stocks and shares are mostly weaker. Substantial falls have occurred in Brazil Traction, Mexico Tramways, Montreal Light and Power, River Plate Ordinary, and Shawinigan Water. For some of these there are special reasons, as, for example, in the case of the Brazil Traction shares, where selling has proceeded from German sources said to be in financial difficulty. Shawinigan Water was affected by the steep fall in Canadian Pacific shares, and the slump which has taken place in Americans cast its reflection upon Latin-Canadians as well. The news from Mexico is tolerably reassuring; but, with markets more political than financial, it failed to have any favourable influence, and the drop in Mexico Trams is 3 points. Kaministiqiua Common lost 2 to 143½. La Plata Ordinary recovered a little to $\frac{9}{16}$ middle. United Electric Trams of Monte Video are easier, while the Anglo-Argentine group maintains its prices with marked strength.

In the manufacturing division, the principal change is a fall of 10s. in India-Rubber shares, which is not surprising in view of the big rise that took place previously. Edison & Swan came back ¼, and British Westinghouse Preference fell ⅛. Castner-Kellners are a trifle easier at $3\frac{11}{16}$. The rubber share market sagged off, in sympathy with a decline in the price of the raw produce at the sales this week. There is, however, a fair amount of quiet investment buying going on in the cases of the leading shares, and the floating supply of stock is steadily becoming restricted.

Electromobile Co., Ltd.—The directors report that the accounts for the year to August 31st show that, after providing for debenture interest, writing off £4,683 in respect of the Charrington Street building scheme, and £5,862 for depreciation of carriages and plant, the debit balance of £19,978 brought down was increased to £30,145.—*Financier.*

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending December 31st, and the third quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax, for the year to December 31st.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, December 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2⅜d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£25 10	10s. dec.
a Lead, Nitrate	,,	£28	£1 dec.
a ,, White Sugar	,,	£25 10	..
a ,, Peroxide	,,	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3⅛d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3⅛d.	..
a ,, Perchlorate	,,	4⅜d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	72/6	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3⅝d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£95	£5 inc.
b ,, Wire, in ton lots	,,	£112	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9d.	⅛d. dec.
c ,, Tube (brazed)	,,	10⅞d.	¼d. dec.
c ,, ,, (solid drawn)	,,	9½d.	¼d. dec.
c ,, Wire, basis	,,	9d.	⅛d. dec.
c Copper Tubes (brazed)	,,	1/0¼d.	¼d. dec.
c ,, ,, (solid drawn)	,,	11½d.	½d. dec.
g ,, Bars (best selected)	per ton	£90	£3 dec.
g ,, Sheet	,,	£90	£3 dec.
g ,, Rod	,,	£90	£3 dec.
d ,, (Electrolytic) Bars	,,	£82	..
d ,, ,, Sheets	,,	£99	..
d ,, ,, Rods	,,	£87	..
d ,, ,, H.C. Wire	per lb.	$10\frac{9}{16}$d.	..
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	4/6	½d. dec.
i Iron Pig (Cleveland warrants)	per ton	66/9	4d. dec.
i ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£18 10	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 8 6	4/- dec.
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
p Phosphor Bronze, plain castings	,,	1/2 to 1/4	..
p ,, ,, rolled bars & rods	,,	1/2	..
p ,, ,, rolled strip & sheet	,,	1/2½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11½d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£229 10 to £230 10	£1 inc
n ,, Wire, Nos. 1 to 16	per lb.	2/9	..
p White Anti-friction Metals	per ton	£45 to £230	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£31 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd
p
r W. F. Dennis & Co

Blackpool, St. Anne's and Lytham Tramways Co.—In the report for the year ended October 31st, the directors regret the unsatisfactory result on the year's working. Up to the end of May the traffic showed a gradual expansion, the increase to that date totalling about £1,000. Afterwards, owing to bad weather, there was a diminution of traffics in the summer months of £2,480. On the other side, there is an increase in the expenditure, arising on the upkeep of the permanent way. The trustees for the debenture-holders have, upon the recommendation of the directors, intimated their intention of paying 1½ per cent. on account of the arrears of interest due on the debenture stock, and to enable this payment to be made the annual payment of the sinking fund has been suspended for this year.

Electrical Securities Trust, Ltd.—The directors report for the year to November 14th, a loss of £1,436, increasing the total deficiency to £56,026.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 17th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9¾—10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾— 9¾	..	4 13 4
Do. Second 6 % Pref.	10	6	6	10 —10½	..	5 11 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100		4 10 0
Brompton & Kensington, Ord.	5	10	9†	8¾— 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8½— 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	96 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅝— 5⅛	—⅛	4 17 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝— 4⅞	..	4 11 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	92 — 94 xd	..	4 5 1
Chelsea, Ord.	5	5	4†	4½— 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	100 —103	.	4 7 5
County of London, Ord.	10	6	4†	11½— 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11½— 12½	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 8 3
Edmundson's, Ord.	£3	Nil	..	½— ¾	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4 — 5	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1 — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅞— 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅞— 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½— 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7¾— 8¼	.	5 10 9
Do. 4 % Deb.	Stock	4	4	93 — 95	+2	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	.	1¾— 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4¾— 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91 xd	..	4 8 0
Metropolitan	5	4	4†	[illegible]	..	5 5 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼— 4¾	..	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 —101		4 [illegible] 1
Newcastle-on-Tyne 6 % Pref., Non Cum.	5	6	6	4⅝— 4⅞	..	6 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½—101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6⅛— 6⅜	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9¾— 10¼	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾— 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord.	5	2	..	1⅜— 1⅞	..	..
South London, Ord.	5	5	..	2⅞— 3⅜	..	5 18 4
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1¼— 1⅜	..	5 9 5
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord.	£3	Nil		½— ¾	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅞— 3⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½— 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾— 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4¾— 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½— 5¾	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅞— 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞— 5⅛		4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	94 — 96	.	5 1 2
Canadian Gen. El. Com.	$100	7	7	117 —121	1	5 17 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	5	[illegible] xd	..	5 6 8
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94 xd	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	86 — 89	.	5 12 4
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½— 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	[illegible]	..	Nil
Do. 6 % Pref.	1	6	6	[illegible]	..	8 11 6
Kaministiquia Power, 5% G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½— 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 8
Mexican El. Lt., 5% 1st M. Bds.	..	5	5	[illegible]	.	5 18 0
Mexican Lt. & Power, Common	$100	4	4†	83½— 86½		4 12 6
Do. 7 % Cum. Pref.	$100	7	7	103 —106	—1	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	85½— 87½	..	5 14
Montreal, Lt., H. and Power	$100	8	9†	227 —232	7	3 17 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5*a*	29 — 33	..	..
River Plate, Ord.	Stock	10	..	225 —235	—11	4 5 1
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111	..	5 6 8
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	138 —143	—2½	3 10 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	.	4 8 3
Toronto Power, 4½ % Deb.	Do.	4½	4½	97½— 99½ xd	..	4 10 [illegible]
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½— 96½	..	5 3 8
Victoria Falls Power, Pref.	1	11⅞d.	17⅜d.	[illegible]	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½—105½	..	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7½	—⅛	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	142 —144	—½	5 11 0
Do. Collat. Trust	$1000	4	4	93 — 95		4 4 8
Anglo-American Telegraph	Stock	3	3	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½—111½	..	5 7 8
Do. Def.	Do.	30/-	..	25½— 25¾	¼	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7½— 7¾	..	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	80½— 82½	..	4 17 0
Cuba Telegraph	10	6	6†	8½— 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3¼— 3¾	¾	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅝— 7	..	7 2 10
Direct United States Cable	10	6	4	7 — 7½	..	6 13 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	+ ½	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	133 —136	..	5 3 0
Do. 3½ % Pref. Stock	Do.	3½	3½	77 — 79	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	+ ½	4 1 8
Eastern Extension	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10½— 11 xd	⅛	5 9 1
Do. 6 % Pref.	10	6	6	12⅜— 12⅞ xd	—⅜	4 13 2
Great Northern Telegraph	10	18	18	27½— 29½	—½	6 2 0
Indo-European Telegraph	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common	$100	5	5	85 — 88 xd	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70 xd	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	4¼— 4⅜	—⅛	4 11 6
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅝— 3⅞	—⅛	4 7 8
Monte Video Telephone, Ord.	1	6	6†	15/16— 1 1/16	..	5 18 0
Do. 5 % Pref.	1	5	5	23/32— 27/32	..	5 18 6
National Telephone Def.	Stock	6	..	136 — 139	—9	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	97¾— 98¾	..	4 11 2
Oriental Telep. and Elec.	1	8	6†	[illegible]	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	[illegible]	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88½— 90½	+ ½	4 8 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10¾— 11¼	— ¼	8 17 10
Submarine Cables Trust	Cert.	6	6	127 —130	.	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½—101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼— 7⅝	..	5 5 10
Do. 5 % Cum. Pref.	5	5	5	5⅛— 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 11/32— 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3 — 3¼	— ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9½— 10	..	6 0 0
Do. 5 % Debs.	100	5	5	102 —104	+ ½	4 16 2
Western Telegraph, Ltd.	10	7	7†	13 — 13½	— ¼	5 8 8
Do. 4 % Deb.	Stock	4	4	95½— 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97 —100	—1	4 10 0

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 17th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	11½ — 13½	..	..
Do. Do. Deferred	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 89 xd	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	.	..
Do. 5 % Perp. Deb.	100	5	5	92 — 96	+2½	5 4 2
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	3	3†	80 — 82	—1	3 13 2
Do. Pref.	100	4	4	81 — 83	..	4 16 5
Do. Def.	100	2	..	79 — 81	—1	2 8 9
Do. 4 % Deb.	100	4	4	100 —102	.	3 18 5
City & South London, Ord.	100	1⅝	1¼†	34½ — 35½	—1	3 15 4
Do. 5 % Pref., 1891	100	5	5	109 —111	.	4 10 1
Do. Do. 1896	100	5	5	109 —111	..	4 10 1
Do. Do. 1901	100	5	5	109 —111	..	4 10 1
Do. Do. 1903	100	5	5	109 —111	..	4 10 1
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2¾	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	21/32 — 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝ xd	..	4 15 3
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5 — 6	..	..
Do. 4 % Deb.	100	4	4	72 — 75	—1	5 6 8
Metropolitan Railway Consol.	100	1⅞	1½†	51¾ — 52¾	—2½	3 2 2
Do. Surplus Lands	100	2⅞	2¾†	62 — 64	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	39¾ — 40¼	—1	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	88 — 90	..	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1 1/16 — 1 3/16	—1/16	5 1 1
Do. Def.	1	Nil	..	¼ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	¾ — ⅞	—1/16	5 14 3
Do. 4½ % Deb.	100	4½	4½	93 — 95	..	4 14 9
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 3
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3⅞ — 4⅛	— ¼	Nil
Do. "A"	1/-	..	..	3/16 — 5/16	3/32	..
Do. 6% First Cum. Inc. Deb.	100	..	6	112 —114	..	5 5 3
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 3
Do. 6 % Income	100	1½	£2	89½ — 90½	— ½	..
Yorkshire (West Riding), Ord.	5	Nil	..	¼ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	..	4 5
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Dec. 17th.	Rise + or Fall —	Present Yield p.c.
Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	4 17 9
Do. 2nd Pref.	5	5½	5½	4 11/16 — 4 15/16	..	5 17 4
Do. 4 % Deb.	100	4	4	93½ — 95½	+ ½	4 3 9
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	97½ — 99½	..	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brazilian Traction Light and Power	$100	..	..	90 — 92	—3¼	..
Brisbane Trams Invt., Ord.	5	8	8†	7 1/16 — 7 5/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	139 —144 xd	..	5 11 2
Do. Pref. Ord.	100	6	6	116½ —120½	..	4 19 7
Do. 5 % Pref.	100	5	5	106½ —109½	..	4 11 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½ —101½	+ ½	4 8 8
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	.	4 5 9
Do. 4¼ % Con. Deb.	100	4¼	4¼	97 —100	—3	4 5 0
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4 13/16 — 5 3/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	⅝ — ¾	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16 — 5 11/16	..	4 8 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	1/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	17/32 — 21/32	+ 1/32	..
Do. Pref.	1	6	.	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	109 —111	—3	6 6 2
Do. Gen. Con. 5 % Bonds	..	5	5	95½ — 97½	..	5 2 7
Do. 6 % Bonds	100	6	6	101½ —103½	..	5 16 0
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅛ — 7⅝	— ⅛	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	+ ½	5 1 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1 3/32 — 1 11/32	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	96½ — 98½	— ½	5 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101½ —103½	..	4 16 7
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	—1	5 3 1
Un. Elec. Trams Monte Video	5	7	6†	5⅛ — 6	— ⅛	5 16 8
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	— ⅛	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Dec. 17th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	1	6	..	½ — ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	21/32 — 25/32	—1/32	7 13 11
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	3 16 10
British Aluminium, Ord.	1	Nil	..	⅜ — ⅝	..	..
Do. 6 % Cum. Pref.	1	Nil	..	11/16 — 13/16	.	..
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	—1	5 6 5
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	103 —105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	5	Nil	Nil	⅜ — ⅝	— ⅛	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb.	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10½ — 11½	..	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	20	3⅝ — 3¾	—1/16	5 6 8
Do. Deb.	100	4½	4½	106 —109	+1	4 2 7
Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	9/16 — 13/16	..	..
Do. Pref.	1	6	6	¾ — ⅞	..	6 17 2
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	⅛ — ⅜	..	Nil
Do. fully paid	5	Nil	..	1 — 1¾	— ¼	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	13/16 — 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 9
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12¼ — 13	..	6 10 9
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	9¾ — 10¾	— ½	6 19 6
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	34½ — 36½	..	5 13 0
Do. Deb.	100	4	4	97½ —100½	+ ½	3 19 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	½ — ¾	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

INDUSTRIES AND INDUSTRIAL CONDITIONS IN THE ARGENTINE.

By ALFRED H. GIBBINGS, A.M.I.C.E., of Buenos Ayres.

(*Continued from page 972.*)

From what has already been said, it is apparent that the really important works are few in number. The following are the principal:—

Sugar Industry.—As stated, the centre of the sugar industry is at Tucuman, where there are 37 sugar factories, which also turn out a considerable quantity of rum. This industry is also being extended to other parts, notably in the territories of Misiones, Chaco and Formosa. The value of the sugar produce and its by-products amounts to over £5,000,000 per annum. The machinery for sugar crushing and refining is principally of British manufacture, certain well-known firms having made a speciality of the market. The crushed cane residues are used as fuel for raising steam in specially-constructed boilers, and wood is also used as fuel. From other points of view, the industry is not of any special engineering interest, except perhaps, now that the Hydro-Electric Co., of Tucuman, will shortly be supplying electricity in bulk, electric driving, lighting, and possibly electric processes may replace some of the existing methods.

The annual output of sugar is about 200,000 tons.

Wine Industry.—In the Argentina there are 3,409 wine presses, principally in the province of Mendoza, with 1,077 establishments, and also in San Juan, Salta, Rioja, Catamarca, Entre Rios, Cordoba, and Buenos Ayres. The raw materials used annually amount to over £4,000,000 in value, producing wine to the value of nearly £6,000,000. The most popular wines are red and white clarets, the better qualities of which are excellent. Nearly the whole output (about 50,000,000 gallons) goes to the City of Buenos Ayres, and even then the importation of foreign wines is about equal in quantity.

Electricity Works.—These are referred to again under the section on Industrial Conditions. On the 56 undertakings in the country, 18 are operated by the Compania Alemana Transatlantica de Electricidad, and of these 14 are substations. The electricity works at Bahia Blanca is now under the control of the Buenos Ayres and Pacific Railway Co.; the Provincia de Buenos Ayres Electric Light and Power Co., Ltd., own the undertakings at Azul, Junin, and about half a dozen other small towns, in the province of Buenos Ayres. There is also a German Syndicate, which is obtaining control of several of the existing private companies.

The Rosario Electric Light and Power Co., originally a British concession and undertaking, has now passed into the hands of the Belgians with head offices in Brussels.

In Cordoba and Tucuman there are a few waterfalls, but the energy they furnish is comparatively small. There is one below the Barrage San Rogue, in the Sierra de Cordoba, belonging to the North American Light and Power Co., and having a capacity of about 3,000 H.P. It supplies electric energy for lighting and power to the city of Cordoba and also for the manufacture of carbide of calcium.

A company has recently been formed, called the Hydro-Electric Co., of Tucuman, to utilise the waterfalls in that neighbourhood and to supply electric energy in bulk to the city of Tucuman and district.

The National Government own a large number of small electric light and power works.

Cold Storage.—The following are the principal cold-storage concerns:—

The La Plata Cold Storage Co., Ltd., La Plata.
Cia. Frigorifico Armour de la Plata, Buenos Ayres.
The River Plate Fresh Meat Co., Ltd., Buenos Ayres.
Cia. Frigorifico Santiago, Ltda., Buenos Ayres.
Las Palmas Produce Co., Ltd., Buenos Ayres.
The Sansinena Frozen Meat Co., Ltd., Buenos Ayres.
Sociedad Anonima La Blanca, Buenos Ayres.
Sociedad Anonima La Negra, Buenos Ayres.
Cia. Frigorifico Argentino.

These companies jointly kill upwards of 8,000 head of cattle per day, principally for export as chilled meat. The Compania Frigorifico Armour de La Plata, a branch of the great Chicago house, has no separate works in operation, but is building an immense factory at La Plata. It has also some controlling interest in some of the other companies.

Breweries.—The principal breweries are:—

Cerveceria Argentina, Quilmes.
Cerveceria Bieckert, Buenos Ayres.
Cerveceria Palermo, Buenos Ayres.
Cerveceria Buenos Ayres, Buenos Ayres.
Cerveceria Rio Segundo.
Cerveceria San Martin.

Of these the Quilmes is the largest, turning out more than half the total beer consumption of the country. These breweries use a large amount of machinery, and there is room for other breweries, owing to the continual increase in the demand, and hence for machines for the preparation of malt, power plant and handling.

Ship Repairing, Engineering Works, Foundries, &c. The only important engineering works in the Republic are situated in Buenos Ayres, the most prominent being *(a)* James Majoribanks, Boca, ship repairers and launch builders; *(b)* Pedro Vasena & Sons, engineers and iron and brass founders; *(c)* Talleres y Fundicion La Union, Ltda., foundry; *(d)* Zimmerman, Noe & Co., Barracas, agricultural implement makers.

These firms employ many thousands of hands, and the firm of Pedro Vasena & Sons are also large erectors of steel work for buildings.

Flour Mills.—Of the 330 flour mills scattered over the country, the majority are small concerns meeting the requirements of the immediate localities respectively. Much of the grain produced is exported without milling, and the heaviest demands for flour are in the City of Buenos Ayres, with its 1,500,000 population.

The largest establishment situated adjoining Dock 3, in Buenos Ayres, is the Molino del Rio de la Plata. It employs over 2,000 hands, and has machinery for milling and endless belt transmission of over 7,000 H.P., which consumes over 100 tons of coal per day. The power required for this one mill is equal to that of the remaining 329 flour mills together.

Other Industries.—With the exception of the general information given herein in the statistical tables there are no other works which call for special mention. At the same time interesting descriptions of many others could be given—notably the paper mills of Zarate, and the Alpagatas and cotton factories—but such descriptions would occupy much more space than is here at disposal. As no attempt has yet been made to bring this subject up to date, or to add in any way to the Government statistical information, the writer hopes to give it special attention during the coming year, with the object of issuing a publication of utility to commerce.

Industrial Conditions in the Argentine.—In an official publication of the Government, entitled "Boletin Nacional de Trabajo," issued annually, reports are made by Departmental Commissioners of the state and conditions of the several industries in the respective provinces and territories. The report for the city of Buenos Ayres is kept separate owing to the exceptional nature of its situation. One of the Departmental Commissioners referred to states that during normal periods the shop and factory hands are able to satisfy all demands, but as the years advance manufacturers are beset with serious difficulty in finding skilled artisans, even with an offer of 25 per cent. above the ordinary wage.

TABLE V.—Salaries and Wages in the Republic.

The following is a list of salaries and wages paid in the Republic in 1909. Since that date, however, they have advanced considerably (20 to 25 per cent.) in the case of the more qualified skilled labour.

	Per day.				
	s.	d.		s.	d.
Bricklayers.—					
Front finishers (piecework)	10	0	to	12	6
Qualified workers	7	0	,,	8	8
Improvers	5	0	,,	5	10
Labourers	4	0	,,	4	6
Carriages.—					
Box makers	8	4	,,	12	6
Spring makers	—			8	4
Anvil workers	10	0	,,	12	6
Filers	7	6	,,	8	4
Upholsterers	—			8	4
Painters	9	2	,,	10	0

	Per day.				
	s.	d.		s.	d.
Carts.—					
Blacksmiths	7	6	to	8	4
Carpenters	6	8	,,	8	4
Rim fitters	8	4	,,	13	4
Carpenters.—					
Qualified workers	7	6	,,	8	4
Improvers	5	0	,,	6	0
Labourers...	per month £7 to £7 8s. 4d.				
Ebanists (Cabinet Makers).—					
Qualified workers	8	4	,,	10	0
Improvers	5	0	,,	7	0
Polishers ...	7	6	,,	8	4
Apprentices	1	8	,,	3	4
Electricians.—					
Qualified workers	7	0	,,	8	4
Improvers	5	0	,,	6	0
Apprentices	1	8	,,	3	4
Tinkers.—					
Qualified workers	6	8	,,	8	4
Improvers	5	0	,,	6	0
Apprentices	1	8	,,	2	6
Blacksmiths.—					
First-class qualified workers	—			9	2
Second-class qualified workers	7	6	,,	8	0
Improvers	5	0	,,	6	0
Labourers	—			5	0
Stonemasonry.—					
First-class qualified workers (placers)	8	4	,,	10	0
Second-class qualified workers	6	8	,,	8	4
Improvers	5	0	,,	6	0
First-class polishers	—			8	4
Second-class polishers ...	—			6	8
Third-class polishers	5	0	,,	6	0
Painters.—					
Plain painters ...	7	6	,,	8	9
Letter painters ...	8	4	,,	9	2
Improvers	—			6	8
Apprentices	2	6	,,	3	4
Bronze and Brass (Mechanical and Metallurgical Shops).—					
Founders	6	8	,,	7	6
Improvers	4	2	,,	5	0
Apprentices	—			1	8
Mounters	6	8	,,	8	4
Filers	5	0	,,	6	8
Turners ...	7	6	,,	8	4
Enamellers	7	6	,,	10	0
Grinders and polishers ...	7	6	,,	8	4

	Per day.				Per month.
Dock Labourers.—	s.	d.	s.	d.	
Stevedores			6	8	
Stevedores for night work			13	4	
Coalers ...			6	8	
Elevator hands ...	5	0 to	6	8	
Cranemen (private)					£8 6 8 to £10
Depôt labourers ...			6	8	
,, ,,					£7 10 0

The foregoing rates are those published in the Government returns for 1909—the latest available—but since then there has been an increase of 20 to 25 per cent.

This is not due in any sense to the influence of Trade Unions, but arises solely from the increased demand for locally manufactured goods—such as carts, carriages, motor-cars, boots and shoes, furniture, clothing, &c.—and the small percentage of the immigrants who are craftsmen. The Trade Unions, except as regards railway employés, are not in a strong position; and, in fact, they have a very poor sort of material to work upon, including many nationalities.

With regard to the nationality of these workmen, exclusive of the native Argentino, the immigration statistics for 1910 are as given in Table VI.

Of the foregoing, 189,866 were men, 58,414 were women, and the remainder children under the age of 13 years. Of the men, 78,016 were agricultural labourers, 4,398 masons, bricklayers and plasterers, 3,001 carpenters, 9,406 clerks and business men, 391 electricians, 140 stokers, 231 engine drivers, 1,626 mechanics, 525 miners, 479 painters, 75,967 day labourers and journeymen, and 2,135 shoemakers. Of the women, 16,432 were domestic servants. Up to the end of September last, the figures for 1911, so far as they are available, show an increase over those for 1910.

The number of factory workers—skilled and unskilled—in the whole of the Republic is under 40,000. It might be held that the high rate of salaries and wages is an object lesson of the value of import duties to the workman. But, as a matter of fact, it does not benefit the workman at all, as rent and food cost more than twice as much as in England; sanitary conditions are sadly neglected; clothes, domestic articles, and furniture are more than double in price, while recreations and every form of luxury are at prohibitive prices.

TABLE VI.—Immigration for Year 1910.

Nationality of the Immigrants.

Italians	102,019	Dutch	281
Spaniards	131,466	Fins	27
Russians	12,765	Montenegrins	151
Turks ...	15,478	Swedish	96
French ...	4,380	Peruvians ...	43
Austrians	4,542	Japanese ...	72
Hungarians	694	Paraguayans	13
Germans	3,282	Servians	226
English	1,825	Cubans	58
Argentinos	1,381	Bolivians ...	43
Roumanians	310	Bulgarians...	880
Swiss ...	710	Norwegians	64
Danes ...	553	Africans ...	48
Belgians	349	Venezuelans	27
Portuguese	2,848	Mexicans ...	17
North Americans	467	Chinese	13
Brazilians	795	Boers	5
Greeks ...	3,289	Indians	31
Moroccans	128	Colombians	9
Uruguayans	106	Egyptians ...	25
Chileans	103	Persians	21
Total ...			289,640

Workmen's Insurance.—During the past four or five years insurance against accidents to workmen, both as regards personal insurance and insurance by the masters, has become almost as general as in England. The percentage of accidents in industrial establishments is slightly higher than in England. The percentage of accidents in the building trades is abnormally high, arising principally from the indifferent manner in which the scaffolding is fixed. The cause of this, again, is partly due to the very narrow pavements and streets which do not admit of the scaffold poles being erected from the ground. They are brought out from the building at a height of about 12 ft. from the street level.

The regulations and customs existing between the insurance companies and the insured firms are practically on similar lines as those in England. The floating policy is in vogue, usually on a six months' liquidation. The insurance companies, of course, reserve the right of inspecting the insured firm's pay-sheets at any time. Most of the well-known insurance companies are represented out here, and the competition amongst them is fairly keen.

The usual premiums paid are:—

All workmen employed on building erections, 23 per cent. of wages paid.

Mechanics and others employed in machine-driven shops, 14 per cent. of wages paid.

Other classes in proportion.

(*To be concluded.*)

THE COMMERCIAL DEVELOPMENT OF ELECTRICITY SUPPLY.

IV.—The Relation of Supply Authorities and Contractors.

The present unsatisfactory position in the relations of these two important sections of the electrical world cannot be denied, and it is the more deplorable seeing that a sound working understanding would exert a powerful influence on the welfare of electricity supply. A further regrettable fact is that unless the cause of unpleasantness is soon removed, the breach will tend to widen instead of close. With interests so closely allied it seems absurd that wise counsel on both sides has not found a way out of the threatened impasse. Constantly at cross purposes, the two parties would appear to regard one another with a feeling somewhat resembling the natural antipathy which exists between cat and dog.

Those who have laboured in both camps will no doubt find some difficulty in locating any sound cause for friction. That irritation does exist is undeniable, and it may probably be accounted for by the failure hitherto to find some common basis for amicable working. At the present time, when the need for re-organisation of the forces of the electricity supply industry is most unmistakably apparent, the possibility of effectively enlisting the activities of the contracting fraternity in the cause of progress must be fully considered. Further mutual friendly overtures might result in clearing up grievances, real or imaginary, and a frank understanding might be arrived at enabling a co-operative policy to be adopted. An unbiased consideration of apparent existing conditions may be of assistance in improving the position.

From the supply engineer's standpoint the contractor is regarded as lacking in business energy. He is constantly suspected of inferior work, and although a sigh of thankfulness is breathed when an installation passes the insulation resistance test, it is tinged with regret that there is nothing to grumble at. A certain amount of disappointment is felt if no low-grade wire, shoddy accessories, or bad workmanship are found. The adoption of this attitude on the part of the mains engineer is largely due to the existence of the jerry wireman or black sheep of the contracting community, the man who undertakes work at a price inconsistent with soundness and a reasonable living profit. Such work is sometimes accomplished by the utilisation of inferior wire bought up in job lots of broken coils, and cheap and nasty accessories mounted on poor quality porcelain, the erection of which is carried out by incompetent boy labour. Injustice may also be done to contractors of high standing by subsequent additions in a very indifferent manner to first-class installations. The supply authorities may have no knowledge of such additions, and should their attention be drawn to serious faults which develop in consequence, it is possible that the whole of the work may be condemned, and the reputation of the original contractors unjustifiably damaged. With regard to the accusation of lack of business ability, the position of the electrical contractor renders him to a great extent dependent upon the commercial policy of the supply industry, which is at present indeterminate. The contractor justifiably feels a distinct lack of security in his sphere of activity, and it is unreasonable to expect him to jeopardise further capital in extending his business operations on an unstable foundation. Under the existing chaotic conditions there is no satisfactory assurance that progressive efforts would receive an adequate return.

Reviewing the contracting community, it will be found that there is great diversity with regard to the status of individual members. Included in its ranks are expert electrical engineers of long standing, many of whom are regarded as authorities on installation matters, and the humbler members are reinforced by the foreman and intelligent journeyman wireman commencing business on their own accounts. Many large furnishing and decorating firms have electrical departments, and the field has also been entered by a proportion of the plumbing and gas-fitting fraternity, who have hoped to retrieve business which vanished with the decline of the private gas-fitting industry.

Although the interests of electricity supply authorities and contractors are to a great extent parallel, the fact must not be overlooked that many of the latter are as busily engaged in installing generating plant as in carrying out installations to be supplied with current from public mains. In fact, the electrical equipment of country houses and other self-contained installations forms the bulk of many electrical contractors' businesses. In the case of the Metropolis, another point to be considered is that in comparison with the gas companies the territories of individual electricity supply authorities are almost parochial, and contractors cannot afford to restrict their activities to the district in which their business premises happen to be situated. Many contractors may, therefore, be doing excellent work in the interests of electricity supply generally, although perhaps not in sufficient quantity in any one particular district to attract the attention of individual supply engineers.

It may not be unreasonable to assume that as electricity supply authorities have displayed so little energy with regard to business development, whatever increase has been obtained has been largely due to the existence of contractors, who in their own interests have induced additional installations. It is no exception to find that reputable contractors have the implicit confidence of their clients, and their recommendations and advice are generally acted upon. This inclination to turn to the contractor rather than the supply authority has probably arisen on account of the lack of interest displayed by the latter in the welfare of the consumer, except on quarter days.

Among those officials of the electricity supply industry who are giving serious attention to the subject are a section of extremists, who are propounding the firebrand gospel of the total extermination of the contractor. They profess to see exactly similar circumstances in electricity supply to those existing when the elimination of the private gas fitter by the gas companies was commenced. In all probability the positions are not so analogous as the casual observer might be led to believe. It may be recalled that at the time when gas companies were seriously menaced by the competition of electricity, the incandescent gas mantle was also introduced. In accepting the inevitable, the gas industry adopted a thoroughly broad and liberal-minded policy. It was realised that the sale of gas for lighting purposes would be greatly reduced, and all efforts were directed to developing business in heating and cooking. Attention was also turned to the value of by-products, with such good effect that they will probably in the near future rank equally in importance with gas itself. At any rate, it is certain that to supply the present demand in the residual market, gas must necessarily be manufactured and sold. Gas companies, therefore, saw that abnormal efforts had to be made to put before the general public effectively the special claims for the utility of gas for purposes other than lighting, and, furthermore, that careful attention must of necessity be given to the maintenance of existing installations. Apparently the private gas fitting industry was not regarded as being in a position to meet the pressing requirements, and gradually sank into obscurity as a negligible quantity in gas progress.

In order to secure further development under the broader policy, it is imperative that action in the matter be taken by supply authorities, and the policies that may be adopted may be defined mainly on the following lines :—

1. Extermination of the independent contractor as at present existing.

2. Establishment of installation departments by supply authorities, and sub-letting of labour to contractors.

3. Combining the forces of supply authorities, contractors and manufacturers by amicable co-operation.

Those who adopt the whole-hogging attitude of extermination must bear in mind that in the process advocated the closing of contractors' establishments will really entail the loss of centres of activity, exerting in a greater or less degree a beneficial influence on the expansion of electricity supply, and, unless similar branches are established by supply authorities, will tend to greater centralisation and lessened elasticity of the commercial system. Assuming that the elimination of the contractor is gradual, there is certain to be solid opposition to the scheme, even where powers already exist, and measures to obtain legislative sanction in the future will prove costly.

With the necessary powers the question of the suitable organisation of the new department must then be considered, and in the case of supply companies, there is no doubt that in course of time the various details would straighten out, and work would proceed satisfactorily, but in the case of municipal authorities the result is not quite so certain. The few examples of the past working of such departments where constructive work has been carried out by direct labour are instructive, if not praiseworthy. Expert supervision is essential, and cannot be undertaken by "volt-ticklers," fresh from the station, or "ohm grinders," from the mains department. Efficient labour must be employed, and although odd jobs may be carried out on installations in the buildings of the supply department by cable jointers, such men are not necessarily practical wiremen. The conditions of employment in a municipal department of this description would not be conducive to efficient labour. Workmen would not feel that necessity to expend their energy at the same rate as in private employ, and this aspect would be reflected in a *bonâ fide* system of accounts.

The sub-letting of labour to contractors would also prove expensive, as this would in such a case necessarily be expected to bear its full measure of profit. Under present conditions, contractors are content to shorten somewhat the return on labour in consideration of profits resulting from the sale of material, fittings and apparatus. The establishment changes in connection with the department would not in all probability be less on account of the sub-contracting of labour, and the overall result of either of the above experiments would possibly be higher cost of installations, which would be distinctly contrary to the aims and expectations of the promoters.

Having seen that the circumstances under which the gas manufacturers embarked upon the policy of extermination of the private gasfitter are not exactly similar to those with which the electrical industry is confronted, we may now consider the proposals for co-operation. Electricity supply is not menaced by a new competitor, but by the thoroughly earnest efforts of a rejuvenated and reorganised industry, and in order to embrace the attractive opportunities for development which are now presented, it is necessary to discard effete methods, and in formulating a new policy to give full consideration to the utilisation of existing forces in the cause of progress.

If assured that the intentions of supply authorities were in no way antagonistic to the interests of contractors, it is quite possible that the latter body would welcome friendly overtures, and render valuable assistance in the formulation of a programme of co-operative effort. They probably realise in common with other reasonable people that a house divided against itself is a very unstable structure, and that measures undertaken for its permanent security are worthy of support.

As contractors would share in the prosperity which would result from properly organised co-operative endeavours, there is no reason why they should not be regarded as important factors in the success of the industry. Up to the present reputable contractors have been in many quarters regarded in the light of canvassers in the interests of electricity supply, and the advantage might be extended by making their establishments really useful branches for publicity activity. Satisfactory arrangements might be made whereby the expense of literature and other items might be suitably apportioned, and with the feeling that their interests were vitally associated with those of the supply authorities, the zealous support of the contracting fraternity might be brought to bear on the fortunes of the industry.

The importance of the manufacturing community working in accord with both supply authorities and contractors has also a distinct bearing on the question of expansion. At present, owing to lack of co-ordination and organisation of these powerful factors for the common welfare, full benefit is not being obtained by the supply authorities from the activities of manufacturers. No really decisive line with regard to apparatus can be drawn, as exact requirements are not clearly understood, and makers are working independently, and more or less in the dark. Joint conference would, however, eliminate many difficulties in this respect, and as it is important that existing prices of apparatus be materially reduced in order to assist in the popularising of electricity for all purposes, the case for co-operative publicity efforts is forcibly and prominently established. In reviewing the foregoing leading points, it is to be hoped that the various aspects of the case will be thoroughly deliberated upon before vital steps are definitely taken, and that able and experienced counsels will be brought to bear on the subject with success, and a really forward policy inaugurated.

WIND MOTOR DEVELOPMENTS.

THE wind motor and the possibility of using it for electricity supply purposes on a small scale have attracted considerable attention in all parts of the world. Competition, however, in the shape of oil and spirit engines, and the necessity of providing for the very uncertain behaviour of the wind itself, have rather tempered enthusiasm for the wind motor as a possible prime mover.

Still, a good many examples of this class of apparatus have been brought into use, and an interesting description appeared in the *Mining and Engineering Review* of a new plant of this class, designed by Mr. W. A. P. Turnbull, electrical assistant to the N.S.W. Government Railways and Tramways, specially for dynamo driving, which was exhibited at the Sydney Agricultural Show early in the year.

The novel feature of the mill is the method of speed regulation, which has been patented.

This is shown diagrammatically only in fig. 1, in which (*a*) is a plan, and (*b*) an elevation of the apparatus. The wind wheel X runs on shaft D, which is rigidly connected to casting Z, which is

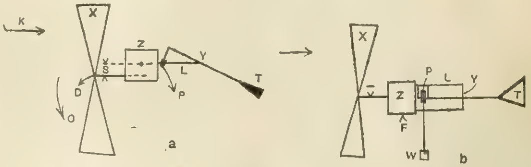


Fig. 1.

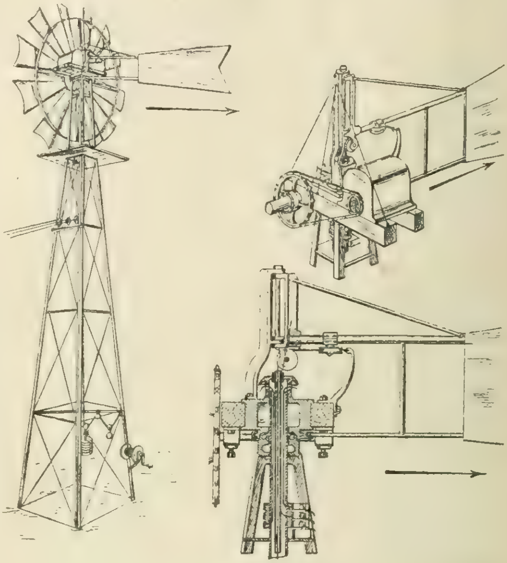


Fig. 2.—An Australian Wind Motor, showing Arrangement of Dynamo, Slip-Rings, &c.

pivoted at F on the supporting tower. The centre line of shaft D is to one side of the centre line of the pivot and tail apparatus. The tail of the mill T is free to turn horizontally on a fulcrum Y

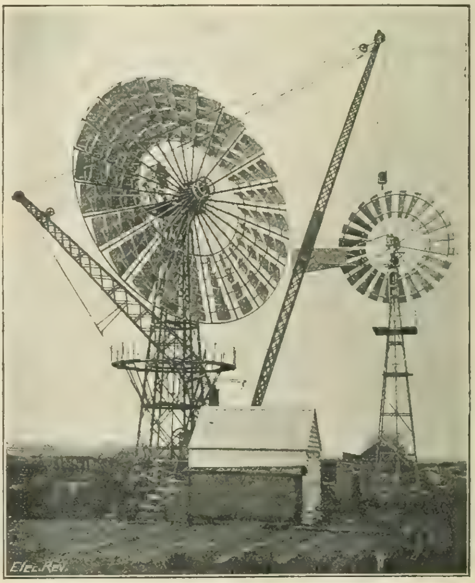


Fig. 3.—A 40' dia. British Wind-Motor, with Movable Vanes.

rigidly supported from the casting Z, through frame L; the other end of the tail arm is, however, restrained in its movement by a weight W, to which it is attached by a rope running over a pulley P carried on the framework.

The regulation is automatic. When the wind is blowing in the direction shown by the arrow K, the wind-wheel tends to turn out of the wind in the direction shown by the arrow O. The wind, however, tends to keep the tail T in the direction of the wind. If W were made extremely heavy the tail would act as though rigidly connected to Z, and the regulation would be unstable. The weight, however, is so adjusted that the resultant of the two parallel forces acting at each end of the tail at right angles thereto, and which takes effect on Z through the pivot Y, balances the turning movement of the main wheel about the vertical axis of F, in such a manner that the wind-wheel turns out of the wind or into the wind according to whether the wind velocity rises or falls; the wheel then revolves at practically constant speed, over and above a maximum wind velocity—generally fixed at from 10 to 15 miles per hour. No matter what hurricane is blowing, the speed of the wind-wheel does not exceed this maximum, turning right out of the wind momentarily when the gusts are very severe, but maintaining the constant speed. In actual practice, in the larger sizes of wind-wheel, the inertia of the apparatus to a slight extent was found to affect the theoretical regulation, and for that reason Mr. Turnbull devised a simple and inexpensive electrical means of overcoming this. The most convincing proof of the regularity of the speed lies in the reading of the voltmeter connected across the generator terminals; this reading was found with very variable winds to be quite steady.

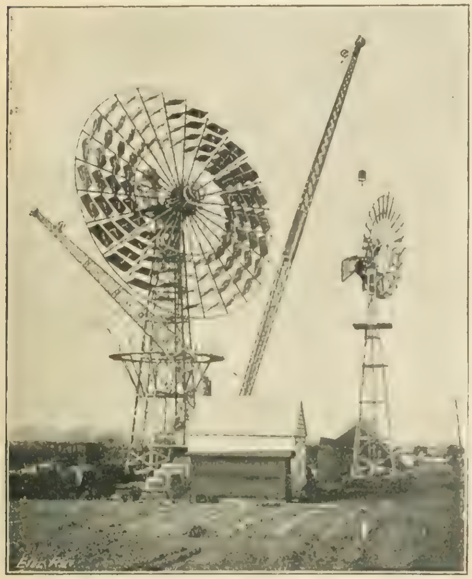
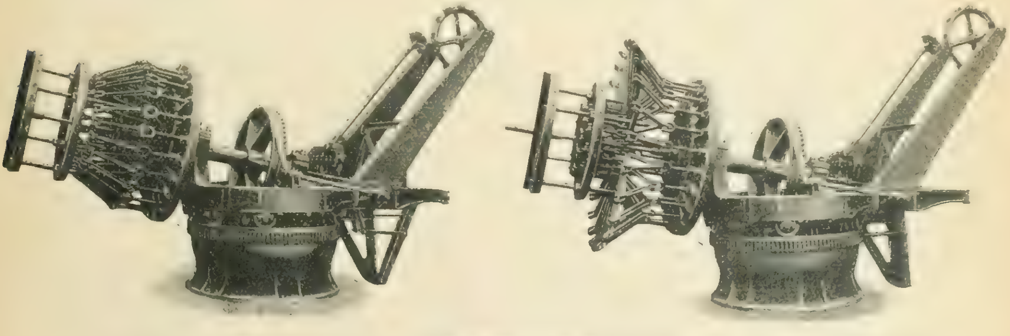


Fig. 4.—40-ft. Wind Motor with Vanes out of the Wind.



Figs. 5 and 6.—Views of Mill Cap, 40-ft. Wind Motor, showing Link Motion for Operating the Vanes.

The action of the equipment, as a whole, is then as follows:—The main shaft of the wind wheel is connected directly (or through suitable gearing) to the generator, mounted in a water-tight case, on top of the tower, as shown in fig. 2.

The current is collected from slip-rings mounted inside the main casting, by brushes, and carried thence by suitable connectors to the battery and switchgear, which may be situated at will, in the base of the tower or within the premises, taking up very little room with the few cells employed. A simple, effective cut-in, cut-out (also specially designed by Mr. Turnbull), is provided on the switchboard, so as to connect or disconnect the generator and battery at the voltage of supply, say 12 to 50 volts, as required. The battery is always connected to the house wiring, unless specially switched off.

With limited wind velocities the battery will supply the required current until the generator takes up its load, and, if necessary, charges the battery. From observations by Mr. Turnbull and others, extending over lengthy periods, and from statistics furnished from the office of the N.S.W. Government Meteorologist, batteries can be provided with each equipment of sufficient capacity to tide over even abnormal periods of windless weather. It is not claimed that the apparatus will work satisfactorily in all localities.

According to our contemporary, a strong syndicate is in charge of the business arrangements connected with the invention, which is designed to suit Australian conditions.

Several firms in this country have specialised more or less successfully in the modern windmill, and, of course, examples of their work are to be found in most of our Colonies. We illustrate herewith a 40-ft. diameter mill constructed for pumping purposes for an Indian railway by Messrs. Robt. Warner & Co., and designed to move in a light wind of about 10 miles an hour, but provided with movable vanes on account of the large area exposed to heavy winds.

Our illustrations show the mill with the vanes both in and out of the wind, and the mill cap with the link motion for operating the vanes. The views also show the erecting cranes and a smaller mill of normal type with fixed vanes in the rear.

TRADE STATISTICS OF THE STRAITS SETTLEMENTS, 1911.

The following statement, showing the imports of electrical and other materials into the various Straits Settlement ports in 1911, is taken from the recently issued trade statistics. The figures for 1910 are given for purposes of comparison, and notes of any increases or decreases have been added:—

Imports into Singapore.

	1910. Dollars.	1911. Dollars.	*Inc. or dec* Dollars.
Electrical goods (not otherwise shown).—			
From United Kingdom ...	114,000	Not	—
„ British India ...	16,000	shown	-
„ Belgium	1,000	as	—
„ Germany	6,000	such	-
„ Italy	5,000		—
„ Other countries ...	5,000		
Total ...	147,000		
Gas and electric lighting materials.—			
From Germany	9,000	Not	—
„ United Kingdom ...	64,000	shown	—
„ United States ...	1,000	as such	—
Total ...	74,000		
Telegraph and telephone materials.—			
From Belgium	10,000	39,000	+ 29,000
„ Germany	1,000	28,000	+ 27,000
„ United Kingdom ...	162,000	123,000	— 39,000
„ Other countries ...	5,000	9,000	+ 4,000
Total ...	178,000	199,000	+ 21,000

	1910. Dollars.	1911. Dollars.	*Inc. or dec.* Dollars.
Tramway and railway materials.—			
From Belgium	21,000	21,000	—
,, Germany	—	1,000	+ 1,000
,, United Kingdom ...	254,000	102,000	— 152,000
,, Australia	51,000	—	— 51,000
,, Other countries ...	2,000	2,000	—
Total ...	328,000	126,000	— 192,000
Machinery.—			
From Belgium	1,000	Separately	—
,, Denmark	1,000	classified	—
,, France	21,000	in	—
,, Germany	93,000	1911	—
,, Holland	6,000		
,, United Kingdom ...	1,242,000		—
,, United States ...	97,000		—
,, Other countries ...	145,000		—
Total ...	1,606,000		
Electrical machinery.—			
From United Kingdom ...	Not	181,000	—
,, Germany	shown	14,000	—
,, Italy	separately	11,000	—
,, Belgium		6,000	—
,, United States ...		4,000	—
,, Other countries ...		20,000	—
Total ...		236,000	
Engines, boilers and parts.—			
From United Kingdom ...	Not	330,000	—
,, Germany	shown	11,000	—
,, Netherlands ...	separately	20,000	
,, United States ...		12,000	—
,, Other countries ...		45,000	
Total ...		418,000	
Machinery, other (except sewing machines).—			
From United Kingdom ...	Not	686 000	—
,, Australia	shown	18,000	—
,, Germany	separately	26,000	—
,, United States ...		83,000	—
,, Other countries ...		66,000	
Total ...		879,000	
Lamps and lampware.—			
From Belgium	10,000	6,000	— 4,000
,, Germany	264,000	238,000	— 26,000
,, United Kingdom ...	103,000	148,000	+ 45,000
,, United States ...	12,000	12,000	—
,, Other countries ...	34,000	32,000	— 2,000
Total ...	423,000	436,000	+ 13,000

IMPORTS INTO PENANG.

	1910. Dollars.	1911. Dollars.	*Inc. or dec.* Dollars.
Electrical goods (not otherwise shown).—			
From United Kingdom ...	21,000	Not	—
,, Germany	30,000	shown	—
,, Other countries ...	2,000	as such	—
Total ...	53,000		
Machinery.—			
From Belgium	18,000	Separately	—
,, Germany	22,000	classified	—
,, United Kingdom ...	322,000	in	—
,, United States ...	14,000	1911	
,, Other countries ...	35,000		—
Total ...	411,000		
Electrical machinery.—			
From United Kingdom ...	Not	56,000	—
,, Germany	shown	39,000	—
,, Other countries ...	separately	7,000	—
Total ...		102,000	
Engines, boilers and parts.—			
From United Kingdom ...	Not	429,000	—
,, Germany	shown	38,000	
,, Belgium	separately	8,000	—
,, United States ...		22,000	—
,, Other countries ...		21,000	—
Total ...		518,000	
Machinery, other (excepting sewing machines).—			
From United Kingdom ...	Not	54,000	—
,, Belgium	shown	4,000	—
,, Germany	separately	3,000	
,, Other countries ...		10,000	—
Total ...		71,000	
Lamps and lampware.—			
From Austria	2,000	—	— 2,000
,, Belgium	1,000	3,000	+ 2,000
,, Germany	43,000	47,000	+ 4,000
,, United Kingdom ...	48,000	61,000	+ 13,000
,, Other countries ...	6,000	7,000	+ 1,000
Total ...	100,000	118,000	+ 18,000
Telegraph and telephone materials.			
From United Kingdom ...	4,000	23,000	+ 19,000
,, Other countries ...	—	3,000	+ 3,000
Total ...	4,000	26,000	+ 22,000
Tramway and railway materials.—			
From United Kingdom ...	—	6,000	—

IMPORTS INTO MALACCA.

	1910. Dollars.	1911. Dollars.	*Inc. or dec.* Dollars.
Telegraph and telephone materials.—			
From United Kingdom ...	1,000	2,000	+ 1,000
,, Other countries ...	1,000	—	— 1,000
Total ...	2,000	2,000	—
Machinery.—			
From United Kingdom ...	5,000	Separately	—
,, Other countries ...	11,000	classified	—
Total ...	16,000		
Electrical machinery.—			
From United Kingdom ...	Not shown	1,000	
Engines, boilers and parts.—			
From United Kingdom ...	Not shown	1,000	—
Machinery, other (except sewing machines).—			
From United Kingdom ...	Separately	34,000	—
,, Other countries ...	classified	20,000	
Total ...		54,000	
Lamps and lampware.—			
From United Kingdom ...	—	2,000	+ 2,000

IMPORTS INTO LABUAN.

	1910. Dollars.	1911. Dollars.	*Inc. or dec.* Dollars.
Machinery.—			
From United Kingdom ...	72,000	—	— 72,000
Telegraph and telephone materials.—			
From United Kingdom ...	—	7,000	+ 7,000

N.B.—Dollar = 2s. 4d.

THE OTHO ELECTRIC ENGINE STARTING, IGNITION AND LIGHTING DYNAMO FOR MOTOR-CARS.

IN view of the interest which is just now being taken in arrangements for enabling the engines of motor-cars to be started from the driver's seat, and so avoid the old familiar, yet troublesome handle grinding, it is not surprising that new devices are continually making their appearance. At present the movement in favour of abolishing the starting handle has made most progress in the United States, where quite a number of devices, wrongly named "self-starters," have recently made their appearance. Among the latest to come under our notice is the electrical system introduced by the Otho Motor Co., Boston, U.S.A., and as the arrangement is such that it acts not only as an engine starter, but provides the current for the ignition, and the lighting of the lamps, and also for the operation of the horn, the following description may be of interest.

Though the mechanism is similar to others of the same nature in that it generates its own current, stores it in an accumulator and then uses it to start the engine and light the lamps, the Otho arrangement is radically different from anything else of its kind in construction and the disposition of its few parts. Briefly, there is but a single moving part, and that forms the fly-wheel of the engine. There are no moving wires, no rotating field or armature coils, and there is nothing to require lubrication, the bearing which supports the fly-wheel being lubricated automatically from the crank case of the engine.

Technically, the system is of the type in which the principal unit is a combined electric generator and motor, the generator capacity being 40 amperes at 6 volts. A feature of the arrangement is that all the wiring, both that for the field and the armature, remains fixed, only the pole pieces and the brushes rotating. The engine fly-wheel itself forms the pole pieces, which are eight in number, and also carries the brushes, the arrangement being indicated in figs. 1 and 2, which show two views of the movable portion. All the wiring is fixed on a "plunger" or central member, which is bolted to the engine crank case, and remains stationary between the rotating pole pieces formed in the fly wheel. In addition, this central member carries the commutator, which is also shown in one of the accompanying pictures. By reason of the fact that there is no moving wiring the possibility of damage to this portion of the system is claimed to be extremely remote.

In operation the system is as simple as it is in construction. A single switch serves to divert current from the storage battery to the motor-generator, the excitation of the field coils causing the fly-wheel pole pieces to rotate, and thereby start the engine. As a motor, the device is stated to be powerful enough, and the capacity of the battery sufficient to permit of the crankshaft of the engine being rotated at 75 R.P.M. for a period of 20 minutes if necessary. Such long applications of current are, however, rarely necessary, three or four revolutions of the crankshaft being sufficient to cause the engine to take up its own cycle of operations. Nevertheless because of the speed at which the crankshaft is rotated, it is quite possible to start the engine on the magneto, though it is considered that a magneto will be an unnecessary adjunct, as current from the storage battery may be used for ignition purposes.

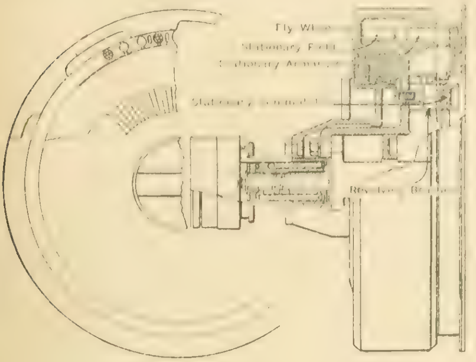


Fig. 1.

Immediately the engine commences to fire the motor automatically becomes a generator, though it is not connected to the storage battery until the car speed reaches approximately 10 miles an hour, when an automatic centrifugal switch comes into action. Current control depends not upon the strength of the current, but upon the speed of the engine, there being no magnetic switches in the make-up of the system. The centrifugal switch, which cuts in the battery when the car speed approximates 10 miles an hour, also cuts it out immediately the car speed becomes higher than 35 miles an hour. The charging current from the generator is, therefore, maintained between the limits which have been ascertained by experiment to give the best all-round results.

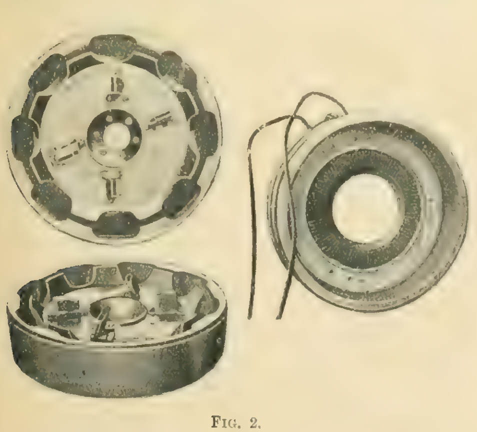


Fig. 2.

The simplicity of the apparatus is carried even to the wiring which connects the motor-generator unit with the storage battery. For this purpose only two wires are used, and they lead to the battery. A third wire to the chassis for earthing purposes completes this portion of the installation. Despite the comparatively large size of the motor-generator, the total weight of the system, exclusive of the storage battery, is only about 50 lb. Inasmuch as a set of accumulators is generally carried for lighting purposes, the total net weight added by the motor-generator is nominal.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

MEXICO.—Information has been received at the B. of T. to the effect that a Bill has been submitted to Congress by the Ministry of Finance authorising the Government to revise the existing Customs Tariff of Mexico. The proposed measure authorises the Government to increase in the interests of national industries, the duties leviable on foreign articles similar in character to those produced in the country, such protection being limited to what may be indispensable to enable native to compete with foreign goods, due regard being paid to the interests of consumers. For similar reasons the duties on raw materials used in national industries are to be correspondingly reduced, provided that such materials produced in the country are not sufficient in quantity, or of sufficiently good quality, or can only be obtained at prices too high to be borne by the industries. It is also proposed to increase, to a reasonable extent, the duties on articles which are not of prime necessity, and which are at present dutiable at a low rate in the Tariff. The Bill also contains certain further provisions, including a proposal to increase the duties on goods imported through the Parcel Post.

It was anticipated that the Bill would be passed by Congress in a few days, and that the new duties would probably be promulgated and enforced by the Government within a comparatively short time.

URUGUAY.—A new law designed to accord privileges in favour of national industries has recently been passed. Under this law the Government is allowed to provide exemption from Customs duty for a period of 10 years for machines, apparatus, spare parts, accessories and material for the first installation of new factories established in the Republic; and to extend a like privilege, during the same period, to factories already existing, in connection with the renovation or improvement of their machinery. Exemptions from duty already conceded in virtue of special Laws remain in force. "Drawback" and "temporary admission" privileges may be conceded by the Government is respect of all articles imported from foreign countries and re-exported in any form. Imported goods which are free of Customs duty in virtue of this law are not to be subject to the surtax of 5 per cent. of the official valuations imposed in [illegible], but they are to be subject to the surtaxes of 3 per cent. for port works, ½ per cent. for Consular service and 1½ per mil. in respect of merchant's licence.

Poulsen Radiotelegraphy.—In a letter addressed to our American contemporary *Science*, Mr. Robert Anderson draws attention to recent achievements of the Poulsen system of wireless telegraphy in which undamped continuous waves produced by an arc are employed. He states that "Stations ranging in power from 5 to 30 KW. are in operation in the large cities on the Pacific Coast, from Seattle to San Diego and at Phœnix, El Paso, Fort Worth Kansas City and Chicago. Telegraphic messages are being transmitted constantly, day and night, along the Pacific Coast and as far east as El Paso, and messages are sent from there by night to and from the comparatively low-power stations so far installed at Fort Worth, Kansas City and Chicago. Since the recent establishment of a 30-KW. station at San Francisco, with two 440-ft. towers, it has been found possible to send messages direct from the coast to Fort Worth and Kansas City, and do away with the intermediate relays. Within the past few weeks a station has been completed at Honolulu, and every day from 1,000 to 4,000 words of news and private messages are sent thither by the San Francisco station. . . . This distance is more than 2,350 miles, and is the longest over which continuously successful wireless communication has ever been established. Furthermore, it is the longest single span of ocean necessary to cross in circling the globe, and forecasts trans-Pacific wireless communication in the near future. The power used at these Pacific coast stations is only a small fraction of that necessary for sending messages by the spark system across the 2,000 miles of ocean from Ireland to Nova Scotia.

"With the aid of mechanical transmitters and receivers, from 100 to 300 words per minute are accurately sent and received by the Poulsen system over distances of several hundred miles, and a method has been devised whereby two messages can be sent or two received simultaneously over the same antenna. The wave-lengths can be readily varied, and, as each station has its assigned wave-length to which it keeps its receiving apparatus attuned, messages can be sent to any point desired without troubling other stations. Or, if desired, all stations within range can receive the same message simultaneously. Messages sent by the Poulsen system are not read by the operators of other systems and the stations do not experience the interference from outside operators which is so troublesome a feature of the spark stations.

"In addition to telegraphic communication the Poulsen system has been proved successful for wireless telephony. I can personally attest the simplicity and clearness of this method of transmitting speech, having telephoned more than two years ago between Stockton and San Francisco, a distance of 80 miles over land. Subsequently speech has been carried in this way from San Francisco to Los Angeles, 450 miles, but as yet no thorough tests have been made of the system's telephonic possibilities, attention having been concentrated upon the telegraph."

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,664. "Dynamo-electric machines." Brolt, Ltd., B. Brooks and W. Holt. (Addition to 26,880, 1910.) December 2nd.

27,738. "Electric insulators." A. R. Muller. December 2nd.

27,758. "Regulating mechanism for electric distribution systems." British Thomson-Houston Co., Ltd., E. Garton and A. H. St. C. Watson. December 2nd.

27,765. "Electric lamps or torches. F. J. Turquand. December 2nd.

27,775. "Spring mounted footstep bearing for electricity meters." Korting and Mathiesen Akt. Ges. (Convention date, March 15th, 1912, Germany.) December 3rd. (Complete.)

27,780. "Thermostats for controlling electric circuits." A. W. Prim and F. W. Roper. December 3rd.

27,781. "Electric arc lamps." A. H. Railing and A. E. Angold. December 3rd.

27,783. "Electric lamps for automobiles." J. Gallay. December 3rd. (Complete.)

27,808. "Controlling switches for self-regulating dynamos." G. Inrig and G. Inrig, Ltd. December 3rd.

27,837. "Control of electric motors." F. E. Case. (Convention date, December 4th, 1911, United States.) December 3rd. (Complete.)

27,854. "Electrical switches." W. A. Knapton. December 3rd.

27,859. "Manufacture of tungsten." C. Gladitz. December 3rd.

27,874. "Electric switches." Siemens Bros. Dynamo Works, Ltd., and R. A. R. Bolton. December 3rd.

27,881. "Electric reduction of zinc ores." W. McA. Johnson. (Convention date, October 17th, 1912, United States.) December 3rd. (Complete.)

27,911. "Process and means for the production of electrotypes for letterpress printing." I. T. Nelson and J. Murray. December 4th.

27,922. "Electromagnetic lifting device." K. Miram. (Convention date, December 4th, 1911, Germany.) December 4th. (Complete.)

27,923. "Electric machines." Soc. S.T.A.R. (Systeme de Traction Auto-Regulateur). (Convention date, December 4th, 1911, France.) December 4th. (Complete.)

27,924. "Apparatus for the heating of liquids by means of electric resistance or gas." L. J. Simon. December 4th.

27,934. "Method for directing wireless radiations and means therefor." G. E. Heyl and T. T. Baker. December 4th.

27,956. "Starting devices for mercury vapour, electrometers, and the like." G. W. Johnson. (W. C. Heraeus, G.m.b.H., Germany.) December 4th.

27,961. "Devices for the automatic regulation of electric machines." R. Bosch (firm of). (Convention date, November 15th, 1912, Germany.) December 4th. (Complete.)

27,968. "Art of electrical smelting." G. H. Benjamin. December 4th. (Complete.)

27,969. "Telephone receivers." J. Schiessler. (Divided application on 4,407, 1912. February 21st.) December 4th. (Complete.)

28,006. "Device for automatically reversing connections of electric motors and like vehicles." C. H. Spencer. December 5th.

28,015. "Apparatus or appliances for use in connection with the electrodeposition of metals. A. Round and F. Fisher. (Addition to 15,492, 1912.) December 5th.

28,012. "System of duplex wireless telegraphy." S. D. Williams. December 5th.

28,046. "Electrically-heated cooking apparatus." A. F. Berry. December 5th.

28,061. "Electrical potential regulators." M. Fuss. (Addition to 7,220/11. Convention date, December 6th, 1911, Germany.) December 5th. (Complete.)

28,070. "Circuit arrangements for the reception of signals transmitted by means of electromagnetic waves." O. Imray. (Compagnie Generale Radiotelegraphique, France.) December 5th. (Complete.)

28,071. "Method of charging condensers in parallel and discharging them in series." O. Imray. (Compagnie Generale Radiotelegraphique, France.) December 5th. (Complete.)

28,086. "Electric storage batteries." G. O. Davies. December 5th.

28,094. "Joint boxes for electrical cables." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. December 5th. (Complete.)

28,100. "Trackway for electric telphers." S. Cutler, jun. December 5th.

28,118. "Electrical horns or like sounding devices." F. L. Hollister. December 5th.

28,122. "Electric arc lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) December 5th.

28,140. "Electric signalling system and appliances to be used therewith." Veritys, Ltd., and H. Green. December 6th.

28,152. "Electromagnets." E. C. Villiers. December 6th.

28,159. "Electric welding." W. A. E. Crombie. December 6th.

28,189. "Electro-medical physical developers and the like." R. Fox. December 6th.

28,222. "Starting device for induction motors." Phœnix Dynamo Manufacturing Co., Ltd., and R. Pohl. December 6th.

28,227. "Electrical measuring instruments." British Thomson-Houston Co., Ltd., and F. Holden. December 6th.

28,229. "Electric lighting systems." Soc. Internationale de Lumiere Froide (Procedes Dussaud). (Addition to 8,087, 1912. Convention date, December 8th, 1911, France.) December 6th. (Complete.)

28,284. "Electrical adaptor." S. R. Lloyd. December 7th.

28,300. "Electric lighting systems of railway carriages and other vehicles." Variable Speed Gear, Ltd., and J. Robson. December 7th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Refractory Metallic Bodies and their Manufacture. W. D. Coolidge. 18,467. August 15th. (August 15th, 1910.)

Electric Lighting Equipment for Personal Wear. H. H. Husch. 20,565. September 16th.

Electric Lighting of Vehicles. Compagnie Internationale d'Electricite Soc. Anon. 25,331. November 14th. (February 1st, 1911. Patent of Addition not granted.)

Electric Torsion Dynamometers. F. Lux. 25,337. November 14th.

Insulation of Electrical Coils or the like. Pollak (Specialfabrik fur Aluminium-Spulen und Leitungen Ges. m.b.H. 25,672. November 17th. (Convention date not granted.)

Electric Light Fittings for Attachment to Musical Instruments and Music Holders. P. R. J. Willis. (J. G. Mackenzie.) 25,756. November 18th.

Safety Devices for Electrical Installations. W. Dierman. 25,776. November 18th. (August 22nd, 1911.)

Apparatus for Measuring, Indicating and Determining the Charges incurred by a Consumer of Electrical Energy. E. T. R. Murray. 26,426. November 25th.

Starting Apparatus of Internal-combustion Engines. N. A. Christensen. 26,619. November 28th.

Control of Electric Motor-Generator Sets. British Thomson-Houston Co. and E. I. David. 26,863. November 30th.

Electrodes for Arc Lamps. British Thomson-Houston Co. (General Electric Co.) 27,620. December 8th.

Dynamo Electric Machines for Use in Electric Generative Systems of Motor Vehicles and the Like. B. Brooks and W. Holt. 28,137. December 14th. (Cognate application No. 13,396 of 1912.)

1912.

Sparking Plugs. G. Farina. 14,251. June 18th.

Electric Radiators. V. C. J. Nightingall. 16,506. July 15th. (March 19th, 1912.)

Arc Projectors. Korting & Mathiesen Akt.-Ges. 16,937. July 20th. (December 27th, 1911.)

Automatic Electric Shock Machine. L. Bauer and A. Ficker. 17,152. July 23rd.

Wireless Telegraph Transmitters. A. Shaw. 18,111. August 6th.

Arc Lamps. L. Kamm. 23,155. October 10th. (Divided application on No. 24,333, 1911. November 2nd.)

Joint for the Metallic Coverings of Insulated Electric Wires. F. J. Whiting. 81. January 1st.

Incandescent Electric Lamps. T. W. Lowden. 1,180. January 15th.

Electric Power Transmission Apparatus. Macfarlane Engineering Co. and W. A. Macfarlane. 2,817. February 3rd.

Hygienic Attachment or Cover for Telephone Mouthpieces. F. M. Stanton. 2,992. February 5th.

Pyrophorous Metal Alloys. Elektrochemische Werke Ges. 3,350. February 9th. (March 28th, 1911.)

Electric Couplings or Connectors. J. Wilkie. 3,772. February 15th. (July 9th, 1912.)

Electric Searchlights. Geb. Siemens & Co. 3,812. February 15th. (April 29th, 1911.)

Arc Lamps for Optical Lanterns. F. W. Branson. 4,431. February 22nd.

Intercommunication Telephone Systems. H. G. White and I. H. Parsons. 5,035. February 29th.

Brush holders for Magneto Machines for Electric Ignition. A. G. Bloxham. (Robert Bosch, Firm of). 5,146. March 4th.

Apparatus for the Electro-deposition of Iron. G. Tischenko. 5,851. March 8th.

Carbon Electrodes for Electric Furnaces. Planiawerke Akt.-Ges. fur Kohlenfabrikation. 14,267. June 18th. (July 21st, 1911.)

Electrical Contact Plugs for Switchboards or the Like, and the Method of Producing the Same. M. B. Richter. 16,141. July 10th. (July 10th, 1911.)

Illuminated Indicating Device or Sign. R. H. Hutchison and Fred. Wilkins and Brother, Ltd. 161. January 2nd.

Electric Fuses. C. H. Wordingham and E. R. Grote. 1,389. January 17th.

Methods of Neutralising Electric Charges formed on Textiles, Fibres, Paper and like Materials during the Working Processes. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 1,555. January 19th.

Electric Arc Lamps. E. E. Prestwich. 1,980. January 24th.

Means for Governing the Speed of Alternating-Current Commutator Machines. H. C. E. Jacoby. 3,007. February 6th. (Addition to No. 23,619 of 1909.)

Dynamo-electric Machines of the Homopolar Type. British Thomson-Houston Co. (Noeggerath.) 4,186. February 19th.

Switch-locking Arrangements on Switchboards used in Connection with Electrical Installations on Motor-cars and like Vehicles. C. A. Vandervell and A. H. Midgley. 4,682. February 24th.

Electrically-operated Means or Devices for Exhibiting Advertisements, Pictures, Notices or the Like. H. F. Joel. 4,974. February 28th.

Telephone Metering Systems. A. J. Boult. (International Telechronometer Co.) 5,972. March 9th.

Remote-controlled Electric Switches. H. G. C. Fairweather. (Hart Manufacturing Co.) 10,838. May 7th.

Means for Attaching Electric Wires and Cables to Insulators. T. Taylor. 15,324. July 1st.

Circuit Connections for Alternating-current Commutator Motors. Siemens Schuckertwerke G.m.b.H. 16,790. July 18th. (July 18th, 1911.)

Process and Apparatus for the Supply of Mica Flakes to Machines for making Composite Mica Plates. M. Meirowsky and Meirowsky & Co. Akt.-Ges. 17,332. July 25th.

Automatic Sectionalising Devices for Electric Distributing Systems. L. A. Hawkins. 21,264. September 18th. (September 11th, 1911.)

Method of Preventing Cathodic Reduction. A. Pietzsch and G. Adolph. 22,028. September 7th. (October 7th, 1911.)

New York's 30 Years of Electric Supply.—*The Electrical Review and Western Electrician* recently recalled the fact that September 4th last was the thirtieth anniversary of the beginning of commercial incandescent electric lighting, for in 1882 Mr. Edison commenced in New York his first central station, with a single 125-H.P. generator, which supplied some 400 lamps in an area of less than a square mile, through underground cables. Thirty years of commercial growth has seen the system of the Edison Co. become one of 1,300 miles of cable (360 being H.T. transmission cables), while the incandescent lamps in use now number 5,245,000, the connected load equalling 714,000 H.P. The system now covers an area of about 60 square miles in Manhattan and Bronx, supplied from the Waterside stations built in 1900 and 1905, and forms an interesting comparison with the original Edison plan, calling for 36 independent L.T. steam stations. So far as figures are available, it appears that the connected load for lighting and power (exclusive of traction) in the London area is something like 600,000 H.P. The recent return relating to London's electricity supply for the year 1910-11 shows that the total number of units sold for municipalities and companies (excluding traction supply) was 231,169,502, and that the capacity of the generating plant was 228,000 KW.

THE

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ELECTRICAL REVIEW.

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THE WOOLWICH LOAN.

The agenda paper of the London County Council for Tuesday, December 17th, contained a long report from the Finance Committee to the Council with regard to the application for a loan of £40,000 by the Woolwich Metropolitan Borough Council.

Set out briefly, the facts are as follows: In March of this year Woolwich applied for £36,570 to extend its electricity undertaking in order to meet further demands. In view of the unsatisfactory results of the undertaking, the County Council suggested that Woolwich should obtain expert advice on the undertaking generally. This was done, and the advice received was to abandon one of the two existing generating stations, viz., Plumstead, to extend the Globe Lane station, and to increase the loan application from the figures given above to £50,000, when, on the basis of carefully prepared estimates, it appeared that the present loss of £16,000 per annum would be reduced to about £9,561. Further consultations resulted in a reduction of the proposed capital expenditure from £50,000 to £40,000 by removing some of the plant from the station to be abandoned at Plumstead, and fixing this plant at Globe Lane, *the cost of removal being charged to revenue*—the revenue, as noted above, being £16,000 deficit (or as actually printed in the latest return issued by the statistical officer of the L.C.C., £16,813, aggregating since the undertaking has been in the hands of the Borough Council a deficit of £106,318). The consulting engineer also considered the question of taking a partial bulk supply, which would have involved a capital expenditure of £16,330, upon which the L.C.C. Finance Committee made the comment, "even if the Borough Council's estimates are fully realised, as to which there is considerable doubt, the scheme proposed is only slightly more favourable than the partial bulk supply scheme, while it has the great disadvantage of involving much larger capital expenditure." The Borough Council, however, definitely declined to adopt the partial bulk supply scheme.

The only redeeming feature about the whole business is the undoubted increase of output, which must be met to enable Woolwich to meet its obligations in the matter of electricity supply—obligations as to keeping down the rates are, of course, a secondary consideration now that the elections are over. After dealing with the question of certain outstanding loans on the machinery to be abandoned, and the early repayment thereof, the L.C.C. Finance Committee said: "We do not feel that the County Council can in this case decline to sanction the application," and therefore appended a form of recommendation that a substantial amount on account be sanctioned, which was duly agreed to.

Evidently the whole matter has been very carefully looked into; the very great and grave cause for regret is the sad financial position in which municipal mismanagement has engulfed this enterprise—in a district, curiously enough, where some of the largest and most prosperous electrical manufacturers have their works. It will be remembered that the Borough Council purchased the Globe Lane Works from the Woolwich District Electric Light Co. in 1903 for £79,700, some 10 years after the establishment of the works by the company, which had paid a dividend of 5 per cent. in 1900 and of 6 per cent. in 1901, so that the business has now been in existence for some 19 years, involving during the last nine years losses, as stated above, which total £106,318, with a present annual loss of £16,813. We search in vain amongst the statistical columns of a contemporary, whose every sentiment is in favour of municipal ownership, to see the Woolwich figures. The name does not appear with the other metropolitan undertakings owned by Local Authorities; its absence naturally gives rise to the question, Why? Information, however, is provided in abundance in the complete return dated 1910-11 issued by the County Council, from which we have previously quoted. Here it is seen that the units sold for the year amounted to 2,889,022, with a load factor of 26·79, the highest figure under the latter heading in London except one. With such figures again a question forces itself upon us: Why the disastrous results? It is at all times a pleasure to us to know that electrical enterprise is expanding, that output is increasing, and that means must, of necessity, be found to meet the demands of new consumers, but we have never hesitated to condemn such a profligate policy as is here set forth. We acquiesce in the advice tendered by the Finance Committee of the County Council to limit further capital expenditure, and purchase the additional energy required in bulk; this would give time to reflect and opportunity to reform some weaknesses of the system which have led to the existing drain on the ratepayers, but whilst "system" that is unsound continues, it is a practical impossibility for an engineering scheme, no matter how good, to succeed, and we cannot help doubting the wisdom of the County Council's decision to lend the money without availing itself of its option to refer the question to the Local Government Board, who would hold an inquiry in open Court, and afford the Woolwich ratepayers an opportunity of expressing their views.

The whole matter brings to our mind the words of Maud Muller—

> For of all sad words of tongue or pen,
> The saddest are these: "It might have been."

To which *Truth* added a further stanza—

> Far sadder still are some things I've seen,
> Which are but never ought to have been.

THE PREVENTION OF CORRUPTION ACT.

We have before us "News Sheet No. 25" of the Secret Commissions and Bribery Prevention League, giving counsel's opinion on certain cases submitted by the Society.

The first case is that of a quite independent third party introducing buyer and seller and receiving a commission on the transaction. It is a relief to find that counsel's opinion is that such a commission is legitimate. But why counsel's opinion should be necessary on such a point we cannot imagine. The second case submitted is that of a wholesaler delivering goods to a shipper and sending him two invoices—one a "show-er and the other a blower," as the Irishman said about his two pocket-handkerchiefs.

The "shower" indicates a small cash discount which the shipper allows to his customer abroad.

The "blower" shows the real trade discounts, and is the basis for the shipper's cheque. Some one is evidently itching to say that this is illegal, but he contents himself by saying that if the shipper proved to be in a fiduciary capacity to the actual buyer abroad, and were pocketing a secret discount in addition to what his principal allowed, he would render himself liable under the Act. With that, of course, we entirely agree; but we do not agree that the wholesaler is concerned to inquire whether the shipper, who is actually his customer, occupies such a fiduciary position or not. We should suppose that if he asked any such question he might expect to be told to mind his own business.

Other cases include that of a builder who claims trade discount on ironmongery supplied to him to fix by the owner, to whom, of course, he is not in a fiduciary position. A separate commission note to a merchant is questioned, apparently on the sole ground that it is not to be disclosed to the actual foreign purchaser.

Counsel's opinion is clear, that the whole essence of the question is that of the relationship between the intermediary and the final buyer. Are they as defined by the Act, principal and agent? Counsel says it would be for the Court to decide whether the wholesaler knew, or ought to have known, that such a relationship existed, before giving his two invoices or his commission note. We confess that we are rather surprised that these elementary questions are occupying the energies of the Society and its advisers. They would be wiser to leave alone the ordinary and everyday transactions of commerce, when absolutely free from corruption.

We gather from the Press that they are intervening on the subject of tradesmen's corrupt Christmas boxes to domestic servants, by issuing declaration forms, to be signed by both servant and tradesman, which, no doubt, they will sign with perfect composure. But we are still awaiting the onslaught of the Society upon those larger offenders who, while chiefly in the service of the public bodies, continue to extort large quantities of blackmail on every possible occasion, and to ruin those who refuse it, by means of the "club clauses" in their iniquitous contracts; while they regard the Act as one of the best cloaks ever bestowed upon hypocrisy to cover sin.

Neither the Act nor the Society appears to have any effective machinery for "finding out," and that is the weak point. The result is that the Society, by fussing over trumpery offences, and calling in question such perfectly legitimate, regular and almost universal commercial operations as those referred to, still further lowers the effective force of the Act for any practical good.

India Paper: An Example. The first India paper copy of the *Transactions* of the American Society of Civil Engineers has arrived. It contains 1,230 pages, and, with a considerable number of folded plates on thicker paper, can be pinched down to $\frac{7}{8}$ in. thickness between thumb and finger. If the Americans do this, why not ourselves? All our Institutions and Societies use respectably thick paper, and annually fill many feet of bookshelves that would be better occupied by India paper volumes.

The paper used is such that 50 leaves go to $\frac{1}{16}$th in., or 800 to the inch. This is a fairly thin quality, yet it is quite sufficiently opaque for comfortable reading. The sheets of the folding plates are heavier. The innovation is most commendable, as possessors of the thin edition of the "Encyclopædia Britannica" must have found.

For engineers, who are so nomadic, the use of thin-paper editions is truly valuable, if a man requires to carry any of his library with him.

THE COMMERCIAL DEVELOPMENT OF ELECTRICITY SUPPLY.

V.—The Joint Publicity Committee.

The purpose of the publication of these articles is to assist in the arousing of the electric supply industry to a proper sense of the urgent need for reform in business methods, and the establishment of future development on thoroughly sound and practical lines. Individual authorities are at present blindly groping for a solution of the problem from various standpoints, and throughout the industry there is a general feeling of helplessness and inability to grapple with the situation. The vital importance of the subject is apparent from the fact that it is being dealt with in various ways by the entire electrical Press, and honest endeavours of this nature for the betterment of the industry should at least be recognised as such.

In the opening remarks of the first article of this series brief mention was made of the operations of the Electric Supply Publicity Committee, and while due acknowledgment was made to those gentlemen of the executive who have so generously given their services gratuitously to the work of the Committee, it was pointed out that the formation of a far more effective organisation was imperative to meet the immediate and growing requirements of the electricity supply industry. We have reason for believing that the opinion thus expressed is endorsed in the main in many quarters, and in any case we contend that the remarks are fair comment and of general interest. Anxious as we are to support by all means in our power the furtherance of the interests of electricity supply, it would be absurd for us to disparage any well-intentioned effort to that end, but it is realised that the Electric Supply Publicity Committee's activities are not sufficiently effective or convincing. In taking a broad view of the whole situation, it was intended to confine our remarks on this subject to the passing reference in the first article, but as a letter in the nature of a protest has since appeared in our "Correspondence" columns from Mr. Cramb, who holds the position of vice-chairman of the Committee, a return to the subject has become to a certain extent necessary.

Dealing with the constitution of the Committee, it is admitted that the gentlemen composing the executive hold high administrative positions on important electric supply undertakings, and are undoubtedly well versed in the duties of their respective offices, but it is logical to conclude that such duties absorb practically the whole of their available time and energies, leaving but a small margin for devoting to the emancipation of their brethren who are struggling with the difficulties of efficient organisation. The letter of protest above mentioned commences with the inference that contributors to the electrical Press on the subject of commercial development are ignorant of essential conditions. This is hardly fair or courteous, as it must be evident to the members of the Committee, and the industry generally, that at least equal knowledge of the subject is possessed by many men actively engaged in administrative duties, but who have not assisted at the deliberations of the Electric Supply Publicity Committee.

It is hardly reassuring to those whose support is invited to learn that the Committee which professes to be in a position to perfect the organisation of others, has not been able to complete its own internal organisation. It is understood that a complete scheme was drawn up at the inception of the Committee, but the difficulties met with must have been very real, and practically insurmountable, as they have prevented all but the pamphleteering section being put into operation. This being the net result of nearly three years of organisation, it would be interesting to estimate in how many years, at the present sectional rate of progress, the advantages of the complete scheme will be available to the electric supply industry generally.

Returning to the constitution of the Committee, from whatever cause, the fact remains that the General Committee is comprised, with few exceptions, of gentlemen whose interests are identified with the fortunes of London and suburban undertakings, and one of the chief obstacles to the operation of the Committee's complete scheme appears to be the prevention by Government auditors of financial contributions by London boroughs. This being so, why does not the Committee devote its energies to the disposal of difficulties on home ground? Unless such difficulties are dealt with in a practical manner, it will become increasingly difficult for the Committee to convince the industry that the solicitude for the general welfare is sincere, as already provincial authorities do not feel assured that their interests can be adequately served by the Committee.

If a really valuable comprehensive scheme has been formulated in the past, it surely would not suffer by being brought into the open, but, on the other hand, if approved by supply authorities and other bodies whose interests are allied, it might result in the acquisition of the support so ardently solicited. As matters stand at present, the procedure of the Committee is very similar to asking a man to buy a pig in a poke, and by continuing to hide the light under a bushel, the Committee calls upon its collective head sarcastic comment, cheap and otherwise, which the vice-chairman so strongly resents. Honest criticism exerts considerable influence for good, although from constant reiteration it may appear "sheep-like" to the irritated recipient.

Borrowing this simile, and quoting further from the letter in question, a "bleat" will be noted in regard to the refractory conduct of manufacturers. It is stated that as they have not subscribed literally to the funds of the Committee, they have not realised their responsibilities. By this it is assumed that these responsibilities actually exist, but manufacturers will no doubt contend that in this view their intelligence is computed at a very low estimate. Generally speaking, they are shrewd business men, whose profits are cut fine in the face of keen competition, and who are beset by many harassing details. Until convinced that concrete benefit will result, they cannot be reasonably expected to commit themselves to liberal subscriptions to the funds of the Electric Supply Committee. Their support is also contingent on the publication of the complete propaganda, and at present they are not rushing in where supply angels fear to tread.

The intimate connection between the interests of manufacturers and contractors is also an important point to consider when discussing the question of contributions. The latter community is not yet in a peaceful frame of mind in regard to the designs of a section of the electric supply industry upon its business, and until a definite understanding has been arrived at, a co-operative policy will be difficult to formulate. Both manufacturers and contractors fully realise that measures adopted for promoting an extended use of current must benefit them materially, and, given assurance that honest co-operation was fully intended, both bodies would undoubtedly welcome, and liberally support, an organisation in a position to put a scheme into practice.

With regard to gas interests, the Vice-Chairman of the Committee falls into the "sheeplike" error of repeating the fallacy that gas companies have been driven to combine by realisation that they are fighting for existence. By the attraction of their attention to the puny efforts of the Electric Supply Publicity Committee, the gas companies realised that their immense resources placed them in a very favourable position to organise a thoroughly powerful association which would consolidate their strength. The wise counsels which are brought to bear in the administration of gas companies have taken the precaution of preventing, as far as possible, the weakening of their strong position, and their descent to the penurious condition common to many electric supply undertakings.

Smug self-satisfaction is the bane of electricity supply, and, unless the present significant warnings are heeded, may prove the undoing of many. The satisfaction of members of the Electric Supply Publicity Committee should be tempered with the realisation that in their trifling with the organisation problem they have raised a Frankenstein in the Commercial Gas Association, and, unless they realise the gravity of the situation, the support which they are in a position to give to the electricity supply industry in combatting the activities of the monster will be as serviceable as a pea-shooter in the hands of a man opposed to an adversary armed with a Mauser pistol. The vaunted increase of business may become a vanishing quantity when the forces of the Commercial Gas Association are equipped to carry the war permanently into the competitive camp. In the course of another "bleat" a line of argument is put forward which will not appeal very forcibly to business men. In effect, criticism of the methods of the Committee is unwarranted until, having been provided with sufficient funds, the Committee has been unable to give value for the money. The position of authorities who have handed over money which most can ill-afford, would, therefore, be similar to that of the man who is granted the privilege of locking the stable door from which his horse has been stolen. On the evidence of the vice-chairman, the Committee apparently wishes to work on autocratic lines, and it yet remains to be proved that such an attitude commends itself to the industry generally. It is fully realised by those who, in spite of opinion to the contrary, are not ignorant of essential conditions, that the formulation of a complete scheme involving the co-ordination of existing forces is not an easy matter, and it is also equally realised that the existing organisation of the Electric Supply Publicity Committee does not inspire hope that such a scheme will materialise in the immediate future. The Committee cannot accomplish impossibilities, and no one of the many critics would be idiotic enough to expect it to do so. To expect the Committee to spend huge sums on advertising, and to do many other things which can only be carried out when a proper technical staff is at command, would be absurd.

To sum up the situation it must be admitted that the Committee, after nearly three years' existence, has not even the lukewarm support of the industry. The position might have been greatly improved had the Committee openly stated the details of the complete scheme, and given the industry an opportunity of estimating the value of its proposals. Confidence begets confidence. As professional pamphleteers, the members of the Committee have attained a certain degree of proficiency, but even present supporters would, no doubt, excuse some cessation of activity in this direction if a start were made on another section.

Even if a complete scheme were formulated in the past, there is no guarantee that such a scheme would be of a suitable nature to meet the requirements of the present time and of the immediate future. The characteristics of electricity supply are now rapidly varying, and only those who have closely studied the commercial situation from an expert point of view are in a position to shape the policy of future development. Emphasis must, therefore, be given to our previous assertion that spare time and intermittent effort is merely wasting valuable time, and wearying to those who are anxiously looking for real assistance. The industry generally appreciates the fact that the problem can only satisfactorily be dealt with by the application of permanent and unremitting expert ability.

The Publicity Committee excuse their lack of progress on the ground that, owing to the withholding of financial support, it has been impossible to establish the necessary expert technical staff. Potential subscribers contend that the non-existence of such a staff precludes the possibility of receiving value for their money. Thus a deadlock has arisen, and a satisfactory settlement appears to be no nearer accomplishment as the years pass. Speculation naturally arises in the mind of the average supply man as to whether this position is to be maintained indefinitely, and the internal difficulties of the Committee are to be allowed to retard the progress of the whole industry. The adherence to a Micawber-like policy at the present critical juncture will, no doubt, have a serious effect on future expansion, and it is difficult to satisfactorily account for the complacent attitude of the Committee in the light of recent events.

What is really needed, and will become an accomplished fact, perhaps without the acquiescence of the Committee, unless that body rises to the occasion, is an association with a permanent staff selected from those possessing the highest expert commercial organising ability in the electric supply world. An association so equipped would be eagerly welcomed and assured of adequate financial support. Its practical utility for the serious work to be coped with would engender the confidence of supply authorities and others whose interests are concerned. Even pamphleteering under expert guidance would be materially improved, and the general smoothing of the rough commercial path of the harassed supply engineer would be gratefully appreciated. Compilation of statistics should be an important branch of the work of a real development association. At present a custom prevails among municipal managers of circularising their *confrères* for information on various matters and tabulating replies. Although possibly convenient, it is at the best a rather cumbersome proceeding, and often a source of irritation to the recipients of the lists of queries if carried out to any great extent. The existence of a statistical branch to which reference could be made, and from which information could be promptly received, would save much time, labour, and mental stress.

A thoroughly organised development association would also be in a position to act in an advisory capacity on commercial matters generally, and many instances of difficulties similar to the above will readily occur to those who have up to the present been compelled to flounder along unaided. With expert assistance assured, it may be safely assumed that the supply industry would only be too glad to avail itself of the advantages to be obtained by rendering the requisite financial support.

The adoption and recommendation of apparatus, more especially for domestic purposes, is with most supply authorities rather a haphazard proceeding. Manufacturers are more or less working in the dark, and their goods are disposed of more on the strength of the maker's reputation than on practical knowledge of the construction and performances. Selection of the most suitable apparatus may thus prove a tedious and costly process to all concerned, and might well be simplified by the existence of a central body who could undertake the examination and testing of all types of apparatus likely to be of service. In addition to conferring a distinct advantage on the electricity supply industry, the interest of manufacturers would also be served by the pointing out of unsatisfactory details, and the direction of energies into the right channels.

Among other leading duties of a development association should be the education of the supply industry to the importance of exhibition and showroom details, and the proper recognition of an efficient business-getting staff. These matters have up to the present received but scant attention, and are but imperfectly understood. This position is largely due to the fact that in no quarter has authoritative advice been available, and the blind have been turning to the blind for guidance. Although overlooked or disregarded in the past, the right material is in existence for the formulation of at least a nucleus of a really effective development association, and the sooner such material is usefully employed, the better will be the outlook for the welfare of electricity supply. We feel that in continuing to offer the advice "Wake up, Electricity Supply!" we are acting in the best interests of the industry, and at the risk of being deemed monotonous, and in all probability arousing resentment in some quarters, we intend to point out the weakness and disadvantages of the present system. At the same time we do not profess to be in a position to offer a complete panacea for all the existing ailments, as we are of the opinion that the adoption of curative measures must be the result of a consensus of expert opinion, but we are anxious to do all that lies in our power to assist in deliberations to that end, and in taking this stand our advice to the somewhat invertebrate Joint Publicity Committee is: "Get on or get out."

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Hal" asks: "Is it compulsory for a company (running an electricity supply undertaking under provisional orders, granted under the 1882 and 1896 Acts) to comply with the *local building by-laws*, such undertaking not being within the area of the London County Council?"

⁂ If there are any building by-laws in force in any district outside the metropolis, it is presumed that they will apply equally to all persons and companies in that district. The mere fact that a company is working under the provisions of a private Act will not exempt it from liability to observe those by-laws.

A PLEA FOR THE USE OF HIGH-TENSION CONSTANT CONTINUOUS CURRENTS IN MINES.

By SYDNEY F. WALKER, R.N., M.I.E.E.

It is common knowledge that electricity is used all over the world in mines for lighting and power transmission. It is also well known that in the great majority of mines three-phase alternating current is employed. Further, it is also common knowledge that, owing to the large areas served by each pair of shafts in the case of coal mines, and the great depths and large areas in the case of metalliferous mines, it has become absolutely necessary to employ high-tension, and, in the great majority of cases, extra-high-tension; 2,000 volts has been employed in mines for a long time, 3,000 volts has also been employed for a number of years, and 6,000 volts is quite common for distribution to groups of mines from a central generating station. The generating stations of large mines, and of groups of mines, compare very favourably in regard to size with those of a great many towns. An installation of 5,000 KW. for a group of mines is quite common, while the power generated at stations supplying mines of various kinds ranges from a figure above 5,000 KW. down to very small figures—under 100 KW.

High-tension, and extra-high-tension, three-phase current has captured the mining field for two reasons. It lends itself so very conveniently to transformation, from higher to lower pressures, and *vice versâ*. In the second place, with the exception of M. Thury's method of using high-tension continuous current, there has been no other system available; and while M. Thury has been very busy, developing his system, and his works, continually enlarged, have been kept fully employed, no one has apparently taken much interest in it in this country. The present writer raised the question in the discussion upon Mr. Robert Nelson's paper before the Institution of Mining Engineers in 1909, but Mr. Nelson, in reply, appeared to ridicule the idea. Since then a great step has been made towards the attainment of a footing in the United Kingdom for the high-tension continuous-current system, by its adoption by Mr. Highfield, in connection with the Metropolitan Electric Supply Co.'s transmission. The writer understands that the Board of Trade have sanctioned the use of a pressure, with high-tension continuous current, by the Metropolitan Co., of 170,000 volts; and, further, that they have allowed the Metropolitan Co. to use "earth," practically as they choose, for 12 months, in order to carry out necessary experiments. It may, perhaps, be as well to outline briefly, the difference between the method of working by high-tension continuous current, and by three-phase alternating current. With three-phase alternating current, it will be remembered, the generators are connected to the bus-bars in parallel, and the feeders are also connected to the bus-bars in parallel; and any service that is required, whether for lighting or power, is connected either to the three phases, again in parallel, or between two of them. If no current is being taken for lighting or power, there is an open circuit between all the feeders.

With the high-tension constant-continuous current there is always a closed circuit. The generators are connected in the circuit, in series; any service that is required, either for lighting or power, has also to be connected in the circuit in series. A generator or a motor that is out of service is short-circuited, and either is put into service by opening the short-circuiting switch.

With the three-phase method of distribution, every effort is made to maintain the pressure as nearly as possible constant at the terminals of lamps and motors taking current from the feeders.

With the high-tension continuous-current system, the strength of the current is maintained as constant as practical working will allow. It is maintained as constant as the pressure is maintained with the three-phase system.

With the three-phase system, if any considerable amount of load is suddenly switched on, the pressure at the bus-bars is lowered, and the engineer in charge of the generating station provides the additional current necessary, either by allowing one or more of the generators to furnish more current, or by running up an additional generator and connecting it to the bus-bars.

In the high-tension continuous-current system, if any considerable load is suddenly thrown into service, the strength of the current passing throughout the circuit is reduced, and the engineer in charge of the generating station takes the necessary steps to add to the pressure, so as to bring the current up to its proper strength. He does so by either increasing the pressure furnished by one or more of the generators already in service or by running up another generator, exciting it, and switching it into the circuit.

The Advantages of the High-Tension Constant Continuous-Current System.

As the writer understands them, the following are some of the advantages of the high-tension continuous-current system, as developed by M. Thury, over the three-phase system.

In the first place, there are two cables everywhere, instead of three. This in itself is a great advantage in mining work. Those who have any experience of mining will appreciate the great importance of keeping everything as simple as possible. Everyone who has had anything to do with making connections to three-phase plant, particularly in the awkward positions in a mine, where sometimes connections have to be made, will appreciate the advantage of the greater simplicity of two cables over three. We do not know, it is probable we never shall know, how many fatal accidents have been caused indirectly, by mistakes in connecting up three-phase apparatus quickly, in a flurry, and with the service alive.

In the second place, it appears to the writer to be a very great advantage that while, with the three-phase system, the full pressure of the service, less, of course, any drop in voltage due to the passage of the current through the conductors on its way to any particular apparatus, is present everywhere, with the high-tension constant continuous-current system, the full pressure between the two cables is only present near the switchboard. As the switchboard is receded from, the difference of pressure between the two cables decreases. In mining work, this again appears to the writer to be a matter of considerable importance, seeing that at the face of the coal, after allowing for all special arrangements for supplying the different districts, the pressure existing between the two conductors of the service, would be comparatively small. Next, it will be remembered that with the three-cored cable almost universally employed with three-phase work, there are six times as many chances of a "short" as there are with the high-tension constant continuous-current service. With a three-core cable there is the possibility of a "short" between any two of the three cables, and between any one of them and the lead sheath or armour. The difference of pressure between either of the conductors and the lead sheath or armour, presuming the neutral to be "earthed," is of course only 58 per cent. of the pressure between any two of the conductors, but as with a 3,000-volt service this means 1,740 volts, the effects of a "short" to the armour are sufficiently disastrous to that core to cause trouble in the other cores and in the cable generally, owing to the heat liberated by the current passing up to the "short," and possibly the arc at the "short."

A point may be noted in connection with this which M. Thury has mentioned. With three-phase parallel working, if a "short" occurs anywhere between two phases, the whole service is put out of gear until the "short" is taken off, and the cable repaired. Even when a short occurs between one core and the armour, it is more than probable that the whole of the service will be temporarily put out of gear, owing to the liberation of heat mentioned above. With the high-tension constant continuous-current system, the only effect of a "short" between the two cables anywhere, is the cutting out of the apparatus previously in service beyond the "short."

Next, there is the question of armouring. The Home Office evidently favours the use of armour very strongly. The present writer has no need again to repeat his objections to the use of armour. He will only mention here that the

Home Office has very wisely decreed that the armour must be "earthed" on the surface; and that it must be maintained absolutely continuous. As readers of what the writer has written upon the above subject will be aware, this is one of his greatest objections to the use of armour. If the armour is "earthed" at the surface, say, and is continuous from the surface to the pit bottom, and thence perhaps along the main roads where falls are not likely; if a fall occurs further in-bye, and the cable is broken, as so frequently happens, it is a matter of very great difficulty to thoroughly repair the armour; so that the conducting earth path by way of the armour, wisely insisted upon by the Home Office, is not easily arranged beyond the break. As he has also pointed out, it is particularly difficult to make the armour good when a break occurs in a three-phase cable. Joint boxes, of course, may be used, but for a joint box to be of any service, for three-phase cables, it must be fairly heavy, and the writer submits, it is not an easy thing even with joint boxes, to keep the armour thoroughly continuous on three-core cables. Their use if frequent, might add seriously to the sheath losses referred to below. On the other hand, with high-tension constant continuous-current working, if the concentric system is adopted, as would be convenient, it would be absolutely necessary that the armour, and the outer conductor, which are virtually one, electrically speaking, should be properly jointed. Unless the outer conductor was properly jointed, the resistance in the circuit would be increased, and if the joint was a very bad one, it might mean a severance of the circuit, so that the whole system was put out of gear for the time.

Some years ago, when the concentric system was developed in connection with parallel working of the medium pressure continuous currents, it was claimed by the eminent firm who had worked it out, and who were exploiting it, that the system prevented, or at any rate, very considerably lessened the possibility of shock. It appears to the present writer that if concentric cables were adopted with the high-tension contant continuous-current system, the chance of shock would be reduced to an absolute minimum, and with a reasonable amount of care in looking after the apparatus, should be practically eliminated.

It should be remembered also that the chances of shock with the high-tension constant continuous-current system, would be considerably lessened in the working of most mines, by the fact that the pressure between the live cable and the return conductor, the outer, would be lessening all the way from the surface to the workings.

Further, it should be perfectly practicable to arrange that it was very difficult, indeed, for anyone to get a shock under conditions similar to those ruling where so many shocks have been received in mines during the last 10 years. It will be remembered that a great number of fatal shocks have been received by men touching metal objects which ought to have been perfectly harmless. Thus, a man taking hold of the haulage rope of a coal-cutting machine, received a shock which killed him, because one of the conductors of the three-cored trailing cable had become connected to the case of the motor. Apparently it had been impossible to protect it by "earthing." With what may be termed very ordinary precautions, with precautions that can easily be taken in every mine, and which every electrician about a mine knows how to arrange, and which many colliery managers know also how to arrange, such an accident as the above should be rendered practically impossible with H.T. constant continuous-current and concentric cables. In another case, it will be remembered, some men received a shock by touching signal wires, which had themselves become connected to the three-phase service. The writer believes he is correct in saying that, in that case, the armour of the three-phase service had become alive, and that the electric signal wires had touched either the live armour, or some other metal which was making contact with the live armour at some other part of the mine. With the high-tension constant continuous-current system, worked with concentric cables, it should be almost impossible for such a case as this to occur.

But when referring to the question of shock, it should not be forgotten that, in mining work, under certain conditions that may easily arise, it has been shown to be practically impossible to guard everyone from the chance of receiving a fatal shock with three-phase currents. Readers of the Electrical Review will doubtless remember the paper read by Mr. W. Wellesley Wood before the Newcastle Section of the I.E.E., upon "Earthed *v.* Insulated Neutrals in Colliery Installations." In the volume of *Transactions* in which the paper is printed, a diagram is given, in which a case is shown where a man actually received a severe shock, fortunately not fatal, but which, under quite ordinary circumstances, might have been fatal, from *touching the case of a three-phase electric motor that was connected to earth.*

As will be seen from the diagram, particular care had been taken to efficiently "earth" the motor, and strictly in accordance with the new Home Office Rules. The motor was connected by means of an "earthed" wire to an "earth" on the surface, to which also the neutral of the generator was connected. The liability to shock arose from the fact, to which the writer has frequently called attention in the *Transactions* of the Institute of Mining Engineers and elsewhere, viz., that the strata of a mine vary in their electrical properties. In the mine in question there was a considerable thickness of high-resistance strata between the surface and the coal seam in which the motor in question was fixed. Further, the ground upon which the motor was standing was also of high resistance. Consequently, when a leak to "earth" developed upon one of the cables of the three-phase motor, "earth," or, as the far more expressive American term "ground" would more properly describe it, became alive. Ground in the neighbourhood of the motor was in more or less direct connection with one phase of the supply service; while the case of the motor itself was in direct connection with the "earthed" neutral. Hence, a man standing on the ground, and touching the case, would get a more or less severe shock, depending entirely upon the nature of the ground, and the resistance of the fault.

It may be objected that something of this kind might occur with high-tension continuous currents. The reply is that it is not as likely to occur; and in any case, there are three chances of the conditions arising, necessary for a shock between ground and the motor case, with three-phase working, to one with high-tension continuous-current working.

The Question of Economy.

And behind all this there is the question of economy. There will, of course, be cases where three-phase working may be more economical for special reasons, than high-tension constant continuous current, but a little consideration of the matter will show, the writer believes, that economy is all in favour of the latter. The volumes of *Transactions* of the Institution of Electrical Engineers for some years past, are full of very ably written papers, by men who have taken a great deal of trouble to investigate the sources of loss in distribution cables in towns, in which high-tension alternating currents are employed. Mining work is not town work; but as anyone who has followed mining work and town work closely will know, mining work has copied town work to a very considerable extent. When mine owners were persuaded that switchboards were necessary, the first switchboards that were fixed were designed on exactly the same lines as those that were then in use in town generating stations. In fact, it would not be too much to say, in the writer's opinion, that a good many of the troubles that have arisen in connection with the use of electricity in mines, have been due to the fact that the designers of the mining plant have not appreciated the difference between the conditions ruling in mines and those ruling in towns. There are certain conditions, however, that are common to both. With both town supply services and mining electric power services, the same conditions rule up to a certain point. Where three-phase currents are employed it has become the common practice to use three-core cables in nearly every case, the cables being armoured, with single or double armour, according to the fancy of the engineer. It has been shown very clearly in the papers which have been presented to the Institution of Electrical Engineers by Mr. Mordey, Mr. M. B. Field, Mr. Miles Walker, and others, that there are several important sources of loss, wherever alternating currents are employed. There is the well-known transformer loss. The writer is mentioning that first, because it is the smallest source of loss in the great majority of mines. It is the common practice to take the 2,000 or 3,000 volts directly from the service to the motors driving haulage, fans and pumps, where the power is above a certain figure; and in those cases there are no losses due to the transformer magnetisation currents. In all groups of mines, however, there are a certain number of transformers, it is so convenient to transform down to some low pressure for a particular service, and the transformer losses may be in some cases at least appreciable.

There are the more important losses, however, in the cables themselves; the loss due to dielectric hysteresis, and the loss due to the currents generated in the sheaths and armour of the cable, and to the magnetisations and demagnetisations of the armour. Mr. M. B. Field, in a paper read before the Institution of Electrical Engineers, estimated that the loss in the sheath of a three-core cable, having circular cores, each 0·275 in. radius, with distance between the cores of 0·8 in., and a mean radius of sheath of 1·05 in., a thickness of lead sheath of 0·188 in., with a current per core of 200 amperes, and a frequency of 60 periods, was 0·67 KW. per mile with a lead sheath only, and 8 KW. per mile with steel armour.

Taking a mine with 5 miles of cables, and a distribution by means of three-phase alternating current at 3,000 volts, the writer estimates that the combined losses in the sheath of the cables by dielectric hysteresis, and by magnetising currents, &c., in transformers, might easily be in the neighbourhood of 500,000 B. of T. units per annum.

And this, unfortunately, is not the whole story. The above represent the losses which cannot possibly be got rid of. As everyone who has gone into the matter of working with alternating current knows, the actual losses are nearly always very much greater than those that would occur if every precaution were taken to reduce them. The charging currents for the dielectrics of the cables have to be provided by the generators, though in some cases they go to assist the exciting currents of the same generators. The power factor of a mine service as a whole is usually fairly low. In mining work, in fact, the idea usually is to keep things working. It is necessary that that idea should be uppermost. Any loss in output would be serious. But when continuous working is ensured, the questions arise, Cannot economies be obtained? Is it not possible to work the thing cheaper? Electricity is produced in generating stations in mines, in the majority of cases at a very low figure, but it is quite easy to practically raise the cost of generation, by throwing away a large portion of the current that is generated: and that the writer maintains is done to some extent under the very best conditions with three-phase alternating current, and to a very much larger extent in the great majority of cases. The conditions in mining work, in connection with the use of electricity, are very much the same to-day, as they were in the early days when steam was applied to mining. No one thought then of economising in the use of steam; no one thinks now of economising in the use of current generated.

The Question of Complication in the Switchboards.

There are a number of other points the writer would like to have dealt with, had the space been placed at his disposal. He will only now mention in conclusion that the bug-bear, as it appears to him, of the supposed complication in switching, &c., with high-tension constant continuous currents, will be found literally to be a bug-bear, and, like many other difficulties, will be found to be easily overcome when it is faced. If anyone will take the trouble to go into the question of the switches necessary in the generating station, and at the different points where power is used, with three-phase alternating currents, and with high-tension constant continuous currents, he will find, the writer believes, that the latter has slightly the advantage in the matter of simplicity. It is claimed by M. Thury also that it has great advantages in the working of motors, in the avoidance of loss in useless resistances. It has the undoubted advantage that the speed of motors can be regulated easily, and within wide limits, and with as many steps as may be desired.

There are many other advantages in the writer's opinion, which he has not space to detail.

ELECTRICAL WORK IN CANADA.

During the past year electrical developments in Canada have been many and various, and constantly from all parts of the Dominion records of new schemes and extensions are being received. We are indebted for the particulars given in the following notes to the *Electrical News*, Toronto.

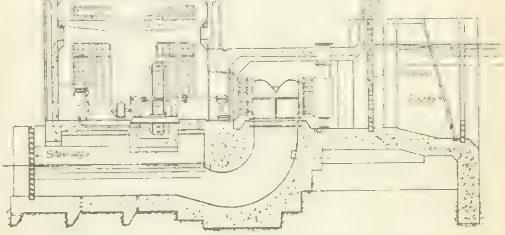
As with ourselves, the street-lighting problem is in a period of evolution, and in many of the towns the principal streets are being well equipped with ornamental standards carrying incandescent lamps or flame arcs. The main shopping centres in Vancouver are now almost entirely provided with ornamental cast-iron standards spaced from 85 to 100 ft. apart and carrying, generally, five 75 or 100-watt tungsten lamps each in an opalescent globe. By the close of the present year it is expected that some 800 standards will be in use, serving about 7½ miles of street.

In a number of streets the benefiting property-owners paid the whole of the installation costs, and are providing 75 per cent. of the cost of current, the remaining 25 per cent. being met by the City Council.

The lighting service is at 110-220 volts three-wire, and for the main streets the service leads are brought down the poles in nearby lanes, and run thence, through fibre conduit in some cases, and sherardised conduit in others, along the sidewalks to the standards. For any future underground work, however, it has been decided to use steel armoured cable, as being less costly in labour and material, and as likely to obviate many of the minor troubles common to the usual conduit system.

Two systems of lighting are in use, one consisting of 11·3-volt, 6·6-ampere tungsten lamps in series, with automatic cut-outs, and the other employing standard 110-volt lamps.

An arrangement has just been made for a trial of G.E. ornamental luminous (flame) arcs in certain streets, the City Council being always on the look-out for something which may be likely in any way to suit their requirements better.



Section of Generating Station at Magog, Quebec.

At Moose Jaw (Assiniboia) some 50 well-designed 5-light ornamental standards have just been installed. The bases, which are 20 in. square, are cast with inside lugs to take the holding-down bolts. The columns are fluted, and taper from 8 in. diameter above the base to 4 in. diameter at the top. The height from ground to top of top globe is 14 ft. 8 in., from ground to bottom of bottom globe 10 ft., and the upper and lower cross-arm lamp centres are 24 in. and 36 in. respectively.

Whilst for many purposes the five-lamp standard is particularly suitable, the light is not sufficiently strong for wide streets of 80 ft. and over, and in a large number of places luminous (flame) arcs are being adopted therefor. At Edmonton (Alberta) the lighting department, on a careful examination of the conditions, and after visiting many cities in the various provinces, have reached the conclusion that luminous (flame) arc lighting is the most efficient and best adapted form for the business centre of the city. In the latter city the increase this year in the lighting and power demands has been phenomenal. A new 2,000-KW. steam turbine, by the Willans & Robinson Co., is being installed, and specifications for an additional one of 4,000 KW. are now being issued.

An interesting hydro-electric plant has been inaugurated during the past 12 months at Magog (Quebec). A concrete dam 144 ft. long, 35 ft. high and 45 ft. wide at the base, has been built across the river at a point which gives a 20-ft. head some two miles below the town. Six stop log sections 14 ft. × 15 ft., and two blind sections are provided, and tumble bays break the force of the falling water. To enable the racks to be cleaned and repaired, the gate chamber has two sets of stop logs also.

The present installation consists of two Escher-Wyss water wheels of the twin horizontal type, each of a rated capacity of 850 H.P. at 150 R.P.M., with a guaranteed full load efficiency of 81 per cent. The turbine gates are of the wicket type controlled by Escher-Wyss governors. The regulation is 3 per cent. variation in speed on a 25 per cent. change of load, and 15 per cent. on a 100 per cent. change, on a basis of a fly-wheel effect of 225,000 lb. ft. The generators are of 500 KW. capacity, 2,400 volts, 60 cycles, two-phase, and have a full load efficiency of 94·7 per cent. at 100 per cent. power factor.

The temperature rise is 35° C. for 24 hours' run at full load, and at 25 per cent. overload it will not exceed 50° C.

The stator outside diameter is 14 ft., and the total weight of generator 50,000 lb. The two 50-KW. shunt-wound exciters are driven from the shafts of the generators by silent chain drives, and each is capable of exciting both machines. Double-throw oil switches connect the generators to either of two sets of bus-bars, and the outgoing cables from the latter are protected by Garton Daniels lightning arresters.

The transmission lines are carried on 35-ft. cedar poles, spaced at intervals of 125 ft., and consist of No. 0000 B. & S. bare aluminium wires, 21 in. apart. The entire power house, 70 ft. long × 29 ft. wide, is built of reinforced concrete, and space is left for a third unit when that becomes necessary.

In quite other directions also electricity is playing an increasingly important part in the laying out of Canadian cities, a case in point being the new fire-alarm system recently installed at Port Arthur, on the north shore of Lake Superior.

The equipment includes a four-circuit repeater, 52 alarm boxes, and from 20 to 25 miles of No. 10 double-braided, hard-drawn copper wire. Two battery sets charged by a motor-generator, together with the necessary charging board and circuit panels, are located in the central fire hall, as well as a protector board equipped with lightning arresters and fuses, to protect the magnets of the various station apparatus against damage due to the alarm circuits getting crossed with foreign systems in any way.

The street boxes are of the non-interfering type, and are divided into four circuits covering the entire city. Over each box a red light is placed, rendering location easy at night. An Ideal punch register at the central station automatically records any signal given, and stamps out the number of the box from which the alarm came, on a tape. At the same time this number is also displayed from an indicator over the station gong, as well as being struck out by the tower bell in the belfry over the fire hall. A stop clock is part of the equipment, and by means of it the time of receipt of a call can be recorded. The giving of an alarm is further automatically recorded on the gong and indicators at the two hose houses, and is received on gongs at the pumping station, as well as at the chief's residence. An automatic control releases the horse stall doors at the first blow of the signal from any street box.

The four circuits are entirely separated, but a call from either box is automatically transmitted over the whole system by means of the repeater. The latter is positive and non-interfering in its action, and will allow one call only to be transmitted at a time; no confusion is caused, therefore, by two calls being given practically simultaneously. Either of the boxes would give its four rounds of complete signal.

PROCEEDINGS OF INSTITUTIONS.

A Single-Phase Motor with Pole-Changing Windings.

By J. S. Nicholson, B.Sc., A.M.I.E.E., and
B. P. Haigh, B.Sc., Assoc.M.Inst.C.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, December 12th*, 1912.)

A new type of single-phase commutator motor, recently installed in the James Watt Engineering Laboratories of the University of Glasgow, was brought to the notice of the Institution on the occasion of its recent visit to Scotland. This motor, which is the invention of one of the authors, may be termed a railway motor, although the machine tested is of small size and open construction, suitable for experimental work. The main difference between this type of machine and other commutator motors lies in the use of pole-changing windings, and the first part of the paper deals with the principles involved in the use of such windings in commutator motors.

When the motor has to work over a wide range of speed, and especially when it has to develop a heavy torque when starting, a commutator is necessary to ensure that the bands of armature currents are kept in suitable positions relatively to the flux, so that the useful flux per pole shall be as nearly as possible identical with the total flux produced by the field magnets. This essential principle being common ground for all commutator motors, the new motor shares in many of their characteristic features and limitations. In order to ascertain the proper aim of a pole-changing winding applied to a commutator motor, the authors make a brief comparison between two ordinary motors of equal size, developing equal torques, but differing in their design in the choice of the number of poles.

The stator winding of their motor is shown in fig. 1, which shows how eight or four poles are obtained by means of four coils. When these are coupled in the two pairs, 1, 2, and 3, 4, which may be connected in series, as in fig. 1, *a*, or singly, or in parallel, an eight-pole field is produced, covering nearly five-sixths of the total pole area at uniform density. By reversing the currents in Coils 3 and 4, while those in Coils 1 and 2 remain unchanged, as shown in fig. 1, *b*, the directions of the currents in four of the eight groups of slots are such as to fulfil the purpose of an extra main winding, while the directions of the currents in the remaining four groups are such as to neutralise one another.

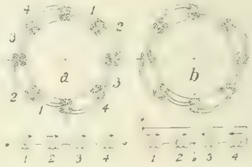


Fig. 1.

Comparing the motor with a normal repulsion motor, the authors state that the output of the armature is not greatly reduced by using the shortened-step connections suitable for pole changing. The pole-changing motor is, therefore, not only capable of developing a greater starting torque, but is equally efficient, and on account of the shorter armature end connectors and commuator, is more compact and simpler in construction than the normal design of compensated-repulsion motor.

While the above comparison is applicable in the case of motors of moderate size, suitable for multiple-unit vehicles, it does not apply directly to large-sized locomotive motors. The compensated-series motor, working with a rectangular field-wave and designed with a large number of poles, appears to give better results than the repulsion motor with sinusoidal field, in machines of large size. The pole-changing motor is similarly handicapped by its sinusoidal field, and on account of the distribution of its windings the output is not greatly increased when a rectangular field-wave is used. The output is, therefore, materially less than that of a series motor with the greater number of poles.

The authors describe four methods of controlling a pole-changing motor intended for railway service. Part of the problem lies in making provision for reversing when running with each number of poles, and in each case the motor is reversible and controllable over the full range of speed in both directions. The motor is started as a repulsion motor with the greater number of poles, and after running up to half speed is changed over to the lower number of poles, running as a compensated-repulsion motor excited by a magnetising current in the armature.

The motor installed in the James Watt Engineering Laboratories, which embodies the principles dealt with in the paper, is directly coupled to a small generator which acts as a load. The output of the motor is controlled by regulating the excitation and load resistances of the generator, and is measured by the torque transmitted from the magnet-wheel to the stator of this machine. The stator, which is mounted on ball bearings, carries a graduated arm with a movable weight, and a counterpoise is fitted so that the complete alternator is balanced on its ball bearings when the moving weight is almost at its innermost position. The torque developed is therefore proportional to the distance the weight has to be moved outwards in order to effect a balance. The moving weight is fitted with a vernier, and as the alternator is balanced with a slow period of oscillation and has little friction in its ball bearings, it is possible to measure the torque with remarkable exactitude, the error being within one-thousandth part of full load.

The motor tested is one rated at 10 H.P. at 150 volts, 30 cycles this size being chosen to suit the supply available in the laboratories. The stator-winding is similar to that shown in fig. 1, and is arranged for eight and four poles, so that the speeds corresponding to synchronous running are respectively 450 and 900 R.P.M. The motor was built by Messrs. Mavor & Coulson, Ltd., Glasgow, to the authors' design.

FIG. 2.

The motor was run with eight poles as a plain repulsion motor and with four poles as a compensated repulsion motor with eight working brushes, connected together in four pairs.

Curves giving the relation between the speed and line current of the machine, supplied at various voltages, are shown in fig. 2. The two sets of curves correspond to eight and four poles respectively, and it will be noted that the working speed ranges are in the neighbourhood of the synchronous speeds of 450 and 900 R.P.M. In fig. 3 the torque (measured in "equivalent horse-power at 1,000 R.P.M.") is plotted as a function of the speed. It will be noted that the curve for 200 volts with eight poles approximately overlaps the curve for 100 volts with four poles, and it follows that if the connections are changed over from one of these ranges to the other, the motor continues to run against any given torque at approximately the same speed, and no mechanical shock is experienced. For lower speeds the eight-pole winding is supplied from transformer tappings giving 120, 150, or 180 volts, while for higher speeds the four-pole connections are used with 120 or 150 volts. The dotted lines indicate the speeds at which the contactors are operated in order to maintain a high and fairly uniform torque during the starting period. These speeds are 300, 460, 650 and 800 R.P.M. During this process the torque varies between 13 and 8 "H.P. at 1,000 R.P.M." A higher average torque may naturally be maintained by changing over at somewhat lower speeds, and in this case the motor is liable to spark slightly when subject to the extra load. This is especially noticeable when changing over to four poles at the lower speeds, and on this account it is preferable to use the 200-volt eight-pole tapping in place of the corresponding 100-volt four-pole connection.

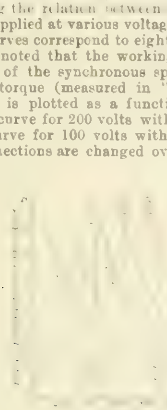


FIG. 3.

It is not intended to suggest that the pole-changing motor is in general preferable to the compensated-series machine as a traction motor. Where low-frequency current is employed, it appears that the latter machine is simpler and equally satisfactory, as good commutation is obtainable, together with a sufficiently high power-factor to meet practical requirements. When a higher frequency is employed, the repulsion motor in which armature excitation is employed gives a materially higher power-factor than the series machine, and it may be that the pole-changing motor marks a sufficiently great advantage over the normal repulsion motor, as regards commutation, to warrant the use of the higher frequency.

The discussion was opened by **Dr. S. P. Smith**, who, while appreciating the work carried out by the authors, felt that the motor was not one that would establish itself for single-phase railway work. It was, he thought, impossible to build a plain repulsion motor of the size required for a locomotive, say, of 1,000 to 2,000 H.P., and he felt satisfied that it would not be possible to make a satisfactory machine of the type suggested by the authors of 500 H.P., as they had the added complication of pole changing. Moreover the motor was tied to synchronism. It gave only two efficient speeds—synchronous and double synchronous. The commutator was introduced to get over the frequency difficulty in the compensated series motor, but it did not effect this in the authors' machine, and he thought it did not carry them any nearer to the desirable single-phase railway motor.

Mr. Roger Smith said the authors had themselves pointed out almost as many disadvantages as advantages in their design, and left it to the judgment of their hearers. It appeared that the rotor was shorter than that of a corresponding repulsion motor, but any saving in dimensions for railway work should be in diameter, and unless the new motor showed a comparative saving in weight, its advantages would not be many for railway use. He asked whether it was always possible to arrange a smooth change-over from the eight to the four-pole connection. He assumed from the paper that the advantages of this machine only came in at over 25 periods—the highest usual figure for railway work.

Mr. W. M. Mordey suggested that the authors might profitably carry out experiments with their machine, using a fixed rotor and stator, with a view to obtaining the iron loss with a rotating field.

Mr. W. E. Burnand thought the worst feature of the design was the large initial current at starting, which was the trouble with A.C. motors generally. He favoured the straight series machine, but had always found better results from repulsion motors, and he considered that for stationary work, if a motor was used for any length of time, a plain slip-ring motor would give the best result.

Mr. Haigh, in replying, said the difficulty in regard to starting and sparking was the same in all the three motors referred to. The synchronous character of the repulsion motor was overstated; it was not like an induction motor. The pole-changing motor was only suited for small sizes, and the moderately high frequency suggested was, for railway work, say, 25 periods. Tappings from the transformer could be easily arranged to give a smooth change-over between the different pole connections.

Mr. Nicholson added that they were carrying out experiments to ascertain the iron loss in the machine.

The International Electrotechnical Commission.

On December 19th Prof. Silvanus Thompson delivered a lecture on "The Work of the International Electrotechnical Commission," at the Institution.

In the course of an interesting address he dealt chronologically with the events which have led up to the present time, illustrating the necessity for international agreement and uniformity in the matter of standards, definitions, symbols, &c., by many well-known examples.

He traced the inception of the idea of international standards to a paper by Sir Chas. Bright and Prof. Clarke Maxwell, touching on the various events which intervened between that time and the International Electrical Congress of St. Louis in 1904, when Col. R. E. Crompton—the present hon. secretary of the Commission—read a paper on electrical standardisation, the discussion on which ultimately led to the formal constitution of the present permanent Commission in 1906 under the presidency of the late Lord Kelvin.

Since then the work of the Commission has been continued under the successive presidencies of Prof. Elihu Thomson and Prof. Dr. E. Budde, and the 1908 Meeting in London, the Brussels Conference of 1910, and last year's Turin Meeting have been held, while future meetings in Berlin, next year, and San Francisco, in 1915, have been arranged.

In the course of his remarks, Prof. Thompson explained the working and organisation of the Commission, the formation of the Special Committees to deal with the preliminary details of subjects brought forward, and the progress which has been made in such matters as nomenclature, symbols, &c.

He further emphasised the world-wide approval of the Commission's objects as evidenced by the probable formation of electrotechnical Committees in Australia, New Zealand, Siam, South Africa and South American countries, some of which have already taken this step. Detailed information on this subject is, of course, contained in the published reports of the Commission and the Institution *Journal*.

At the conclusion of the address, **Col. Crompton** said he himself had not been able to realise the great development which had taken place, in regard to which English electrical engineers could congratulate themselves. All the countries which had taken part had already gained from the mutual work, and he felt wholly a gainer by his own exertions in that connection. He concluded by paying a tribute to the work of the secretary, Mr. Le Maistre.

Prof. Miles Walker said the main benefit of the work accomplished now was in the direction of machinery; as to nomenclature, he thought the only fault was the small number of words dealt with, although he appreciated the labour involved. He urged that no hesitation should occur in adopting foreign words where they were more appropriate than English ones, giving instances, and further suggested the advisability of employing sketches where possible instead of long descriptions. Symbols for mathematical use should never be letters, which should be displaced by a distinct notation.

Mr. Robt. Hammond caused some amusement by remarking that as hon. treasurer of the I.E.E., he had attended with a view to hearing what the Institution had got for its expenditure on the delegates, and had heard with pleasure that Prof. Thompson had had a very good time. He thought the Institution was entitled to hear from time to time an account of the work accomplished, and defended the labours of the Nomenclature Committee, explaining the difficulties which had to be contended with, a matter which was also mentioned by Mr. A. P. Trotter, who pointed out that the Committee was merely trying, in the first place, to record the accepted usage of words by British engineers, and that later the difficulties of international ageement would have to be overcome.

Reference having been made to the use of the word "Kelvin," MR. TROTTER said that 20 years ago Sir Courtenay Boyle advised the President of the B. of T. to adopt the name "Kelvin" for the "unit." The President cordially approved, and the decision was communicated to the electrical Press of that day; a fortnight afterwards, Lord Kelvin, on grounds of mere modesty, desired that it should be withdrawn. No one need wait for any authority to use it; it had been already officially sanctioned, and it only remained for them to use it.

PROF. THOMPSON briefly replied to the various speakers, indicating a preference for the term "continuous" rather than "direct" current, which, however, could not be arbitrarily enforced. The question of mathematical symbols was outside the scope of the Commission's work; the question of printing would have a great influence on any new symbol adopted.

Modern Methods of Indirect Lighting.

A PAPER under this title was read by MESSRS. F. W. WILLCOX and H. C. WHEAT, before the ILLUMINATING ENGINEERING SOCIETY, on December 3rd. The authors, after a brief description of various forms of direct and semi-indirect lighting, claimed that indirect lighting was an improvement on the other systems for the following reasons:—While on the score of pure physical efficiency (in lumens per watt) indirect lighting may stand below other systems, yet in point of visual efficiency its general results are comparable, and in many cases superior, to those given by direct lighting. The efficiency of indirect lighting depends very largely on the appliances used. The development of the "Eye-rest" system has given to indirect lighting an economy comparable with that of the best systems of direct lighting, and higher than that found in the general run of direct lighting installations. The substitution of eye-rest lighting for direct-lighting has, in numerous cases, resulted in improved illumination and reduced current consumption. Theoretically, the ideal direct lighting installation must have a higher energy efficiency than indirect lighting, because, in the latter case, the light has to undergo double reflection; the great point, however, about indirect lighting is that it enables one to get from a single point a more evenly distributed illumination than can be obtained from a much larger number of direct lighting units. In other words, the man who has become converted to the desirability of a uniform general illumination can, by substituting an eye-rest fitting for a single direct lighting point, make the intensity of illumination on the working plane approximately even. Without the aid of indirect lighting he would need in a fair-sized room at least half a dozen direct lighting units to accomplish this. Therefore, in view of the usual type of installation, with its strictly limited points, indirect lighting is actually and practically more economical than direct lighting, because it provides an ideal illumination with a minimum of wiring extension or alteration to the wiring.

Glare is undoubtedly reduced to a minimum by the indirect system of lighting. The lamps themselves are completely hidden, and the greatest surface brightness, that on the ceiling, is very much lower than with other forms of lighting. The large area of the reflecting surface, *i.e.*, the ceiling, ensures perfect light diffusion, with a total absence of the uncomfortable effects associated with glare.

In respect of shadow effect, indirect lighting stands preeminent. Shadows are less dense, and have softer edges than in the case of direct lighting. Indirect lighting, however, is not shadowless—it would be objectionable if it were. Indirect lighting does not affect the natural contrasts of light and shade given by good daylight illumination, and thus there are no flat or monotonous effects such as accompany cornice or cove lighting.

A diffused illumination is produced resembling the effects of daylight entering a room through a skylight or obscured glass roof. By proper tinting of the walls the light can be toned to give rich warm attractive effects. Harsh contrasts, glare and heavy shadows are eliminated, and the architectural features of the room are shown to the best advantage.

RECENT IMPROVEMENTS IN MERCURY VAPOUR RECTIFIERS OF LARGE POWER.

AN account appeared in these columns some two years ago giving particulars of a mercury vapour rectifier of large size in which sheet steel cylinders took the place of the usual glass containing vessel. Since that time further improvements and alterations have been suggested by the experience gained, and some account of these and of the first completed European installations are given by Herr B. B. Shäfer in the *Elektrotechnishe Zeitschrift* for November 7th.

The form of joint originally adopted, and consisting of a double packing of asbestos or similar material, with a layer of mercury between, has proved thoroughly satisfactory. Fig. 1 shows this joint as used on the main enclosing tube. *g* is the wall of the steel tube turned at the lower end, and having a ring *a* shrunk on to it. This ring is bolted to the base *b*, and exerts a uniform pressure on the asbestos packing *c*, leaving the space *e* for the mercury. Exhausted vessels sealed in this way have been sent by rail, and have arrived at their destination with unimpaired vacuum. Fig. 3 shows the arrangement for leading in the upper electrode. It will be seen that a single nut applied outside holds the whole in position, and at the same time provides a simple means of taking up any slack in the asbestos packing if this should be necessary at any time.

Although the jointing employed has thus proved itself satisfactory, it was soon found that some modification of the internal arrangement of the electrodes was necessary if "back-firing" (or the flow of current in the reverse direction, instead of only in the rectified direction) were to be avoided. This back-firing trouble has long been known to occur, especially with higher voltages, such as 220 or more, and with higher outputs. Normally the current flowing through the rectifier in the reverse direction is a matter of only a few milli-amperes, and of quite negligible importance. Occasionally, however, the valve-like action of the rectifier will disappear suddenly, and current flows equally readily in both directions, and this, with the connections ordinarily adopted, means the complete short-circuiting of the supply. With the older glass rectifiers this occurrence generally resulted in the destruction of the glass vessel, whilst with the new steel apparatus an explosive blowing of the fuses at least follows.

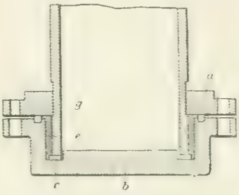


FIG. 1.

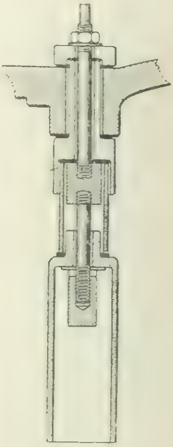


FIG. 3.

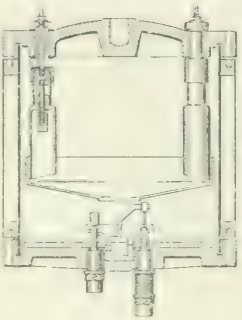


FIG. 2.

As a result of lengthy experiment, it was found that "back-firing" may occur:—

1. If the vapour pressure in the exhausted vessel bcomes too great, and so permits the discharge to change from the harmless glow discharge into an arc-like discharge.

2. If the electrode normally intended for the anode comes into contact with the condensed drops of mercury dripping back to the cathode, under such circumstances the anode develops the same characteristics as the mercury cathode.

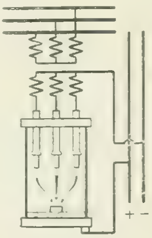


FIG. 4.

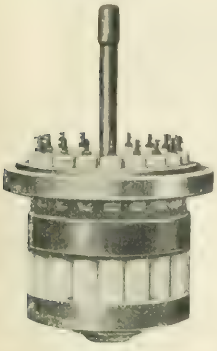
3. If the solid electrodes lie in the path of the so-called "negative flame," or stream of hot conducting vapour rising from the cathode.

The question of a sufficiently high vacuum can be satisfactorily dealt with in practice, but points (2) and (3) require a complete modification of the arrangement originally adopted. Following the construction adopted in the glass rectifiers used in America for very high D.C. voltages, such as 6,000 or 8,000, the new steel rectifiers are now arranged with the anodes enclosed in long protecting hoods, and removed from the centre line directly over the cathode and placed close to the sides of the vessel.

One great additional advantage of this arrangement is that it lends itself to the use of a number of small anodes in parallel instead of one large one, and this prevents overheating and vaporisation of the anode material.

The new arrangement is shown in fig. 2. Here the cathode at the bottom of the vessel is separated from the anodes by a non-conducting screen with a central opening. The conducting part of the vapour, after passing through this opening, is deflected towards the various anodes whilst the non-conducting portion is partly cut off by the screen before entering the anode chamber at all, and partly rises up vertically through the opening—in either case avoiding all risk of coming into contact with the anodes.

FIG. 5.



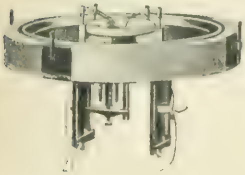


FIG. 6

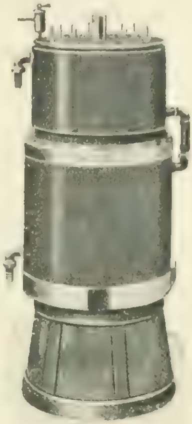


FIG. 7.

This type of rectifier lends itself especially well to polyphase work, the various anodes, in a single enclosing vessel, being distributed amongst the different phases, as shown, *e.g.*, in fig. 4, for the case of a three-phase supply.

The peripheral arrangement of the anodes also enables a large and effective cooling chamber to be easily fitted above the rectifier in much the same way as that used with the small power glass rectifiers. Figs. 5 and 6 show the arrangement of the anodes and cathode respectively of a 100-KW. rectifier, whilst fig. 7 shows the general arrangement of a finished 100-KW. rectifier.

Amongst the other improvements introduced as a result of extended experience is an arrangement for measuring the state of the vacuum. The vacuum required is a high one of the order of ·01 mm. of mercury or less, and no convenient direct method of measuring this is available, consequently an electrical indirect method has been adopted, as shown in fig. 8. In this apparatus the fact that the conductivity of the gap between an anode and the active cathode depends greatly on the vacuum, is made use of. If the ordinary supply voltage is applied, and a suitable ammeter is introduced into the circuit, the indications of the instrument (after calibration with a McLeod gauge) serve as a very delicate indicator of the state of the vacuum.

Another arrangement for the same purpose is shown in fig. 9. A glass chamber containing an iron wire resistance is connected to the rectifier chamber and a voltage is applied to the resistance through an ammeter. The current flowing depends on the temperature of the wire, which itself varies with the vacuum owing to the greater or less heat conductivity of the surrounding gas.

Both these arrangements are suitable for mounting on the switchboard at a distance from the rectifier, and, if desired, they can be made to operate alarms when the vacuum becomes defective.

With regard to the actual plant in practical operation up to present time the following particulars are given :—Since November, 1911, a 220-volt 80-KW. rectifier has been in regular use in an iron foundry, and has been supplying the whole power plant for some 10 hours daily. The supply is a single-phase one at 2,850 volts 45·3 ~. In this case the continuous excitation of the cathode is maintained by a small rotary converter of 1·4-KW. output, but this might equally well be replaced by a small stationary rectifier When the current taken from the rectifier exceeds about 200 amperes, it is found necessary to keep the vacuum pump running continuously, but for smaller loads this is not necessary.

A smaller rectifier of 20-KW. capacity and self-exciting is in use in a sub-station at Strassburg, giving 110 to 160 volts for use in a small local D.C. network, and for charging a stand-by battery. In this case, three separate rectifiers of 100 amperes output each are installed, one of them being a spare.

Another larger self-exciting rectifier of 300-KW. capacity has recently been erected at an engineering works in Mannheim. It is supplied from a 3,150-volt three-phase 50 ~ circuit through a transformer, arranged to give out low-tension six-phase currents, which are rectified into a direct current of 2 × 220 volts, with practically no pulsations. Complete efficiency and other tests are now being carried out on this plant, and will be published later.

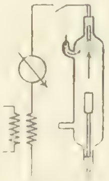


FIG. 8.

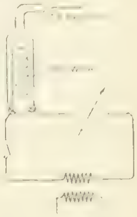


FIG. 9.

Tests on various rectifiers have shown that the pressure drop in the arc is as low as 11·7 volts, with a 7-cm. gap, and 14 volts, with a 25-cm. gap, between electrodes. The temperature of the iron anode in the case of a 32 sq. cm. anode loaded with 30 amperes, was found to be from 550° to 650° C. The temperature at the hottest point in the arc was about 1,000° C.

The amount of the reverse current was only about ·4 milliampere at a load of 110 volts and 30 amperes, and ·6 milliampere at a load of 60 amperes. As the voltage is raised the reverse current also increases, but not quite in proportion.

In conclusion, the following weight comparison between these mercury vapour rectifiers and ordinary high-speed rotary converters is given :—

KW. output.	Approx. total weight in lb. Mercury rectifier.	Approx. total weight in lb. Rotary converter.
20	400	1,040
40	470	1,820
75	760	2,880
100	1,060	4,200

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Stage Lighting B.T.H. Lens Arc Lamps.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, 77, Upper Thames Street, E.C., have brought out a lens or spot lamp for theatrical purposes, designed to withstand the rough usage to which such apparatus is constantly subjected. The mechanism is of extreme simplicity and reliability. The lamp is of the "hand-feed" type, and is easily adjusted ; after the first adjustment of the carbons, an arc can be maintained without interference for 30

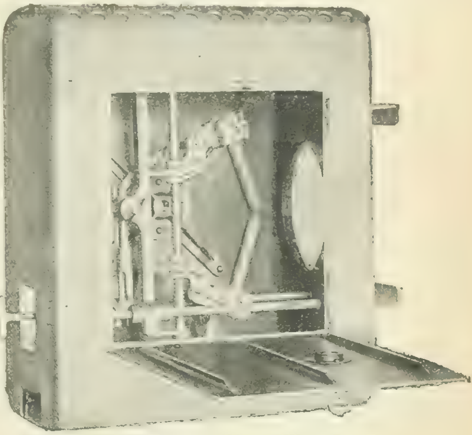


FIG. 1.—B.T.H. LENS ARC LAMP.

minutes or more. It can be tilted in any direction while burning, without readjustment and without fear of the lamp parts earthing on to the casing.

The lamp box is a solid aluminium casting, with an aluminium door held closely against a rabbet set in the box casing, by self-closing phosphor-bronze spring hinges, thus preventing leakage of light. The lamp and lens frame are well ventilated; the orifice is adapted for standard lenses of 4½ in. or 6 in. diameter, expansion being allowed for in either case.

Focusing is accomplished by the operation of a carriage rod, to which is attached a handle in the rear of the lantern controlling the mechanism of the focusing rod. The vertical spindle which supports the carbon-holders is fastened to two focusing rods by means of spring steel shoe slides. The carbon-holders are adjustable by means of heavy thumb screws, so that practically any position of the carbons may be obtained, and the holders are made in two parts, one of which is detachable. The vertical spindle for an alternating-current arc is made six threads to the inch (right and left hand), and for direct current, four and six threads to the inch respectively. This arrangement renders the use of carbons of different diameters unnecessary, as the positive carbon, burning more rapidly than the negative, is fed at a proportionately greater speed.

New Electric Winch.

The accompanying illustrations show the construction of a new patent electric winch which has been made for the inventors, Messrs. Tyler & Freeman, by the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., of Silvertown, and which possesses remarkable features. Briefly, the motor is inside the barrel of the winch, and the whole is totally enclosed and waterproof.

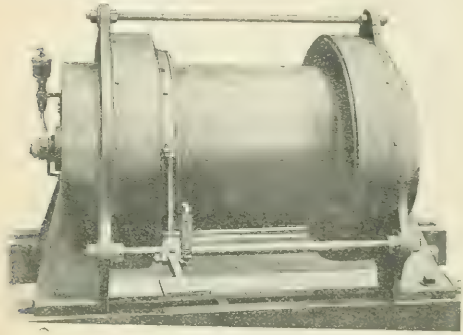


Fig. 2.—Tyler & Freeman's Self-Contained Electric Winch.

As will be seen in the drawing, fig. 5, the revolving barrel on which the hoisting rope is wound forms the yoke of the d.c. motor, the pole-pieces being screwed to its internal circumference; the windings are attached to the pole-pieces, and the brush gear carrier is also fixed to the barrel, together with a flange to which a diaphragm with a gland on the armature shaft is attached, thus shutting out any oil that might leak from the gear to the windings.

The gearing is of the epicyclic type, with three pinions, which engage with two internally toothed rings; one of the latter is attached to the revolving barrel, and the other to the end bearing. For high-speed hoisting the barrel is mounted on ball bearings of large diameter, but for low-speed work the bearings are plain.

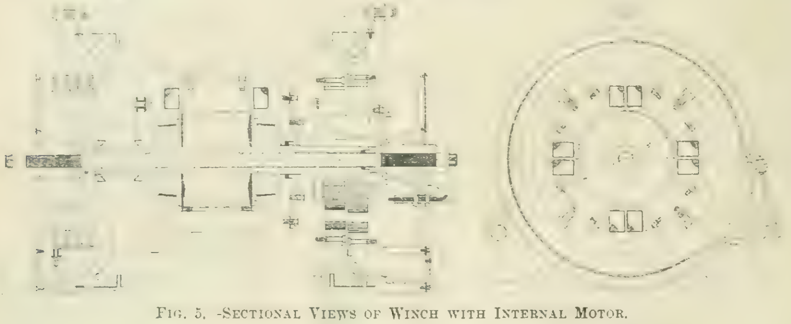


Fig. 5. -Sectional Views of Winch with Internal Motor.

The armature shaft is also mounted on ball bearings, and is hollow, a central tie-rod passing through it. The end bearing at the armature end carries four slip rings, which enable the current to be taken to the fields and to the armature. Reversing is effected by means of an ordinary controller. The separate views (figs. 2 to 4) show the details very well. A curious feature of the design is that the field magnets revolve slowly in the same direction as the armature, carrying the brushes with them.

The design shows that the motor is entirely enclosed, there being no openings for water at either main or central bearings. Hand holes are provided in both end bearings, which have water-tight covers.

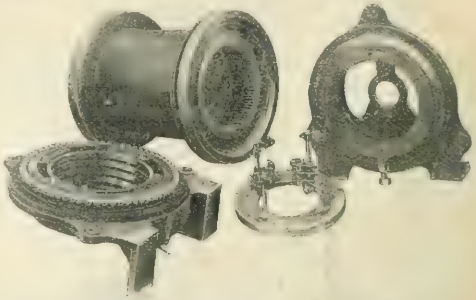


Fig. 3.—Winch Details: Barrel, Slip Rings, Brushes, &c.

Lubrication is well provided for, and the winch is mounted on a substantial cast-iron base.

The gear shown is very fairly silent, and the efficiency is very high. The winch is specially designed for shipwork, but is equally applicable to any position where compactness and complete protection from weather, &c., are essential. It is made in various sizes, and the gear lends itself especially to adaptation for any ratio of reduction, high or low.

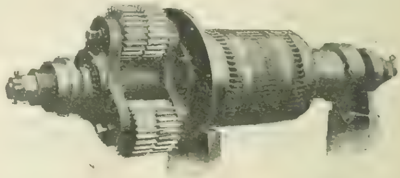


Fig. 4.—Internal Armature and Epicyclic Gearing.

Henley's Cable Suspenders.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C., have issued a new price list of their patent cable suspenders. These are now made in Balata canvas and impregnated canvas, as well as in raw hide and zinc, new suspenders in these materials having been standardised by the firm to meet a demand for cable hangers having a much longer life in damp situations or places where they are likely to come in contact with fumes which would be injurious to other types. The present list also contains particulars of 1½ in. suspenders in all types suitable for use where it is impossible to place the suspenders close together, or for use with very heavy cables. We learn that many hundreds of thousands of Henley patent suspenders have been sold in the British Isles and abroad, and that the approximate breaking strains are as follows:—

	¾ *in. wide.*	1½ *in. wide.*
Zinc	200 to 250 lb.	400 to 450 lb.
Impregnated canvas	200 lb.	300 lb.
Balata canvas ...	200 ,,	300 ,,
Raw hide	100 ,,	200 ,,

The firm will send copies of the list and discounts to anyone in the trade. In the figure we show a ·2 sq. in. cable suspended by

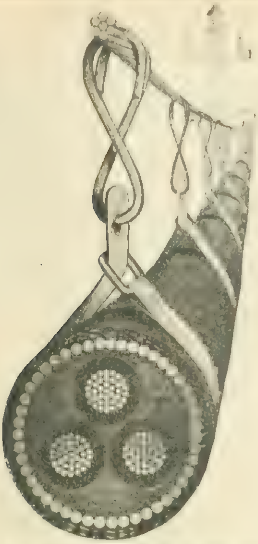


Fig. 6.—Henley Zinc Suspenders in Use.

Henley patent zinc suspenders (1½ in. wide) from a 7/10 strand. The illustration is half full size.

Arc Lamp Lowering Gear.

The London Electric Firm of George Street, Croydon, have fitted up at their works working exhibits of their raising and lowering gear for arc lamps, including swan-neck and wall-bracket gear, span-wire suspension gear, and lyre-shaped centre-pole gear, for the inspection of prospective buyers.

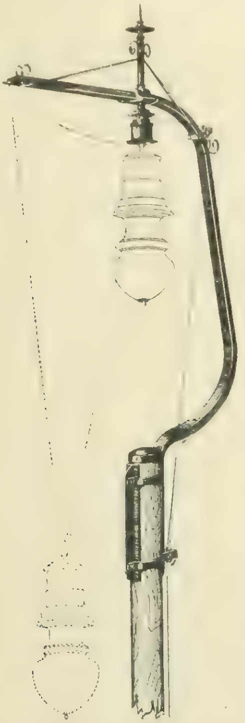


Fig. 7.—Shadowless Arc Lamp Carrier.

The accompanying illustration shows their new shadowless ("half lyre") arc lamp carrier, superseding, at less cost, jibs and swan necks, or ladders, for the lighting of railways, docks, harbours, quays, works, &c. This is an adaptation of the firm's patent lyre-shaped centre carrier, and is adaptable for any size or kind of pole, of wood, iron or concrete. It is provided with their automatic connector and patent suspender, or if a cheaper arrangement is desired, with their patent safety catch only, either plan ensuring that the weight of the lamp is positively taken by the carrier and is not left on the hauling rope when in the burning position.

In designing this new carrier the makers have had in mind the desirability of obviating the excessive swinging of the lamp in exposed positions during windy weather, and an efficient limiting device can be provided when necessary. The winch used with these carriers is of their patent self-sustaining type, by which the risk of failure in raising or lowering is eliminated.

Electric Vulcaniser.

The St. Helens Cable and Rubber Co., of Warrington, have recently designed and patented (No. 23451—1911) a novelty in the form of an electric vulcaniser, of which fig. 8 is a view.

This has been specially devised for use in connection with the jointing and repairing of their patent cab-tire sheathed cables, and is based upon arrangements suggested by Mr. R. W. Besford, of Chester-le-Street.

The principle is the electrical heating of the mass of wax used for vulcanising purposes, by means of a current passing through wire spirals contained in the wax. The heat is regulated by the rheostat shown, so that the maximum heat can be switched on at first to melt the wax, and when the required temperature is obtained in the bath, it can be kept constant by switching on to a more suitable combination

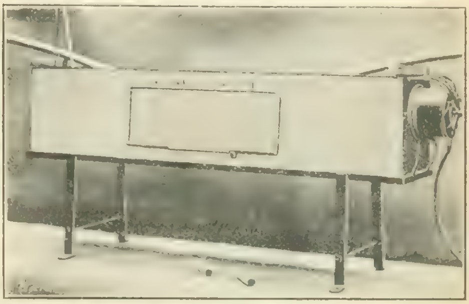


Fig. 8.—An Electric Vulcaniser.

It is not always easy or possible to vulcanise cables (at the place of use, such as in mining work) by means of steam, as this varies so considerably both as to pressure, heat and humidity. Gas is not always available, whereas electric current can be had wherever cab-tire sheathed cables are used, and the practical constancy of electrical pressure renders the apparatus easily used without skilled attention.

We have received a piece of jointed cable, which shows the homogeneous character of the joint made with this apparatus.

The jointing tape is the same cab-tire material as that used in the sheathing, made in the form of tape, which is bound around the already prepared joint and then further lapped with a strong fibrous tape, which compresses it tightly, and under the heat of the vulcanising process, makes the solid joint.

A recent instance of this electrical vulcaniser's usefulness may be mentioned: A cab-tire sheathed crane cable at a Middlesbrough dock had been damaged by the crane making a split in the sheathing of 28 in. This was repaired by this patent electric vulcaniser while the crane was operated by current passing through the cable under repair. The operation took two hours, and the completed job appeared to be equal to new.

Lightning Files.

A high-speed Lightning file has recently been placed on the market by Messrs. Lockwood Bros., Ltd., of Spital Hill, Sheffield, who inform us that a 14-in. file, tested on both sides, made 120,000 strokes, and in 39 hours removed 78·8 in. of metal weighing 22 lb. from an inch-square bar, and at the conclusion of this severe trial the tool was "slightly worn." The makers claim the result of the test to represent the highest point of working efficiency ever attained by a file under similar conditions. It is stated that the Admiralty require the files they buy to make only 20,000 strokes and to remove 6 in. of material. In round figures the Lightning file is capable of doing treble the amount of work that can be got out of an ordinary file, and as the increased price is inconsiderable, it must be highly economical in use.

THE PHYSICAL SOCIETY EXHIBITION.

The exhibition of physical apparatus which was held on Tuesday last week at the Imperial College of Science, while less comprehensive than usual, contained several features of great interest. Amongst these may be mentioned the beautiful "rainbow cup" recently devised by Mr. C. V. Boys, F.R.S., for the examination of liquid films, with which the most fascinating colour effects can be produced; the Gray-Burnside motor gyrostats; the Marconi radiogoniometer; the Nalder insulation recorder for A.C. circuits; new "Unipivot" instruments; the Levy apparatus for the estimation of firedamp; and a Cardiographic apparatus.

In the afternoon and evening Mr. S. G. Brown lectured on "Some Methods of Magnifying Feeble Signalling Currents."

Westminster Engineering Co., Ltd.

A very neat projection arc lamp was shown by this firm, for currents from 2½ to 12 amperes on D.C. or A.C. circuits, of 100 to 250 volts pressure. As shown in the accompanying illustration the mechanism is of great simplicity; the arc is formed in a closed chamber, enabling it to burn for half an hour or more without attention, and the adjustment is effected by hand. The carbons are at right angles, the crater of the positive carbon (in the case of direct current) being thus utilised to the utmost, and the source of light remains practically stationary at the focus of the lantern for long periods, being always on the centre line of the condenser. The light is very steady, and the consumption of carbon is small. The light obtained is either white or violet-tinted, according to the purpose for which the lamp is being used, and the humming of the lamp on A.C. circuits is very much reduced by the glass enclosure.

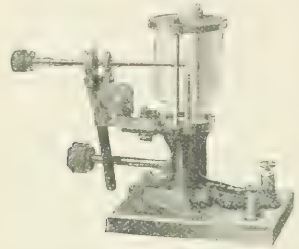


Fig. 1. "Westminster" Projection Arc Lamp.

Alex. Wright & Co., Ltd.

An instrument for the continuous registration of the specific gravity of a gas to 1 part in 1,000 was shown, as well as an improved arrangement of the Orsat gas analysis apparatus. The most noteworthy novelty was Dr. Leonard A. Levy's apparatus for the estimation of fire-damp in the air of mines, to meet the requirements of the Coal Mines Act of 1911. This interesting device is illustrated in fig. 2.

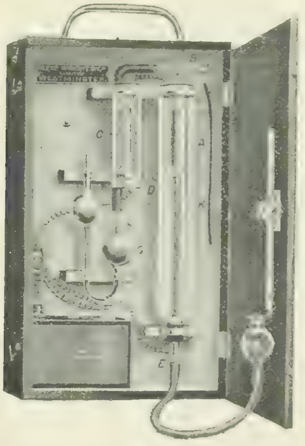


Fig. 2. -Levy Fire-Damp Estimating Apparatus.

The measuring burette A, surrounded by a water jacket, contains 10 c.c. The narrow graduated stem contains 0·4 c.c., and reads to 2 per cent. of fire-damp. The burette is graduated to read to 0·01 per cent. B is a cock with an L-shaped bore arranged so that it is impossible to place the oxidation tube C in communication with the atmosphere. The plug of the cock has a screw washer fixed at the back, so that it cannot be accidentally withdrawn from the barrel. C is a new type of oxidation tube devised by Dr. Leonard Levy; it consists of a quartz capillary tube through which a platinum wire runs axially. This wire is heated to whiteness by a current derived from the small storage cell J supplied with the apparatus; the expansion of the wire on heating is taken up by a spring to which one end is attached. The walls of the capillary tube are coated with a very thin layer of platinum, which catalytically accelerates the rate of oxidation of the combustible gases. This oxidation tube is entirely surrounded by a water-jacket. The current passes through the platinum wire when the mercury in the burette reaches the fused-in platinum contact D, connection to the mercury being made through the fused-in contact at E. It is thus evident that the current only passes when the reservoir F is raised to drive the gas through the tube C. Thus the operation of passing the gas over the wire automatically switches on the current.

During its passage through the quartz platinum capillary tube over the heated wire, the fire-damp present, no matter how little, is completely oxidised by the oxygen in the air to carbon dioxide and water; a contraction equal to twice the volume of fire-damp is thus produced. The burette is graduated to read directly the percentage of fire-damp present. The graduations at 0·25 per cent., 0·5 per cent. and 1·25 per cent., the three limits specified in the Act, are marked in red. Two passages of the gas through the quartz platinum capillary are sufficient, and an estimation can readily be effected in 2 minutes. An accuracy of 1 part in 1,000 is easily attainable.

Before using the apparatus, the vessel G must be filled to the mark H on the capillary neck with mercury, the cock B being turned so as to communicate through the *empty* burette with the atmosphere: H is therefore the level of the mercury in G at atmospheric pressure. The reservoir F is also filled with mercury, and the jacket surrounding the burette is filled with water. These manipulations are made on receipt of the apparatus, and do not require subsequent repetition.

The apparatus is very small and compact; the external dimensions of the case are 13½ in. × 8 in. × 3 in., and the total weight ready for use is 8 lb.

By adjusting the reservoir F by the rack and pinion until the mercury in the capillary neck at H is accurately at the mark, any change in the temperature of the gas is corrected.

The apparatus can be used in the most fiery mine, without the slightest danger, as it is impossible to produce a spark in air with it, even if it is dropped and broken, and it can be manipulated by an inexperienced person. A more elaborate apparatus is made for the complete examination of the air of mines.

In view of the stringent provisions of the Act regarding the use of electrical apparatus in places where the percentage of fire-damp present exceeds 1¼, this device is of considerable importance to mining electrical engineers.

Evershed & Vignoles, Ltd.

This firm had an interesting historical exhibit of Evershed resistance testing sets, from the first made, in 1889, to the introduction, in 1904, of the "Megger" and, in 1904, of the "Bridge-Megger," covering a range of measurements from 0·1 ohm to 5,000 megohms.

Gambrell Bros., Ltd.

The convection radiometer and thermo-galvanometer recently designed by Mr. F. W. Jordan for measuring small steady rates of evolution or absorption of heat was shown; this was described in our issue of November 15th, page 814.

John J. Griffin & Sons, Ltd.

The most novel exhibit of this firm was the Boys "rainbow cup" mentioned above; the electrically-driven gyrostats of Messrs. J. G. Gray and G. Burnside were also shown in operation.

The Synchronome Co., Ltd.

A complete working exhibit of electrical instruments suitable for the measurement and distribution of time in observatories and scientific institutions was shown, employing the Synchronome astronomical regulator; the improved Synchronome controlling pendulum with Mr. W. H. Shortt's inertia escapement was also shown in operation.

(*To be continued.*)

LEGAL.

The Distribution of the Assets of the National Telephone Co.

(*Continued from page 988.*)

Continuing his address on behalf of the deferred stockholders, Mr. Younger, K.C., said the preferred stockholders, he contended, had not established any right to a dividend or interest in respect of their holding after December 31st, 1911, the date of the sale of the company's business, and beyond the £105 which had been repaid to them as their capital holding, they were not entitled to share in the assets of the company. Beyond the £105, everything else went to the deferred stockholders, according to the terms of the resolution by which the stock came into being. The sum which the deferred stockholders were entitled to bring forward as their contribution to capital, and in respect to which they were entitled to participate, was £5,950,000, the capital paid up on the preferred and deferred stock. The first and second preference shareholders were excluded by the articles of the company, and the third preference shareholders were, on the principle that a preference share gave its holder no more than it bargained to give, and also on the principle laid down in another case, they were not entitled to participate in the surplus assets.

After Mr. Younger had concluded his arguments, his Lordship said that any order made on this or any other summons dealing with the matter was to be a final order covering everything in relation to the way the assets were to be distributed, so that if there should be an appeal from his judgment to the Court of Appeal, and ultimately to the House of Lords, which might very well be, having regard to the magnitude of the sums involved, the decision of the House of Lords would govern the matter. He proposed, therefore, to put the matter in such a form that, if it went to the House of Lords, that House would be in a position to pronounce a final judgment on the whole case, and to have a final order of his going up to the House of Lords, and the whole of the distribution of the assets remaining in abeyance until some further points were decided. Of course, there could not possibly be any final settlement or distribution until after the award, when one knew the amount to be distributed. He therefore proposed, at the conclusion of the arguments upon the present summons, not to reserve judgment, but to adjourn the further hearing of the matter, first, until after the award, and, secondly, until after any person who might wish to take out a summons raising any other point, had had an opportunity of doing so. If and when such a summons was taken out it would be adjourned to come on for further hearing, so that there might be one comprehensive order dealing with every point.

Mr. Younger said that the course proposed by his Lordship would cause no inconvenience, because there could be no distribution until after the award was made.

The further hearing of the summons was then adjourned until after the award.

Hereford Electricians' Claim.

At the Hereford County Court Messrs. Walker & Co., of 11, Widemarsh Street, Hereford, electrical engineers, sued Leonard Lane, a commission agent, of Victoria Street, for £24 5s., for work done. There was paid into Court the sum of £20, and the full claim was resisted, because it was alleged that part of the work was not done properly.

Evidence was given by Mr. Walker, who claimed that the charges for the work were quite reasonable. He said he did not put a main switch in because it would have cost £5, and Mr. Lane had complained of what the work was costing. It took from May to September to put in the supply, because the firm had to work with the builders.

Mr. C. E. Gray, electrical engineer and chief secretary of the Ross Electric Light Co., said the price Messrs. Walker had charged was reasonable.

The Solicitor for the defendant contended that the work took a long time, and the requirements of the local by-laws had not been complied with. No main switch was provided, and when the authorities knew that this was the case, they sent to Mr. Lane and told him if the matter was not attended to within 48 hours the supply would be cut off.

In giving judgment, His Honour said there were two points in the case. One was that the work was not properly done, because a switch was not provided. He thought two guineas must come off the claim because of work that had to be done later owing to this omission. The second point was that of the percentage on the discount—Messrs. Walker had promised 10 per cent.—but as Mr. Lane was not present, he would not go into that. He would give judgment for £21, costs to follow the event.

Workman's Compensation Case.

At the Manchester County Court on the 19th inst., a peculiar case under the Workmen's Compensation Act came before Judge Millor. Messrs. Halliwell & Co., electrical engineers, of Thomas Street, claimed an award terminating compensation of 17s. 8d., payable to Thos. M'Dunough, of Tell Street, Chorlton-on-Medlock. It was stated that in December, 1910, the workman struck his left hand with a hammer and injured it so severely that one of the fingers had to be removed, owing to blood poisoning. Eventually, his mind gave way, and the Court appointed Mr. James Rowan, secretary of the Electrical Traders' Union, of which Mr. M'Dunough was a member, as his guardian *ad litem*. Mr. T. Lord, solicitor for the employers, contended that the present incapacity did not arise out of the accident, and produced the evidence of two medical men to the effect that the lunacy was caused by disease and alcohol. Mr. Ashworth, solicitor for the workman, admitted that his medical men being of the same opinion, all he could now insist upon was a declaration of liability to cover possible future developments.

The Judge agreed, and made an order accordingly.

Appeal by Bristol Tramways and Carriage Co.

The Court of Appeal, composed of the Master of the Rolls and Lords Justices Farwell and Hamilton, on Friday delivered a considered judgment on the defendants' appeal in the case of Newberry *v.* Bristol Tramways and Carriage Co., Ltd., in which the plaintiff was awarded £150 at the trial before Mr. Justice Channel and a special jury at Bristol.

The plaintiff, Mr. James Newberry, a traveller and dealer in general goods, of Bristol and Birmingham, claimed damages in respect of personal injuries sustained by him while travelling on the outside of one of the company's tramway cars. It appeared that the trolley came away from the overhead wires, and while the conductor was endeavouring to replace it, the trolley arm became detached from the standard, and in its fall it struck the plaintiff. The plaintiff pleaded that there was an onus on the company to prove absence of negligence on its part, or, alternatively, that it was guilty of a number of acts of negligence, which were set out in the particulars. The defence was a denial of liability. The jury found that the company, having used a detachable trolley arm, knowing the risk to passengers, did not take sufficient precautions for their safety, and in reply to the judge, the foreman added that not being engineers, they were not able to state what precautions should have been taken. Judgment being entered for the plaintiff, the company appealed on the ground that there was no evidence that it could, by the exercise of ordinary care and diligence, have avoided the accident, and also that it was protected from the consequences of the accident by its statutory powers.

The Master of the Rolls said he thought the verdict of the jury showed that the company had discharged the burden upon it. It was sufficient that the company, as carriers, should have and use the best known apparatus, keep it in proper order and worked properly by competent men. The company discharged all these obligations, and, therefore, he was of opinion that the appeal should be allowed and judgment entered for the company, with costs.

Lord Justice Farwell said that the evidence was that nobody on the company's behalf had ever tried experiments in order to see what could be done to protect the passengers from these accidents. The truth was that the company had not troubled to see whether it could find any remedy for it, and it had taken the chance. In his opinion, the verdict was one the jury were entitled to give upon the evidence, and he was not satisfied that the company had exercised due diligence and care. There was nothing in the Act of Parliament which justified the company carrying a full load of passengers outside if, by rearrangement of the seats, safety to the passengers could be secured. Under the circumstances, he thought the appeal should be dismissed.

Lord Justice Hamilton agreed with the judgment of the Master of the Rolls, and by a majority of the Court, therefore, the appeal was allowed, with costs.

BUSINESS NOTES.

Private Arrangement.—The Simms Magneto Co., Ltd., Kimberley Road, London, N.W.—Pursuant to the provisions of the Companies' (Consolidation) Act, 1908, a meeting of the creditors of the above was held on Tuesday, December 17th, at the Institute of Chartered Accountants, Moorgate Street, E.C. It was reported that the shareholders of the company had already met at the offices of the company, Welbeck Works, Kimberley Road, Kilburn, on November 28th, when a resolution was passed in favour of voluntary liquidation, with Mr. Archibald White, C.A., of 79, Wool Exchange, E.C., as liquidator. The chair was occupied by the liquidator, who stated that it had not been possible in the short space of time at his disposal to fully investigate the position, but he had prepared an approximate statement. There had been an action by debenture-holders, and he was appointed by the Court to act as manager and receiver, and he was now in possession of the whole of the company's property and undertakings. The debenture action was started in the name of Mr. Agnew, who was a holder of 6,800 debentures, Sir George Wm. Agnew who held 1,000 debentures, Miss Agnew who had 5,500 debentures, and two others. The total amount of the debenture charge was £34,000, but in addition there were debentures for £6,000 deposited as collateral security for a loan of £10,000. Therefore the total debenture charge was £40,000, plus the arrears of interest of £3,770. The company was formed in October, 1907, when it took over the business previously carried on by the Simms Manufacturing Co., Ltd. The assets taken over comprised stock, £7,100; plant and machinery, £6,200; fixtures and fittings, £1,220; patterns, £1,000; new buildings, £2,300; book debts estimated at £7,750; cash in hand, £1,600, and expenditure in advance, £445. In addition there were other assets consisting of licences, patents, and goodwill of the value of £25,921. There were also liabilities amounting to £18,435 which the company discharged, and that left the net value of the property taken over, including the goodwill, &c., at £34,270. The consideration in respect of that was the allotment of 10,508 fully-paid shares of £1 each in the new company; 16,917 shares of £1 each, on which 13s. 4d. was paid; 4,645 shares of £1 each, of which 15s. was paid; and £9,000 in fully-paid debentures. The debentures were allotted to Mr. F. Simms, one of the vendors. Debentures to the extent of £6,000 were also subscribed for in cash, and subsequently a further £10,000 was raised on second debentures. At a later date those debentures were cancelled, and there was a fresh issue of debentures for £40,000. Certain of the debentures were subscribed for at 80 per cent. of their face value, but the balance of 20 per cent. was paid over, and shares were taken in the company for the amount. Mr. Agnew and Mr. Simms held debentures for £6,000, against an advance of £10,000. The total issued share capital was £61,727. With regard to the assets, they were of a problematical character. The goodwill, licences, &c., stood in the books at £26,339, but what they were worth at the present time he was unable to say. The stock in trade was estimated at £20,000, and it was said to have been taken at cost. The stock included finished machines worth about £7,000, the remainder being in parts. The company manufactured all its goods in this country, and none were purchased from the Simms Magneto Co., of America. The English concern had no connection with the American company. The machinery and plant were valued at £10,417, and the other assets, included fixtures £875; book debts, £7,619, expected to produce £6,900; cash in hand, £562; and Paris branch, £6,000. The liquidator added that the Paris branch had always been a losing concern, and in the previous year the loss had been over £1,000. The company also held 1,525 shares of $100 each in the Simms Magneto Co., of America. Of those shares, 250 were attached in New York, and certain of the other shares were held as security for a cash advance. He had no intimation as to what the value of the American company's shares was. Excluding the goodwill and the shares, the assets of the company amounted to £44,714. Against that there were debentures and interest for £43,700, a charge of £4,550 on the American shares, and preference claims of £800, or total liabilities to secured creditors of £48,020. With regard to the unsecured claims, they aggregated £10,284, and were all due to trade creditors.

In answer to questions, Mr. White said that there was a possibility of the business being sold as a going concern. He was continuing the business with a view to finding a purchaser for it, and was now in negotiation with two or three people.

Mr. E. H. Hawkins asked if the liquidator was making any profit in carrying the business on, and Mr. White replied that he would not like to say he was, although he had reduced the standing expenses very considerably. In answer to further questions, he stated that the business had been carried on latterly at a heavy loss, and no dividends had ever been paid.

A creditor said he understood that originally Mr. Simms had a working agreement with Mr. Bosch, and he asked if the company was formed after the termination of the agreement.

Mr. White replied that it was, and the creditor then stated that "of course Bosch has now got the trade."

Replying to further questions, the liquidator said that the business had been too heavily weighted by the establishment and supervision expenses. The company suffered very severely by the keen competition of Continental firms, who were selling at very cheap prices. He could not tell whether the Continental manufacturers were turning out goods cheaper than the Simms Magneto Co., or whether they were making a bid for the trade. At the present prices he did not know how the company could hope to make a very large profit.

The opinion was expressed that a joint liquidator should be appointed to represent the interests of the trade creditors. The matter was discussed at some length, and eventually it was decided that application should be made to the Court for the appointment of Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., as joint liquidator with Mr. White. A committee of the principal creditors was also elected. The principal creditors are :—

Johnson, Matthey & Co.	£1,216
Krefeld Steel Works	730
Simpson Bros.	975
Electrical Co.	773
Automatic Standard Screw Co.	640

Trade in 1912.—Messrs. Bolling & Lowe, in their annual trade review, refer to the unprecedented improvement that took place in trade conditions in all departments, in spite of labour troubles during the year. Not only in the British Isles was this the case, but in all industrial countries there is evidence of exceptional prosperity, and this is accentuated in the iron, steel and allied trades. In regard to the copper market, they write as follows :—

"The copper market has been in a wonderfully strong position, and prices of standard metal rose from about £61, early in the year, to £80 or thereabouts, about the middle of June, remaining in the neighbourhood of the higher figure, though with fluctuations, until now. The advance was based upon a continuance and extension of the sound conditions which in 1911 took prices from £53 to £64. Throughout the first six months of the year the world's statistical position improved steadily. On December 31st last the total visible supply was 110,619 tons, while on June 30th low-water mark was reached at 67,930 tons. During the second half of the year the visible supply increased steadily in consequence of accumulations being in progress at the United States refineries, which more than counterbalanced a drain upon the reserves in Europe, hence the market suffered a diminution of buoyancy, standard metal developing an irregular movement, even though the big American producers, who lifted their price for electrolytic copper to £82 in the autumn, showed an unbending front. The war in the Balkans has affected sentiment adversely during the past two months or so, and this, in conjunction with the very heavy American production, affords ample justification for the halt which has been called in the upward movement. Just at present, and on the basis of current supplies and demands, copper judged from a broad standpoint, seems sufficiently dear, although a boom in America, synchronising with exceptional activity in Europe, might justify higher prices. The extent to which production has increased is shown by the fact that the United States output for the first 11 months of 1911 was 584,000 tons, while for the same period of this year it was 642,000 tons. The monthly average of 53,000 tons last year has thus been converted into a monthly average of about 58,500 tons. Actually the increase has been on a progressive sale from 49,030 tons in November last year to 65,000 tons in October of this year."

In their concluding observations Messrs. Bolling & Lowe describe 1912 as "the banner year" of British prosperity, and they add :—"We do not attach the importance that some of our friends do to the troubles in the labour world. The leaders of Capital and Labour bound by the common bond of economic conditions, will find a satisfactory method, possibly that of Sir Charles Macara, to adjust the claims of both without the suicidal strike or lock-out. With an absence of labour troubles, and a settlement of the European complications, we see no reason why the present prosperous trade conditions should not continue throughout 1913."

Messrs. W. C. Martin & Co., electrical engineers, of Glasgow, &c., who specialise in the electrical equipment of steamships, report having experienced a steady flow of business during the past year. Among the larger vessels fitted out by them were the British India Steam Navigation Co.'s t.s.s. *Aronda*, built at Linthouse, and the t.s.s. *Hurunvi*, built at Port Glasgow, for the New Zealand Shipping Co., Ltd. Special mention may be made of the s.s. *El Uruguayo*, also built at Linthouse for the South American frozen meat trade, containing the largest refrigerating plant ever fitted on board a ship, also the large Austro-American steamer *Kaiser Franz Joseph I*, built at Monfalcone, Trieste. In addition, this firm completely refitted the t.s.s. *Carmania*, involving some 2,500 lights, besides power circuits, after the disastrous fire which practically gutted the vessel. Messrs. Martin have large orders in hand with which to start the New Year, including the electric installation on the new Cunard R.M.S. *Aquitania*, the largest ever fitted on board a vessel, also the t.s.s. *Gelria* and *Tubantia*, for the Koninklijke Hollandsches Lloyd, Amsterdam, as well as a number of other smaller vessels. One of the greatest lessons emphasised by the terrible disaster to the R.M.S. *Titanic* was the advisability of providing means on board ship, by which the electric supply of the principal parts of the vessel could be maintained up to the very last moment in the event of such a disaster. The method employed by Messrs. Martin to provide an emergency generating plant fitted on the highest deck, is now being adopted on a number of large vessels.

Another special feature in electrical installations as fitted by Messrs. Martin is the increased use of electrical appliances of all kinds on board ship, not only in driving auxiliary machinery in the engineers' department, such as pumps, fans, thermotanks, &c., but for working goods and passenger elevators, cranes, winches, and also in the culinary and stewards' departments. Electric dough-mixers, knife-cleaners, egg-boilers, grills, hotplates, toasters, and other appliances too numerous to detail, are now the rule rather than the exception, while a ship's laundry is not now considered up-to-date without electric washing and ironing plant, and no liner is complete without an electrically-driven gymnasium, not to mention such appliances as electric hairbrushes, electric hair dryers, electric curling irons, electric cigar lighters, &c.

Liverpool Exhibition, 1913.—We have received a copy of the prospectus of this Exhibition, which is to be held from May to October next on the Edge Lane Hall Estate, Liverpool, under the direction of Liverpool Exhibitions, Ltd. Applications for space are required by the general manager (Mr. C. P. Hainsworth, 31, North John Street, Liverpool), by January 21st, so firms interested should write for particulars and forms at once. Sir Chas. Petrie is chairman, and Sir Robert Cranston is one of the directors. The object is to demonstrate to the citizens and to the general public, the commercial development of the city and its great activities as a centre of commerce and industry. It is stated that no great industrial exhibition has been held in Liverpool for over a quarter of a century. There will be, among other features, a "Palace of Electricity" for the display of electrical appliances, machines, &c., also a "Machinery Hall" and a "Palace of Industries." In the classification list, mention is made of mining engineering and metallurgy, transportation and motive power, lighting, heating and ventilation, chemistry and scientific appliances, and so on.

Fire Alarms.—At a cost of £182, the Sutton (Surrey) U.D.C. has accepted a tender for the installation of an electric system of fire-call bells ; 19 bells will be fitted at the firemen's houses, and an automatic switch at the fire station, together with an "on" and "off" switch to the turncock and steam hooter.

Catalogues and Lists.—The Hoyt Metal Co. of Great Britain, Ltd., 26, Billiter Street, London, E.C.—32-page booklet, also a number of separate testimonial leaflets, relating to Hoyt's standard Babbitt or anti-friction metals, tests of same, directions for use, output figures over 13 years. code-words, and so forth.

The Foster Engineering Co., Ltd., Wimbledon, S.W.—Leaflet concerning their A.C. electric geyser, showing the alteration in general appearance since its first introduction. It is now supplied with an external casing of sheet copper or brass. Copies will be sent on application.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park.—Envelope pamphlet entitled "The Power Policeman—What He Can Do for You," in which are described and illustrated their portable wattmeters and watt-hour meters.

The British Prometheus Co., Ltd , Salop Street Works, Highgate, Birmingham.—Third edition of catalogue No. 141. It consists of some 40 pages, and contains illustrations and prices of a variety of their electric cooking and heating apparatus, from a curling-iron heater to a hot cupboard. A number of original designs of Prometheus convectors are shown and priced on a separate leaflet. Contractors can have a number of copies of the catalogue bearing their own name and address.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Twenty-page pamphlet entitled "Table Cooking by Electricity," containing illustrations, descriptive notes, and prices of electric toasters, cookers, hot-plates, "composite" breakfast sets, tea-pots, kettles, flat-irons, and so on.

Messrs. Borland, Hagedorn & Co., Ltd., 66a, St. Martin's Lane, London, W.C.—Illustrated and priced four-page list, describing stage projectors, gallery and vertical projectors, resistance frames, stage connectors, &c.

The Hart Manufacturing Co., 76 and 77, Rochester Row, Westminster, S.W.—Leaflet briefly describing and giving prices and diagrams of connections of their series-parallel three heat "Diamond H" switches.

Messrs. Tetley & Co., Falcon Electrical Works, Salford.—An illustrated leaflet describing their "Standard" ironclad stage plug also a price leaflet of "Falcon" mercury cut-out, permanent magnet type.

Trade Announcement.—Messrs. Shoolbred and Connell, engineers and electricians, announce that their only address is now 11, Cheapside, Luton, Beds. and all communications should be addressed there.

Holidays.—Messrs. Cryselco, Ltd., of Bedford, have their works closed from the 24th inst., until Monday morning, the 30th inst.

The London Electric Firm, of Croydon, announce that their works are closed until Monday morning next, December 30th, for holidays.

Patent Restoration.—An order has been made restoring patent No. 5,542, of 1900, granted to C. Darrah, jun., and J. G. Patterson, for "Improvements in safety devices for miners' safety lamps."

Dissolutions and Liquidations.—The Marzi Loud-Speaking Telephone Co., Ltd. This company is winding up with Mr. A. D. Foggo, 11, Queen Victoria Street, London, E.C., as liquidator. A meeting of creditors is called for January 4th. They are required to send particulars of debts, &c., to Mr. Foggo, by February 1st.

Electric Flash Lights, Ltd.—This company is winding up voluntarily with Mr. R. G. Sidford, 20, John Street, Adelphi, W.C., as liquidator. A meeting of creditors is called for December 30th.

Cowper-Coles Galvanising Syndicate, Ltd.—A meeting is called for January 23rd at 11, Ironmonger Lane, E.C., to hear an account of the winding up from Mr. A. E. Tugwood, the liquidator.

The Reflector Syndicate, Ltd.—A meeting of this company is called for the same time and place for a similar purpose.

Langdon-Davies Motor Co., Ltd.—A meeting is called for January 22nd at 12, Coleman Street, E.C., to hear an account of the winding up from the liquidator, Mr. C. Cape.

Bankruptcy Proceedings.—W. F. Flint, electrical engineer, Hull.—Release of trustee (W. G. Hall), November 28th.

Mexico: Leaving the Field Without Fight.—The following letter has just appeared in the *Glasgow Daily Herald*:—

"Servicio Consular Mexicano,
"116, Hope Street, Glasgow, December 14th.

"Sir,—I beg space in your important paper for these few remarks, calling the attention of the merchants who received from me an invitation to participate in the local exhibition in the State of Colima, Mexico, towards the not very despicable fact that those not availing themselves of that kind of advertisement really miss a good opportunity to introduce their products in a new market, leaving the field without fight to other very enterprising competitors, a very considerable factor for commercial supremacy. As the expense would not be ruinous for those wishing to send samples to that Exhibition, it would be desirable for me to know how many of them are they, so that the steamship company could give the capacity required for freight up to Puerto Mexico, in the Gulf of Mexico.—I am, &c.,

"Miguel Barrera, *Consul for Mexico*."

Meters Approved.—According to the *London Gazette* for December 20th, the Board of Trade has approved of the following meters:—

Rex meter, type S.G. 1, deposited April 16th, 1912, on behalf of the Société Genevoise, Geneva, for constant-pressure S.P. two-wire A.C.

Bat Meter type H, deposited February 23rd, 1912, by the Bat Meter Co., Ltd., for constant pressure two-wire C.C.

Calendars and Diaries.—From the Union Electric Co., Ltd., of Park Street, Southwark, London, S.E., we have received an interesting wall calendar for 1913, the outstanding feature of which is a Union motor with pulley and belt-driving machinery, executed in colour. This cannot help effectively driving home the power side of the firm's business. Neat monthly date sheets are interleaved with illustrations of Union apparatus. As only a limited number of the calendars are available, applications should be sent in at once. It is intended later to issue the card itself as a showcard.

Mr. John Whitelaw, of 15a, Duncan Street, Edinburgh, has sent us a serviceable monthly sheet wall calendar for 1913, lighting-up times being indicated in small red figures. The upper half of each sheet has a "Highways and Byways" picture appropriate to the month—"Ploughing in Hope," "A Halt in the Lane," "Springtime's Bounty," and so on.

As a Christmas souvenir the St. Helens Cable and Rubber Co., Ltd., of Warrington, are sending out to their friends a small desk-card, "Lest ye Forget," with small monthly date slips for 1913.

Messrs. Geo. M'Cartney & Co., makers of Orb switchgear, Cumnock, N.B., have brought out a serviceable calendar for the coming year, with clearly-printed dates on monthly sheets.

The Brimsdown Lamp Works Ltd., Kingsway House, W.C.—A neat little calendar and postage stamp case has been received from this firm, together with a pack of playing cards ornamented on the backs with a reproduction of the familiar poster recording the world-wide popularity of the well-known "Wirum" lamps.

To the Electric Construction Co., Ltd., for whose New Year souvenir we always look with interest, we are indebted for a very neat and handy vest-pocket diary and stamp-case, together with a pocket wire gauge—a nickel-plated gem.

LIGHTING and POWER NOTES.

Australia.—The following interesting notes show the progress that is being made by the Newcastle City Council electrical department:—The reconstruction scheme which has been in hand for the greater part of this year is now nearing completion. Two-thirds of the entire mains for the city have been reconstructed and completed; new high-pressure feeders have been erected to the city sub-station, which is an entirely new building, containing three banks of transformers with high and low-tension switchgear, suitably housed in a three-storey fireproof building. The top portion of same contains the switch-gear, the middle section the transformers, and the bottom section the cables from the switchgear to the transformers. New low-tension feeders have been erected in the main streets, which will increase the carrying capacity. The new General Electric Co.'s series incandescent system single lamps of 60 C.P. is now partly installed with gratifying results. The water-softening plant, which is of Kennicott type, has been delivered and erected by the contractors, and is now in operation. The condensing plant, which embraces a multi-jet condenser of Mirrlees-Leblanc type, is partly erected, with the oil eliminating plant, and the spray cooler as designed by Messrs. Fyvie & Stewart, of Melbourne. Two other sub-stations are in course of erection and will be in operation early in the new year. The mains have been extended into the municipality of Hamilton and Wickham, and a third municipality is now negotiating street lighting, which will also give the Council the right of private supply.

The financial results of the first half of this year under the present management, as compared with the first half of 1911, show a net difference of £1,600, despite the fact that during this year a considerable sum has been spent from revenue for reconstruction purposes, and to date the undertaking has not received the full benefit of the extra £10,000 that is now being spent, which will be reflected in largely increased business, and greatly decreased working costs. It is expected that the system will be completely in order during the first few months of the new year. Mr. Guy Allbut is the city electrical engineer.

Baildon.—The District Council decided last week to ask the B. of T. for a prov. order to construct electric tramways, and also for an Order under the Electric Lighting Acts. Negotiations are in progress with the Bradford Corporation with reference to the proposed tramway facilities.

Bolton.—The Electricity Committee has decided to supply current for motive power to the works of Messrs. Dobson and Barlow, Ltd., on terms to be arranged.

Bradford.—The Electricity Committee of the Corporation has decided to recommend the City Council to illuminate Tong Street—a long thoroughfare commencing at Dudley Hill and extending therefrom for over 1¼ miles to Westgate Hill—with electricity in place of gas.

Bradford-on-Avon.—The U.D.C. has deferred the electric light question, broached by Messrs. Purves, of Exeter, until the new Council is elected next April.

Bridlington.—The T.C. on December 18th decided to apply to the L.G.B. for a loan of £5,000 for the provision of new generating plant of 600-KW. capacity and extensions to the engine room.

Canada.—The New Westminister (B.C.) Power Co. is about to obtain extensive water rights on Brandt Creek, Indian River, Young Lake and Norton Lake, waters contiguous to the city. The object of the company is to establish a power plant to supply the Fraser Valley district with current for lighting and power purposes. The New Westminster Power Co. is composed of a number of local parties backed by English capital.

Chesham.—The U.D.C. has entered into a seven years' agreement for public lighting with the local electricity company.

China.—The establishment of generating stations has made great strides in China in recent years. Besides Shanghai, the use of electricity has extended to all the large cities in the surrounding districts—Hangchow, Ningpo, Soochow, Chingkiang and Wousih. Four-fifths of these undertakings are, says *La Revue Pratique de l'Electricité*, in the hands of German firms, whose sale prices defy all competition.

Chorley.—A Bradford firm have taken land for a new cotton mill to be erected in Chorley, and to accommodate 700 looms. It will be the first shed in this locality to be electrically-driven.

Chorley Wood.—The Watford U.D.C. has, in view of the formation of an Urban Council for Chorley Wood, deferred the question of the electric light scheme included in a prov. order being applied for by a private company. The draft order provides that the local authority shall have the option of purchasing the undertaking at the end of 21 years, and each subsequent seven years.

Cleckheaton (Yorks.).—At the last meeting of the District Council it was decided to confirm the recommendation of the Electricity Committee that the prices for electricity should be advanced by 10 per cent., except in cases where the supply is under agreement. This increase is a result of the enhanced prices of coal.

Germany.—The monopolist tendencies of the large electric construction and supply companies in Germany are generally resented, and in Schleswig-Holstein some nine districts have banded themselves together in an electric Zweckverband, with the object of safeguarding the interests of its members in all questions relating to the supply of their districts with electric current. The Verband will not itself carry out installations, but will confine its operations to tendering advice and clearing the ground for private initiative. The departure is expected to prove a boon to the smaller electrical manufacturing firms who have hitherto been excluded from participation when schemes were launched by any of the monopolist companies.

Holland.—Several schemes for the establishment of generating stations are being considered in Holland. One station is planned to serve the Communes of Nieuw Buinen, Buinerveen, Cosselle and Gieten in the province of Drenthe; a second is for the supply of the Communes of Wondsen, Ijlst and Balk in Friesland, and a third for Giekerk, Molesend and Roodkerk, also in Friesland.—*Revue Pratique de l'Electricité.*

Cwmavon.—The U.D.C. has decided to apply to the B. of T. for a prov. order for electric lighting; exclusive of the cost of the site for the generating station, the cost of the scheme is placed at £6,000.

Fife.—The Fife Electric Power Co. has acquired a site in Nethertown, at the south side of Dunfermline, for the purpose of erecting a sub-station, in order that power may be better transmitted to the Rosyth area.

Finchley.—At the last meeting of the Council, the Electricity Committee reported that it had considered a special report of the electrical engineer on the matter of the cheaper production of electricity, and recommended that tenders be invited for the installation of an oil engine at the electricity works at an estimated cost of £4,500. The report was adopted.

Fleetwood.—The U.D.C. has decided to apply to the L G.B. for sanction to borrow £7,176 to meet the cost of proposed extensions at the electricity works, and to request that permission may be given for the work to be proceeded with.

Hornsey.—The Council has decided to ensure the electricity works against loss of profits in the case of fire or explosion. According to the statement of the working of the electricity department for the half-year ended September 31st last, it appears that the amount received from private consumers had been £6,987, an increase of £435 over the corresponding period. The total receipts were £7,799, as against £7,334, or an increase of £465. With regard to the expenditure, this had been £4,456, as against £3,730 at the corresponding period.

Huddersfield.—The Corporation has decided to apply to the L.G.B. for powers to borrow £60,000 for the purposes of the local electricity undertaking, to which a number of detailed improvements are proposed to be made, including some alterations to the buildings, and the fixing of new single-phase switchgear.

King's Lynn.—At a recent meeting of the T.C., the chairman of the Electricity Committee stated that the Committee felt the time had come when considerable outlay must be made on extension of plant. This was owing to the large number of fresh customers who had lately been obtained, several of them being large consumers. They include the Great Eastern Railway Co., which has introduced electricity in the place of gas at the passenger station, and also lighted the harbour sidings. The total private connections are now equivalent to 41,591 lamps of 8 c.p., and this in a town with a population of 20,000. In addition, all the streets are electrically lighted.

London.—The Bethnal Green Council has decided to adopt the electricity supply proposals, particulars of which were given in our last issue.

Mexborough.—The Council has decided to apply to the L.G.B. for powers to borrow £10,000 to be devoted to the extension of the local electricity works.

New Zealand.—The Council of Devonport, New Zealand, is inviting schemes, for adoption by the Municipality or for execution by private enterprise, for the installation of electric lighting in the town. Full details are required, including, in schemes for private enterprise, the charges that would be made for the supply of current and what share of profits would be given to the local authority.—*Financier.*

Salford.—A fire broke out at Salford electricity works early last Thursday. The extent of the damage is estimated at £10,000, including the destruction of a switchboard which will cost £5,000 to replace. It is stated that the fire was caused by a workman dropping a spanner which in its fall came in contact with a live wire. There was a great blaze, and the fire extended rapidly, destroying many cables. The fire brigade were able to prevent serious damage being done to the electrical machinery. The tramway service had to be suspended for several hours, but the co-operation of the Manchester, Bury and Eccles electrical systems greatly minimised the dislocation. Some of the larger works which depend entirely upon electricity for their motive power have been compelled to close until the damage at the electricity station is repaired.

South Africa.—At a public meeting recently held, the Harrismith, O.F.S. Municipality were authorised to raise a loan for the carrying out of a hydro-electric scheme. The power will be generated by water supply on the top of Platberg mountain, and used for the lighting of the town, and supplying power for industries. This scheme, it is supposed, will be the first of its type in the country.

Swinton and Pendlebury.—At a meeting of the D.C., held last week, a letter was read from the Lancashire Electric Power Co., stating that it had arranged, subject to the consent of the Council, to supply Messrs. A. Knowles & Sons, Ltd., with current for haulage purposes, principally at the Pendlebury and Clifton Hall Collieries. The present requirements were about 320 h.p. at Pendlebury, and 250 h.p. at Clifton Hall. It was resolved that the Council consent to the arrangement.

Wood Green.—The District Council is one of the few local authorities round London which has no electric supply in its district, with the result that the largest firms generate their own energy. About 12 years ago Wood Green and four contiguous districts combined in a proposed scheme of generation and distribution, but in the end that fell through. Six or seven years ago Wood Green decided to embark on a scheme of its own, involving an outlay of £60,000. The L.G.B., however, refused to sanction the application for a loan. Then the District Council obtained a provisional order, which was from time to time extended. Now the Council has another scheme on foot—viz., to sell the order outright to the Tottenham and Edmonton Gas Co., and, with that aim in view, the company, with the sanction of the local authority, is promoting a Bill in Parliament in the ensuing session. The company has agreed to pay the Council the sum of £500, together with the full amount of its costs and charges incurred in applying to Parliament for the necessary powers, and to commence a supply of electricity within a period of 12 months from the date of the transfer of the order. The actual prices to be charged are limited for lighting purposes (private consumers) to 5d. per unit; for power, heat and domestic purposes (private consumers) to 2d. per unit; for street lighting, 2½d. per unit in roads or streets in which houses are being supplied by the company. The Council will have the right at any time after the expiration of 14 years to purchase the undertaking upon payment of the capital expenditure, and, in addition, a sum calculated on that capital expenditure at rates ranging from 20 per cent. if the purchase is made in the fifteenth year, the percentage decreasing 1 per cent. on each additional year's purchase. In the course of a discussion on the subject, Councillor Holmes said it might be useless to oppose the scheme, but he should do his very best to prevent one company obtaining a monopoly of both electric and gas lighting in the town. The present automatic gas lighting was bad. Councillor Davies said the automatic gas lighting was experimental, and it was improving. The Council signified its approval of the scheme.

The North Metropolitan Power Supply Co. has also given the Council notice of its intention to apply for a provisional order for Wood Green.

West Kirkby.—The Electricity Supply Committee of the U.D.C. has reported that for the year's working up to November 30th last there was a profit on the undertaking of £116.

The L.G.B. has sanctioned the borrowing of £1,157 and £168 for the purposes of the electric light undertaking.

West Wickham.—The Beckenham U.D.C. proposes to apply to the B. of T. for a prov. order for electric supply at West Wickham, which is in the area of the Bromley R.D.C.

Wisbech.—The B. of T. has forwarded to the T.C. an application from the National Electric Construction Co., for its E.L. Order to be extended, and not revoked. The Council has referred the matter to a Committee for consideration.

Southend-on-Sea.—The T.C. has decided to apply to the L.G.B. for a loan of £11,000 for additional plant, &c., at the electricity works. It is proposed to install two new Babcock boilers, with economisers, feed pumps, and an automatic coal and ash conveyor.

Willesden.—In considering the proposed improvements in the public street lighting, the Electricity Committee is to be given an opportunity of submitting tenders in competition with the gas company.

South Africa.—According to the *South African Mining Journal* an application to amend its licence by the Victoria Falls Power Co., and any objections thereto, was to be heard in public by the Power Undertakings Board on December 17th, at the office of the Government mining engineer, Johannesburg.

Rhodesia.—The Lone Hand mine on the Tuli River is installing machinery with electricity for motive power. An overhead railway has been erected between the pit head and the mill, and a powerful pump, driven by electricity, has been placed in the river bed. Prospects are held to be most promising.

MESSRS. J. SADD & SONS' TIMBER MILLS AT MALDON, ESSEX.

Messrs. Sadd & Sons, Ltd., can claim to be one of the most progressive firms engaged in the timber trade in the Eastern Counties, if not in the whole country. Their history, from the establishment of the business about 150 years ago to its conversion into a limited liability company in the year 1889, is a record of steady, natural growth. The firm made great strides under the guidance of its late head, Mr. John Granger Sadd, J.P., who was five times Mayor of Maldon, but the most noteworthy developments have occurred since the mill was burnt down three years ago.

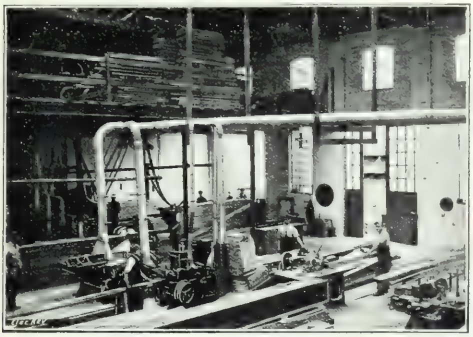
The opportunity which this afforded for a complete reorganisation and layout on modern lines was immediately realised, and since that event an immense amount of careful thought has been devoted to every detail of construction and operation of all the machinery, both mechanical and commercial, which is vital to the welfare of a successful concern.

General View of the Timber Mills.

After the death of Mr. J. G. Sadd the management devolved upon the three present directors, Messrs. John, Harry and Herbert Sadd, and Mr. Alfred Thorn, who has just resigned after 45 years' service.

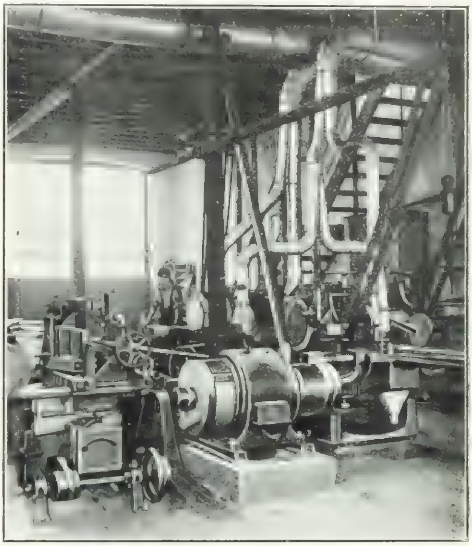
The work naturally divides itself up into four sections :—The foreign timber trade, the English timber trade, the engineering plant, and the secretarial duties. Each of the four directors had received a training specially fitting him for one of these branches in particular, and in the order named.

The foreign timber trade, which is under the special care of Mr. John Sadd, now involves a capital of about £30,000. and includes the purchase and resale of all squared-up imported timber and its conversion into suitable scantlings to meet the builders' requirements. Practically the whole of this timber is brought up the Blackwater by steamers of about 1,000 tons, and delivered to the extensive yards, which are well covered with lofty sheds, containing at all times large stocks of Swedish and Russian timber ; this is seasoned under very favourable conditions, and afterwards transported to the Foreign Mill, siding, or barge by gravity feed conveyors.



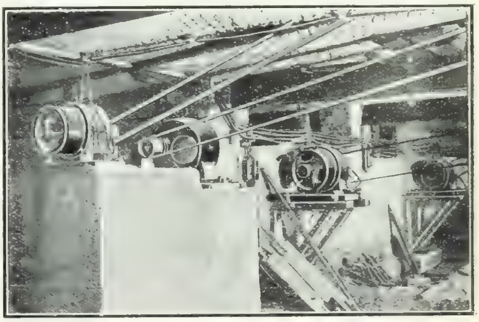
Part of the Foreign Timber Mill and Joinery Loft.

This Foreign Mill has been built upon the site of the old mill, which previously to the fire dealt with both English and foreign timber, and was much handicapped by lack of space and modern conveniences. It is constructed of brick with reinforced concrete floor, to minimise the danger of fire. A second floor of lighter construction is utilised for joinery manufacture. The whole is covered by an Anderson lattice girder roof of 64 ft. span, with a skylight giving an excellently distributed light in the daytime; electric arc and incandescent lamps perform this duty at night. The mill is provided with an excellent equipment of machinery.



American Planer Driven by 50-h.p. Crompton Motor.

The largest machine is a No. 77 eight-cutter planer and moulder, by the American Woodworking Machinery Co., U.S.A., driven by a 50-h.p. Crompton compound-wound interpole motor, and needs about eight men to keep it supplied with raw material and to remove that which has passed through it. This amount of labour is being reduced by the installation of runways from the timber storage sheds to the finished goods warehouse, or direct to the railway siding or river.



Motors on Concrete Piers in the Basement.

The cutters are designed upon the pencil-sharpener principle, and consist of thin knives of high-speed steel, firmly secured to a cylindrical hub at the best cutting angle. Mechanism is provided for "jointing" these knives in position, and they are afterwards ground up to the best angle for the stock upon which they are to be used by a double-wheel automatic grinder, specially designed for the purpose by the same firm, and driven by a small 2-h.p. motor attached to the ceiling. The whole of the cutters are driven by belts kept at a suitable and uniform tension by means of adjustable jockey pulleys, the two main cutters being driven from both ends.

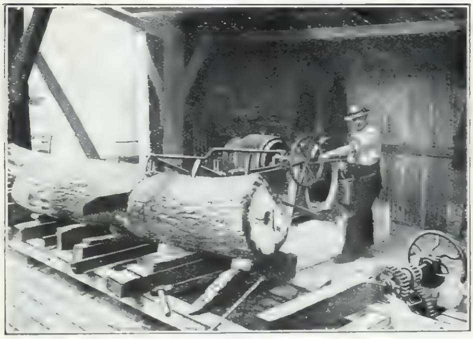
For lighter work, a Bolinder No. 7B planing and moulding machine has been installed, with six rotary cutters, and fixed knives top and bottom, to ensure a perfect finish. This machine is capable of turning out about 20,000 ft. of matching in an ordinary day's run, and is driven by a 24-h.p. Crompton motor, placed under the floor, to which a Sandycroft liquid starter has been applied with very satisfactory results. To this machine has been fitted the Miles patent attachment, enabling the stock to be split and planed or moulded on the two inner faces simultaneously with the other six.

Electric Gantry in Timber Yard.

Next to this machine and feeding from the opposite end is a No. 5 Bolinder circular re-saw, which is capable of a very large output and easily keeps the above planer supplied with freshly sawn timber. It has three speeds of feed, operated by a feed roller which is readily turned out of the way when not required.

In addition to these there is a very complete equipment of minor machines of modern design, each driven by a separate Crompton motor, the whole electrical installation being below the floor on concrete piers in a roomy basement about 7 ft. high, which enables it to be inspected or attended to without disturbing the workmen.

The first floor is occupied by a turning and joinery department, which, though only recently established, is proving itself to be a very promising branch of the industry. The plant comprises drum, radial-arm and belt sanders, vertical spindle and panel planers, tenoning, morticing, and boring machines, and copying and other lathes. All these machines are motor-driven, electricity being further utilised for heating glue kettles and for lighting purposes.

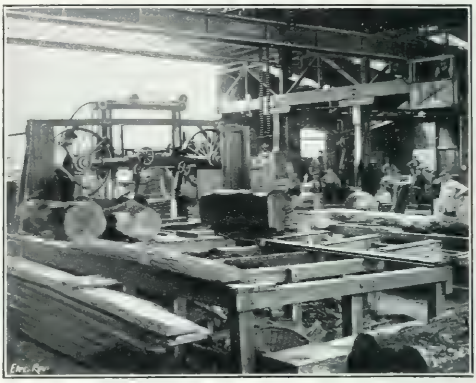


Ransome Cross-Cut Saw and 8-h.p. Slow-Speed Crompton Motor.

The whole of the refuse from this mill is removed by means of a pneumatic installation operated by a 25-h.p. motor, part being deposited on the producer house charging floor, and the surplus on a dump heap well away from the mill.

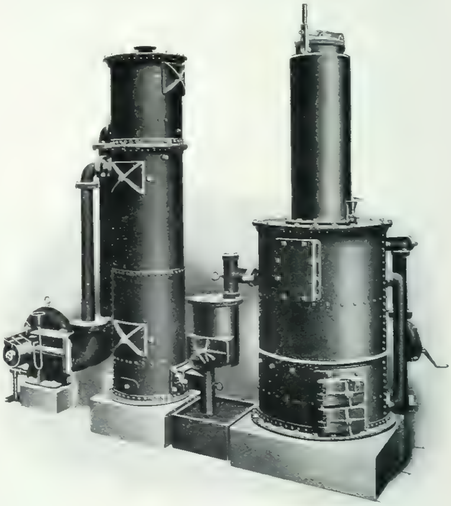
This department also handles all classes of builders' material such as slates, tiles, drain pipes, cement, roofing felt, sideroleum, and tar of all descriptions, the demand for treated timber being met by a creosoting plant recently installed.

The English mill, before the fire, was much handicapped by lack of room. It was therefore decided to put up a second mill at the opposite end of the yard, the employment of electric power alone making this arrangement practicable. This gives ample yard room and storage space round each mill for the class of timber for which it is designed.



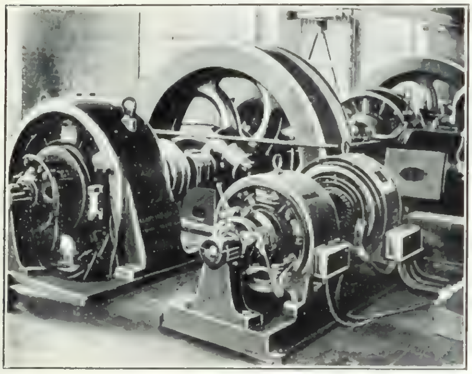
Ransome Horizontal Band-Saw with Lancashire Motor Built on R.H. Wheel Axle.

The building is of timber and corrugated iron, and is fitted with an "Anderson" roof of 54 ft. span, with a 37-ft. span lean-to on the one side to accommodate the lighter machinery, and a smaller lean-to on the other side used as a sharpening shop. The main building has open ends to admit of the unhampered use of the 3-motor H.M. and B. electric traveller of 5 tons' capacity, with a 50-ft. span, running on a timber gantry 200 ft. in extent. The height of the gantry above the ground is 22 ft., and the whole of the laying ground beneath it is utilised to its utmost capacity with oak, elm and ash timber as it is brought in by road, rail or water.



Crossley Wood Refuse Gas Plant.

The logs are first cut off to the dead length required by a



Power House, showing Crompton Generators and Automatic Booster.

Ransome reciprocating cross-cut saw, which is direct coupled to a low-speed 8-H.P. Crompton motor running at 220 R.P.M. It is capable of dealing with logs up to 5 ft. diameter, which are placed on a geared travelling carriage to facilitate rapid and accurate adjustment.

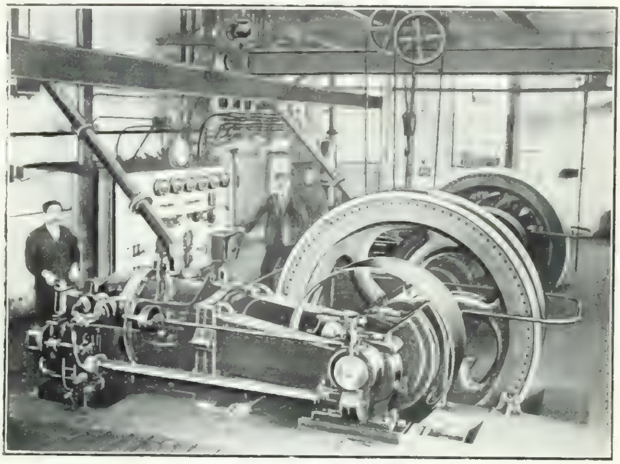
The main feature of this mill is the No. 1 Ransome and Lavo type horizontal band-saw, nominally capable of handling timber 5 ft. in diam. or 4 ft. sq., by unlimited length on account of the open-ended building. It has actually dealt with a pollard oak 8 ft. × 5 ft. × about 20 ft. long, cutting it into planks of suitable thickness with perfect satisfaction, and without any special gear being required. This machine is driven by a 35-H.P. Lancashire enclosed fan ventilated motor, the feed works and gear for raising and lowering the saw being operated by a separate 12-H.P. motor of the same make. The capacity of this machine is remarkable, 10,000 ft. super. per day being quite easily dealt with.

The less valuable timber is broken down at the Lane Rack bench, which has a 5-ft. hoe inserted-tooth saw, and is driven by a 75-H.P. Crompton motor. The planks so produced are converted into boards at a 54-inch Clement vertical band re-saw, marketed by the American Woodworking Manufactory Co. It possesses several advantageous adjustments, the whole of the feed rolls being on a movable bed, which enables them to be canted to any desired angle for the cutting of feather-edged boards. All the feed rolls are power-driven, thus producing constant feed, which can be modified at will by means of patent variable gear.

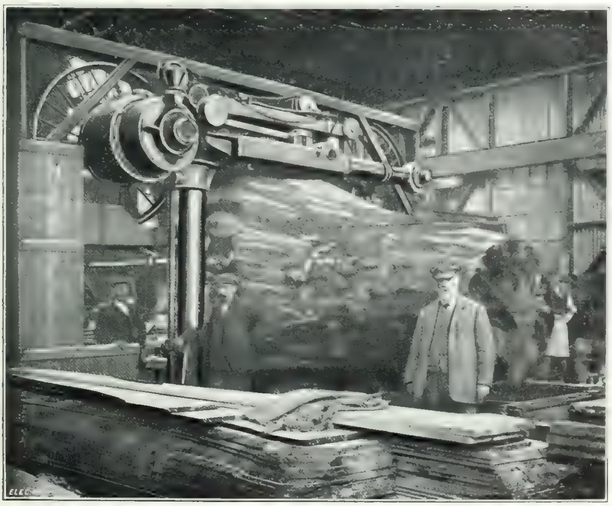
In the lean-to are placed four circular saw benches, one swing and one pendulum cross-cut, 36-in. band-saw, and a large hollow chisel mortising machine, all of which are driven by separate Crompton motors from 4 to 16 H.P.

The refuse from this mill is removed by a motor-driven conveyor and elevator and discharged into a large hopper, high enough for a cart to come under the chute.

The power plant, which was arranged and installed by Mr. H. P. Girling, M.I.E.E., consists of two 100-H.P. sets with space for a third. It is run entirely from wood refuse, which is produced on the premises in sufficient quantity to supply about 1,000 H.P. if required. Each set consists of a No. 6 Crossley gas plant, and Z.E. type horizontal low-speed engine running at 200 R.P.M., direct-coupled to a Crompton 63-KW. D.C. multipolar, compound-wound, interpole generator by means of a Zodel Voith flexible coupling.



Crossley Gas Engines in the Power House.



View of Horizontal Band-Saw, showing Motor on Wheel Axle.

The wood-refuse gas plants, which were among the first of their class to be installed on a satisfactory basis, have proved to be very efficient and give the utmost satisfaction; they are connected to a bus-pipe through wheel valves, and both engines have been run simultaneously from one plant for a period of over one month, which shows that they are very generously designed. Although they are arranged for the injection of water vapour as in the case of anthracite plants, this has been found unnecessary, owing to the large amount of natural moisture in the refuse.

The gas is first passed through a dust-collecting box over a water seal, and then up through a coke scrubber and afterwards through a centrifugal motor-driven tar extractor to the wood-wool scrubber, and thence to the bus-pipe.

The gas produced is of such excellent quality that the engines, though, like most gas engines, only designed to give

90 per cent. of their nominal output continuously, will and do with perfect freedom give the full 100 b.h.p. each for considerable periods.

The engines are governed on the hit-and-miss principle, the variation in speed being so small that a perfectly steady voltage is maintained at the bus-bars. This desirable end is considerably facilitated by the very heavy fly-wheels, one of which, weighing about 9 tons, is fitted to each engine. The exhaust valves are water cooled and the exhaust valves and piston are lubricated by forced feed.

The generators run absolutely sparklessly at all loads up to 25 per cent. overload without brush shifting, and will easily do 50 per cent. overload for short periods and 100 per cent. momentarily without dangerous sparking or overheating.

The engines are now assisted by a battery consisting of 112 P21 E.P.S. cells of 1,200-ampere-hour capacity, capable of giving 1,000 amperes momentarily, and a fully automatic reversible Crompton booster designed to deal with the maximum output of the battery. By this means, the engines can be kept at full load in spite of the exceedingly variable station output, which is characteristic of all timber mills. The nature of the peaks to be dealt with can easily be imagined when the fact is borne in mind that the plant deals satisfactorily with 500 aggregate h.p. of motors of varying size up to 75 h.p., in addition to lighting and town supply.

The switchboard supplied by Messrs. Crompton and Co. consists of nine panels, one for each generator, three for booster and battery, and four distributing panels. It is designed to be as nearly fool-proof as possible, and includes eight heavy-current automatic circuit-breakers, dead-beat meters, integrating wattmeters in all outgoing mains, and a recording central zero ammeter in the battery circuit.

The three-way battery and booster switch, the booster motor starter and automatic circuit breakers are all fitted with auxiliary trip switches as specified by the designer, so that no harm can result from the attendant accidentally operating the wrong switch other than the opening of the battery circuit-breaker, which is fitted with a similar auxiliary switch and coil. The generator circuit-breakers are of course fitted with reverse coils to facilitate parallel running, and the compound winding is never cut out. There is never the least inclination for the generators to pump.

A 10-ton overhead traveller has been erected to cover the whole of the engines.

The lighting of the mills and the extensive yards and sheds is accomplished by 20 arc lamps and numerous incandescent lamps. This lighting proved so satisfactory that the directors decided to extend it to their own homes, some half a mile away, by overhead wires. Wayleaves were readily granted by the owners of property *en route*. This led to a number of applications for supply from other parts of the town, and current is now available throughout the whole of Maldon and also the adjoining village of Heybridge. The total output for the year ended September, 1912, including power and heat and light, was 275,000 units, and it is growing all the time.

Electricity for heating purposes is being very favourably received in the town. One consumer has been cooking over 100 dinners a day electrically, and considers the quality of the cooking quite equal to that obtained by the much-advertised paper bag system. Besides the usual heating apparatus, automatically-regulated incubators are in use in the town. The first service water heater is now in operation, and several others are shortly to be installed.

As regards the last, but by no means least important, department—the office—this is now being completely reorganised and extended with the aid of the new secretary, Mr. W. Ives, who is thoroughly conversant with the most approved modern systems of office management and cost keeping.

We are indebted for the photographs and particulars embodied in the foregoing article to the engineer and contractor for the installation, Mr. H. P. Girling, M.I.E.E.

LIVERPOOL'S NEW ELECTRICAL ENGINEER.

Mr. Harold Dickinson, A.M.Inst.C.E., M.I.E.E., M.I.Mech.E., engineer and manager of the Leeds Corporation electric supply undertaking, will shortly leave Leeds to take up the post of electrical engineer for Liverpool.

H. Dickinson, M.I.E.E.

Educated at Tettenhall College, near Wolverhampton, he left there in 1883, and served a pupilage of three years in the workshops of Messrs. Elwell-Parker, Ltd., electrical and mechanical engineers (afterwards formed into the Electrical Construction Co., Ltd.). Following that Mr. Dickinson took a three years' course in electrical and mechanical engineering at Mason's College, Birmingham. From 1899 to 1890 he occupied the post of electrician with the House-to-House Electric Light Supply Co., Ltd., now the Brompton and Kensington Electric Supply Co., Ltd. The next year he was appointed assistant electrical engineer to the Electricity Supply Co. for Spain, Ltd., and was engaged in superintending the construction of the Madrid electricity works and the laying of mains. Mr. Dickinson was, from 1891 to 1893, electrical engineer for Messrs. Hammond and Co. for the construction of the Dublin Electricity Works and the laying of mains, and had control of the running of the works until they were taken over over by the Dublin Corporation. The following 19 years of his professional labours were spent in Leeds, the first five as engineer and manager of the Leeds Electric Supply undertaking for the Yorkshire House-to-House Electricity Co., Ltd. When the company's business was bought by the Corporation in 1898, Mr. Dickinson was retained, and he has occupied the post up to the present time.

From the commencement, when Mr. Dickinson was appointed engineer and manager of the Leeds Electric Supply Undertaking, he has been responsible for the design and construction of the generating works and mains and for the reorganisation of the works, as well as for the administration of the undertaking.

During his 19 years in Leeds, Mr. Dickinson, through his courtesy and kindness, has endeared himself to the hearts of the members of his staff, the City Council, and all those with whom he came into contact, and whilst they keenly regret his departure, nevertheless at the same time he has their best wishes for his prosperity at Liverpool.—S. R. C.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The doings of the Hydro-Electric Power Commission are again before the people of Ontario on account of a further reduction in rates. Only a few weeks ago the fact that substantial reductions were being made to take effect on November 1st last, was recorded in these notes, but in going over the new rates on the basis of the load for November, it was found that the cost of power could be brought still lower. The total saving to the municipalities due to the decreased price of power will be about £20,000 in the year to come. The new rate for Toronto, which takes very nearly one-half of the total power supplied by the Commission, is equal to £3 2s. 6d. per H.P. per year, and covers all charges, including capital costs, maintenance, depreciation and sinking fund. From present indications, it is not at all unlikely that a further reduction in power cost can and will be made in six months' time. In one case the rates have been increased, and in four others they are unaltered, but all the remaining municipalities will obtain cheaper power than before.

In addition to the dealings of the Commission with the municipalities, there are those of the latter with their customers to be considered, and it is gratifying to learn that most of the towns and villages are already doing business on a paying basis.

The Eastern Canada Power Co., which was formed some time ago, and has not since been heard of, is coming to the front again. It is said that it proposes to build a very large dam across the St. Lawrence, near the Catean, Cedar, Split Rock and Cascade Rapids, a few miles south-west of Montreal. The rapids themselves will disappear, as the water-level will be raised to that of Lake St. Francis a little higher up the river. This scheme will provide 1,000,000 H.P. according to estimates.

The city engineer of Moose Jaw, Saskatchewan, has proposed the erection of a power plant on the site of some coal mines a few miles from the town, with the object of transmitting power, at high voltage, into the town.

The New Westminster Power Co., B.C., are going to apply for water rights in order that they may erect a power plant to supply the Fraser valley district.

At St. Catherines, Ontario, a large power house is to be erected by the Niagara, St. Catherines and Toronto Railway.

The Dominion Government has been investigating the lignite deposits of Saskatchewan, and it is now reported that some 2,000 million tons of this fuel are available, in the southern part of the province, for power purposes.

The dispatching of trains by telephones is growing rapidly in favour in this country. The C.P.R. has over 40 per cent. of its entire mileage equipped in this way, and other lines are adopting it very largely. In a recent paper read before the Western Canada Railway Club many advantages were claimed for the telephone over the telegraph, among them being a saving of time and labour, greater freedom from error, and that it is unaffected by wet and foggy weather, as is the case with the telegraph.

The Hobart (Tas.) Tramways.—In the Legislative Assembly, Mr. Ogden moved that the Government should take over the tramways owned and operated by the Hobart Electric Tramways Co. As was mentioned in a recent issue, the Assembly had previously rejected a Bill under which the City Council would have power to purchase the tramways, and a similar Bill has now been introduced in the Legislative Council. The voting was against the proposal.

TRAMWAY and RAILWAY NOTES.

Australia.—The Melbourne Railway Electrification.—The resolution providing for the electrification of the Melbourne suburban lines which was passed by the Legislative Assembly recently, has now been passed by the Legislative Council (Upper House) by 21 votes in favour to 6 against. The voting in the Lower House was 38 in favour, not 13 as mentioned in our last issue.

Bingley.—In connection with the proposal to borrow £43,500, the estimated cost of laying and equipping the tramway track, including the provision of the feeder cables, the D.C. will obtain the necessary powers, and the interest and sinking fund on the outlay will be paid by the Bradford Corporation.

Blackpool.—The "toast-rack" car has proved so popular that the Tramways Committee, on December 19th, decided to purchase another half-dozen, making the total number of these open cars 18. The cars will cost, with electrical fittings, about £575 each.

An experiment is being made in replacing the wooden seats of an old car with more comfortable rattan seats. If the experiment answers satisfactorily, the whole of the regular service cars will probably undergo a similar alteration.

The total receipts, from April 1st to December 4th, were £63,130, an advance of £5,884 compared with the same period last year.

Brighouse.—Much surprise has been caused by the decision of the Huddersfield Corporation not to proceed with the scheme for tramway connection with Brighouse. It had been generally expected that an attempt would be made to override the agreement arrived at between Brighouse and Halifax, giving the latter primary rights in Brighouse. This tramway question has been a very heated one for some time past in various parts of the district surrounding Huddersfield and Halifax, and in some places active hostility has been displayed to the proposals of the Halifax Corporation.

Canada.—A proposed new electric railway from Morrisburg, on the St. Lawrence River, to Ottawa, is having some difficulties with the city of Ottawa on the agreement for entrance. The company desires a 20-year agreement, but the city will grant only 12, this being the number of years which the Ottawa Electric Railway's franchise with the city has to run. The city will buy out the Ottawa Electric Railway, and wishes to avoid trouble with another railway occupying the streets of the city.

An electric railroad stretching from Winnipeg to Quebec, a distance of about 1,500 miles, and with seven points of contact with the great steam roads of the country, was the future outlined for the Porcupine Rand Belt Electric Railway at the directors meeting in Toronto. A charter has been granted for operations on 500 miles of road in Ontario, and applications have been made to allow construction of joining pieces of the line in Quebec and Manitoba. The road is to be equipped with storage battery cars each capable of running seven hours on a single charge. The power is to be obtained from the various water powers *en route*, and a number of small power plants will be built at various points along the line, where the batteries may be recharged.

Continental Notes.—France.—A bargain has been arranged between the Compagnie des Chemins de Fer du Midi and the French Government, whereby the former undertakes to build certain lines of railway declared "of public utility," on condition that the latter constructs two hydro-electric stations of 12,000 H.P. each. The Government has accepted the condition. The lines in question to be built are the Quillan to Mont Louis and the Quillan to Balesta. In addition, the company will build the Villefranche to Vernel, les Bains and Sahorre and the Bourg Madame to Latour de Carol lines. The stations to be built by the State will be situated at Porté and in the Carol Valley respectively.—*Revue Pratique de l'Electricité.*

Switzerland.—For some considerable time the question has been discussed of the practicability of electrifying the Swiss Federal Railways. It appears that the Swiss railways are at present dependent upon the importation of fuel from abroad up to an amount approximating £1,000,000 annually. Experiments made in view of the working of the Lötschberg Railway by electric traction have shown that by utilising the available hydraulic power an economy of something like £30,000 to £40,000 per annum can be effected. The Committee entrusted with the investigation of electrifying the whole Federal system proposes to conduct operations in stages, commencing with those sections which can be most easily converted. Arrangements are already being made for the erection of an electric generating station at Amsteg in the Uri Canton. This station will be constructed and worked by the State, and the electrification operations are to be commenced on the Gothard line. The total expense of electrifying the whole Swiss Federal system is estimated at £20,000,000.

Crewe.—The T.C. has again under consideration the question of providing a tramway service. Several schemes have been mooted within the last 40 years, but they have never materialised. The latest proposal is to provide a railless traction system, which would undoubtedly be an improvement on the present horse 'buses

Doncaster.—Over 2,000 citizens have petitioned the Council to proceed with the work of tramway extension as soon as possible. The scheme is estimated to cost about £40,000, and it is contended that the outlay would be returned with profit in ten years.

Lancaster.—The traffic returns for November show 91,550 passengers and £343 receipts, against 89,097 passengers and £332 receipts in November, 1911. The Lancaster and District Tramway Co. is not proceeding with the proposal to apply electric or petrol traction to its line from Lancaster to Morecambe, now worked by horse cars.

Leeds.—It had been decided by the tramway men to take a ballot of both unionists and non-unionists on the question of withdrawing their labour until those recently dismissed or reduced were reinstated. In the result, the ballot was against a strike, and the matter has been dropped for the present.

Little Hulton.—Ater an agitation lasting for many years, the inhabitants are to have a tramway service from Walkden to Farnworth *via* Little Hulton. The negotiations between the D.C. and the South Lancashire Tramway Co. were broken off by the Tramways Co. about a fortnight ago, but the D.C. reopened them with the result that the Tramways Co. has given an undertaking to construct the tramways within the next 12 months. The D.C. has agreed to maintain the new track, in consideration of which the company will pay the D.C. £100 per annum for 33 years.

London.—The Bermondsey B.C. has decided not to consent to any but the conduit system for the proposed electrification of the existing horse tramway from Tower Bridge Road to Rotherhithe New Road.

Oldham.—The Tramways Committee decided on the 19th inst. to purchase two motor-omnibuses to be used as feeders to the cars.

Southport.—The Sub-Committee's report on the recommendations of Mr. C. W. Mallins on the tramway undertaking, was considered at a meeting on the 18th inst. It was decided to recommend to the T.C. that in future what is known as the inner circle should be discontinued, and that the cars should run from the town *via* Manchester Road to the corner of Ash Road and Scarisbrick Road, and back by the same route, instead of continuing the journey down Scarisbrick New Road: the number of cars would thus be reduced from four to two. Another recommendation was that the system of contract tickets be abolished from the end of the year, but allowing the present contracts to run on to the date of their expiration. Books containing 26 halfpenny tickets will still be issued.

TELEGRAPH and TELEPHONE NOTES.

Imperial Wireless System.—On December 17th the Select Committee on the Marconi agreement again examined Mr. Mr. C. Ll. Davies, solicitor to the Post Office, who prepared the draft agreement. He said there was nothing in the tender or draft agreement to decide what information the Postmaster-General should give to the company when obtaining their advice regarding new inventions; the Postmaster-General would decide what was necessary. If apparatus used were found to infringe someone's patents, and an injunction were obtained, the Post Office would be entitled to an indemnity from the company. The right of inspection would not be granted to the company unless the latter could show reasonable ground for suspicion that their patents were being infringed. He had no financial interest in the Marconi Co.

Mr. E. W. Farnall, assistant secretary to the Post Office, was also recalled. He stated that the conditions embodied in the tender had been settled in discussions between Mr. Godfrey Isaacs and himself He had employed every argument that he could think of to induce Mr. Isaacs to lower his terms. He would not think it wise to give a contract to the Poulsen people. The question was becoming very urgent indeed; if some other country secured the commercial business, it would be very difficult to recover it. After hearing all the evidence, he thought the agreement was a better one than he at first supposed it to be. He had no interest in the Marconi Co.

Mr. R. Wilkins, chief clerk at the Treasury, said the royalty of 10 per cent. was the best figure the Post Office could secure, and he thought the Treasury was justified in agreeing to it. He was not surprised that the Technical Sub-Committee's report was not presented, but it would have been better to circulate it. He thought the clause objectionable which compelled the Government to pay full royalties until 1930 or 1940, irrespective of the number of Marconi patents in use.

On the 18th inst. letters from the Postmaster-General, showing that his relative, Mr. G. S. Montagu, had never held shares in the Marconi Co., though his name had been used *pro forma* in this connection on behalf of one of his firm's clients, were read. Sir George Reid then stated that in his previous evidence he had underrated the importance of the wireless stations at Fremantle and Sydney, and that he had no financial interest in the Marconi Co.

Mr. R. Wilkins's evidence was resumed, and he was questioned regarding the opinions expressed by his superiors with respect to the royalty of 10 per cent. The chairman having ruled that the questions must be answered, the Witness said that his superiors generally approved of the line he had taken. Regarding the detailed memoranda of the Department, which were called for, it was decided that the Treasury should be consulted as to their production. The Witness thought that the 10 per cent. royalty was a very decent bargain. He had no interest in the Marconi Co.

The case against the contract was then begun with the evidence of Sir Henry Norman, M.P., who said the ratification of the agreement would be against the public interest, as it would establish something like a monopoly for the Marconi Co. If it were ratified, inventors would either be unable to develop their ideas or would have to sell them to the company, and in that case the monopoly would be strengthened. To get rid of the Marconi patents would be an expensive and wasteful operation. It would be to the interest of both the company and the inventor of a new and improved system of wireless telegraphy that the latter should sell his rights to the former. The Marconi patents could quite well be dispensed with, and in any case the agreement was unnecessary, in view of Sec. 29 of the Patents and Designs Act. He disputed the urgency of the matter, and stated that during the past two years wireless telegraphy had made a revolutionary advance. The strategical needs of the North Sea, the Eastern Atlantic, and the Mediterranean were met by the Admiralty station at Malta which was about to be set in operation, and which would be in regular communication with the Admiralty stations in England. He saw no force in the argument that other countries might forestall the British system; moreover, other countries were not dependent upon the Marconi Co.

On the 19th inst. Sir Henry Norman expressed his views as to the scientific value of various wireless systems, discussing the spark, continuous wave and high-frequency generator systems. He considered that the Goldschmidt system would render wireless telegraphy possible over great distances, and that the signals would be untapable except with special apparatus. The continuous-wave system, he thought, must eventually supersede the spark system, and a few months would show whether one or other of the continuous-wave systems could fulfil the conditions of the Imperial service. He suggested that the Marconi Co. had not demonstrated their ability to carry out the contract. The agreement would not establish State-owned stations. He did not think the delay would be greater if some other system than the Marconi were adopted; the stations might still be completed by August, 1914, as provided under the agreement. He considered only the scientific side, not the commercial or financial aspect of the matter. The advantage of getting the best system would outweigh the disadvantages of further delay. If the agreement was not ratified, he supposed there would be nothing to prevent all the companies from combining except natural jealousy and the desire to be independent.

Sir G. C. Marks, M.P., who was the next witness, maintained that the wording of the agreement would allow all inventions and improvements made by the company to be classed as patents, whether patented or not, and therefore there would be no limit to the period during which the company could claim a monopoly, nor could the validity of the claim to such an invention be questioned. Hence the company would not need to take out patents while the agreement was running, nor would they be subject to the 14 years' limit. The whole equipment could be made dependent upon unpatented apparatus, so that the Postmaster-General could not free himself from the payment of royalty unless he removed everything from the stations. Inventors were working in the direction of dispensing with the high masts, and thus reducing the capital outlay very greatly. There was nothing in the agreement that would allow of a variation in the price if a different system were adopted, and for 28 years every new long-distance installation erected by the company would cost the Government £60,000.

The Committee adjourned until January 1st.

Train Dispatching by Telephone.—The system of dispatching trains by telephone has proved so satisfactory to the Canadian Pacific Railway that over 1,000 miles of telephone line are being put in this season. The C.P.R. is the second largest user of this method of dispatching trains in the world, and will soon be the largest. Practically all the main lines in the eastern division are now using this method, by means of which it is possible to get telephonic communication with any train on the line. Every train carries a long pole and telephone, which may be hooked to the wire along the right of way whenever the need arises.

Turkey.—The telephone installation in Constantinople has advanced so far that some 3,150 km. of wire are laid, the cast-iron pipe network having an extent of 30 km. At the present rate of progress it is expected that the system will be ready for inauguration by August next year. A European and an Asiatic district will be established, with 16 exchanges, three of them being of the largest size.—*Zeit. für Schwachstromtechnik.*

Suffragist Outrages.—A number of telephone wires in public call-boxes at Nottingham and in the Birmingham district were cut last week by suffragists.

CONTRACTS OPEN and CLOSED.

OPEN

Atherton.—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" to-day.

Australia.—Victoria.—January 24th. Two 1,000-kw. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" November 22nd.

January 3rd.—1,100 opalescent arc lamp globes for the Melbourne City Council. See "Official Notices" December 20th.

January 10th.—14,500 metal-filament lamps, for the Melbourne City Council. See "Official Notices" to-day.

January 28th.—Paper-insulated lead-covered cable for the P.M.G.'s department. See "Official Notices" December 20th.

February 21st.—Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

Sydney.—January 20th. Storage batteries, motor-generators and switchgear. City Electrical Engineer, Town Hall.

Tasmania (Hobart).—January 13th. P.M.G.'s department:—Paper-insulated lead-covered cables. See "Official Notices" December 6th.

Queensland.—January 29th. Detectors (Schedule 242), for the P.M.G.'s Department. See "Official Notices" December 20th.

Victoria.—February 4th. Thirty-six Morse keys, for the P.M.G.'s Department. See "Official Notices" to-day.

Western Australia.—February 19th, 1913. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

Belfast.—January 1st. The Harbour Commissioners are inviting tenders for a 120-ton electric derrick crane at Alexandra wharf. Specifications, &c., from Mr. W. R. Kelly, Harbour Engineer, Harbour Offices, Belfast.

Belgium.—December 31st. La Société de l'Exposition Universelle et Internationale de Gand, 1913, (Rue des Moineaux) Ghent, are inviting tenders for the supply, laying and maintenance of the low-tension electric mains required in connection with the 1913 International Exhibition at Ghent.

Eastbourne.—January 14th, 1913. One 1,000-kw. horizontal steam turbine and alternator, without condensing plant, for the Corporation. See "Official Notices" December 20th.

France.—Bourges (Cher).—January 16th. Tenders are invited for the ~~supplying of two~~ lots of electric cable, wire and accessories for the electric installation at the Bourges railway workshops. For further particulars see this column last week.

Rouen.—January 7th. Tenders are required for the supply of electric lamps for the Théâtre des Arts and the municipal establishments for the year 1913, in two lots. Particulars from the Secrétariat de la Mairie, Bureau No. 8, Rouen.

Chalons-sur-Marne.—March 1st. Tenders are invited for the supply of an electric pump for the local waterworks. Particulars at the Mairie of Châlons-sur-Marne, France.

Harwich.—January 13th. Four motor-driven centrifugal pumps, two motor-driven sewage rakes and screens, with switchgear, and about 400 yd. of 15-in. cast-iron rising main, for the Corporation. See "Official Notices" December 20th.

Hebden Bridge.—December 31st. One 240-kw. Diesel engine and dynamo, for the U.D.C. See "Official Notices" December 13th.

Ilford.—January 11th. Refuse destructor for the U.D.C. Mr. H. Shaw, engineer, Town Hall; (returnable deposit of £5 5s.).

Italy.—The municipal authorities of Rome are about to invite tenders for the supply of the material required for the new electric tramway between the Piazza Independenza and the Porta Traionfale; the contract includes 600 tons of tramway rails, Mannesmann poles, the overhead conductors, trailing cars, &c.

London.—Fulham.—January 9th. Steam dynamo, switchboard and connections for the Workhouse, Fulham Palace Road, W., for the Guardians. See "Official Notices" December 6th.

New Zealand.—January 6th. Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Nottingham.—January 4th. The Corporation Tramways Department is inviting tenders for the supply of (*a*) 350 tons, steel tramway rails Bs B4, 150 tons, steel tramway rails Bs B4 (Sandberg), and (*b*) 5 tons, mild steel tie bars. Specifications and forms of tender (£1 1s. each returnable) from Mr. A. Brown, engineer, Guildhall, Nottingham.

Spain.—February 10th. The municipal authorities of Badajoz are inviting tenders for the concession for the public electric lighting of the town during a period of 20 years.

Tenders have just been invited by the municipal authorities of of Cancarlos del Valle (province or Ciudad Real) for the concession for the electric lighting of the town during a period of 5 years.

Sweden.—December 31st. An electrically-driven trestle crane of 50 tons, 17 metres gauge, for Alfkarleby power station. B. of T. C.I. Department in London.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

CLOSED.

Ashton-under-Lyne.—The T.C. has accepted the tender of Messrs. Robert Dempster & Sons, Ltd., for additional plant for the electricity works.

Australia.—Melbourne.—A tender has been accepted by the City Council for the supply of 20,800 yd. of lead-covered cables for the electric supply department. Two tenders were received—one from the Western Electric Co. (Sydney), at £5,433, and the other from Siemens Bros., at £3,866. The Electric Supply Committee recommended the acceptance of the lower tender, there being such a significant difference in the amounts.—*Tenders* (*Mining and Engineering Review*).

The same contemporary says that contracts have been secured by the India-Rubber, Gutta-Percha and Telegraph Works Co., for the electric light installations at the towns of Horsham (Vic.) and Temora (N.S.W.). In the case of the last-named town, seven months have been allowed for the completion of the work, the contract value being £6,188. Mr. J. E. Donoghue is the consulting engineer.

Barnsley.—The T.C. has accepted the tender of Messrs. S. Rushforth & Son for electric wiring work at the new waterworks and workshops, at £35.

Buenos Ayres.—The *Review of the River Plate* states that the Government has accepted the tender of Messrs. A. Scapusio and Co. for the electric light installations in the new Customs warehouses in the port of Buenos Ayres. The cost is $106,955 paper.

Finchley.—The U.D.C. has accepted the tender of Engineering and Arc Lamps, Ltd., at £314, for arc lighting at North and East Finchley. It is is proposed to use 30 flame arc lamps.

Germany.—The German Daimler Motor Co., of Marienfelde, Berlin, has just secured a contract from the Hamburg Fire Brigade authorities for six petrol-electric motor fire engine chassis.

An order has been placed with Messrs. Brown, Boverie & Co., of Mannheim, for a 40,000-h.p. steam turbine unit for the Communal Electricitätswerk A.G., at Hagen in Westfalia. This, it is claimed, will be the largest steam turbine hitherto built in Europe.—[illegible]

Hull.—The B. of G. has accepted the tender of Messrs. W. F. Flint & Co., of Springbank, Hull, for electrical work.

Manchester.—Messrs. Chamberlain & Hookham, Ltd., have received an order from the tramways department for 150 car meters. This is the third repeat order.

Norwich.—The T.C. has accepted the tender of Messrs. Lucy & Co., Ltd., for brackets, fuses, switch boxes, hoods, reflectors, &c., for public lighting at scheduled prices.

The Council has also accepted the tender of Messrs. R. Coller and Sons, Ltd., for 100 tons monthly of Griff peas coal for the electricity works from April, 1913, to December, 1913, at 17s. per ton.

Rawtenstall.—The T.C. has accepted the tender o Messrs. G. & J. Weir, Ltd., for a steam boiler feed pump for the electricity works.

South Africa.—The Rand Water Board received 29 tenders for an electrically-driven centrifugal pump, and the lowest was that of the British General Electric Co., at £720, for a Sulzer two-stage pump, driven by a British G.E. 260-b.h.p. two-phase motor. The time for delivery, &c., is 5½ months. According to the *South African Mining Journal*, a tender of Orenstein Arthur Koppel, at £784, had previously been accepted, for a d.c. motor, owing to a misunderstanding with the Johannesburg municipality as to the kind of current available.

Southend-on-Sea.—The following tenders have been accepted by the T.C.:—

North Eastern Steel Co., Ltd.: Rails, fish plates, &c., for tramway extensions to Southchurch [illegible], £1,[illegible].

E. Green & Sons, Ltd.: Economiser and air heater, £9[illegible].

Worthington Pump Co., Ltd.: Five centrifugal pumps, three steam engines and electric motors, £1,[illegible]1.

Expanded Metal Co., Ltd.: Expanded metal, £35.

British Thomson-Houston Co., Ltd.—Switchboard for new steam generator, £[illegible].

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday evening, January 3rd. Paper "Some Notes on the Practical Operation of Electrical Machinery for Power Purposes," by Mr. C. E. Catterson.

Association of Engineers-in-Charge. Saturday, January 4th. At St. Bride's Institute, E.C. Social. Dance.

Railway Train Lighting.—In his report on the fatal accident at Ditton Junction on September 17th, the B. of T. Inspector, Lieut.-Col. Yorke, referring to the burning of a number of the coaches, points out the danger of gas in railway carriages, and says that the companies would be wise to recognise the fact that electricity is safer and better.

NOTES.

The Sheffield Corporation Bill.—In the ELECTRICAL REVIEW of August 9th we reported the proceedings before the Select Committee of the House of Lords on the Sheffield Corporation Bill, the contentious part of which was Clause 90, providing that the Corporation might "sell, let for hire, and fix, repair and remove, but not manufacture, lamps, motors, electric fuses, switches, lampholders and other electrical fittings for lighting, motive power, and other purposes." This proposal was opposed by a body of electrical engineers and contractors who were ratepayers, and as a result the Committee substituted the usual model clause, which only allows the local authority to sell electrical fittings through a contractor.

The matter came before the House of Commons on December 16th and 17th, when Mr. Pointer proposed a motion disagreeing with the amendment made by the House of Lords, and this was carried, and ordered to be communicated to the House of Lords.

Fatalities.—JOHANNESBURG, TRANSVAAL.—Our Cape Town correspondent writes:—"A serious accident occurred in the distribution chamber of the Victoria Falls Power Co., on Bantjes Deep on November 29th, as a result of which two men have lost their lives and two others were seriously injured. It appears that the transformer at the distribution chamber had been opened up, and four men of the maintenance department started emptying the oil out preparatory to taking it apart. About a quarter of an hour after they had started the work an explosion was heard, and when the attendant at the station went round to see what had happened, he found all four men enveloped in flames. The necessary aid was at once forthcoming, and the flames were put out. One of the men, however, died practically immediately, while the other three were taken to the Johannesburg Hospital in a very serious condition. The name of the man who was killed is W. F. Pullen. He was a young man and unmarried. Another man named McCann died in hospital the following day. A tragic scene occurred at the funeral of McCann. Over 70 people were gathered about the grave, when a flash of lightning struck half of them to the ground. One man, Michael Connell, an employé of the Victoria Falls Power Co., was found to be past human aid, and many others were very seriously injured and taken to hospital."

CHESTER.—The Chester Coroner (Mr. E. Brassey) on Saturday held an inquest on the body of Albert Alcock (29), crane driver, who met with a fatal accident while following his employment at Messrs. Summers's Ironworks, Shotton, on Thursday, last week.

John Williams, scrapman, said that he was removing scrap from the electric crane on Thursday, when he saw the deceased fall from the crane to the ground. He went to him and found him unconscious. He died in the infirmary.

Mr. Thos. Davis, consulting engineer, of Liverpool and London, said investigations showed that one of the fuses had slipped out of contact, which caused the current to fail. The deceased probably thought there was something wrong with the crane switch, and when he opened the box his body must have come into contact with the current. The shock would cause momentary paralysis, and deceased would be unable to hold on to the crane. Witness was of opinion that where practicable, steps should be taken to prevent crane drivers from meddling with the switches. He also recommended the provision of a rope ladder, so that the driver could descend at any time.

Mr. Kenneth Younghusband, the chief electrical engineer at the works, said the suggestion of a rope ladder was a feasible one.

The jury returned a verdict of "Accidental Death," and recommended the provision of a rope ladder for the crane.

Strikes.—BRADFORD.—Our correspondent says that the strike of electricians in Bradford is settling itself by natural failure. "To so large an extent have the strikers been replaced, that they now see that there is no prospect of their success, and are dribbling back and asking for some job where they can be out of sight, if possible, of those still left out. Their organiser has moved on to Glasgow, it is understood, with the intention of stirring things up in that city."

EDINBURGH.—According to a Glasgow paper, between 40 and 50 men in the employment of Messrs. D. Bruce Peebles & Co., electrical engineers, Pilton Works, Edinburgh, stopped work on 17th inst. They were employed as armature winders, and had made certain demands for increased rates of pay, which the firm did not accede to. "According to the firm the wages range from £2 10s. to £4 per week, and whether on piecework or not the men are guaranteed certain weekly wages."

Calendars Going Astray.—"Colliery Electrician" writes to point out that many electrical manufacturers' calendars, &c., sent to collieries fall into the hands of the clerical staff, and never reach the technical men for whom they are intended, and who would profit by the useful information often contained in them. It would be better if they were addressed to the electrician by name if possible, or at any rate to the manager or electrician, enclosing an unstamped postcard for acknowledgment.

Stocktaking.—Messrs. Siemens Bros. Dynamo Works inform us that their store and showroom at 38 and 39, Upper Thames Street, E.C., will be closed for stocktaking on Monday and Tuesday, the 30th and 31st inst. The incandescent lamp and fittings department at Tyssen Street, Dalston, N.E., will, however, be open as usual for the sale of tantalum and "Wotan" lamps and fittings

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE SECTION).—The thirteenth annual dinner of the Section was held at Messrs. Tilley's rooms on Friday evening last, Mr. W. C. Mountain being in the chair. The toast of "The Lord Mayor, the Sheriff and the Corporation of Newcastle" was proposed by Mr. C. Faraday Proctor, who remarked upon the important part that local men had played in the development of electrical science, particularly Sir Joseph Swan and Sir C. A. Parsons. Turning to the achievements of the Newcastle Electric Supply Co., he mentioned that they had 14 power stations running, one having a capacity of no less than 40,000 KW.; their total generator capacity was 173,000 KW., not including that of the Cleveland and Durham Co. They had 76 rotary and 140 static sub-stations, 360 miles of H.T. mains, and 191 miles of L.T. mains. As evidence of the advantages of a cheap power supply, he mentioned that eight new industries were being started up in the district, and that these would take at least 50 million units per annum. The utilisation of waste heat was also largely a local industry. and he had been told that the Cleveland and Durham Co. obtained 90 per cent. of their power from this source. The Lord Mayor, in reply, said that Newcastle had moved with the times. They had a tramway system second to none, and in addition to a cheap bulk supply of electricity, they had what was of equal importance, viz., low rates.

Mr. Robert Nelson (H.M. Electrical Inspector of Mines) proposed "The Institution of Electrical Engineers." He said that Newcastle was already famous in the worlds of hydraulic, military and electrical engineering, and it had recently acquired fresh fame as the birthplace of a new beverage of singular potency. They were fortunate in their President, who had achieved what he believed to be the highest honour in the scientific world, namely, the Fellowship of the Royal Society.

Mr. W. Duddell, in reply, said that it had been decided to institute a Research Committee to co-ordinate results and also to institute research. There was a vast amount of material regarding which further information was required, and manufacturers were ready to help in regard to such raw materials as steel, india-rubber, insulating varnish, mica, &c. The question of nomenclature had also been engaging the attention of the Institution, as it was of importance that they should come to an understanding with their Continental and American friends regarding the terms to be used in connection with electrical engineering.

Mr. C. S. Vesey-Brown proposed "The Armstrong College, Learned Societies, the Newcastle Chamber of Commerce, and our Guests." Dr. Neil Maclay, replying on behalf of the medical profession, said that medical men owed a debt of gratitude to the electrical men for giving them many new means of diagnosis and treatment. Mr. Herbert Shaw (Secretary, Newcastle and Gateshead Chambers of Commerce) replied on behalf of these bodies, and said there was a fortune awaiting anyone who could devise some electrical means of recording telephone calls which would be thoroughly reliable and automatic.

In proposing "The Newcastle Local Section of the Institution of Electrical Engineers," Mr. W. Judd said that the Section, which started in 1899 with 150 members, had increased to 340 in 1912, with over 120 students. Mr. W. C. Mountain, in reply, said that 30 years ago he was asked by Mr. Cookson, of the North Seaton Colliery, whether he could pump water from a point ¾ mile in-bye, and considerable surprise was created when he undertook to do so, and to use a voltage of 350 D.C. He was pleased to say that the pump was still in existence, and he believed that it was working very well at the present time. He hoped to see the membership of their Section brought up to 500 before his term of office expired.

The speeches were interspersed with songs by Messrs. Belbin, Richardson, Scope and Willcox, the programme being arranged by Mr. J. R. Andrews. Votes of thanks to these gentlemen and to Mr. Clothier, who had organised the dinner, terminated the proceedings.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—The monthly meeting of the members of the Yorkshire branch was held at Leeds on Saturday, when a paper by Mr. S. A. Simon, of the West Scotland branch, was read on the subject of "Speed Control of Three-Phase Motors."

At King's College, London, there is to be a course of lectures on Fridays, commencing January 17th, by Mr. C. H. Wordingham, on "Design, Organisation and Operation of Central Electric Stations." Particulars will be found in our "Official Notice" pages to-day.

Tramway Socials.—The annual employés' entertainment in connection with the Yorkshire (West Riding) Electric Tramways Co., Ltd., took place at Lofthouse Park, near Wakefield, last week, extending over two days. In the evenings concerts and cinematograph entertainments were provided. The manager of the company, Councillor H. England, presided each evening, and a number of Wakefield and other Corporation and tramway officials were present. Some interesting speeches were made.

At the invitation of Ald. Higham, J.P., chairman of Accrington Tramways Committee, the electric tramway employés were entertained on December 19th. Ald. Higham and members of the Tramways Committee were present, along with Mr. H. Pilling, tramways manager, and 95 tramway employés. Ald. Higham expressed regret that there was discontent among the men. It was the wish of the Committee to make their conditions as satisfactory as they were on any other tramway system in the country, and he invited those with any grievances to put their case before them. It would receive attention.

Inquiry.—A correspondent asks for the names of makers of electric water fountains; also for the makers of diaphragms for telephone receivers

Appointments Vacant.—Junior assistant to the Superintendent of Telegraphs, for the Telegraph Department of Ceylon (£300), engineer-in-charge, for the Borough Electrical Engineer's Department, Stoke-on-Trent (£130); shift engineer for the Neath R.D.C. (25s.). See our advertisement pages in this issue.

Educational Notes.—The Annual Conversazione of the Royal College of Science and Royal School of Mines was held on Wednesday last week. The programme included a lecture by Mr E. A. Wraight on "Aluminium," and the R.S.M. Dramatic Society in "The Bishop's Candlesticks," as well as a concert by the R.C.S. Musical Society.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On Friday last the Hastings Council appointed Mr. William Travis, of Southport, assistant electrical engineer, at a commencing salary of £150. There were 120 applicants for the post. Mr. Travis was with Messrs. Dick, Kerr & Co., and has since held an appointment at Singapore.

Mr F. J. Delves, constructional superintendent for some time past of the sales department of the West Ham Corporation electric supply undertaking, has resigned that position on his appointment as electrical engineer to the United Malaysian Rubber Co., Ltd., whose operations extend over Singapore and other islands in the Malay group. Mr. Delves is leaving England for Singapore on January 8th, and carries with him the heartiest good wishes of his colleagues at West Ham for his future welfare.

Tramway Officials.—In acknowledgment of his services as lecturer to the Huddersfield Tramway Men's Ambulance Class, Dr. Raffan has been presented with a case of pipes by the students. The presentation was made by Mr. J. H. Tunnicliffe, who said that the good work which Dr. Raffan had done could be understood when it was stated that only one of 28 members of the class had failed to pass when examined.

General.—*Indian Industries and Power* states that Mr. J. H. Cardew, M.Sc. (McGill), was appointed as an electrical engineer, and posted to the Oudh and Rohilkhand Railway from October 1st.

At the Presbyterian Church, Muswell Hill, on Saturday last, Mr. Francis E. Phillips, London representative of the Wardle Engineering Co. and the St. Helens Cable Co., was married to Miss Janet Drysdale, daughter of Rev. Wm. and Mrs. Ferguson.

A financial paper states that Mr. T. Frame Thomson has accepted a seat on the board of the La Plata Electric Tramways Co.

Mr. A. H. Stanley has resigned the position of managing director of the London United Tramways, Ltd., but will retain his seat on the board. Mr. James Devonshire, who has been elected a director, has been appointed to succeed Mr. Stanley as managing director. Mr. W. G. Verdon Smith, secretary, has also resigned, and Mr. A. L. Barber has been appointed as his successor.

Alderman H. W. Peal, J.P., has been re-elected chairman of the Ealing Borough Electricity Committee.

Miss J. Arminson MacIntyre, over 10 years manager of the publicity department of the C. W. Hunt Co., West New Brighton, New York, is resigning that position early in the New Year, and will travel for a time. Communications will find her—care of National Arts Club, New York City.

Messrs. Dodd & Dodd, civil and consulting engineers, of 37, Waterloo Street, Birmingham, have removed to more spacious offices at County Chambers, Corporation Street, Birmingham.

NEW COMPANIES REGISTERED.

Thermo-Electric Ore Reduction Corporation, Ltd. (126,015).—Registered December 18th, by Bennett, Leaver & Hayward, 41, Moorgate Street, E.C. Capital £150,000 in £1 shares. Objects: to take over the business of smelters carried on by the Electric Furnaces and Smelters, Ltd., at Luton, Beds. The signatories (with one share each) are:—H. W. Primrose, 44, Ennismore Gardens, S.W.; A. F. Maclaren, 110, Cannon Street, E.C., director, Robert Maclaren & Co., Ltd.; F. B. Henderson, Little Blakenham, Ipswich, director, National Minerals Corporation, Ltd.; A. Goodlet, 6, Broad Street Place, E.C., chairman-secretary; E. Hayward, 41, Moorgate Street, E.C., solicitor; W. B. Ballantine, 15, Devereux Court, Temple, E.C., metallurgist; D. C. Lee, 4, Paper Buildings, Temple, E.C., barrister. Minimum cash subscription, £7. The first directors (to be not less than two or more than seven) are H. W. Primrose, A. F. Maclaren and F. B. Henderson; qualification, £300; remuneration, £200 each per annum (chairman, £250). Registered office, 6, Broad Street Place, E.C.

Mid-Sussex Electric Light and Power Co., Ltd. (125,936).—This company was registered on December 16th, with a capital of £15,000 in £1 shares, to carry on the business indicated by the title. The subscribers are:—T. Caffyn, Haywards Heath, gentleman, 25 shares; C. G. M. Dawson, High Combe, Balcombe, gentleman, 25 shares; J. Finch, Queen's Road, Haywards Heath, builder, 25 shares; T. White, Franklynn Road, Haywards Heath, retired builder, 25 shares; E. Prior, Church Road, Burgess Hill, electrical engineer, 25 shares; H. P. Summer, Leyntonville, Haywards Heath, assistant overseer, 10 shares; S. Eaton, Haywards Road, Haywards Heath, clerk, 1 share. Minimum cash subscription, 5,000 shares. The number of directors is not to be less than three or more than five; the first are T. Caffyn, C. G. M. Dawson, J. Finch, T. White and E. Prior; qualification, £25. Registered office, office of E. J. Waugh, Bottro Road, Haywards Heath; solicitor, F. J. Waugh, Haywards Heath.

Electrolite, Ltd. (12[illegible]921).—This company was registered on December 11th, with a capital of £1,000 in £1 shares, to carry on the business of gas and electrical engineers, manufacturers of and dealers in gas mantles and burners, gas and electrical fittings and electric lamps, ironmongery, &c. The subscribers (with one share each) are:—[illegible] Durrant, 84 and 86, Gresham Street, E.C., contractor; A. Wright, 84 and 86, Gresham Street, E.C. accountant. Private company. The number of directors is not to be less than two or more than five; the first are F. Durrant and A. Wright; qualification £25; remuneration as fixed by the company. Registered by A. D. Lear 11, Ironmonger Lane, E.C.

Craig & Paton, Ltd. (3,928).—This company was registered in Dublin on December 11th, with a capital of £10,000 in £1 shares, to acquire the business of laundry and electrical engineers and contractors, &c., carried on as "Craig & Paton." The subscribers (with one share each) are:—G. R. Craig, 11, Fisherwick Place, Belfast, merchant; G. Paton, 11, Fisherwick Place, Belfast, merchant; G. A. Shipp, Rosetta Avenue, Belfast, merchant; E. Larrsay, 59, Royal Avenue, Belfast, solicitor. Private company. The first directors are G. R. Craig, C. Paton and G. A. Shipp; qualification, 100 shares. Registered office, 11, Fisherwick Place, Belfast.

Kettlewell Electricity Supply Co., Ltd. (125,980).—This company was registered on December 17th with a capital of £625 in £1 shares, to carry on the business indicated by the title. The subscribers with one share are:—O. Robinson, Kettlewell, Yorks., worsted spinner; W. L. Carradice, Kettlewell, schoolmaster; J. H. Coutes, Kettlewell, farmer; W. P. Inman Kettlewell, postmaster; J. Ram, Kettlewell, joiner; C. H. Walsh, Kettlewell, manufacturer. Private company. Table "A" mainly applies. Solicitor C. P. Charlesworth, Bank Buildings, Skipton, Yorks. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Schinz & Co., Ltd. (125,931).—This company was registered on December 14th, with a capital of £1,000 in £1 shares, to construct, equip and work public works, including railways, tramways, gas and electric light, &c. The subscribers (with one share each) are:—E. R. Calthrop, M.I.C.E., M.I.Mech.E., Eldon Street House, E.C.; J. B. Earle, M.I.C.E., Eldon Street House, E.C.; J. R. Williams, 17, Gracechurch Street, E.C., export merchant; P. Schinz, 8, Bloomsbury Place, W.C., gentleman. Private company. P. Schinz is the first director. Registered by J. J. Edwards & Co., 28, Sackville Street, W.

CITY NOTES.

Melbourne Electric Supply Co., Ltd.

The thirteenth annual general meeting was held on Monday at the Office, Finsbury Pavement House, E.C., Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, last week), said he had again to congratulate them upon the remarkable progress which the undertaking had made during the year, which was reflected in every branch of the business. They would find very great changes in the balance-sheet. The capital account had been considerably increased during the year. They had issued the remaining £50,000 of their 7 per cent. cumulative preference shares, which now stood at the full amount of £150,000 instead of £100,000 last year. They had also issued the balance of the consolidated ordinary stock, viz., £125,830, raising that to £300,000, and in addition they had sold their Adelaide shares which appeared in the last balance-sheet at £82,375. Those three items together made an addition to the capital of £258,205. In addition they realised by the sale of the Adelaide shares a premium of £30,000, so that altogether they had provided themselves with £288,205 additional capital. The effect of that had been that they had been enabled to meet the expenditure at Melbourne and Geelong amounting to £11,965 for Melbourne, and £14,386 for Geelong; to pay off the bank loan, and they had £55,000 cash on loan against security and a sum of £23,241 at the bankers or in hand. The arrangements which they were able to make for the issue of the additional capital were of a very satisfactory kind. They had gentlemen who believed in the future of the company, who approached them early in the present year, and who offered to purchase the entire amount of their holding in the Adelaide Co. on terms which gave the company a profit of £30,000. At the same time they asked the directors to give them an option for a period of a certain number of months to take the unissued balance of the ordinary stock at par. At that time the shares were quoted on the Stock Exchange at from 83 to 88, and they therefore felt they would be doing a good stroke of business if, by the one transaction, they sold their Adelaide shares at £30,000 profit, and, at the same time, got an option to take the unissued ordinary capital at par. The efforts of the gentlemen in question to introduce the stock into the Colonies and make it better known had been successful, with the result that they exercised their option and they had received the whole of the cash. Turning to the profit and loss account, there were considerable changes there, owing to their having parted with their Adelaide shares. Last year they received from those shares £9,715, a source of profit which was, of course, not open to them this year. On the other hand, Melbourne had yielded them an additional profit of £17,055 and Geelong £2,050, whilst the little tramway system which they opened early this year had yielded £738, so that they had £19,843 extra revenue. Against that they had to put the loss of the £9,715 from the Adelaide shares, leaving them with a net improvement of £10,128. Turning to the accounts of the two stations at Melbourne, the gross increase in the revenue was £20,019, the figures being £84,738 this year, against £61,719; whilst, on the other side, the generating expenses had only gone up from £15,237 to £17,470, from which they would see that of the £20,019 gross increase they retained 85 per cent. of it as net—that was, £17,055—which spoke extremely well for the ability of their staff and for the excellence of the management. So well had the staff worked that the generation costs had actually been reduced 20·4 per cent., and the coal consumption alone had been reduced

13 per cent. That, of course, was due to the new turbines and other generating plant which they had sent out, and which was more economical in its operation. At Geelong they saw the same story repeated, although on a smaller scale. The gross increase in the revenue was £3,057, and they had retained £2,045 as net—that was, 66 per cent. The tramways account was only in its inception. The line was only opened for traffic for five months up to August, and the receipts amounted to £5,471, showing a small profit of £738. The total population of the district served by the tramway was 26,000; the total length of the track at present was four miles. The total number of passengers carried for the five months was 422,000, and the passengers carried by the motor-'buses which they had to supplement the tramways was 26,000, so it would be seen that every one of the population had ridden on the tramways about 20 times. They were now constructing an additional 1¼ miles for the South Geelong section, and no doubt when that was opened it would immediately increase their earnings from the tramways. With regard to the general position in Melbourne, he could not do better than read them an extract from the report of Mr. F. W. Clements, their local managing director and chief engineer. Writing under date November 6th last, that gentleman said:—

"The financial year under review should prove a red-letter year with us, for not only has the general progress during that period been phenomenal, but it is the first time that we shall have been in a position to pay a reasonable dividend on the whole of our invested capital. The progress made by the company has been manifested not only by the enormous number of consumers connected during the year, but also by the very large increased output in units and the increased maximum load. At no previous period of our history have we ever made anything like the advance in any of these three items in one year. The year is, therefore, a record one from nearly all points of view. The causes conducing to the great advances made appear to be several, the principal one of which is probably the long run of good seasons from the agricultural point of view which has taken place since the great drought in 1903 and 1904. This has been responsible for making the community generally much more prosperous, and the result has been that through the gravitation of the more well-to-do squatting and farming population to the city, an acceleration in the natural increase in population, a more active policy of immigration adopted by the Government, and the fact that large numbers of people have gradually got into the position of being able to build their own houses, enormous areas of suburban Melbourne have been built over, and the bulk of the new houses have taken on electric supply. This, however, is only one cause, and it is quite certain that unless the metallic-filament lamp had come to the fore, even under the conditions of general prosperity obtaining, people would not have been so ready to avail themselves of an electric supply. A third cause operating in the direction of the great increase experienced has undoubtedly been our policy of pushing forward into the residential districts with our mains in advance of the wave of houses rolling out into the country. It is a well-known thing amongst electric supply people that once an area newly built over has been missed, it may take years to get the houses to come on to the mains, whereas, if the houses, as they are being built, find a supply available, the chances of securing the bulk of them are enormously increased. So much so has this been the case with us in Melbourne, and to a smaller extent in Geelong, that we can say that there is hardly a house in any new area which does not come on to the mains. Best of all, architects, builders and small speculative builders, all now specify electric lighting as a matter of course, and newspaper advertisements announce the presence of an electric supply in a house as an added advantage."

Continuing, the chairman said that during the year they had pushed out into three new districts, and their mains now pretty well covered the whole of the suburbs of Melbourne. The following figures were, he thought, very remarkable. The area of their Melbourne district was now 43 sq. miles, showing an increase of 24 per cent. since last year. The population of the city was 317,000, an increase of 2 per cent. The miles of street in which their supplies were available were 304, an increase of 47 per cent. The capacity of their plant was now 5,600 KW., an increase of 48 per cent., and they had another 3,500 KW. alternator, which would shortly be shipped, which would bring their plant up to over 9,000 KW. The number of new consumers they had connected during the year was 3,620—slightly over 300 a month—and an increase of 75 per cent. over last year. The total number of consumers on their mains at the end of the year were 8,696, showing an increase of 71 per cent. The units sold for the year were 7,082,000. At Geelong the story was the same, although on a smaller scale. There were now 33 miles of street in which their supply was available, an increase of 19 per cent. They had connected 215 new consumers during the year, an increase of 36 per cent., and they had now 1,099 consumers at Geelong, with its population of 27,800—an increase of 24 per cent. As to the future, as far as their information at present went the prospects for the current year were fully as satisfactory as those for the past. Down to the end of November, the first three months of the new financial year, their gross profit in Australia was £15,700 this year, against £6,076 last year. The total number of new consumers connected was 1,400, as compared with 690, and the number of new consumers awaiting connection was 720, as compared with 428 last year. At the moment the outlook for the present year was extremely good, although it would be foolish to expect that such a phenomenal rate of increase could possibly continue indefinitely. The general resolution for the electrification of the Melbourne railways had been approved by the Victorian Government, and there was no doubt that the electrification would take place within the next three or four years. If the Government could generate current cheaper than they could—which he very much doubted—and supply it to them in bulk, it would be to their advantage to take it from that source. The Government claimed that they were only going to supply the railways and that they were not going to enter into the field of distribution or compete with them in any way, and it would be for the directors to see that their promises in that respect were kept.

Mr. David Finlayson seconded the motion, and the report was adopted.

The Chairman then proposed a resolution increasing the number of directors from five to six. He explained that the reason for the change was that he and his colleagues considered it would be to the advantage of the company to have a gentleman connected with Australia on the directorate, and should the resolution be carried and confirmed, they intended to nominate Mr. Benjamin Brookman as the sixth director specially to represent the interests of the Australian shareholders.

Mr. Nicholls seconded the resolution, and it was carried.

The Chairman said that the next resolution, as follows, was intended to carry out what was suggested at the last meeting, but which he did not consider justified in accepting at the time: "That the remuneration of the directors for the year ended August 31st, 1912, be £1,500 instead of £1,000 as provided in Article 87, and that as from September 1st, 1912, the remuneration of the directors be upon the following basis, viz.: 'So long as the issued capital of the company (including debentures or debenture stock) does not exceed £750,000 the remuneration of the directors shall be £1,500 per annum, and that if and when the issued capital of the company (including debentures or debenture stock) exceeds £750,000, then the remuneration of the directors shall be increased at the rate of £125 per annum for each £100,000, or part thereof, of further capital (including debentures or debenture stock) issued by the company.'"

Mr. B. Brookman said that as he was the shareholder who suggested at the last meeting that they should increase the remuneration of the directors, he had much pleasure in proposing the resolution which the chairman had read.

Mr. Hawes seconded the resolution, and it was carried unanimously.

The auditors having been reappointed, the proceedings terminated with a vote of thanks to the officers and staff of the company in Australia and in London.

Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd.

The *Financial News*, of December 20th, contains an article relating to this company in which it reprints the report to November 30th last, and says that the annual meeting was held in private on December 19th, at 40, King Street, Cheapside, E.C.—The report states that:—"During the past year great progress has been made, both from a financial and from a technical point of view. The Universal Cheap Cables, Ltd., which was formed for the purpose of acquiring the undertaking of this syndicate, has now 10,000 working capital shares issued, and arrangements are contemplated for the disposal of the balance of such shares. It is the intention of that company to get a special settlement granted by the London Stock Exchange in its working capital shares, and in due course in its vendor shares.

"An agreement has been entered into for the transfer of the Johnson-Varley Patents and Instruments to the Universal Cheap Cables, Ltd., and the actual transfer will take place without delay. An agreement has been entered into, for the benefit of all concerned, to pool the shares to be allotted to this syndicate in respect of the purchase price. Arrangements are also being made for the payment of the syndicate's debts.

"The Universal Cheap Cables, Ltd., has agreed to purchase the site at Norman's Bay on which the mast erected by this syndicate stands, and arrangements are being made to fit up a practical wireless station again there. Another station is being erected in London, and it is expected that demonstrations in the Johnson-Varley untappable system will be made between Norman's Bay and London, and elsewhere.

"An exceedingly interesting report on the system has been given by Prof. Silvanus Thompson, F.R.S., and a copy of this report can be seen by shareholders at the syndicate's registered office. The Universal Cheap Cables, Ltd., have appointed Mr. F. Heron Rogers, A.M.I.M.E., consulting engineer, to represent the interests of the Johnson-Varley system before the Marconi Commission and at the War Office Secret Committee on Wireless Telegraphy."

Hobart Electric Tramway Co., Ltd.—An interim dividend of 9d. per share, as compared with 6d. last year, is announced.

J. G. White & Co., Ltd.—The directors have declared an interim dividend at the rate of 12 per cent. per annum on the ordinary shares for the half-year ended August 31st.

Hart Accumulator Co., Ltd.—The directors have declared the usual dividend for the year, viz., 10 per cent., and 2½ per cent. bonus, free of income-tax.

Central London Railway Co.

Dr. H. F. Parshall (chairman) presided on Thursday, December 19th, at the Holborn Restaurant, over an extraordinary meeting of the shareholders of the above company held for the purpose of explaining the proposed arrangement with the Underground Company.

The Chairman having explained that the meeting was held as a matter of courtesy, and that matters dealing with the domestic affairs of the company could not be raised until the ordinary meeting in February, said that in any dealing with the shares the fundamental consideration was, of course, the security of the guarantee. Their railway was opened in 1900, and was the first of the railways opened from east to west in London with a modern electric service. The takings of the line during the first few years were such as to warrant the company in paying 4 per cent., but later the Metropolitan District and the Metropolitan Railways were electrified, and the Great Northern, Brompton and Piccadilly Railway constructed, so that they were in close competition with railways which gave substantially the same facilities over different routes. As a result the dividend fell to 3 per cent., and had been since maintained at that rate under increasing difficulties in consequence of the 'bus competition over the route. In the last year they paid 4 per cent.; 155 'buses passed a certain point on their route in a given period, whereas to-day 354 'buses passed the same point in the same period. The earnings of the present half-year would amount approximately to £131,000, as against £186,000 in the past half-year, which was to say that there had been a shrinkage on the half-year of £55,000, which had arisen purely on account of the competition never anticipated when the railway was built. Since he had been chairman there had been a large reduction in the working expenses, and they had found new sources of revenue in the carriage of parcels, advertising, &c., so that taking advantage of all the means before them, the 3 per cent. dividend had been maintained. Last August they were able to open the Liverpool Street extension. Owing to the efforts of their engineers and contractors, it was opened earlier than anticipated, and they got five months' working into their balance-sheet of this year. Liverpool Street would contribute from £40,000 to £50,000 in their takings, but the unsatisfactory element was that from £20,000 to £30,000 had been absorbed by increasing 'bus competition. However, that extension had enabled them to maintain the 3 per cent. The other prospective advantage was the Ealing extension, which would take from 1½ to two years to complete, and as Ealing was not as populous a neighbourhosd as the district they drew on from the Great Eastern, it might readily happen that the 'bus competition would anticipate any profit they might obtain from that extension. Consequently, it would appear that the best the shareholders had to look forward to was the 3 per cent. dividend, after taking advantage of every possible resource available to the company. Under the proposed arrangement, the Underground Co. would guarantee a dividend of 4 per cent., and in case the Underground Co. had a surplus, after having earned 4 per cent. on the average for three successful years, the ordinary shareholders of the Central London Co. would be entitled to 40 per cent. of that surplus. It had been suggested that the Underground Co. might never be likely to declare a surplus, but if they did not pay the shareholders the 40 per cent., they could not get the 60 per cent. As regarded the financial position of the Underground Co. to make that guarantee, the figures in the last balance-sheet showed that it was secured more than 11 times over. The question of what would happen if the Underground Co. failed in their obligations had been most carefully considered, and the trust deed provided that in such an event the property should be restored to the shareholders in as good a state as it was taken. The Underground Co. in the trust deed undertook (1) to exercise its voting power so that there should always be on the board of the Central London Railway Co. two directors to represent the interests of the guaranteed stockholders. (2) That the railway should be properly maintained and operated, so that in the event of the determination of the trust the railway and rolling stock should be found to be in proper and efficient condition. (3) Not to use the present reserve fund of the Central London Railway Co. for the payment of dividends. (4) That the provisions of any contract entered into by the Central London Railway Co., which would alter the position or character of the undertaking, or which would be calculated to prejudice the guaranteed stockholders in the event of their exchanging their guaranteed stock for railway stock, should be so expressed as to come to an end, if and when the trust was determined, unless such provisions should have been approved in writing by the two directors representing the guaranteed stockholders or by an extraordinary resolution of a meeting of the guaranteed stockholders. (5) That any further capital which was issued by the Central London Railway Co. should be issued on such terms as would secure the greatest advantage to the undertaking of that company. The debenture-holders and preference stockholders were not affected by the scheme. The ordinary stock consisted of the proportions of 56⅔ undivided ordinary, 21¾ preferred ordinary, 21¾ preferred ordinary and 21¾ deferred ordinary, and they were treated in the same way, as it was necessary to have the preferred shareholders' assent if the requisite majority of 75 per cent. of the stockholders was to be obtained. The preferred stockholders might, of course, say that they were receiving 4 per cent., and there was no reason for going to the trouble of handing over their stock to anybody else; but the answer was that it would be to the interest of the Underground Co. to make the company as remunerative as possible, and the stockholders would share in any surplus. The whole expenses of the arrangement would be borne by the Underground Railway Co.

Mr. Walford said he had been connected with the company from the first, and had taken great interest in it in good times and bad. He congratulated the board on the terms obtained from the Underground Co. They had been told what the Liverpool Street extension had done for them, and when the Ealing extension was opened he thought the probability was that the takings would be as great as the Liverpool Street extension. There was also the proposal to join up at Gunnersbury with the South-Western Railway, and, taken altogether, he considered their contingent rights were very valuable. They all knew what the general manager, Mr. Partridge, had done in reducing expenses, and what Mr. Moss, the secretary, had done, and he trusted that they would be well looked after.

Mr. Sturdy asked on what principle the board gave the deferred shareholders the same as the preferred. His opinion was that this was jobbery.

Mr. Fitch asked if the money now set aside for depreciation was to be used for dividends.

The Chairman said the funds could only be used on the railway and not for dividends. It would be seen that they were amply guaranteed to have their railway back in good condition.

Mr. Fitch thought the arrangement was a good one, and that they would be able to get their electric supply at a cheaper rate from the generating station of the Underground Railway.

Mr. T. H. Hawkins asked if the company kept their reserve fund.

The Chairman said it would be carried forward as Central London property, and would be available for the purposes of the railway.

Col. Bentley asked how the two directors of the company were to be appointed to the new board, and how future elections were to be made.

Mr. Sefton Jones, as a preferred shareholder, supported the proposal.

Mr. Anderson thought they were bound to come into the scheme of controlling the traffic of London.

Mr. Beard asked why the deferred shareholders, receiving 2 per cent., were to be put in the same position as the preferred holders getting 4 per cent. If they ever had to receive their railway back, would they get their reserve fund back also? He also wished to know what compensation was being given to the directors.

The Chairman, in reply, said he had already explained that to get the necessary majority it was necessary that the preferred shareholders should have some slight incentive to come in, and under this arrangement they got a better guarantee and also the right to share in the 40 per cent. It had to be remembered that the offer came from the Underground Co. As to the directors, two of the directors from the present board might be elected, or any two as representing the interests of the company. The compensation to directors and staff fell on the Underground Railway Co. Suitable provision was made for the staff, and the staff were satisfied with it.

Mr. Morris (solicitor) said two directors of the company would remain on the board and the others would retire, and be replaced by nominees of the Underground Co. In the event of either of the two retiring from the board, a fresh director would be elected by the shareholders of the Central London Co. Everything else would go on as now.

Several other matters with respect to the quotation of the shares in the future having been answered, the meeting ended with a vote of thanks to the chairman.

Metropolitan Railway Co.—It is stated in the daily papers that the directors of this company have decided to insert in their Bill for next session power to raise £1,200,000 additional capital, exclusive of the capital that will be required to purchase the undertaking of the Great Northern and City Railway Co. Of the £1,200,000 new capital, £300,000 is proposed to be raised by the issue of debenture stock, if necessary "at a discount," and the balance of £900,000 is to be raised "on such terms and conditions at such price above or below the nominal amount, and in such manner as the directors think advantageous to the company."

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Consolidated Diesel Engine Manufacturers, Ltd.—427,076 shares of £1 each, 15s. paid (Nos. 1 to 427,076), and 67,470 shares of £1 each, fully paid (Nos. 527,077 to 594,546).

Continental.—Austria.—The report of the Austrian Brown-Boveri Works Co., of Vienna, for the last financial year states that large orders have been secured for tramway motors from the municipal authorities of Vienna and for a number of tramway equipments for the towns of Teplitz and Mahrisch-Ostrau. The net profit for the year amounted to £13,280, out of which a dividend of 5 per cent. is being declared.

Direct West India Cable Co., Ltd.—The directors, says the *Financier*, have declared an interim dividend at the rate of 6 per cent. per annum (1s. 6d. per share) on the ordinary shares for the half-year ended December 31st.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended November 29th, 1912, amounted to 817,119, compared with 712,454 units in the corresponding four weeks of 1911.

Osram Lamp Litigation.—An injunction has been granted in the Chancery Division against David Smith & Co., on the application of the Osram Lamp Co. We shall report the matter next week.

STOCKS AND SHARES.

Saturday Afternoon.

ONLY the prospect of a bare larder and a cold radiator on Christmas Day compels unwilling attention to such inappropriate matters as Stock Exchange markets at this season of the year. We could fill a couple of columns or so with descriptive matter of Mr. "Salvation" Smith's journey through the Stock Exchange markets, and the various other incidentals which are inseparable to the House in Throgmorton Street at Christmas time. But it is to be doubted whether the editorial frown would not censor such purely topical subjects, and one cannot write indefinitely even upon the charming effect produced by covering the electric lights in the Stock Exchange with tissue paper of various shades.

Descending laboriously, therefore, from these considerations, it has to be noted as a feature of the electrical markets that prices are decidedly better than they were when we wrote at the beginning of the week. The Stock Exchange was relieved by the announcement on Thursday forenoon of the retention of the Bank of England Rate at 5 per cent.; while the pacific progress of the peace negotiations is another influence making for more confidence. A smart recovery in the price of Consols formed a useful adjunct to the strength of investment markets as a whole, and it looks as though the year will wind up with firmness in most of the active departments.

This applies particularly to the Home Railway market, where there is a substantial rally. At the meeting on Thursday, Central London holders gave sufficient assent to the scheme of the Underground Electric Railways Company to make the offer made by the latter company binding upon it, and Central London stocks have improved to the extent of a point apiece in the Ordinary and Deferred, and two points in the Preferred. It seems somewhat anomalous that the quotations for the three stocks should not be on all fours; but what seems more anomalous still is that the Preferred should be treated in precisely the same manner as the other two stocks. Of course, the scheme is purely optional on the part of holders, and therefore they cannot complain logically at the treatment offered them. There is, however, a good deal of feeling on the subject, and quite possibly the resentment may come to a head before the year is out.

City & South London rallied ½, and Metropolitans jumped 1¼, while Districts put on ¼. The Metropolitan Company announces that it intends to take powers for the issue of fresh capital, but this had no effect upon the buoyancy of the market. Underground Electric Railway shares have forged ahead on the successful passage of the company's offer to the City & South London and to the Central London stockholders, the shares rising ⅜ and the 6 per cent. Income bonds being 2½ up at 92½, amid vague suggestions that the latter will certainly receive their full 6 per cent. for next year, while optimists look for the redemption of the whole of this issue at par before very long.

The English Electricity Supply market is not featured by one solitary movement. It would require the pen of a professional journalist to do full justice to a market which flouts in this way the energies of the weekly paragraphist, so maybe it is better to say no more upon the subject.

The market in National Telephone stock continues to attract a good deal of what little attention is left for stocks and shares. The price was jerked down the other day to 134, whence ensued a recovery to 138½, this leaving a rise of 1 on the week. All kinds of estimates are now current as to the figure at which the stock will be ultimately paid off; and since, so far as we can tell, it is impossible to form any reliable guess as to the final figures, we will forbear quoting the various prophecies. Marconis, after being still flatter, rallied a shade; but the market is not yet by any means a good one, and even some of the Company's supporters begin to admit that other competitive systems need to be taken into account. A little activity revived in American and Canadian Marconis, the prices for both hardening up; but it is noticeable how any improvement brings in sellers. However, Americans are better at $1\frac{1}{16}$, and Canadians at 17s. 9d.

United River Plate Telephones and Chile Telephones both gained $\frac{1}{16}$, while American Telephone capital stock picked up its small loss of a week ago. In the Telegraph list proper, there is practically nothing doing. Reuters shed ¼, taking the price down to 10¾.

In the Latin-Canadian group, the principal change is a fall of 4 points in Northern Light and Power bonds; but the rest of this section is steady, and improvements of a point or so have occurred in Brazilian Tractions, Shawinigan Water, Mexican Electric 5 per cent. bonds, and Sao Paulo Debenture. Kalgoorlie Electric Trams Debenture stocks are weak, especially the "B," which has dropped to a nominal quotation of 35. Underwriting letters in respect of the new issue of British Columbia Electric Debenture stock had to be lodged, at the latest, this (Saturday) morning. The underwriting commission was 2½ per cent. in cash.

The Manufacturing group maintains its steadiness. India-Rubber shares, after their recent drop, recovered ¾ to 10½. Babcock Preference are a shade easier. The rubber auction sales this week at Mincing Lane proved somewhat disappointing to the expectations of those who had been looking for an advance in prices, and the share market became very dull in consequence. Upon the completion of the sales, however, an improvement occurred in the price of the raw stuff, which was reflected in a general rally amongst the shares, and the market has regained its firmness.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Aberdeen	Dec. 18	2,695	+ 8	29	44,628	+ 521	14·4	..
†Ayr	" 14	200	+ 10	30	10,887	+ 279	8	..
Bath	" 21	1,374	— 6	51	44,550	+ 2,258	..	..
Birmingham Corp.	" 14	22,867	+5,572	37	897,768	+118,190	57·17	..
†Blackburn	" 11	1,120	+ 105	37½	44,604	+ 1,065	14·62	..
Blackpool Corp. ..	" 19	878	+ 48	..	63,570	+ 5,910	11·87	..
†Blackpool-Fleetw'd	" 14	235	+ 20	23	24,756	— 478	8	..
Bournemouth ..	" 18	3,004	+ 62	37¾	71,278	+ 2,159	21·95	..
Bradford	" 14	10,669	+ 508	37	206,160	+ 1,017	56	..
†Brighton	" 15	793	+ 17	37	89,256	— 941	9·5	..
Bristol	" 20	14,178	+1,630	..	353,275	+30,155	80·5	..
Brit. Elec. Trac. Co.								
‡Airdrie	" 3	571	+ 43	50	14,954	+ 3,528	8·65	..
Barnsley	" 3	394	+ 31	"	9,119	— 137	..	..
Barrow	" 3	635	+ 47	"	18,816	+ 3,392	5·87	..
Devonport ..	" 3	809	+ 21	"	26,700	+ 1,761	8·85	..
Gateshead ..	" 3	2,184	+ 96	"	52,431	+ 331	11·25	..
Gravesend ..	" 3	403	..	"	10,563	— 96	6·5	..
Greenock	" 3	1,443	+ 19	"	40,247	+ 3,983	7·25	..
Kidderminster ..	" 3	193	+ 5	"	5,888	+ 109	..	..
Merthyr	" 3	383	— 12	"	10,061	— 883	2·9	..
Metropolitan ..	" 3	16,664	+ 341	"	437,411	— 143	22	..
Middleton ..	" 3	557	— 27	"	16,566	— 353	8·5	..
Mid. Joint Com'tee	" 3	6,643	+ 621	"	165,150	+ 9,113	..	..
Oldham—Ashton	" 3	1,126	+ 21	"	3[illegible],434	+ 1,707	9·18	..
Peterborough ..	" 3	229	+ 10	"	6,781	+ 385	5·31	..
Potteries	" 3	4,225	+ 29	"	97,312	— 1,149	[illegible]	..
Rothesay	" 3	80	+ 1	"	10,614	+ 500	2·75	..
Southport ..	" 3	483	+ 24	"	14,875	— 179	8·17	..
S. Metropolitan ..	" 3	1,456	+ 75	"	41,949	— 712	..	..
Swansea	" 3	2,281	+ 89	"	57,596	+ 429	12·5	..
Tynemouth ..	" 3	491	+ 113	"	12,001	— 814	3·75	..
Weston-s-Mare ..	" 3	52	+ 27	"	6,894	— 1,293	8	..
‡Worcester ..	" 3	483	+ 3	"	14,619	— 41	5·75	..
Wrexham ..	" 3	204	+ 6	"	5,740	+ 623	..	..
Yorks. Wool. Dist.	" 3	2,071	+ 64	"	54,069	+ 1,402	17	..
Miscellaneous ..	" 3	4[illegible]7	+ 81	"	11,575	+ 293	..	..
†Burnley	" 14	1,553	+ 199	..	..	..	12·44	·8
†Burton-on-Trent ..	" 15	271	+ 10	37	10,100	— 445	6·6	..
†Bury	" 15	1,225	+ 79	37	48,249	+ 38	22·5	..
†Cardiff	" 14	2,519	+ 169	37	90,776	— 1,033	17·35	..
Chatham and Dist.	" 12	1,575	+ 59	50	42,681	+ 144	14·98	..
Cork	" 19	912	— 21	51	24,403	— 963	9·89	..
†Croydon	" 6	1,619	— 13	36	65,154	— 625	11·6	..
Darlington	" 14	458	+ 18	37	8,347	+ 125	4·87	..
†Darwen	" 13	274	+ 28	37	10,367	+ 360	4·36	..
Dover	" 14	375	..	37	9,266	— 576	4·75	..
†Dublin	" 13	5,576	+ 316	..	138,203	— 7,630	54·25	..
†East Ham	" 14	1,056	+ 6	37	39,772	— 839	7·87	..
†Glasgow	" 14	19,317	+1,755	..	529,953	— 8,419	98	..
†Hastings	" 12	684	— 10	..	..	— 2,409	19·8	..
†Hull	" 14	3,100	+ 101	37	110,025	+ 1,573	13·5	—1
Ilkeston	" 19	225	— 17	38	4,286	— 769	..	..
†Ipswich	" 14	270	— 20	37	16,735	— 124	10·5	..
Kilmarnock ..	" 14	306	+ 10	30	4,992	— 154	4·25	..
Lancashire United	" 18	2,614	+ 118	51	68,592	+ 303	[illegible]	..
†Leeds	" 14	7,752	+ 454	37	289 238	+10,277	65	7·5
†Leicester	" 14	2,674	+ 175	50	128,014	+ 4,534	20	..
Leith	..	..	..	..	..	..	8·72	..
Liverpool	" 14	24,565	+1,015	49½	598,698	+26,264	119	2
‡L.C.C.	" 11	81,973	—2,683	..	1,534,760	—77,448	142·2	4
†London United ..	" 14	5,540	+ 301	..	309,707	—13,239	..	..
†Lowestoft	" 14	177	..	10	1,883	— 13	8·5	..
†Manchester ..	" 14	17,034	+ 957	37	622 813	+22,579	105	..
†Newcastle	" 14	5 080	+ 656	..	164 354	+ 4,241	81·8	..
Newport	" 14	1,429	+ 103	37	26,236	— 219	7·25	..
†Oldham	" 15	1,979	+ 783	38	78,063	+ 4,696	28	..
Pontypridd	" 16	832	+ 52	37	14,839	— 548	5·5	..
Preston	" 4	1,497	+ 78	36	29,919	+ 1,376	10	..
Rotherham	" 18	1,748	+ 579	37¾	29,214	+ 3,401	18	·6
†Salford	" 16	6,022	+ 243	37	187,226	+ 4,647	41	..
†Sheffield	" 17	7 226	+ 560	..	255,425	+11,783	40	..
Southampton ..	" 11	1 117	+ 62	36	45,926	— 140	11	..
Southend-on-Sea ..	" 18	1,093	+ 171	38	30,716	+ 3,807	7	..
†South Shields ..	" 14	641	+ 54	37	23,641	+ 321	10·25	..
Tyneside	" 18	1,190	+ 339	25	12,391	— 240	11	..
Wallasey	" 14	1,934	— 1	37	41,456	— 203	8·72	..
†Walthamstow .	" 14	664	+ 49	37	27,008	— 1,012	9	..
West Ham . .	" 12	5,016	— 189	36½	96,172	— 3,872	13·45	1·2
Wolverhampton		..	..			..	13·75	..
†Cen. London Rly.	" 14	5,795	+ 355	24	118,635	+ 4,121	6·78	·4
†City & S. Lon. Rly.	" 15	3,204	— 134	24	70 696	— 6,092	7·26	..
Dublin-Lucan Rly.	" 20	225	— 11	25	3,592	— 97	7	..
†G.N. and City Rly.	" 14	1,482	— 210	24	33,94[illegible]	— 1,084	8·5	..
†L'pool Overh'd Rly.	" 15	1,595	+ 51	24	[illegible]	+ 3,225	6·6	..
Llandudno-Col. Bay	" 13	133	+ 17	2	234	— 17	6·5	..
†Lond. Elec. Ry. Co	" 14	14,890	+ 125	24	816,205	+ 4,645	41·25	..
†Mersey Railway ..	" 14	2 370	+ 82	24	51,876	+ 4,948	4·5	..
†Metropolitan Rly.	" 15	18,4[illegible]6	+ 9	24	410,481	+ 5,279	5 75	..
†Met. District Rly.	" 14	13 053	+ 546	24	300,831	23 524	26	..
Anglo-Argentine ..	" 16	115 919	+13 857	..	2,586,217	+130,489	..	..
§Auckland	Nov.	19 174	2 580		97,203	+15,752	34·11	·8
Bombay (B.E.T.) ..	Nov 21	7 237	+ 659	47	142 763	6,714	.	..
§Brisbane	Nov.	24,310	+2,420	11	228,421	— 551	.	..
†Calcutta .	Dec. 14	[illegible]	+ 289		..			..
§Kalgoorlie, W.A...	Nov.	[illegible]		..	34,004		30·5	..
Madras .	Dec. 15	[illegible]	- 73	..	57,220	+ 1,873	14 7	2
§Montevideo .	Nov.	[illegible]	+3 009			..	..	.
†Perth (W.A.)	Dec. 13	[illegible]	+ 322	..	[illegible]	12 36[illegible]	29	..

Compared with the corresponding period of 1911. † One week only.
Includes horse, steam and other receipts. § One month.

Reduction of Capital.—Application for confirmation of a reduction of capital of Miller & Sons (Ltd. and Red.) from £30,000 to £18,447, was presented to the Court on December 5th and is now pending. Reference is made to the matter in our advertisement pages to-day.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	1912	Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	5½	5†	9½ — 10½	..	5 4 9
Do. 4½ % Pref...	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	9†	8¼ — 9¼	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	96 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4¾ — 5¼	..	4 17 7
Do. 4½ % Cum. Pref... ..	5	4½	4½	4½ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb... ..	100	4	4	92 — 94 xd	..	4 5 1
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb...	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 [illegible]
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 9 0
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	100 —108	.	4 7 5
County of London, Ord... ..	10	6	4†	11½ — 12	..	5 [illegible]
Do. 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 8 3
Edmundson's, Ord.	£3	Nil	..	[illegible]	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4 — 5	..	..
Do. 6% Non Cum. Pref. .	5	..	..	1 — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4¾ — 5¼	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4¾ — 5¼	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½ — 8	..	5 12 6

NAME.	Stock or Share.	Dividends for 1911.	1912	Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Kensington & Knightsbridge, Ord	5	9	8†	7¾ — 8¼	..	5 10 9
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	8	2½	..	1½ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb. ..	Stock	4	4	88 — 91 xd	..	4 8 0
Metropolitan	5	4	4†	3¾ — 4	..	5 3 3
Do. 4½ % Cum. Pref... ..	5	4½	4½	3¾ — 4	..	5 9 9
Do. 4½ % First Mort. Deb...	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 — 101	.	4
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4¾ — 5	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6	6¼ — 6¾	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9¾ — 10¾	..	4 17 7
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	.	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	2⅞ — 3⅜	..	5 18 4
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1¼ — 1⅜	..	5 9 5
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord...	£3	Nil		½ — ¾	..	..
Do. 5 % Cum. Pref.	5	2	.	2⅞ — 3⅜	..	..
Do. 4½ % First Mort. Deb...	100	4½	4½	84½ — 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼	.	5 [illegible] 1
Do. 4½ % Cum. Pref... ..	5	4½	4½	4¾ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

NAME.	Stock or Share.	Dividends for 1911.	1912	Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Adelaide, 6 % Pref.	5	6	6	5½ — 5¾	..	5 6 8
Calcutta, Ord.	5	8½	7†	6 — 7½	..	5 19 1
Do. 5 % Pref.	5	5	5	4 11/16 — 5 1/16		4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	94 — 96	..	5 4 2
Canadian Gen. El. Com. ..	$100	7	7	117 — 121	.	5 15 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	5	1⅛ — 1¼ xd	..	5 6 8
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94 xd	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	86 — 89		5 12 4
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	⅝ — ¾	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87 — 89	+ ½	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	85½ — 86½		4 12 6
Do. 7 % Cum. Pref.	$100	7	7	102 — 106		6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1

NAME.	Stock or Share.	Dividends for 1911.	1912	Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	85½ — 87½	..	5 14
Montreal, Lt., H. and Power ..	$100	8	9†	227 —232	..	3 17 7
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5†	[illegible]	..	..
River Plate, Ord.	Stock	10		225 —235	..	4 7 1
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106 —111	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital ..	$100	5	5	139 —143		3 10 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	1	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102		4 8 3
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97½ — 98½ xd	..	4 10 [illegible]
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93½ — 95½	..	5 3 8
Victoria Falls Power, Pref. ..	1	11⅜d.	17⅜d.	[illegible]		..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½ —105½	..	5 13 [illegible]

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	1912	Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Amazon Telegraph	10	4	4½†	7 — 7	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	142½ —144½	+ ½	5 10 9
Do. Collat. Trust	$1000	4	4	93 — 95	.	4 4 3
Anglo-American Telegraph ..	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½ —111½	..	5 7 8
Do. Def...	Do.	80/-	..	25½ — 26½	..	5 16 0
Anglo - Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅛ — 7⅝	+ ⅛	5 1 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	10	6	6†	8¾ — 9¾	..	6 6 4
Do. 10 % Pref...	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	2¾ — 3¼	..	5 6 8
Do. 10 % Cum. Pref... ..	5	10	10	6½ — 7	..	7 2 10
Direct United States Cable ..	10	5	4	7 — 7½	..	6 13 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	133 —136	..	5 3 0
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	77 — 79	..	4 8 7
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	10⅜ — 10⅝ xd	⅛	5 10 4
Do. 6 % Pref.	10	6	6	12⅝ — 13⅛ xd	..	4 13 2
Great Northern Telegraph ..	10	18	18	27½ — 29	..	6 2 0
Indo-European Telegraph ..	25	13	5†	56 — 58	..	5 12 1
Mackay Companies Common ..	$100	5	5	85 — 88 xd	..	5 13 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70 xd	.	5 14 4
Marconi's Wireless Telegraph	1	20	..	4 7/16 — 4 9/16	+ 3/16	4 11 4
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅝ — 3⅞	..	4 7 8

NAME.	Stock or Share.	Dividends for 1911.	1912	Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Monte Video Telephone, Ord...	1	6	5†	1⅛ — 1¼	..	5 13 0
Do. 5 % Pref.	1	5	5	[illegible]	..	5 18 6
National Telephone Def. ..	Stock	6	..	137 — 140	1	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	97½ — 98½	..	4 11 2
Oriental Telep. and Elec. ..	1	8	6†	1⅝ — 1¾	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1¼ — 1⅜	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88½ — 90½		4 8 [illegible]
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10½ — 11	— ¼	9 1 10
Submarine Cables Trust ..	Cert.	6	6	127 —130		4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ —101½	..	4 8 8
United River Plate Telephone	5	8	..	7½ — 7¾	+ ⅛	5 3 3
Do. 5 % Cum. Pref.	5	5	5	5½ — 5¾	..	4 8 11
West Coast of America	2½	2½	..	1 1/16 — 1¼	1/32	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3 — 3¼	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10½ — 10¾	+ ⅛	5 12 8
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd. ..	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95½ — 97½	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97 —100		4 10 0

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* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Dec. 21st.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	[illegible] — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11½ — 13½	..	..
Do. Do. Deferred ..	100	.	.	5 — 7	..	
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 89 xd	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	..	..
Do. 5 % Perp. Deb. ..	100	5	5	92 — 96	..	5 4 2
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	5†	81 — 83	+1	3 12 3
Do. Pref.	100	4	4	83 — 85	+2	4 14 2
Do. Def.	100	2	.	80 — 82	+1	2 8 9
Do. 4 % Deb.	100	4	4	100 — 102		3 18 5
City & South London, Ord. ..	100	1⅝	1¼†	35 — 36	+ ½	3 16 5
Do. 5 % Pref., 1891	100	5	5	109 — 111	..	4 10 1
Do. Do. 1896	100	5	5	109 — 111	..	4 10 1
Do. Do. 1901	100	5	5	109 — 111	..	4 10 1
Do. Do. 1908	100	5	5	109 — 111	..	4 10 1
Do. 4 % Deb.	100	4	4	98 — 100	..	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2½ — 2¾	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	15/32 — 23/32	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜ xd	..	4 15 3
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb. ..	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	..	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5 — 6	..	.
Do. 4 % Deb.	100	4	4	72 — 75	..	5 6 8
Metropolitan Railway Consol. ..	100	1⅞	1½†	53 — 53½	+1¼	3 0 9
Do. Surplus Lands	100	2⅞	2¾†	62 — 64	..	4 6 0
Do 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 85	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	40 — 40½	+ ¼	Nil
Do. 6 % Deb.	100	6	6	141 — 143	..	4 4 0
Do. 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
Do. 4 % Prior Lien	100	4	4	99 — 101	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	88 — 90	..	5 0 0
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1 1/16 — 1 3/16	..	5 1 1
Do. Def.	1	Nil	..	¼ — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	[illegible] — [illegible]	..	5 14 3
Do. 4½ % Deb.	100	4½	4½	93 — 95	..	4 14 9
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	8½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	17/32 — 23/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	4¼ — 4⅜	+ ⅜	Nil
Do. "A"	1/-	..	..	9/16 — [illegible]	..	..
Do. 6% First Cum. Inc. Deb.	100	..	6	111 — 113	—1	5 6 2
Do. 4½ % Bonds	100	4½	4½	100 — 102	..	4 8 3
Do. 6 % Income	100	1½	£2	92 — 93	+2½	..
Yorkshire (West Riding), Ord.	5	Nil	..	½ — ¾	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	..	4 5
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5⅛	..	4 17 9
Do. 2nd Pref.	5	5½	5½	4 11/16 — 4 13/16	..	5 17 4
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	99 — 101	.	4 9 1
Do. 5 % Deb.	100	5	5	97½ — 99½	..	5 0 6
Auckland Trams, 5 % Deb. ..	100	5	5	103½ — 105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11¾ — 12¼	+ ¼	4 18 0
Do. 4½ % Deb.	100	4½	4½	98 — 100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 — 101	..	4 19 0
Brazilian Traction Light and Power	$100	..	..	91 — 93	..	..
Brisbane Trams Invt., Ord. ..	5	8	8†	7 1/16 — 7 5/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100½ — 103½	..	4 7 0
B. Columbia Elec. Rly., Def. ..	100	8	..	139 — 144 xd	..	5 11 2
Do. Pref. Ord.	100	6	6	117 — 121	+ ½	4 19 2
Do. 5 % Pref.	100	5	5	106½ — 109½	.	4 11 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	98½ — 101½	..	4 8 8
Do. 4½ % Vancouver Deb. ..	100	4½	4½	103 — 105	..	4 5 9
Do. 4½ % Con. Deb.	100	4¼	4¼	97 — 100	.	4 5 0
Calcutta Trams, Ord.	5	7	5†	5¾ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 — 102	..	4 8 3
Cape Electric Trams	1	2½	..	[illegible]	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 1/16 — 5 3/16	.	4 8 0
Do. 4 % Deb.	100	5	5	99 — 102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 — 103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/32 — 9/32	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	—1	5 11 1
Do. 6 % B Deb.	100	6	3	30 — 40	—4	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	[illegible]	..	..
Do. Pref.	1	6		29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	100 — 102	..	4 18 0
Manaos Trams & Lt., 1st Deb. ..	100	5	5	89 — 92	..	5 8 8
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ — 102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	109 — 111	..	6 6 2
Do. Gen. Con. 5 % Bonds ..	..	5	5	95½ — 97½	..	5 2 7
Do. 6 % Bonds	100	6	6	101½ — 103½	..	5 16 0
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7⅜ — 7⅝	..	6 11 2
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	97 — 99	..	5 1 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1 3/32 — 1 5/32	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	99 — 102	..	4 18 0
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5½ — 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 — 101	..	4 9 1
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102 — 104	..	4 16 2
Do. 5 % Mort. Bonds ..	100	5	5	96½ — 98½	..	5 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 — 104	+ ½	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 1
Un. Elec. Trams Monte Video ..	5	7	6†	5¾ — 6	..	5 16 8
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 — 102		4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	99 — 102	—1	4 8 3

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	½ — ¾	..	8 0 0
Do. 6 % Pref.	1	6	6	[illegible] — [illegible]	..	7 13 11
Babcock & Wilcox	1	28	14†	3 — 3¼	..	4 6 2
Do. Pref.	1	6	6	1⅜ — 1⅝	— 1/16	4 0 0
British Aluminium, Ord. ..	1	Nil	..	[illegible] — ⅞	..	..
Do. 6 % Cum. Pref.	1	Nil	..	13/16 — 15/16	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 6 5
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7¾ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb...	100	4½	4½	103 — 105	..	4 5 9
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	8	Nil	Nil	[illegible] — 2	..	Nil
Do. Deb...	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	.	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10¾ — 11¼	..	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb...	100	4½	4½	99½ — 101½	..	4 8 8
Castner-Kellner	1	20	20	3⅝ — 3¾	..	5 6 8
Do. Deb...	100	4½	4½	106 — 109	..	4 2 7
Crompton & Co.	8	Nil	..	⅛ — ⅜	..	Nil
Do. Deb...	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	[illegible] — 13/16	..	..
Do. Pref.	1	6	6	[illegible] — ⅞	..	6 17 2
Do. Deb...	100	4½	4½	97 — 100	..	4 10 0
Edison & Swan, A, £3 paid ..	3	Nil	..	⅛ — [illegible]	..	Nil
Do. fully paid	5	Nil	..	1 — 1¼	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb. ..	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3¾	[illegible] — 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb...	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb...	100	4	4	90 — 95	..	4 4 5
Henley's, Ord.	5	17	5†	12¼ — 13	..	6 10 9
Do. Pref.	5	4½	4½	4 15/16 — 5 1/16	..	4 9 0
Do. Deb...	100	4½	4½	101 — 103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	+ ¼	6 16 4
Do. Pref.	10	5	5	9¾ — 10¼	..	4 17 7
Telegraph Construction	12	17½	5†	34½ — 36½	..	5 13 0
Do. Deb...	100	4	4	97½ — 100½	..	3 19 6
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	½ — [illegible]	..	Nil
Do. Deb...	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING NOVEMBER, 1912.

Although, compared with the previous month's figures, those for November show a striking reduction in value, yet the total of the exports—£468,465—contained a comparatively small proportion of telegraphic material (valued at £38,467, as compared with £234,311 in October, when the conditions were abnormal), and represents a figure above the average of the earlier months of the year.

The imports, valued at £252,672, compare with £267,328 in the month previous, but the November re-exports, at £30,204— a figure above the average—were an improvement on the October total of £27,491.

As might be anticipated, the export figures were lower all round as compared with those for October; the value of machinery exported, however, reached £177,000 approximately, while the other staple export, cables, was valued in total at nearly £100,000. The import figures show less variation than the foregoing, although it may be noted that Germany's share of the business was some £30,000 less than in the previous month.

Foremost of our own customers during the month was Japan, and it is a sign of the times that Canada occupied the second position in regard to value, outdistancing such well-known purchasers as Argentina, India, our Australian Colonies and New Zealand.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulators.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephones and apparatus and accessories.	Telegraph cables and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,063	700	122	69	69	260	8,025	571	961	56	977	321	13,197
Germany	2,520	4,057	4	...	578	58	1,960	300		...	35	74	9,586
Netherlands, Java & Dutch Indies ...	510	2,627	109	31	29	62	1,664	...	12		17	753	5,814
Belgium	766	1,070	135	...	422	23	2,609	[illegible]	...	[illegible]	689	108	6,283
France	961	...	4,762	...	61	41	13,259	734	2	28	94	464	20,409
Portugal	194	205	107	143	12	...	171	...	180	...	161	372	1,545
Spain, Canary Isles and Spanish N. Africa...	1,975	3,520	160	...	567	678	6,868	926	12	..	101	329	15,140
Switzerland, Italy and Austria-Hungary ...	315	91	293	12	136	9	5,774	408	38	372	.	2,401	9,849
Greece, Bulgaria, Roumania and Turkey ...	155	167	...	...	...	...	697	...	13	.	268	513	1,813
Channel Isles, Gibraltar, Malta and Cyprus...	48	426	196	86	...	76	266		...	..	12	170	1,280
U.S.A., Philippines and Cuba	560	10	53	.	45	108	1,298	215	11	20	...	502	2,822
Canada and Newfoundland	1,113	5,313	1,586	1,365	...	4,593	14,341		12,447	...	1,049	470	42,277
British West Indies and British Guiana ...	33	10	192	96	12	...	281		77	...	13	...	714
Mexico and Central America	413	39	51	77	..	...	152	.	23	...	13	371	1,139
Peru and Uruguay	1,030	30	312	280	...	...	1,331		192	...	20	1,533	4,728
Chile	2,212	464	172	202	52	411	2,608	37	242	17	170	2,122	8,709
Brazil	845	535	551	872	...	40	6,029	223	923	155	17	7,906	18,096
Argentina	1,300	10,798	231	473	171	605	7,176	1,169	[illegible]	[illegible]	4,629	1,542	30,164
Colombia and Venezuela	...	.	1,323	...	...	...	785	...	120	..	12	.	2,240
Egypt, North Africa and Persia	184	220	72	35	...	80	382	365	152	...	353	1,412	3,255
British West Africa	160	204	70	35	...	...	291	...	2	...	30	193	946
Rhodesia, O.R.C. and Transvaal	1,694	1,683	163	544	10	351	2,722	32	116	...	199	[illegible]	7,827
Cape of Good Hope	1,736	4,327	506	367	...	668	2,387	307	1,748	92	297	655	13,086
Natal	750	6,120	376	...	...	66	3,482	.	598	..	214	40	11,646
Zanzibar, Brit. E. Africa, Mauritius and Aden	81	277	58	82	12	1,168	470	86	100	..	7	5,227	7,776
Azores, Madeira and Portuguese Africa ...	176	534	179	117	...	14	381	120	27	11	51	745	2,355
French African Colonies, Madgascar, &c. ...	1	29	...	...	...	.	356	...	...	1	..	14	401
China and Siam	786	1,187	95	1,538	...	242	7,342	2	89	..	370	...	11,651
Japan and Korea	1,712	11,169	373	.	16	2,811	16,244	1,427	6,218	17	7,362	1,460	48,809
India	4,260	15,868	3,514	2,268	150	842	[illegible]	1,000	2,198	[illegible]	[illegible]	2,988	37,619
Ceylon	505	2,173	262	118	...	27	1,318	...	33	14	1,001	139	5,590
Straits Settlements and Federated Malay States	261	1,479	310	38	...	519	1,601	550	83		13	1,583	6,448
Hong Kong	464	202	133	234	...	22	2,888	.	23	81	69	...	4,123
West Australia	470	756	128	574	..	368	843	17	47	...	808	27	4,087
South Australia	431	1,027	78	151	...	84	3,269	16	113	...	11	59	5,368
Victoria	3,554	9,975	902	471	107	154	9,103	584	4,446	...	653	73	29,996
New South Wales	880	4,846	994	282	147	1,462	17,841	615	384	11	1,972	2,453	31,887
Queensland	71	1,453	...	325	...	305	696	...	.	...	1,681	802	5,333
Tasmania	127	...	99	...	...	3	11	...	.	...	...	94	334
New Zealand	1,872	3,973	1,314	96	27	1,120	15,066	690	346	27	9,363	196	34,090
Total, £	35,928	97,542	20,585	10,779	2,588	17,493	166,401	10,498	33,357	1,373	33,454	38,467	468,465

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Country consigning imports	Electrical goods and appliances.	Wires and cables, rubber and other insulators.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephones and apparatus and accessories.	Telegraph cables and apparatus.	Total.
Russia, Norway, Sweden and Denmark ...	128	...	...	142	7	...	12,568	95	606	33	14,436		28,015
Germany	10,645	4,571	1,430	19,985	12,180	2,574	60,822	310	5,394	7,765	27,890		153,566
Holland	33	...	...	1,809	408	...	...	...	8	220	920		3,398
Belgium	672	2,569	...	220	103	30	3,858	5	194	122	5,577		13,350
France	531	8	835	1,577	228	824	3,732	75	1,059	3,395	1,453		13,717
Switzerland	121	2,345	...	60	65	234	1,297	...	...	31	45		4,198
Italy	14	322	...	52	1	...	23	...	..	...	4,011		4,423
Austria-Hungary	...	687	...	483	144	...	178	...	...	1,031	...		2,523
United States	4,193	425	743	116	145	577	12,247	9,788	346	62	86		28,728
Total, £	16,337	10,927	3,008	24,414	13,284	4,239	94,722	10,273	7,607	12,659	54,418		251,918

Additional imports: Canada, goods, £310, machinery, £15; Spain, carbons, £429.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	Electrical goods and appliances.	Wires and cables, rubber and other insulators.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephones and apparatus and accessories.	Telegraph cables and apparatus.	Total.
Various countries, mainly as above ...	17,868	768	...	1,671	205	...	7,987	...	316	577	812		30,204

Total Exports: £468,465. Total Re-Exports: £30,204. Total Imports: £252,672.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

INDUSTRIES AND INDUSTRIAL CONDITIONS IN THE ARGENTINE.

By ALFRED H. GIBBINGS, A.M.I.C.E., of Buenos Ayres.

(*Concluded from page* 1014.)

Fuel and Motive Power.—The question of fuel is of paramount importance in any country, and more particularly in a country of such vast area as the Argentine, where motive power is wanted in all parts. The country produces three classes of fuel, viz., coal, petroleum, and a very hard wood, called "quebracho." Each of these, however, is found at points very remote from the industrial area—so far away, in fact, that the cost of transit alone puts them out of the running with imported fuels. Quebracho wood is brought into Buenos Ayres from the forests of Tucuman and Entre Rios, but is only used for domestic purposes in place of coal. Coal is found but in small quantities in some of the outlying mountain ranges of the Andes, and is very poor in quality. Petroleum has been discovered in Commodore Rivadavia, in the south-east of the Territory of Chubut, and is being worked to a very limited extent. At present the quantity obtained from the few wells sunk is so small that it is of no commercial importance, but some of the locomotives of the Patagonian Railway are using it instead of coal. The oil, moreover, is of poor quality, being only 50 per cent. of the calorific value of Texas or Mexican oil. There are very complete Government reports or Blue Books issued on this oil-field, containing chemical analyses and comparisons with the well-known oilfields of the world.

The object here, however, is only to point out the conditions which exist at present, and it will be seen from the foregoing remarks that the Argentine is really dependent upon importation of coal and petroleum. The present price of good Welsh coal in Buenos Ayres, Rosario, Bahia Blanca, and the other ports is about £2 5s. per ton, and petroleum (crude and in 40-gallon barrels) about £7 per ton. There are practically no facilities for storing petroleum in bulk, but a large fleet of tank steamers is now being built by a British firm for importing to the Argentine about 1,000,000 tons of crude petroleum per annum. Crude petroleum is used for both firing boilers, and in the "Diesel" type of engine. Anthracite is also imported for domestic heating in slow-combustion stoves, and for producer-gas plants.

The motive power in general use is (*a*) steam; (*b*) internal combustion engines using crude petroleum, paraffin, petrol, town's gas, and producer gas; and (*c*) electricity from public supply mains. Steam power is general for all large undertakings, but in some of these cases the Diesel engine is replacing it owing to improvements in design, and particularly as regards reliability. Producer gas plants are not in great vogue, owing to the great difficulty of obtaining sufficiently intelligent men to look after them. At this juncture it may usefully be stated that comparatively small differences between the economy and efficiency of the several classes of prime movers do not appeal to the power-user here. What he wants above all things is reliability, and this can well be understood where any breakdown would mean many days, possibly weeks, before repair could be effected, thereby wiping out any small advantage due to high efficiency, and entailing in addition a very serious loss. Moreover, in a country where everything is expensive and money is plentiful, profits are correspondingly large, and the refinements of economical operation are put on one side.

The largest electric power supply undertaking in South America is the Cia. Alemana Transalantica de Electricidad, of Buenos Ayres, whose network of mains spreads over the whole city. This company has over 100,000 KW. of plant, and by the end of 1913 it is anticipated to reach 150,000 KW. The system of supply is three-phase at 225 volts and 50 periods, and direct current at 220 and 440 volts.

The number of units (KW.-hours) sold in 1911 were :—

Power	18,200.496
Traction	63,718,787
Light	46,909,629
Total	128,828,912

The cost for power averages 5d. per KW.-hour, and for light 10d. per KW.-hour. Electricity supply is also given by the Lacroze Co. and recently there has been formed the Compania Italo-Argentino de Luz y Fuerza to operate competitively in the same area. There are about 40 electric supply undertakings in the provinces, in fact, nearly every town of over 5,000 inhabitants is dependent on electricity for light as well as for power. It is noteworthy that nearly the whole of this enterprise is in the hands of Germans, Belgians or Italians. Great Britain is out of it.

Raw Materials.—The raw materials produced in the country include many metals, with the exception of iron. Steel is manufactured on a small scale in Buenos Ayres, but is employed for small castings only. The minerals embrace granite, marble of excellent quality, slate, china clay, soft stone, sandstone, graphite, chalk, lime, sand, asbestos, mica, and sulphur. There are over 200 varieties of woods of every class and character, india-rubber trees, and a great variety of grasses and willows suitable for wicker work.

Among the by-products may be mentioned skins from the slaughter of over 20,000 animals per day, some of which hides are tanned, others being salted and exported. It is apparent, therefore, that there is ample raw material for manufacturing processes, and without doubt the country will in the near future develop into a manufacturing as well as an agricultural and cattle-rearing centre.

The Position of the British Trader.—These articles would not be complete without some brief reference to the position and interests of the British trader. The term "British Trader" is somewhat a misnomer, especially as regards the manufacturer in England, as in comparison with the business propaganda and hustle of the German, Belgian, Italian and North American, he is conspicuous by his absence. This statement will be at once met by citing the statistics of imports into the Argentine, than which statistics there are no more fallacious indications.

The imports into the Argentine for 1907, 1908 and 1909 are given in Table I, from which it appears that Great Britain holds 33 per cent. of the total imports into the country. This is an indisputable fact, but when subject to analysis it is found that out of the 33 per cent., no less than 25 per cent. is for railway material. Now the railways are practically all owned by British shareholders, controlled by British boards of directors, and have the privilege of importing all their material duty free. Further, the goods are nearly all ordered direct from the London offices, without necessitating representation of the manufacturing and supplying firms in Buenos Ayres. Hence we have the net result of British manufacturing firms' interests in the Argentine limited to about 8 per cent. of the total imports so far as they relate to the industrial trade of the country. This result is being rapidly diminished year by year, due entirely to the apathy, short-sightedness, or too-prosperous position of the manufacturer at home. And it does not merely apply to the Argentine, but to the general export policy of Great Britain, whether appertaining to other foreign countries or the Colonies as will be emphasised hereafter.

The trade, as regards supplying industrial requirements, is split up approximately as follows :—

Great Britain.—Agricultural machinery, cranes, coal, cotton goods, leather goods, hats, clothing, tools, steel, steam engines and a few general specialities.

Germany.—Government contracts, engines (especially gas, oil and hydraulic plants), electrical apparatus and plant of every description, cranes, steam and petrol launches, automobiles, brick-making machinery, textile plant, paper-making plant, printing machinery, steel girders and stanchions, &c.

France.—Electric lifts (by far the larger proportion), all fancy articles, dress goods, household requisites, wines.

Belgium.—Finance of industrial undertakings.

Switzerland.—Watches and clocks, fancy goods.

United States of America.—Machinery of all kinds, boots and shoes, stationery and characteristic products.

Italy.—Electrical plant, telegraph plant, provisions and wines. Nearly all the cafés, catering, and practically the whole of the electrical wiring industry, are in Italian hands.

Of the foregoing some anomalous conditions exist. For example, the cold storage undertakings, of which the British hold a fair control, are rapidly becoming absorbed in the

North American combines. Then the recent large contract for the new underground electric railway has been given to Philip Holzmann & Son, the work being associated with the Anglo-Argentine Tramway Co., which is entirely a German concern. The Rosario Electric Light and Power Co., formerly a British concern with an English board of directors, has been bought out by a Belgian syndicate.

Numerous other instances could be cited, the emphatic point being that wherever British interests can be ousted by foreign capital, the British manufacturer no longer has any market for his goods.

There is of necessity a reason for this state of affairs, which the English engineer or representative finds hinself up against. The following enumeration may help to elucidate the mystery :—

1. Nearly all foreign houses provide plenty of war funds for an active campaign. They are not content with agents or representatives, but have their own branch houses, with their own staff of officials.

2. Foreign firms adapt themselves and their business methods to the requirements of, and intimate association with, the local conditions and market, in contradistinction to the attitude of British firms.

3. The traveller for these foreign houses is a linguist, knowing generally English, German, French and Spanish. He sells customers what they want, not what they ought to want.

4. The English settler or local business man will buy from the German, French, or other nationalities, but the other nationalities do not buy from the Britisher.

5. The foreign firm sells from *stock*. He also gives reasonable credit, and the customer sees what he is buying, The British firm invariably asks for cash against shipping documents in London, takes no risk, will not guarantee delivery, and the customer may wait from three to six months for his goods.

6. The British build railways, run ships, supply coal, and practically guarantee the financial stability of these young progressive countries to facilitate the trade of foreign competitors.

In the Argentine it is fast becoming impossible to take orders for deferred delivery. Supply from stock on the spot is insisted upon, and enormous stocks are kept by dozens of first-class firms of engines up to 250 h.p., boilers, agricultural machinery, traction engines, motor-cars, and of every conceivable commodity and in every variety of size.

In a recent negotiation, the writer was informed by a firm who wished to be represented in the Argentine that "our experience shows us that an important agency such as we are able to confer demands that the agent should have adequate capital to efficiently work the business." The underlying note here is that the name and quality of the goods were alone sufficient to guarantee a market—a fallacy which would be quickly apparent by a visit to the country in question, to say nothing of the other conditions already referred to. The "conferring" of an agency is ideally characteristic of the attitude, but the illogical position of an agent spending his own capital—probably several thousand pounds—for the doubtful privilege of being tied up to one firm is entirely overlooked. In such a case, it is obvious that the agent would be able to buy in the best open market. After all, this "conferring" attitude is a relic of the old *régime*, which is rapidly passing away.

With regard to the Colonies a very similar position exists, of which some striking evidence is given in *The Export World* for November, 1912, page 207, in an article entitled "Are we losing Canadian Trade ?" by an Englishman in Canada.

In a recent paper read before the London Chamber of Commerce on Argentine trade, it was stated that "warships go to the United States, great electricity and lighting contracts go to the Germans, dock and harbour works go to the French." The writer can add that crane contracts go to the Germans, electric lighting and tramway concessions go to the Italians, and that out of 15 tenders for Government contracts during the last 12 months, that of the writer's firm was the only British tender put in.

Water-Power.—A scheme of great importance has recently been presented to the Government for the utilisation of the rapids at "Salto Grande," on the River Uruguay (some 15 miles above the town of Salto), for the generation of electric energy, which should be transmitted to towns on both banks of the river, and possibly even as far as Monte Video and Buenos Ayres.

The scheme also provides for the construction of navigable channels through the rapids, which at present form a complete bar to the navigation of the river at that point, and for a plan of irrigation.

The promoter of the scheme is Senor Antonio Piaggio, a Uruguayan engineer, formerly Director of Traffic in the Port of Buenos Ayres, and he is understood to have the support of Argentine, Uruguayan and foreign capitalists. The capital required is $12,000,000 gold, or about £2,550,000.

The precise financial and technical details of the scheme have not yet been made public, but it is believed that the proponents ask a concession for 90 years, in return for which they offer to hand over to the Government 5 per cent. of the gross receipts and to supply it with a given amount of electric energy at half the current price.

They also undertake to obtain from the Argentine Government the permission necessary to carry out the works on that side of the river, which is under Argentine control.

The utilisation of the abundant water power of Uruguay for conversion into electric energy is an idea which has been present for some time past, and it is bound to be carried out sooner or later, whether by the present scheme or by others. In fact, it is easy to foresee that it is destined, at no remote future, to play a very important part in the economical development of the country, precisely supplying that lack of fuel, which is one of the chief obstacles to its industrial advance.

With an unlimited supply of cheap energy drawn from its rivers, and with the development of its mineral resources that may also be expected before long, Uruguay should rapidly advance from the pastoral and agricultural to the industrial stage, manufacturing its own raw materials both for home consumption and for export, and it is no mere freak of the imagination to see her becoming the Belgium of South America, supporting a population, not of 1 million as a present, but of 20 or 30 millions.

Reference has already been made to the other water-power schemes at Cordoba and Tucuman.

The Protection of Trade Interests.—There exists in Buenos Ayres an industrial organisation known as "La Union Industrial Argentina," which has for its object the protection of trade interests of every kind.

It is composed of representatives of every class of industry, both manufacturing and selling, wholesale and retail. It is divided into "Sections," each being concerned with some particular branch of trade, and these Sections nominate members for the General Council. The General Council consists of a President, two Vice-Presidents, Honorary Secretary, Acting Secretary, Treasurer, Legal Adviser, Delegates, and "Suplentes," which latter are special members elected to watch over the interests of Sections.

The Association includes many nationalities, and its strength and importance are very far-reaching.

The professional element is also strongly represented, especially lawyers, but the Union is a business association entirely.

This Union issues a monthly "Boletin," consisting of about 70 pages, and contains excellent articles and statistics of international progress in trade by recognised authorities. The issue for September, 1912, contained articles on "The Protection of the Constitution," "English Industrial Insurance," "Economical Crisis from 1912 to 1917," "The Sugar and Mining Industry in Columbia," "Discovery of Minerals in the Argentine," "The Importation of Books," "Exportation of Flour," "Superfluous Inspections of the Department of Hygiene," "The National Press," "The Right of Inspection of Machinery," "Various Subjects," and "Patents of Invention," and others of equal interest.

It is very doubtful whether any other country in the world can show so much united and comprehensive force in one organisation.

In addition to including amongst its members many members of the National Congress, and possessing chemical and other laboratories for experiment and research, it is in the favourable position of having the strongest support of the Government, who desire by all means to encourage local industry and new industries. Each Section also has its president, vice-president, treasurer, secretaries and officials.

The Union in association with the Municipality of Buenos Ayres also issues from time to time Grand Diplomas of Honour, Gold Medals and Silver Medals for excellence of workmanship and quality of materials.

Security of Capital and Stability of Trade.—On this subject the Argentine Year-Book says:—"Nothing could be finer than the conception of the Argentine Constitution, the provisions of which are based upon the highest principles of Liberty, Justice and Equality. Every inhabitant of the Republic has the right to engage in any lawful commerce or trade, to petition the authorities, to enter, remain upon, travel over, and leave Argentine territory at will, to publish his ideas in the Press without prohibition, to use and dispose of his property, to form part of any society or association having useful ends, and to practise his religion freely.

"Property is inviolable. Every author and inventor is given the sole rights of the products of his genius for the period allowed by law. A man's dwelling place is inviolate as are also his correspondence and his private papers. Strangers enjoy within the Republic all the civil rights of citizens, with liberty to exercise their trades, industries or professions."

The stability of trade is amply emphasised by the annual official statistics of the growth of the nation in every direction. Some of the principal indications of the extent of business increase here are the congestion of the port, the enlargement of the docks, for which the contract has been given to Messrs. C. H. Walker & Co., Ltd., of London, and the large annual percentage increase in both the exports and the imports.

Licences.—Special licences are required by every trader in Buenos Ayres, and other licences for the several provinces.

REVIEWS.

Modern Illumination. Theory and Practice. By Horstmann and Tousley. London: American Book Supply Co., Ltd. Price 8s. 6d. net.

The authors of this admirable work supply a long-felt want, insomuch that they present a book that deals solely with the subject of "Light and Illumination" from a practical point of view. There is a prevailing idea that the illuminating engineer is a quite unnecessary person, and that illuminating engineering is in itself child's play, but we believe that after even a hasty perusal of the little volume now before us, these ideas would disappear, and in their place one would wonder at one's lack of knowledge and method on such an important subject. It is, indeed, to be hoped that the illuminating engineer will be allowed to justify his name and induce all to take a much more lively interest in good and efficient lighting than has been the case heretofore. Messrs. Horstmann and Tousley certainly help this propaganda and enable one to attain such an understanding of illumination as has up to the present been impossible.

It gives one much pleasure to take up a book which puts before its readers in an understandable and logical manner the subjects which it purports to treat upon. At the commencement we are introduced to the more elementary principles, and after a chapter or so on photometry and calculations, the latter, by the way, being devoid of anything abstruse, we become acquainted with the characteristics of electrical illuminants. These are given at great length, and practically all known types of electric lamps are dealt with; the following points taken at random will suffice to illustrate the utility of the chapter to those interested:—Voltage, current used, rating in candle-power, colour of light, natural distribution of light, life of carbons, general advantages, general objections, and practical hints.

The frequent allusion to certain specialities stamps the book as being written for American readers, and in this respect an English edition would not be amiss, especially if it were printed on thin paper, for, though of pocket size, the present publication is a somewhat weighty volume.

The natural sequence to the chapter on lamp characteristics is a section on shades and reflectors, and following this we learn of the best location and height of lamps, colour of light, choice of lamps, and choice of fixtures. Indirect lighting is becoming quite general, so that a chapter concerning this is by no means out of place.

The practical considerations are well worth perusal, and they should be a very great help to those whose business it is to advise others as to the intensities and arrangements necessary to provide good and efficient lighting for their requirements, for the applications dealt with are most comprehensive.

The authors justly lay great stress upon plans and specifications; the tables which complete the work should enable one to obtain definite figured results, provided that the specification is drawn up on the recommendations and facts stated therein. It augurs well for the utility of a volume when the index is comprehensive, and in this respect "Modern Illumination" is well served, so that it is a work for quick and ready reference. On the whole, all concerned are to be congratulated upon the reliability of the book, for only in one or two places does a slight error appear to have crept in. We have no hesitation in recommending the purchase of such a handbook as this to all.

Memoires sur l'Electricité et l'Optique. By A. Potier. Paris: Gauthier-Villars. 1912. Price 13 fr.

This collection of the writings of A. Potier is prefaced by two interesting and touching appreciations by H. Poincaré and by A. Blondel. Poincaré, in giving a short sketch of the career of this remarkable man, says that few of those who knew Potier as the calm rather austere and absent-minded professor of abstract science, suspected that the little red ribbon in his button-hole referred to his work as a soldier in 1870, when he distinguished himself in several of the engagements in the environs of Paris. A man whose life was for years ravaged by the cruel disease from which he eventually died, his courage and control never deserted him, and to the end he bore himself with tranquil serenity and unclouded mental activity. A few weeks before his death he asked for books that he might take up a new mathematical study.

Maxwell's theories were not well received on the Continent, not so much on account of their method or their conclusions, as for the experimental and non-mathematical work of Faraday from which they started. The great champion of Clerk Maxwell in France was Potier. His name is not well known in England, nevertheless his *rôle* was as great in electrical science as that of Ferraris in Italy, and though he made no sensational discovery his writings on optics are of the first order. Prof. Blondel in collecting and editing these papers pays affectionate tribute to the modesty and disinterested character of his master. To this it is due that the world has known so little of him, though his help and knowledge were generously placed at the service of the physicist or manufacturer who wished to consult him.

Potier was essentially a mathematician, and yet he appears to have produced but little original mathematical work. The list of writings not included in this volume includes papers on thermodynamics and geology. From the point of view of electrical engineering it is remarkable that a man born in 1840, and succeeding Edmond Bequerel in the Académie des Sciences in 1891, should have applied his intellect to alternating-current engineering, particularly to the theory of asynchronous motors, and of alternators. His mathematical work on these was not of the "ironless" type that used to bewilder and discourage students some 25 years ago, and yet he seems to have carried out little, if any, experimental work. In optics, too, he seems to have seized on the essential features of contemporary work, and applied his mathematical ability to carrying it a step further.

One cannot help regretting that Potier had not been born 20 years later, for some of the subjects on which he wrote were in their infancy. For example, his paper for the Société Internationale des Electriciens on the precautions to be taken against electrolysis in connection with electric tramways was written in 1896. He pointed out that the return feeders without boosters entailed a huge expenditure of copper, and discussed various methods of returns, graphically and otherwise. But the conditions of modern practice have advanced, and this paper serves mainly as a hint for others to work upon.

The volume owes much to the valuable notes by Prof. A. Blondel.

Boiler Explosions. By E. P. Rimmer. London: Constable and Co., Ltd. 1912. Price 4s. 6d. net.

This book, written by a barrister and introduced by a K.C., tells us that there have been 2,000 inquiries held under the Boiler Explosions Act of 1882. It has been our fortune to be present at some of these and to note the huge mass of useless verbiage through which the inquiry drags itself, the thousands of questions put to witnesses by learned counsel absolutely ignorant of the subject on which they try to look so wise, the browbeating of honest witnesses by some counsel, whose one aim is not to elicit truth, but to shield one party at the expense of another. To an engineer it is a pitiable and lamentable sight. That such inquiries are conducted by the Board of Trade is, unfortunately, no guarantee that all is well. It may not be so bad now, but in the early days of the Act, the reports of marine surveyors on happenings to land boilers did not tend to make an engineer feel so very safe as a passenger at sea in a vessel passed as safe by a B. of T. inspector. The author of this work, though a barrister, seems to have come to the conclusion that the voluntary boiler insurance companies know more about their work than the Board of Trade can teach them, and in this we do not think he is far wrong. At the same time, when he says the boiler insurance companies guarantee the safety of the boiler, it is not quite clear what he means. What they do is to pledge themselves, under certain conditions, to pay a fine should the boiler fail. We believe the Manchester Steam Users' Association do this to the fairly liberal extent of £2,000, while the insurance companies issue policies, with amounts according to premium. The risk of a boiler explosion is now a very small risk, but, unlike fire offices which take risks and do not inspect, the boiler insurance companies spend probably the bulk of their premium income in the work of inspection. Readers must have noticed in cases of certain explosions that boiler insurance companies will make recommendations, which boiler owners have for years continued to ignore. If the Insurance Co. say "we will no longer insure your boilers unless you remedy these faults," the owner may try to place his insurances elsewhere. This has been done, and competition in boiler insurance has occasionally led to courses which are dangerous. Hence the advantage of the M.S.U. Association system.

The Association will continue to inspect, and will draw the equivalent of the premium payment, but it suspends its guarantee pending attention to the faulty matters in dispute. With the fatuity of our lawyer-drafted Acts of Parliament, a boiler owner must have his boiler inspected periodically by a competent person, but there is no definition as to competency. According to recent decisions it is a serious matter for any engineer to profess to be in charge of steam boilers if he is not technically competent. A chief engineer of an electric light station was heavily fined on account of an explosion at his station, because he was not a steam engineer, however able he might have been as an electrical engineer. There are hundreds of electrical men in a similar position, and the knowledge of this was public property in the world of engineers, for steam men had been loud in their complaints that electrical men had been put in charge of steam plant. Had our Board of Trade had reasonable wisdom beforehand—any decent sort of prevision—would they have waited for a fatal boiler explosion before declaring that who tends fat oxen should himself be fat? It was at least unkind to let an electrical engineer put his neck in a noose without warning him. Of course, the Board will say they were not cognisant of the fact. But that is just what they should have been, or why do we have such a Board, if not to put things right before disaster?

The author is, we think, to be congratulated on the way he has compiled his book and the extracts which he has inserted from various reports. We think, however, that many engineers will join with us in the wish that inquiries into accidents should be conducted in a different manner, and with less cost and waste of time. It is really absurd to watch half-a-dozen bewigged, and often befogged, counsel puzzling themselves and confusing witnesses by their futile questions on technical points.

We believe it is still true, as pointed out some years ago by Mr. Longridge, if memory serves us right, that the measure of safety secured by our English boiler insurance system is superior to that obtained either by German State Control or by our own Board of Trade, which supervises marine boilers.

The Una-Flow Steam Engine. By Prof. J. Stumpf. London: Constable & Co., Ltd. Price 10s. 6d. net.

The author of this work, in spite of his professorial duties at the Technische Hochschule, Charlottenburg, appears to have evolved a new type of steam engine (known as the "Una-flow" engine), and not only this, but to have been much more successful than the large majority of inventors, in that more than a year ago, we are told, there were Una-flow steam engines with a total output of over half a million horse-power either working or in actual construction. The first Una-flow engine was built by the Erste Brunner Maschinenfabrik-Gesellschaft, of Brunn, and was an immediate success, having a steam consumption equal to that of a good compound engine, whilst the first Una-flow locomotive is still in satisfactory use on the Moscow-Kazan Railway. Primarily the idea of the inventor was to perfect an engine of the uni-directional flow type, doing with one cylinder what is usually done with several cylinders. This is accomplished somewhat on the lines of the steam turbine, where the steam enters at a high temperature, and has its energy extracted as it passes axially and always in the same direction to the cold exhaust. The success of the uni-flow system depends on an early cut-off and the use of a large expansion ratio, whilst the hot end must be kept hot and the cold end cold. The author shows that the steam consumption of his engine is the same as, if not better than, that obtainable with an ordinary type of engine, whilst the cost of building and lubricating a Una-flow engine is much less. The working steam enters from below the cylinder into a hollow cover, which it heats, then passing by a valve in the upper part of the cover into the cylinder, it does its work on the piston, and, after it has been expanded, passes out at the end of the piston stroke by a ring of exhaust ports arranged in the middle of the cylinder, and controlled by the piston. By thus avoiding the counterflow of steam that takes place in ordinary steam engines, Prof. Stumpf claims that cooling of the clearance surfaces is almost entirely avoided, and hence "cylinder condensation is to a great extent eliminated, as also is the necessity of employing several expansion stages." Thus the gauntlet is very definitely thrown down before the supporters of triple and quadruple expansion engines, but these will be quite able to defend their products, no doubt. An interesting result of the large cross-section of the exhaust passage is that, by arranging for the condenser to be close up to the cylinder, it is possible to bring the cylinder pressure down to that of the condenser. Critics of Prof. Stumpf's engine will require proof of the claim as to the "excellent thermal action of this engine," a proof which is provided in the volume under review by several indicator diagrams, which show the expansion line to be an adiabatic for saturated steam, and the compression line to be an adiabatic for superheated steam. As the writer points out, "the excessive initial condensation, in an ordinary counterflow engine using saturated steam, causes the expansion line to follow approximately the law of Mariotte. In the Una-flow engine, using saturated steam, there is practically no initial condensation, so that the resulting expansion line is necessarily an adiabatic, and all the more so if the steam is superheated." As regards the latter point, it is said to be possible, and there appears to be no reason to doubt the statement, without making any modification in the uni-flow system of construction to work with superheats far in excess of those usually employed at present. The new construction would appear to open up a further field of development by enabling higher temperatures to be used, as the superheat is favourable for the entire cycle. In the ordinary counter-flow engine with multi-stage expansion, however, the superheat is usually excessive in the first cylinder and not sufficient in the succeeding cylinders. The book is profusely illustrated with Una-flow engines of very varied types, including stationary engines, locomotives, portable engines, rolling mill and winding engines, as well as engines for driving compressors, blowers, pumps, stamps and presses, the last chapter being devoted to the Una-flow marine engine. The uni-flow system would seem to be particularly adapted to meet the recent tendency in marine practice to introduce superheating and to employ balanced lift valves for distributing the steam. Though the majority of the engines described are employed on the Continent, an interesting account is given of a 500-H.P. Una-flow rolling-mill engine, built by Messrs. Musgrave & Sons, Ltd., of Bolton. —G. S. S.

MECHANICAL STOKERS AND THEIR EFFECT ON THE COAL MARKET.

By HAROLD C. WRIGHT.

THE wonderful strides made by the various types of automatic stokers during the last 10 to 12 years, combined with the rapid expansion of electrical works run by steam power, have had a very noticeable effect in the coal trade. Perhaps less than 12 years ago the majority of works driven by steam power used large or unscreened steam coal of the smokeless or semi-bituminous variety in hand-fired boilers. Now there are very few works of importance which are not fitted with mechanical stokers.

The chief deterrent to the use of bituminous or semi-bituminous small coals was the question of smoke, especially in the centres of the big towns. The advent of automatic stokers, with their various contrivances for the consumption, or practically total consumption, of smoke, has overcome this difficulty. The result is somewhat startling. Small coal, *i.e.*, the screenings obtained after the large coal, cobbles and nuts have been passed over 1-in. or 2-in. screens, ten years ago was almost a drug in the market, and could be purchased at about 1s. to 2s. per ton at pit. Smaller qualities still would be willingly given away if contractors would pay the wagon hire and railway carriage, or, in any case, a charge of a few pence only was made according to the demand for brick or ballast burning. At the present time rough smalls, *i.e.*, the 1-in. to 2-in. variety, fetch 6s. to 6s. 6d. at pit, and the smaller variety about 3s. to 3s. 9d. The chief cause of this is the increasing use of mechanical stokers, and the demand for the better descriptions of sized small coals, *i.e.*, peas, single, double and treble nuts, is becoming so great, that within the last ten years screening and washing plants (and in some cases coal-crushing plants) have been installed at the principal collieries in Great Britain.

An approximate list of the prices at collieries from 1907 to date, is as follows :—

	Fine slack.	Rough or nut slack.	Peas.	D.S. nuts.
1907... ...	3d. to 6d.	1/9 to 2/6	3/3 to 4/-	4/- to 4/6
1908... ...	1/- „ 1/6	2/6 „ 3/-	3/6 „ 4/3	4/6 „ 5/-
1909... ...	1/3 „ 2/-	2/9 „ 3/6	3/9 „ 4/6	4/6 „ 5/3
1910... ...	2/- „ 2/6	3/3 „ 3/9	4/- „ 4/9	4/9 „ 5/6
1911... ...	2/6 „ 3/3	3/9 „ 5/-	5/3 „ 6/-	6/- „ 6/9
1912... ...	3/- „ 3/9	5/6 „ 6/6	6/9 „ 7/9	7/6 „ 8/6

The average *contract* price is given, and no consideration is given to figures that were obtained through the threats of, and actual occurrence of, coal and lighterage strikes.

It will be seen from the prices mentioned, that in most cases the price has doubled, and in others it has advanced in greater proportion. This advance is not all accounted for by the demand for coal for mechanical stokers, as legislation increasing the cost of working and transporting the coal is responsible for a considerable portion, but without doubt the question of demand and supply is one of the chief reasons.

What will be the outcome of this? Will small coals soon be as dear as the large? In that case will the works revert to the old style of stoking, or will it be necessary for the collieries or consumers to install coal-crushing plants in order to meet the demand for sized small coals?

The erection of crushing plants would not add much to the actual cost of the coal, but when finally sold, it would be more costly than the ordinary types. It must be borne in mind, however, that broken small would give better calorific results. It would all be pure coal, while ordinary smalls contain the natural run of the mine.

There is not the slightest doubt that users of mechanical stokers have hitherto obtained better results in evaporation, owing more or less to the perfect combustion of coal. They have also effected economies with regard to price and quantity of fuel used; but if the demand for small coal increases, the price will soon be as high as that of large screened coal and the economical results that have been obtained by the use of mechanical stokers will be unattainable.

As an example, it may be interesting to note the costs of average contract coal at one of the largest generating stations in London :—

1909-10 ...	11s. 0d.	for single nuts alongside wharf.
1910-11 ...	11s. 4d.	„ „ „ „
1911-12 ...	13s. 0d.	„ „ „ „
1912-13 ...	16s. 6d.	„ „ „ „

In the case of the period 1911-12 purchases had to be made outside contract, and the mean price would be nearer 13s. 3d. than the figure quoted.

With regard to the period 1912-13, it might be noted that an excellent Welsh through-and-through coal could be obtained for certainly not more than the nuts have been purchased at, and, assuming that the fires were hand-fed, the results given would be all round in favour of the Welsh through-and-through.

TRADE STATISTICS OF CANADA.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1912, are taken from the recently issued trade statistics. Figures for the year 1910-11 are given for purposes of comparison, and notes of any increases or decreases have been added :—

	1910-11.	1911-12.	Increase or decrease.
	Dollars.	Dollars.	Dollars.
Brass wire, plain.—			
From United Kingdom ...	5,000	7,000	+ 2,000
„ United States ...	37,000	31,000	— 6,000
Total ...	42,000	38,000	— 4,000
Railway passenger cars.			
From United States ...	57,000	208,000	+ 151,000
Tram or horse cars.—			
From United States ...	5,000	5,000	—
Celluloid manufactures.—			
From United Kingdom ...	9,000	8,000	— 1,000
„ Germany	2,000	5,000	+ 3,000
„ United States ...	42,000	43,000	+ 1,000
„ Other countries ...	6,000	7,000	+ 1,000
Total ...	59,000	63,000	+ 4,000
Coal, bituminous.—			
From United Kingdom ...	20,000	13,000	— 7,000
„ United States ...	14,576,000	18,199,000	+ 3,623,000
Total ...	14,596,000	18,212,000	+ 3,616,000
Copper wire, plain, tinned or plated.—			
From United Kingdom ...	1,000	4,000	+ 3,000
„ United States ...	64,000	72,000	+ 8,000
Total ...	65,000	76,000	+ 11,000
Electric light carbons and carbon points.—			
From United Kingdom ...	8,000	8,000	—
„ Germany	14,000	17,000	+ 3,000
„ United States ...	37,000	29,000	— 8,000
„ Other countries ...	2,000	2,000	—
Total ...	61,000	56,000	— 5,000

	1910-11. Dollars.	1911-12. Dollars.	Increase or decrease. Dollars.
Electric apparatus not mentioned—insulators, electric and galvanic batteries, telegraph and telephone instruments.—			
From United Kingdom ...	360,000	544,000	+ 184,000
„ Austria	5,000	6,000	+ 1,000
„ France	7,000	8,000	+ 1,000
„ Germany	45,000	29,000	— 16,000
„ Sweden	26,000	65,000	+ 39,000
„ United States ...	3,751,000	3,975,000	+ 224,000
„ Switzerland ...	22,000	2,000	— 20,000
„ Other countries ...	2,000	6,000	+ 4,000
Total ...	4,218,000	4,635,000	+ 417,000
Incandescent lamp bulbs, &c.—			
From Austria	15,000	17,000	+ 2,000
„ United States ...	75,000	99,000	+ 24,000
„ Other countries ...	5,000	5,000	
Total ...	95,000	121,000	+ 26,000
Electric motors, generators, dynamos and sockets.—			
From United Kingdom ...	24,000	76,000	+ 52,000
„ France	2,000	2,000	—
„ Sweden	13,000	30,000	+ 17,000
„ United States ...	518,000	871,000	+ 353,000
„ Other countries ...	1,000	4,000	+ 3,000
Total ...	558,000	983,000	+ 425,000
Lamp chimneys, glass shades and globes.			
From United Kingdom ...	3,000	4,000	+ 1,000
„ Austria	13,000	13,000	—
„ Germany	19,000	30,000	+ 11,000
„ United States ...	245,000	275,000	+ 30,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	282,000	323,000	+ 41,000
Rubber belting.—			
From United Kingdom ...	29,000	36,000	+ 7,000
„ United States ...	34,000	47,000	+ 13,000
Total ...	63,000	83,000	+ 20,000
Manufactures of india-rubber and gutta-percha, except clothing and similar goods.—			
From United Kingdom ...	143,000	155,000	+ 12,000
„ Austria	3,000	8,000	+ 5,000
„ France	5,000	4,000	— 1,000
„ Germany	44,000	48,000	+ 4,000
„ United States ...	568,000	645,000	+ 77,000
„ Other countries ...	4,000	1,000	— 3,000
Total ...	767,000	861,000	+ 94,000
Locomotives for railways.—			
From United Kingdom ...	2,000	8,000	+ 6,000
„ United States ...	295,000	407,000	+ 112,000
Total ...	297,000	415,000	+ 118,000
Gasoline engines.			
From United Kingdom ...	126,000	189,000	+ 63,000
„ United States ...	1,322,000	1,935,000	+ 613,000
„ Other countries ...	17,000	15,000	— 2,000
Total ...	1,465,000	2,139,000	+ 674,000
Steam engines.—			
From United Kingdom ...	43,000	47,000	+ 4,000
„ United States ...	202,000	230,000	+ 28,000
Total ...	245,000	277,000	+ 32,000
Boilers, steam.—			
From United Kingdom ...	52,000	74,000	+ 22,000
„ United States ...	128,000	162,000	+ 34,000
„ Other countries ...	1,000	–	— 1,000
Total ...	181,000	236,000	+ 55,000
All machinery not mentioned, except sewing machines, textile machinery, printing machinery, &c.—			
From United Kingdom ...	1,241,000	1,713,000	+ 472,000
„ France	27,000	6,000	— 21,000
„ Germany	220,000	203,000	— 17,000
„ United States ...	10,976,000	13,331,000	+2,355,000
„ Other countries ...	93,000	111,000	+ 18,000
Total ...	12,557,000	15,364,000	+2,807,000
Iron and steel wire, single or double, covered with cotton, linen, silk, rubber or other material, including cables so covered.—			
From United Kingdom ...	201,000	229,000	+ 28,000
„ United States ...	286,000	426,000	+ 140,000
„ Other countries ...	9,000	8,000	— 1,000
Total ...	496,000	663,000	+ 167,000
Iron and steel wire not mentioned (except barbed wire).			
From United Kingdom ...	52,000	13,000	— 39,000
„ Germany	18,000	49,000	+ 31,000
„ United States ...	197,000	218,000	+ 21,000
„ Other countries ...	4,000	8,000	+ 4,000
Total ...	271,000	288,000	+ 17,000
Lighting fixtures of metal, including electric light fixtures of metal.—			
From United Kingdom ...	24,000	34,000	+ 10,000
„ Austria	2,000	3,000	+ 1,000
„ United States ...	470,000	562,000	+ 92,000
„ Other countries ...	11,000	10,000	— 1,000
Total ...	507,000	609,000	+ 102,000
Asbestos manufactures.—			
From United Kingdom ...	33,000	43,000	+ 10,000
„ United States ...	212,000	298,000	+ 86,000
„ Other countries ...	9,000	9,000	—
Total ...	254,000	350,000	+ 96,000
Plumbago, ground and manufactured.			
From United Kingdom ...	4,000	4,000	—
„ United States ...	39,000	35,000	— 4,000
Total ...	43,000	39,000	— 4,000

EXPORTS.

	1910-11. Dollars.	1911-12. Dollars.	Increase or decrease. Dollars.
Mica.—			
To United Kingdom ...	61,000	40,000	— 21,000
„ United States	247,000	218,000	— 29,000
„ Other countries ...	2,000		— 2,000
Total ...	310,000	258,000	— 52,000
Electrical apparatus.—			
To United Kingdom ...	9,000	16,000	+ 7,000
„ Newfoundland ...	3,000	5,000	+ 2,000
„ United States	110,000	110,000	—
„ Other countries ...	10,000	7,000	— 3,000
Total ...	132,000	138,000	+ 6,000
Machinery.—			
To United Kingdom ...	78,000	70,000	— 8,000
„ Newfoundland ...	19,000	35,000	+ 16,000
„ New Zealand	3,000	3,000	–
„ Argentina	8,000	33,000	+ 25,000
„ France	4,000	10,000	+ 6,000
„ United States	570,000	461,000	— 109,000
„ Other countries ...	65,000	75,000	+ 10,000
Total ...	747,000	687,000	— 60,000

The Electric Furnace for Cement Making.—One of the worst difficulties in the manufacture of cement in an electric furnace has been the formation of carbide of calcium, which has combined with the cement and spoilt it. It is now reported that a Swedish engineer, Mr. A. R. Lindblad, has discovered how to prevent this. The invention is patented, and consists briefly in adding to the charge a certain quantity of a metallic oxide which is capable of reducing the carbide of calcium. Oxide of iron is mentioned as a suitable compound, and it can be added to the products at the tapping in pulverised form instead of being added to the charge.

Book Notices.—"The University of Liverpool Engineering Society *Journal*" for December (Vol. I, No. 2; the University Press, Price 1s. 6d.) contains a description of the new Harrison-Hughes Laboratories, which have been specially equipped for work relating to the utilisation of fuel for power purposes, particularly in connection with internal-combustion engines and gas producers, at a cost of £40,000. There are also articles on "Ball Bearings," by G. W. Goodchild; "The Electric Drive," by E. Swinton; "The Law Affecting the Engineer," by E. J. Rimmer; and "The Specific Heat of Gases," by G. E. Scholes.

"*Journal* of the American Society of Mechanical Engineers." December, 1912. New York: The Society. Price 35 cents.

"*Transactions* of the University of Toronto Engineering Society." November, 1912. Toronto: The Society.

"*Bulletin* of the Massachusetts Institute of Technology." Vol. XLVIII, No. 1. December, 1912. Boston: The Institute.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

28,316. "Electricity meters." S. H. Holden and Chamberlain & Hookham, Ltd. December 9th.

28,327. "Automatic device for limiting and regulating the speed of vehicles propelled by internal combustion engines or by electricity." C. Robinson. December 9th.

28,332. "Electric heating device." P. Good and W. Alldis. December 9th.

28,349. "Electric automatic or hand-operated indicator or signal, combining advertisement display, to be used in public placed buildings, vehicles, or sea and river-going vessels." A. G. Grundel. December 9th.

28,358. "Ships' telegraphs or the like." T. L. Knight. December 9th.

28,359. "Apparatus for heating liquids by electricity." J. Von Hentzel. December 9th. (Complete.)

28,409. "Means for controlling electrical devices." A. C. Hulbert. December 9th. (Complete.)

28,412. "Ignition plugs for internal-combustion engines." A. Rupbecht. (Convention date, December 11th, 1912, Germany.) December 9th. (Complete.)

28,437. "Shade supports for electric incandescent lamps." J. N. Mollett. December 10th.

28,469. "Magneto-electric machinery." R. C. Staunton. December 10th.

28,470. "Electrical sign mechanism." E. O. Brown. December 10th.

28,483. "Safety device for electric machines." Siemens-Schuckertwerke G.m.b.H. (Convention date, December 11th, 1911, Germany.) December 10th. (Complete.)

28,486. "Selective signalling apparatus for telephone or telegraph instruments." H. E. R. Roose and W. T. Finlay. December 10th. (Complete.)

28,503. "Electric arc lights." General Composing Co., G.m.b.H. (Convention date, December 11th, 1911, Germany.) December 10th. (Complete.)

28,513. "Electric ignition." F. G. L. Biddlecombe and G. Thomas. December 10th.

28,518. "Process for preventing the development of chlorine gas in such cases where sea water penetrates into the interior of electric boats and the like." H. Wehrlin. (Convention date, March 25th, 1912, Germany.) December 10th. (Complete.)

28,519. "Process and device for the protection of electric accumulators when over-flooded by sea water." H. Wehrlin. (Convention date, March 25th, 1912, Germany.) December 10th. (Complete.)

28,520. "Process and device for the protection of electric accumulators when over-flooded by sea water." H. Wehrlin. (Convention date, March 25th, 1912, Germany.) December 10th. (Complete.)

28,523. "Thermo-galvanometers, electric current detector, radio-meters, and the like." F. W. Jordon, T. E. Gambrell and C. T. Gambrell. December 10th.

28,538. "Fittings of metallic conduits for electrical conductors." Simplex Conduits, Ltd., and L. M. Waterhouse. December 11th.

28,542. "Electrical heating apparatus." E. G. Byng and J. H. Collings. (Divided Application on No. 6,763, 1912, March 19th.) December 11th.

28,565. "Electric lamp lock." J. Bailey. Decemer 11th.

28,595. "Appliances for producing electric oscillations." R. Krause. Convention date, December 20th, 1911, Germany.) December 11th. Complete.)

28,605. "Control gear for electrical and other machinery." G. H. Rae and Cunard Steamship Co., Ltd. December 11th.

28,619. "Limit-switches for use in or with machinery driven by electric motors." W. A. Heywood. December 12th.

28,624. "Electric arc carbon for use in cinematograph apparatus." G. Rathbone. December 12th.

28,627. "Non-shunt electric arc lamps." W. Rogers and G. Rowe. December 12th. (Complete.)

28,634. "Electric current regulating and controlling apparatus, such as electric motor starting and controlling apparatus and the like." J. A. Hirst and P. S. Brook. December 12th.

28,635. "Electric current regulating and controller apparatus, such as electric motor starting and controlling apparatus and the like." J. A. Hirst and P. S. Brook. December 12th.

28,636. "Switches for tramways and the like." R. Cumming. December 12th.

28,639. "Thermo-electric generators." P. Ferra. December 12th.

28,645. "Electrode for diathermic treatment of the interior cavities of the human body." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) December 12th. (Complete.)

28,646. "Watertight insulating plug for submersible vessels." Siemens Bros. & Co., Ltd., and W. D. Le Corney. December 12th. (Complete.)

28,648. "Electric time-keeping apparatus." F. T. Reid and C. Wiener. December 12th.

28,665. "Electrically-operated pulley block." W. E. Evans. (Deutsche Maschinenfabrik Akt.-Ges., Germany.) December 12th. (Complete.)

28,677. "X-ray or like photographic apparatus." H. F. Bigge and F. R. Butt. December 12th. (Complete.)

28,724. "Holders for readily interchangeable electrical apparatus such as glow lamps, fuses and the like." Siemens-Schuckertwerke G.m.b.H. (Convention date, July 24th, 1912, Germany.) December 13th. (Complete.)

28,728. "Electric imitation candle lamps." Candolite Co. and F. J. Weiss. December 13th.

28,740. "Dynamo-electric machines." J. H. Gath. December 13th.

28,748. "Machines for generating electric current for dual purposes such as ignition and illumination." F. L. Hollister. December 13th.

28,751. "Telephone installation in which the subscribers' connections are grouped according to the number of calls." Siemens & Halske Akt.-Ges. (Convention date December 19th, 1911, Germany.) December 13th. (Complete.)

28,772. "Electric miners' lamp." P. Rosenberg. December 13th.

28,779. "Method of transmitting electric current from external sources to the motors of electrically-propelled vehicles." S. M. Searle and J. H. Wilkins. December 14th.

28,793. "Electrical temperature-regulating apparatus." W. E. Gray and W. Best. December 14th.

28,808. "Electric switches." H. G. Robertson. December 14th.

28,809. "Unspillable electric accumulator cells." W. Thomson. December 14th.

28,816. "Electric lamps for mines." H. Joris. December 14th.

28,824. "Electromagnetic relays." Siemens Bros. & Co., Ltd., and W. H. Grinsted. (Divided application on No. 14,564, June 21st, 1912.) December 14th. (Complete.)

28,831. "Means for regulating generator strengths and pressures." E. Eisemann & Co. G.m.b.H. and E. Eisemann. December 14th.

28,841. "Electrical apparatus for telegraphing, signalling and controlling of torpedoes and the like purposes." J. F. Meissner and V. Krasnikoff. December 14th.

28,846. "Electrically-heated garments." A. C. Stubling. December 14th. (Complete.)

28,862. "Relay apparatus particularly intended for use in connection with telephonic and telegraphic systems." S. G. Brown. December 14th.

28,864. "Electromagnets and the like." Soc. Anon. des Etablissements L. Bleriot. (Convention date, December 15th, 1911, France.) December 14th. (Complete.)

28,865. "Wireless telegraph transmitters." G. Marconi. December 14th.

28,866. "Wireless telegraph transmitters." G. Marconi. December 14th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Switches for use more particularly in Voltage Regulating Systems. British Thomson-Houston Co. and E. Garton. 26,119. November 22nd.

Means for Intermittently Indicating or Displaying the Names of Stations or Stopping Places in Trains or other Vehicles or other Situations or other Devices, or Matter in such Vehicles or other Situations. C. J. Evans and J. McI. Cater. 26,450. November 25th. (Cognate application, 4,272 of 1912.)

Switch Apparatus for Use in Connection with the Electric Lighting and Heating Equipments of Railway and other Vehicles. Electric and Ordnance Accessories Co. and J. Etchells. 27,010. December 2nd.

Electric Firing Appliances for Small Arms. Soc. Peuble et Durif, and G. Peuble. 27,121. December 4th.

Electrical Time Switches. W. Hamilton and Ferranti, Ltd. 21,610. December 19th. (Addition to 13,704 of 1910.)

1912.

Means for the Manufacture of Bushes or Bearings for Shafts, Axles, Self-Propelled Vehicles, Engines, Electric Motors, or the Like. W. G. Hanna. 1,698. January 22nd.

Blackleading Machines for the Use of Electrotypers. R. Hoe & Co. and F. G. Lougee. 1,969. January 24th.

Lamp Supports and Casings Particularly Designed for Use with Electric Incandescent Lamps. J. S. Highfield. 3,746. February 14th. (Addition to 27,991 of 1908.)

Controlling Continuous Current Reversible Dynamo-Electric Machines. G. Inrig and L. Inrig. 4,119. February 19th.

Brush or the Like for the Medicinal Application of Electricity. H. Weiss. 4,382. February 21st.

Bath for the Electrolysis of Iron. G. Tischenko. 5,853. March 8th.

Electric Heating Devices. Ferranti, Ltd., and J. Roothaan. 6,182. March 12th.

Construction of Tramcars. R. S. Pilcher. 6,643. March 18th.

Telephone Relays or Repeaters. F. A. Stirrup. 8,793. April 13th.

Galvanometers. C. Hubert. 9,410. April 20th.

Means for Indicating Faults in the Circuits of Electrical Transmission Systems. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 13,854. June 13th.

Refillable Cartridge-Fuses for Electrical Purposes. E. B. Mallory. 14,109. (June 17th, 1911.) June 17th.

Electrical Resistance Devices. E. Ruhstrat. 15,053. (December 18th, 1911.) June 27th.

Processes and Apparatus for Electric Welding. L. W. Chubb. 15,479. (February 16th, 1912.) July 2nd.

Roentgen Ray Examination Table for Gynecological and Like Purposes. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 15,750. July 5th.

Electric Arc Lights. General Composing Co. Ges. m.b.H. 15,757. (July 15th. 1912.) July 5th.

Telephones. H. Sefton-Jones. (Akt.-Ges. Mix & Genest Telephon und Telegraphenwerke.) 18,437. August 6th.

Electrical Regulating Apparatus. W. E. Lake. (J. B. M. Electric Co.) 18,437. August 10th.

Telephone Systems. Western Electric Co., Ltd. (Telephon Apparat Fabrik E. Zwietusch & Co., Ges.) 20,947. (Divided application, 21,260, 1911. September 26th.) September 13th.

Cooling of Dynamo-Electric Machines. Siemens Bros. Dynamo Works, Ltd., and W. Marden. 21,472. September 20th.

U.S.A.—All of the large generating companies on the Canadian side of Niagara Falls are at present engaged in building extensions to their systems with a view to utilising all the water available for power purposes under the existing treaty. The Toronto Power Co. has a number of new units already in place, and early next year will complete its station, which will have equipment aggregating 125,000 h.p. A new line fitted with pin insulators, and operated at 85,000 volts, will also be in operation between Niagara Falls and Toronto. The Canadian Niagara Power Co. is completing its station building, and installing additional units. It will expend $1,250,000 in the next two years in enlarging the forebay, so as to be able to get enough water to generate all the electricity that it can dispose of under the treaty. The station of the Ontario Power Co. has been doubled in size, and will shortly be completed. With the installation of two 12,000-kw. units now on order the company will be using almost all of the water granted to it by the Dominion Government. The stations on the American side of Niagara Falls are now using all the water allotted to them by the Secretary of War, and while the granting of additional water up to the amount at the disposal of the United States under the treaty is optional with the Secretary of War, there does not appear to be any inclination on the part of the Washington officials to release any of this water for power purposes. For the present, therefore, and probably for some time to come, the stations on the American side have reached their maximum development, and no further development will be possible on either side of the Falls after 1915, for by that time all the available water will be used.—*Electrical World.*

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